The Impact of Foreign Aid Allocation on Access to Social Services in sub-Saharan Africa: The Case of Water and Sanitation

Abstract

The Millennium Development target of halving the share of the population without access to clean water and sanitation is a cross-cutting target that has implications for the achievement of the other MDGs. However, achieving this target remains a major challenge for sub-Saharan Africa, while the ability of governments to expand access is constrained by limited financial resources. This paper investigates whether targeting foreign aid to the water and sanitation sector can help achieve the goal of expanding access to water and sanitation services in the region. We specifically examine whether sectoral allocation of aid has an impact on access to water and sanitation. The analysis is based on panel data estimation techniques controlling for country specific effects and potential endogeneity of regressors. The econometric results suggest that increased aid targeted to the supply of water and sanitation is associated with increased access to these services, although the relationship is non-linear. The evidence in this study makes an important contribution to the scholarly debate on aid effectiveness. It also has important practical implications for aid policy: specifically, it suggests that in addition to scaling up aid disbursements to sub-Saharan African countries, donors also need to increase aid allocation to water and sanitation as well as other areas where the region lags behind. There is also a need to identify structural constraints that may limit access to water and sanitation, and structure foreign aid so as to alleviate these constraints.

Key words: Water; sanitation; official development aid; sub-Saharan Africa; poverty.

JEL classification: O55; O18; O15

1. Introduction

Access to social services – education, health care, potable water, adequate sanitation – is vital to securing and sustaining human development, reducing poverty and achieving other development goals (UN 2014). However, while education and health care have received significant attention from governments and from bilateral and multilateral donors, less attention has been paid to the provision of water and sanitation. In sub-Saharan Africa (SSA), this is reflected in the uneven nature of progress towards achieving the different United Nations' Millennium Development Goals (MDGs). While the region appears to have made progress in improving health and education outcomes, the provision of safe drinking water and basic sanitation remains a major challenge (World Bank, 2014). SSA lags behind other regions in access to water and sanitation, and relative to Target 7c of the MDGs, which aims to "halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation." Thirty-seven percent of the region's population does not have access to an improved water source, and 567 million Africans lack access to improved sanitation (UN, 2013). Between 1990 and 2012, the share of the population with access to adequate sanitation increased by only 6 percentage points, compared with an overall increase of 22 percentage points worldwide. There is also a significant rural-urban gap: 84 percent of the 328 million people in the region without access to potable water live in rural areas (Salami et al., 2011), and only a third of the poorest rural households have access to these services (WHO, 2013).

The Millennium Development target of halving the share of the population without access to clean water and sanitation is a cross-cutting target that has implications for the achievement of the other MDGs. Access to clean drinking water and sanitation is directly linked to health outcomes, especially for infants and children. Despite some gains in reducing child

mortality, SSA still has the highest under-five mortality rate (at 98 deaths per 1000) and is the only region to have reduced the rate by less than half between 1990 and 2011 (World Bank, 2014). Worldwide, diarrheal diseases, most commonly caused by gastrointestinal infections and transmitted through the oral-faecal route are the most common cause of childhood deaths (Botting et al., 2010). Frequent occurrences of diarrhoea and other water related diseases resulting from lack of access to water and sanitation undermine human capital formation and reduce the productivity of adults who fall sick or must care for the sick. Therefore, increasing access to water and sanitation can help to improve both health outcomes and human capital, thus contributing to increasing overall productivity.

Inadequate access to clean water sources and sanitation also has implications for MDG 3, i.e., promoting gender equality (especially in the areas of education and labor force participation) and empowering women. In many SSA countries, women and girls are responsible for fetching water and caring for the sick (WHO and UNICEF, 2008). Inadequate supply of water and sanitation infrastructure not only increases the time it takes to fetch water, but by increasing the risk of illness, it also increases the time that women spend on unpaid care of family members. Furthermore, limited access to water and sanitation increases the likelihood that girls will be withdrawn from school to help fetch water, and reduces the time that women can allocate to paid market work. SSA continues to lag behind other regions in lowering the gap in male-female enrolment ratios at all levels of education, and girls remain at a significant disadvantage in access to primary and secondary education (United Nations, 2013). Efforts to narrow the gender gaps in education and paid employment, which tend to be significantly higher in rural areas, will continue to be hampered by the lack of access to potable water and improved sanitation.

Improving access to water and sanitation is therefore a top priority in the SSA region. However, the lack of financing remains an important constraint on the ability of governments to expand and maintain water and sanitation infrastructure. Thus efforts to expand access to water and sanitation have focused on mobilizing more financial resources, both domestically and through increased aid inflows to bridge the financing gaps in the provision of water and sanitation services. In recognition of this fact, at the G-8 summit of 2005 donors committed to doubling aid to the continent to improve the delivery of public services and build infrastructure for health, education, water and sanitation (Wolf, 2007). However, despite having increased to 4.1% in 2008, from a low of 2.8% in 2002, the share of total aid going to the water and sanitation sector remains low relative to other regions and in comparison with aid to other sectors such as education and health (Wolf, 2007; Salami et al., 2011). Moreover, simply increasing the volume of total aid without targeting the water and sanitation sectors may not lead to expanded access to these services, since water and sanitation compete with other public services for funding, and physical infrastructure such as roads tend to be higher on the government's priority list.

In this paper, we use an unbalanced panel data set from a sample of 29 sub-Saharan African countries over the 1990-2010 period to investigate whether targeting foreign aid to the water and sanitation sector can help achieve the goal of expanding access to water and sanitation services. Specifically, we use OECD/DAC data to examine the impact of foreign aid targeted to water and sanitation on the share of the rural population with access to these social services. Because of the wide rural-urban gap in access to water and sanitation in sub-Saharan Africa, we focus on access by the rural population and the urban-rural gap in access to these services.

The study makes a number of important contributions to the literature. First, unlike the standard practice in the aid literature, the study utilizes disaggregated data on aid allocation by

sector, which enables us to link access to water and sanitation with the amount of aid allocated to these sectors. This may shed light on the micro-macro paradox observed in the assessment of aid effectiveness, whereby empirical evidence suggests that targeted aid-funded interventions tend to produce positive results at the micro level, while the impact of foreign aid at the macro level has been harder to document (see Ndikumana, 2012). Second, we use actual disbursements of foreign aid to recipient countries rather than aid commitments, thus linking impact to actual flows of resources. To the best of our knowledge, this paper is one of only a few papers to do so in the context of water and sanitation (Botting et al., 2010; Bain et al., 2015). Third, extending the analysis in earlier studies, we allow for non-linearities in the relationship between aid to the water and sanitation sector and access to these services, and control for the possibility of country-specific time invariant factors as well as potential endogeneity of regressors. Fourth, given the substantial rural-urban gaps in access to water and sanitation, and the fact that the burden associated with the lack of access to water and sanitation falls disproportionately on rural women, our focus on access to water and sanitation in rural areas, as well as on urban-rural disparities in access to these services, enables us to draw implications of the results for equity along gender and geographical dimensions. Fifth, our focus on Sub-Saharan Africa, a region that lags behind other regions in access to water and sanitation despite receiving a substantial amount of total aid relative to other developing regions, may shed light on strategies to improve effectiveness of foreign aid in SSA. To our knowledge, this is the first paper to carry out such a detailed analysis using data on actual aid disbursements disaggregated by sector in sub-Saharan Africa with a focus on water and sanitation. Our results suggest that overall, aid to the water and sanitation sector is associated with improvements in rural access to water and sanitation,

although the relationship between aid to the sector and the impact on access to these services is non-linear.

In the remainder of the paper, we provide a literature review in the next section. Section 3 is devoted to the empirical analysis, with a description of the data and the empirical model, and a discussion of the regression results. Section 4 concludes.

2. Literature Review

Efforts to expand access to social services such as water and sanitation in Africa have typically focused primarily on mobilizing additional financial resources and much less on how the allocation of resources across various uses helps achieve development goals. This is an important part of the fundamental problem encountered in the assessment of the effectiveness of foreign aid, which has largely relied on aggregate data to identify the linkages between foreign aid and economic outcomes. The evidence from the few studies that focus on specific human development indicators suggests that targeted aid interventions can achieve positive results at the micro level (see Ndikumana (2012) for a review). For example, Gormanee et al. (2005) find that aid is associated with improvements in the Human Development Index. Similarly, Mishra and Newhouse (2009) find that foreign aid contributes to reducing infant mortality rates, while Michalowa and Weber (2006) and Dreher, Nunnenkamp, and Thiele (2008) find evidence that foreign aid may help increase primary school enrolment. An important weakness of most of these studies is that they use data on aid commitments. This is problematic because aid commitments often differ significantly from actual aid disbursements.

One exception in this literature is a recent study by Pickbourn and Ndikumana (2013) which uses actual aid disbursements disaggregated by sector to examine the impact of foreign aid

on specific development outcomes. The authors find that increased allocation of foreign aid to the health and education sectors reduces maternal mortality as well as the gender gap in youth literacy in recipient countries. They find substantial cross-regional differences, with SSA performing worse than other regions.

To the best of our knowledge, only three other papers have examined the impact of aid disbursements to the water and sanitation sector on access to these services in developing countries, with conflicting results. Using OLS regression analysis of cross-sectional data to model public service production functions in a sample of developing countries for a single year, Wolf (2007) finds that the share of total aid going to the water and sanitation sector in 2001-2002 has no impact on access to sanitation, and a negative impact on access to water.[1] In contrast, using Spearman's rank correlation coefficients for a group of 48 countries, Botting et al (2010) find that low-income countries receiving the most aid per capita to the water and sanitation sector are 4-18 times more likely than countries in the lowest tercile of foreign aid to achieve greater gains in population access to water over the period 2002-2006. However, this effect disappears when they control for GDP, public health expenditure and land area. In addition to their methodological limitations, neither of these studies addresses possible endogeneity of the regressors, or the effect of omitted variables. More recently, using fixed-effects regressions on panel data covering 20 years and 114 countries, Bain et al (2015) do not find any significant effect of per capita aid disbursements to water and sanitation on improved source coverage over the period 2000-2010. Like the previous studies, Bain et al (2015) specify a linear relationship between aid to the water and sanitation sector and access to these services. However, they do

[1] Bain et al. (2015) note that the negative coefficient on access to water in Wolf's study may be explained by the fact that donors may allocate less aid to the water sector in any given country if there is greater need in other sectors e.g. water coverage is better than say educational attainment or health service coverage.

find a strong association between GDP and water coverage, and between water coverage and sanitation coverage, but no impact of governance and the link between foreign aid and access to water and sanitation.

Our paper adds to the empirical literature on aid effectiveness at a disaggregated level by extending and deepening the coverage of existing studies by using data that spans the period 1990-2010, and by focusing specifically on rural access to water and sanitation in sub-Saharan Africa. We take into account possible endogeneity of regressors and time-invariant country-specific variables. Our paper also differs from earlier studies by specifying a non-linear relationship between aid and access to water and sanitation. This approach is driven by the fact that many studies find a diminishing impact of aid on economic growth, an effect which may also apply to the impact of aid on access to water and sanitation services (see McGillivray (2004) for a review of this literature).

3. Empirical Analysis

3.1 Data and stylized facts

This study uses data on bilateral official aid disbursements at the project level from the OECD Creditor Reporting System (CRS) database. Aid from all donors is aggregated to obtain total aid as well as aid targeted to the water and sanitation sector by recipient country. Data on access to water and sanitation are taken from the World Bank's World Development Indicators (WDI). Country-level social and economic indicators used as control variables in the econometric analysis are also taken from WDI. A governance indicator used to control for the impact of institutions on service delivery is obtained from the International Country Risk Guide (ICRG). The main variables, the indicators of access to water and sanitation, are available only from 1990. Therefore the sample period is 1990-2010. The list of regression variables, their

definition and data sources are given in Table A.1 in the Appendix, and summary statistics are reported in Table 1.

[Table 1 here]

The data shows that sub-Saharan Africa lags behind all other regions in terms of access to water and sanitation (Table 2). On average, only about 57% of the rural population in the region has access to an improved source of water, compared with 85.5% of the region's urban population. There are also disparities in access to sanitation, with only 28.7% of the rural population having access to improved sanitation, compared with 51% of the urban population. There are large cross-country variations in access to water and sanitation (Table 3) and rural-urban disparities in access to water and sanitation vary widely across the countries in our sample. Ethiopia has the largest rural-urban gap in access to water, followed by South Africa and Madagascar, while Eritrea has the largest rural-urban gap in access to sanitation (Table 3).

[Table 2 here]

[Table 3 here]

Aid to the water and sanitation sector averaged around 5 percent of total aid to the region between 1990 and 2010. As a share of GDP, aid to the water and sanitation sector in the countries in our sample began to increase after 2000, averaging 0.5% of GDP over the period (Figure 1). Nevertheless, the sector receives much less aid than other sectors, whether as a share of GDP, a share of total aid or in per capita terms (Figure 2).

[Figure 1 here]

[Figure 2 here]

3.2 Model specification and estimation methodology

The impact of foreign aid on access to water and sanitation is investigated by estimating two separate econometric models. The first model relates the percentage of the rural population with access to improved water or sanitation to aid disbursements to the water and sanitation sector as a whole, controlling for other determinants of access to these services. We use total aid to the sector rather than aid by sub-sector because access to water and access to sanitation are interdependent. Therefore, aid to one sub-sector has an impact on access in the other subsector. In particular, improvements in water infrastructure facilitate access to improved sanitation. The first model is specified as follows:

$$Access_{s,it} = b_0 + \theta Aid_{it} + \lambda Aid_{it}^2 + \mathbf{Z}'_{it}\boldsymbol{\Gamma} + u_i + \omega_{it} \quad (1)$$

where the subscripts *i, t,* and *s* denote the country, time, and sector (water or sanitation). *Access* is the share of the rural population that has access to improved drinking water or sanitation, *Aid* is foreign aid disbursements targeted to the water and sanitation sector, Aid^2 captures non-linearities in the relationship between foreign aid disbursements and access to water or sanitation, **Z** is a vector of control variables consisting of determinants of access to water and sanitation other than aid, *u* is a term that accounts for unobserved country-specific factors, and ω is a random error term.

The second model is specified to investigate the impact of aid disbursements to the water and sanitation sector on rural-urban disparities in access to water and sanitation. The model is specified as:

$$AccessRatio_{s,it} = b_0 + \psi Aid_{it} + \phi Aid_{it}^2 + \mathbf{Z}'_{it}\boldsymbol{\Gamma} + u_i + \omega_{it} \quad (2)$$

where $AccessRatio_{s,it}$ denotes the ratio of the percentage of the urban population to the percentage of the rural population with access to water or sanitation in country *i* in year *t*. The other terms in Equation (2) have the same meanings as in Equation (1).

The control variables included in the analysis are: the log of real GDP per capita, the age dependency ratio, the female literacy rate, government health expenditure as a percentage of GDP, and governance measured by a government stability index. GDP per capita measures both the government financing capacity and the public's effective demand for water and sanitation services. Government health expenditure measures both the government's capacity and commitment to providing social services. These two variables are expected to be positively correlated with access to water and sanitation. The female literacy rate, which tends to be positively correlated with the overall literacy rate, captures not only the extent of gender equality but also the demand for social services, including capacity to exert political pressure on the government. This indicator is therefore expected to be positively related to access to water and sanitation. The age dependency ratio accounts for both demand for services and pressure on public resources for alternative needs. In the context of limited public resources as is typical in all SSA countries, a high dependency ratio is expected to be negatively associated with access to water and sanitation. The governance indicator is a proxy for both commitment and effectiveness of the government in delivering social services. We also include a dummy variable for the post-2000 period to capture the observed acceleration of growth and social development in SSA since the turn of the century. This also corresponds with the era of the MDGs. The models for population access to sanitation include an extra variable – the share of the rural population with

access to an improved water source. This is motivated by the fact that having access to an improved water source would facilitate the provision of improved sanitation facilities.

Determinants of access to services that are not adequately captured in our model may also affect the results. Problems likely to arise from omitted variable bias are addressed by using the fixed-effects estimation method. Potential problems associated with endogeneity of regressors are addressed by using the Arelano-Bover/Blundel-Bond dynamic panel data estimator (DPD) (Arelano & Bond, 1991; Arellano & Bover, 1995; Blundell & Bond, 1998). Using both estimation methods enables us to assess the robustness of the results.

3.3 Econometric Results

The econometric estimation results are presented in Tables 4-7. Tables 4 and 5 contain the results of the regression for the equations for access to sanitation and water, respectively. Tables 6 and 7 present results for the gap between urban and rural access to sanitation and water, respectively.

In the case of rural access to improved sanitation, the estimation results that take into account omitted country-specific factors (Table 4 column 1) as well as the GMM results which take into account the potential endogeneity of regressors (Table 4 column 2) show that aid to the sector has a non-linear effect on the percentage of the rural population that has access to improved sanitation. The relationship appears to exhibit an inverted U-shape. An increase in aid allocation to the water and sanitation sector leads to an increase in access to sanitation up to a threshold, beyond which further increases in aid are associated with declining access to sanitation. The results suggest that a one percent increase in aid to the sector (as a percentage of GDP) is associated with between 0.1 to 0.5 percentage increase in the share of the rural

population that has access to improved sanitation. This relationship turns negative, however, when aid to the water and sanitation sector reaches around 5 percent of GDP, suggesting diminishing returns to aid to water and sanitation. Note that the average ratio of aid to the water and sanitation to GDP for the sample is 0.4%, suggesting that few country-year observations fall in the diminishing returns region. Therefore, we may conclude that an increase in foreign aid will generally have a positive effect on access to sanitation in SSA.

[Table 4 here]

In the case of rural access to water (Table 5), the GMM results (column 2) suggest that the amount of aid allocated to the water and sanitation sector also has a non-linear effect on access to an improved source of drinking water in the rural sector. The positive impact of foreign aid on access to water is quantitatively similar to the effect of foreign aid on access to sanitation. However, access to water begins to decline as aid rises past 8 percent of GDP, which is very high in this sample of countries. Note, however, that the impact of aid on rural access to an improved water source is not statistically significant in the regressions that account for omitted country-specific factors (FE results, column 1), reflecting wide cross-country variations.

[Table 5 here]

The results generally suggest that an increase in official development aid that is explicitly allocated to water and sanitation is likely to have an initial positive impact on access to improved sanitation, followed by a negative impact as aid increases beyond a certain point. However, in

the case of access to water, the effects may vary across countries based on country-specific circumstances. This justifies our inclusion of country-specific determinants of access to water and sanitation in the regression analysis as control variables.

The results on the control variables vary depending on the estimation method. In general, an increase in access to an improved water source is positively associated with an increase in the share of population that has access to improved sanitation facilities. Likewise, income per capita and government expenditure on health are positively related to access to water and sanitation. The results reflect the impact of higher capacity to spend on water and sanitation for any given level of foreign aid to these sectors. A higher female literacy rate positively affects access to water only, but appears to have no impact on access to sanitation. The post-2000 decade is associated with improvements in access to both water and sanitation, as expected. The results on the age dependency ratio and government stability are generally consistent with our expectations only in some specifications.

The results from the second set of estimations analyzing the relationship between aid and urban-rural disparities in access to sanitation provide further confirmation of a positive impact of foreign aid on rural access to sanitation (Table 6). The fixed effects estimation results (column 1) point to the existence of a negative relationship between aid disbursements and the urban-rural access ratio so long as aid to the water and sanitation sector is below 5.1 percent of GDP (suggesting improvements in rural access to sanitation relative to urban access), while the GMM estimation suggests that an increase in foreign aid monotonically reduces the urban-rural access ratio as illustrated by the negative coefficient on the aid to GDP ratio and the insignificant coefficient on the squared ratio (column 2).

[Table 6 here]

Likewise, levels of aid to the water and sanitation sector below 3.5 percent of GDP appear to lower urban-rural disparities in access to water, although this effect is significant only in the GMM estimations (Table 7, column 2).

[Table 7 here]

The post-2000 decade is associated with a reduction in urban-rural disparities in access to water and sanitation. These results are consistent across the fixed-effects and GMM specifications. An increase in female literacy helps to reduce urban-rural disparities in access to sanitation as might be expected, although the coefficient on this variable is significant only in the GMM regressions. The GMM regressions also suggest that greater public expenditure on health is associated with a reduction in rural-urban disparities in access to both water and sanitation (Table 6, column 2; Table 7, column 2).

These results generally suggest that an increase in official development aid that is explicitly allocated to water and sanitation is likely to reduce urban-rural disparities in access to sanitation, although this effect may diminish with increasing amounts of aid. However, in the case of urban-rural disparities in access to water, the effects may vary across countries based on country-specific circumstances.

A possible explanation for the quadratic shape of the relationship between aid to the water and sanitation sector and access to water and sanitation is that aid to water and sanitation appears to be targeted to the poorest countries in the sample (Figure 3). Coverage of water and sanitation services in these countries is also likely to be poorer due to a variety of structural constraints on the supply and demand for water and sanitation that do not entirely disappear with

greater amounts of aid. For example, low incomes can constrain the demand for these services, which will lead to poor coverage if cost-recovery is important to the providers of water and sanitation services, and large-scale water projects may not be feasible in the absence of electricity to operate pumps. Another reason for the quadratic relationship is that aid to the water and sanitation sector includes not only support for expanding access, but also support for behavior modification projects aimed at influencing the attitudes and practices of the population regarding water, sanitation and hygiene. While this kind of aid meets an important need, it does not by itself contribute to expanding access to water and sanitation services. However, by alleviating the fiscal constraints of the government, it may help to free up resources that can then be used to expand access to water and sanitation. Of course, whether or not this actually happens will vary from country to country depending on domestic political factors and public commitment to expanding access to social services. This may also help to explain the heterogeneity of the results across countries.

[Figure 3 here]

4. Conclusion

With the end of the MDG period in 2015, there have been renewed calls for more ambitious development targets, including universal access to improved water and sanitation. This study has produced new evidence on the impact of foreign aid on access to social services in sub-Saharan Africa. In particular, it sought to link access to water and sanitation in rural areas with disbursements of foreign aid targeting these services. The empirical results are consistent with the evidence from earlier studies that show that official development aid is important in

improving social development outcomes. The evidence shows that increases in the allocation of foreign aid to water and sanitation infrastructure are associated with increased access to clean drinking water and improved sanitation facilities in the rural areas in sub-Saharan African countries. This implies that targeted aid can be an important tool for accelerating human development. The policy message is that in addition to scaling up aid disbursements to sub-Saharan African countries, donors also need to explicitly increase aid allocation to water and sanitation as well as other areas where the region exhibits the most substantial gaps vis-à-vis its development goals and relative to other regions. There is also a need to identify other structural constraints to the demand and supply of water and sanitation that may limit access, and consider how to structure foreign aid so as to alleviate these constraints.

The findings in this study also have important implications for the role of official development aid in reducing gender inequalities as well as rural-urban disparities in social and human development. To the extent that foreign aid helps to alleviate constraints to access to water and sanitation, it can help to reduce the time spent by women and girls in fetching water (see Elson, 2002). It can also help reduce the incidence of water-borne illnesses, which would reduce both the disease burden on women and the time spent by women in caring for sick family members. This would free up women's time to be used for other productive activities, while also reducing gender gaps in education outcomes, with substantial positive effects on economy-wide productivity (see World Bank, 2011).

Improved access to water and sanitation in the rural area has substantial spillover effects on productivity and the overall wellbeing of the population. Of course, expanded access to water and sanitation alone does not ensure that these services will be used by all who need them, or in the case of sanitation, in the way that they are intended to be used. Uptake of water and

sanitation services by the population is impacted by a variety of social, cultural, economic and demographic factors. However, once the services are made available, these constraints can be overcome by devoting resources to ensuring that they are fully utilized by the population. Thus, increasing the amount of foreign aid going to support water and sanitation projects in sub-Saharan Africa can substantially help accelerate progress towards achieving not only the MDG on access to water and sanitation, but also the MDGs on gender equality and health as well as other development goals.

References

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo Evidence and an application to employment equations. *Review of Economic Studies, 58,* 277-297.

Arellano, M., & Bover, O. (1995). Another look at instrumental variables estimation of error-component models. *Journal of Econometrics, 68,* 29-51.

Bain, Robert; Luyendijk, Rolf; Bartram, Jamie (2013): Universal access to drinking water: The role of aid, WIDER Working Paper, No. 2013/088

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel-data models. *Journal of Econometrics, 87*(1), 115-143.

Botting et al.(2010): Water and sanitation infrastructure for health: The impact of foreign aid. *Globalization and Health* 6:12, 1-8.

Dreher, A., Nunnenkamp, P., & Thiele, R. (2008). Does Aid for Education Educate Children? *World Bank Economic Review*, 22(2), 291-314.

Elson, D. (2002). Male Bias in Macroeconomics: The Case of Structural Adjustment. In A. K. Dutt (Ed.), *The Political Economy of Development*116-142.

Gormanee, K., Morrissey, O., Mosley, P., & Verschoor, A. (2005). Aid, Government Expenditure and Aggregate Welfare. *World Development,* 33(3), 355-370.

Michalowa, K., & Weber, A. (2006). Aid Effectiveness Reconsidered: Panel Data Evidence for the Education Sector. Discussion Paper (number?): Hamburg Institute of International Economics.

Mishra, P., & Newhouse, D. (2009). Does Health Aid Matter? *Journal of Health Economics,* 28 (4), 855-872.

McGillivray, M. (2004). Is Aid Effective? WIDER, Helsinki, downloaded from http://www.oecd.org/dev/34353462.pdf

Ndikumana, L. (2012). Applying Evaluation to Development and Aid: Can Evaluation Bridge the Micro-macro Gaps in Aid Effectiveness? In F. Bourguignon, et al. (Eds.), *Evaluation and Its Discontents: Do We Learn from Experience in Development?* (pp. 123-150). Paris: Agence Française de Développement.

Pickbourn, L., & Ndikumana, L. (2013). Impact of sectoral allocation of foreign aid on gender equity and human development. WIDER Working Paper 2013/066.

Salami, A., Stampini, M., Kamara, A., Sullivan, C., & Namara, R. (2011). Development Aid and Access to Water and Sanitation in Sub-Saharan Africa. Working Paper 140, AfDB.

UN (2013). *Millennium Development Goals Report 2013*. New York: United Nations.

World Bank (2011). *World Development Report 2012*: *Gender Equality and Development.* Washington, DC: The World Bank.

World Bank (2014). The Global Monitoring Report, 2014: Ending Poverty and Sharing Prosperity. Washington, DC: The World Bank.

World Health Organization and United Nations Children's Fund Joint Monitoring Programme for Water Supply and Sanitation (2008). Progress on Drinking Water and Sanitation: Special Focus on Sanitation. UNICEF, New York and WHO, Geneva

WHO (2013). *World Health Statistics 2013*. Geneva: World Health Organization.

Wolf, W. (2007). Does Aid Improve Public Service Delivery. *Review of World Economics*, 143: 65-672

Table 1: Summary statistics for regression variables

Variable	Mean	Median	Standard deviation	Minimum	Maximum
Access to water (share of rural population)	54.1	51	21.4	5.1	99.0
Access to sanitation (share of rural population)	27.1	18	24.9	1.0	94.0
Ratio of urban access to rural access (water)	1.8	1.4	1.2	0.9	15.8
Ratio of urban access to rural access (sanitation)	3.8	2	4.8	0.9	57
Aid disbursement to water and sanitation sector (% of GDP)	0.5	0.26	0.9	0.0	11.04
Log GDP per capita	6.1	5.8	1.04	3.9	9.1
Age dependency ratio	85.8	87.9	12.4	40.4	107.5
Adult Female literacy rate (% of female population aged 15 and above)	53.8	55.2	25.8	4.5	99.5
Public health expenditure (% of GDP)	2.7	2.23	2.04	0.003	19.2
Government stability index (1=mostly stable, 0=mostly unstable)	0.6	0.67	0.2	0.05	0.9

Source: OECD/DAC Country Reporting System; World Development Indicators; International Country Risk Guide (ICRG).

Table 2: Regional disparities in access to water and sanitation

	Sub-Saharan Africa	Other developing regions
Percentage of population with access to water		
Rural	57.1	79.6
Urban	85.5	94.1
Total	67.6	86.7
Percentage of population with access to sanitation		
Rural	28.7	66.5
Urban	51.0	83.2
Total	36.9	74.6

Source: OECD/DAC Country Reporting System; World Development Indicators; International Country Risk Guide (ICRG).

Table 3: Cross-country variations in access to water and sanitation in SSA

Country	Access to water		Access to sanitation	
	Total	Urban/Rural ratio	Total	Urban/Rural ratio
Angola	45.9	1.33	42.5	7.51
Burundi	71.3	1.28	45.2	1.02
Benin	66	1.34	9.1	8.89
Burkina Faso	60.1	1.59	11.7	13.9
Botswana	94.9	1.11	51.3	2.2
Central African Republic	62.6	1.73	22.3	2.35
Cote D'Ivoire	77.7	1.35	21.7	3.91
Cameroon	63.9	2.07	48.6	1.65
Congo, Republic of	70.7	2.74	19.1	1.22
Comoros	91.8	1.03	27.9	1.98
Cape Verde	83.4	1.05	46.6	2.39
Djibouti	82.6	1.44	59	3
Eritrea	51.9	1.43	11.2	26.3
Ethiopia	28.9	6.6	9.76	9.19
Gabon	85.6	2.11	34.7	1.21
Ghana	70.2	1.59	10.2	2.69
Guinea	63.1	1.75	14.2	2.94
Gambia	82.8	1.17	63.7	1.11
Guinea Bissau	50.2	1.58	15.5	6.83
Equatorial Guinea	51	1.57	89	1.06
Kenya	51.4	2.09	28.4	1.04
Liberia	63.9	1.46	13.2	7.78
Lesotho	79.4	1.23	25.2	1.61
Madagascar	37.7	3.33	12	1.88
Mali	45.9	2.03	18.3	2.84
Mozambique	41.7	2.75	14.2	8.63
Mauritania	40.3	1.21	20.9	4.41
Mauritius	99	1.01	89	1.03
Malawi	62.4	1.72	45.2	1.1
Namibia	80.2	1.42	28.1	4.74
Niger	42.1	2.22	6.95	9.29
Nigeria	53.3	2.15	34	1.18
Rwanda	66	1.35	46.3	1.39
Sudan	79.6	1.26	81.8	1.08
Senegal	65.9	1.85	44.9	2.21
Sierra Leone	46.5	2.47	11.4	4.37
Somalia	69.5	1.45	30.5	5.44

São Tomé and Principe	81.4	1.17	22.8	1.77
Swaziland	90.1	1.3	81.4	1.38
Chad	45.2	1.46	10.3	4.83
Togo	58.4	1.44	40.9	1.8
Tanzania	62.4	1.81	91.2	1.04
Uganda	93.9	1.02	82.5	1.1
South Africa	23.3	4.38	22	5.57
Congo, Democratic Rep.	44.5	3.14	16.1	2.57
Zambia	54.4	2.61	46.9	1.47
Zimbabwe	79.7	1.41	40.3	1.56

Source: OECD/DAC Country Reporting System; World Development Indicators; International Country Risk Guide (ICRG).

Table 4: Impact of aid to water and sanitation sector on rural access to sanitation

	Fixed effects	GMM (Two-step estimates)
Aid to water and sanitation (% of GDP)	0.504*	0.169***
	(0.097)	(0.000)
Square of aid to water and sanitation (% of GDP)	-0.051*	-0.017***
	(0.061)	(0.000)
Percentage of rural population with access to Water	0.193***	0.029
	(0.000)	(0.132)
Log of GDP per capita	4.113***	0.471
	(0.000)	(0.241)
Age dependency ratio	-0.220***	-0.023
	(0.000)	(0.312)
Female literacy rate	-0.042	-0.002
	(0.206)	(0.835)
Government spending on health (% of GDP)	0.398***	0.015
	(0.001)	(0.359)
Government stability	0.186	0.170
	(0.824)	(0.236)
Post-2000 dummy	0.277	0.062**
	(0.399)	(0.036)
Percentage of rural population with access to sanitation in previous year		0.642
		(0.781)
Constant	11.847*	0.169***
	(0.074)	(0.000)
Within R-squared	0.568	
Between R-squared	0.105	
Overall R-squared	0.093	
Sargan test: Chi2 (p>Chi2)		21.413
		(1.000)
AR(2) test: z (p>z)		.763
		(0.445)
Observations	367	338
Number of countries	29	28

The dependent variable is the percentage of the rural population with access to sanitation. Robust p-values are given in parentheses. The asterisks indicate significance at 1% (***), 5% (**), and 10% (*).

Table 5: Impact of aid to water and sanitation sector on rural access to water

	Fixed effects	GMM (Two-step estimates)
Aid to water and sanitation (% of GDP)	-0.561	0.312***
	(0.363)	(0.001)
Square of aid to water and sanitation (% of GDP)	0.029	-0.019***
	(0.607)	(0.008)
Log of GDP per capita	10.945***	0.684
	(0.000)	(0.307)
Age dependency ratio	0.180**	0.052
	(0.017)	(0.269)
Female literacy rate	0.475***	0.051
	(0.000)	(0.129)
Government spending on health (% of GDP)	0.030	0.120***
	(0.896)	(0.008)
Government stability	-4.675***	-0.070
	(0.006)	(0.605)
Post-2000 dummy	3.737***	0.214***
	(0.000)	(0.005)
Percentage of rural population with access to water in previous year		0.932***
		(0.000)
Constant	-52.916***	-7.638
	(0.000)	(0.349)
Within R-squared	0.539	
Between R-squared	0.277	
Overall R-squared	0.277	
Sargan test: Chi2		19.319
(p>Chi2)		(1.000)
AR(2) test: z		.8095
(p>z)		(0.418)
Observations	367	338
Number of countries	29	28

The dependent variable is the percentage of the rural population with access to water. Robust p-values are given in parentheses. The asterisks indicate significance at 1% (***), 5% (**), and 10% (*).

Table 6: Impact of aid to water and sanitation sector on the urban-rural gap in access to sanitation

	FE	GMM Two-step estimates
Aid to water and sanitation (% of GDP)	-0.449*	-0.058*
	(0.070)	(0.081)
Square of Aid to water and sanitation (% of GDP)	0.044*	0.000
	(0.052)	(0.989)
Percentage of rural population with access to water	-0.071***	-0.031***
	(0.002)	(0.000)
Log of GDP per capita	-0.207	-0.293**
	(0.774)	(0.026)
Age dependency ratio	0.011	-0.063***
	(0.711)	(0.000)
Female literacy rate	-0.008	-0.026***
	(0.780)	(0.000)
Government spending on health (% of GDP)	0.003	-0.011**
	(0.976)	(0.018)
Government stability	0.119	-0.851***
	(0.862)	(0.000)
Post-2000 dummy	-0.616**	-0.230***
	(0.022)	(0.000)
Lagged value of urban-rural ratio		0.677***
		(0.000)
Constant	8.299	11.983***
	(0.125)	(0.000)
Within R-squared	0.181	
Between R-squared	0.091	
Overall R-squared	0.106	
Sargan test: Chi2 (p>Chi2)		21.782
		(1.000)
AR(2) test: z (p>z)		1.377
		(0.169)
Observations	367	338
Number of countries	29	28

The dependent variable is the ratio of the percentage of the urban population with access to sanitation to the percentage of the rural population with access to sanitation. Robust p-values are given in parentheses. The asterisks indicate significance at 1% (***), 5% (**), and 10% (*).

Table 7: Impact of aid to water and sanitation sector on the urban-rural gap in access to water

	FE	GMM Two-step estimates
Aid to water and sanitation (% of GDP)	-0.053	-0.007***
	(0.314)	(0.009)
Square of aid to water and sanitation (% of GDP)	0.006	0.001***
	(0.204)	(0.003)
Log of GDP per capita	-0.520***	-0.082***
	(0.000)	(0.000)
Age dependency ratio	-0.007	-0.002***
	(0.279)	(0.000)
Female literacy rate	0.007	0.000
	(0.202)	(0.492)
Government spending on health (% of GDP)	-0.012	-0.003***
	(0.553)	(0.000)
Government stability	0.280**	0.007
	(0.049)	(0.199)
Post-2000 dummy	-0.299***	-0.012***
	(0.000)	(0.000)
Lagged value of the urban-rural ratio		0.834***
		(0.000)
Constant	5.328***	0.945***
	(0.000)	(0.000)
Within R-squared	0.193	
Between R-squared	0.126	
Overall R-squared	0.109	
Sargan test: Chi2 (p>Chi2)		20.888
		(1.000)
AR(2) test: z (p>z)		-.969
		(0.333)
Observations	367	338
Number of countries	29	28

The dependent variable is the ratio of the percentage of the urban population with access to water to the percentage of the rural population with access to water. Robust p-values are given in parentheses. The asterisks indicate significance at 1% (***), 5% (**), and 10% (*).

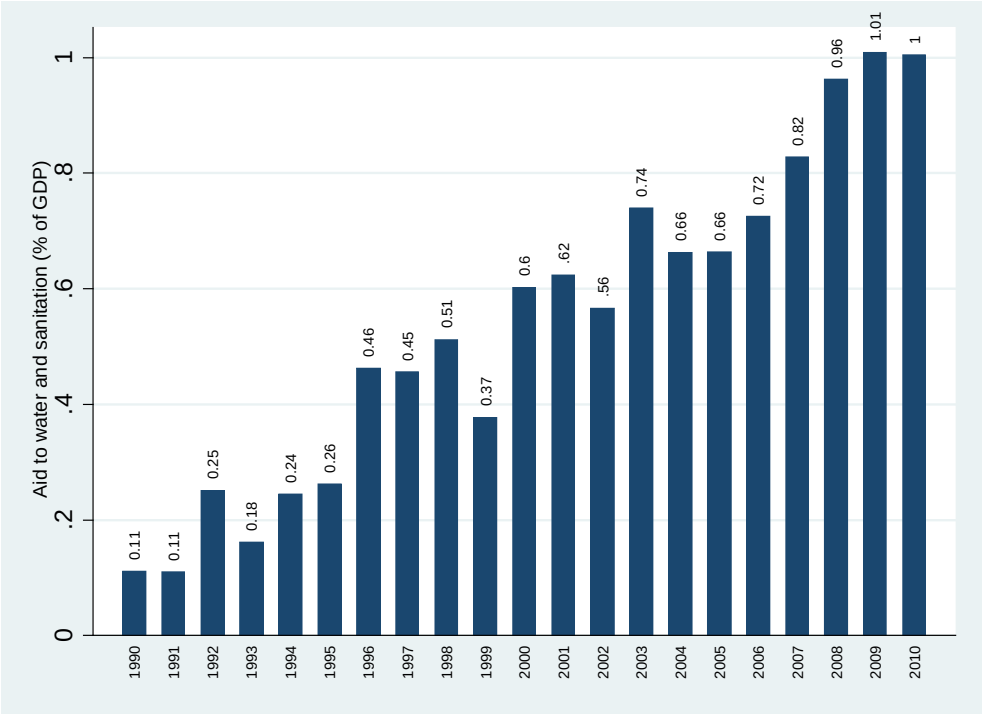

Figure 1: Foreign aid to the water and sanitation sector in SSA (% of GDP), 1990-2010

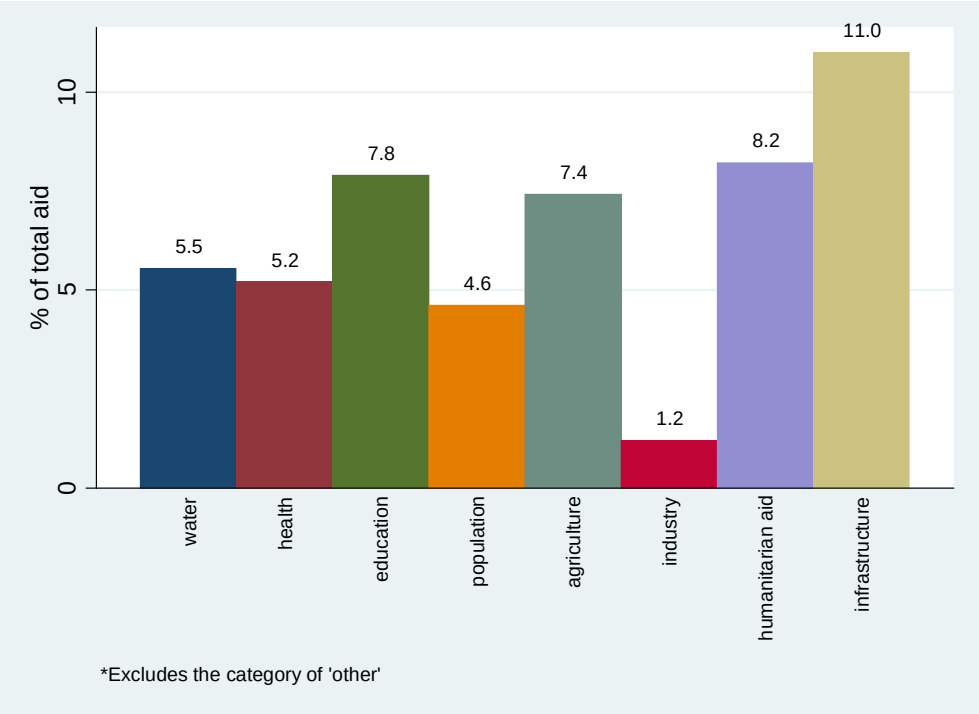

Figure 2: Sectoral shares of foreign aid in total aid in SSA (1990-2010)

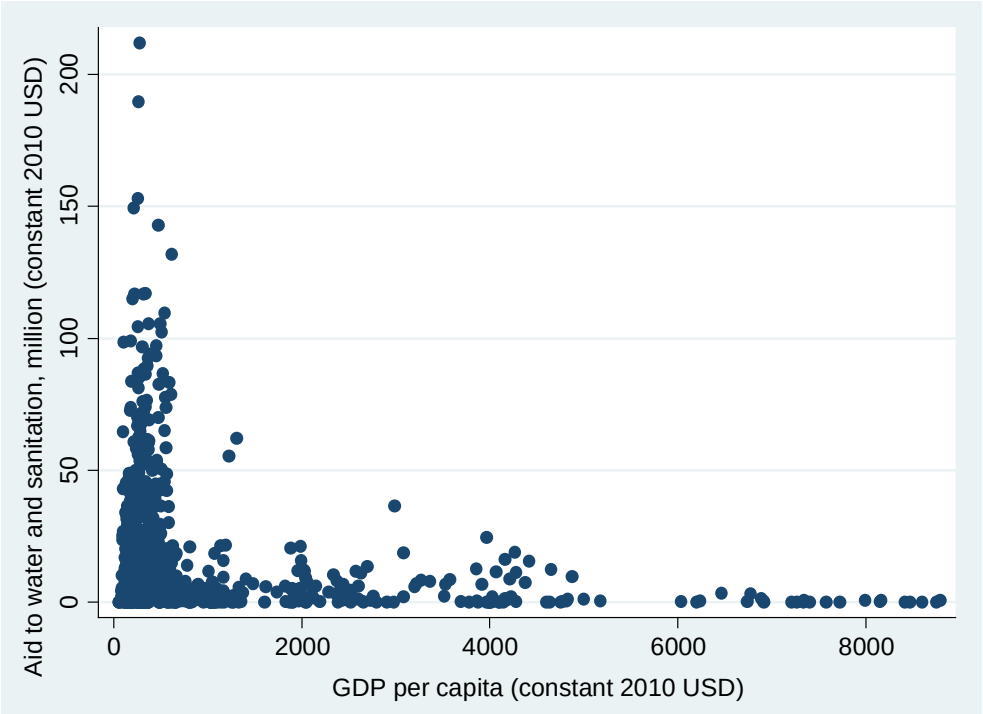

Figure 3: Foreign aid to the water and sanitation sector and per capita GDP in SSA: 1990-2010

Appendix

Table A.1: Variables, definition and data sources, 1990-2010

Variable and definition	Source
Total disbursement of aid to water and sanitation sector (constant USD); entered in the regression as percentage of GDP	OECD DAC, WDI and authors' calculations
Real GDP per capita (constant USD)	World Development Indicators
Public health expenditure as percentage of GDP	World Development Indicators
Age dependency ratio	World Development Indicators
Percentage of rural population with access to improved sanitation facilities	World Development Indicators
Percentage of rural population with access to improved water source	World Development Indicators
Adult female literacy rate (% of women aged 15 and above)	World Development Indicators
Government stability index	ICRG
Post_2000 (a dummy variable = 1 if year is between 2000-2010)	Authors' construction