Evaluating water- and health related development projects: A new cross-project and micro-based approach*

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ABSTRACT

We present a new micro-based approach to evaluate the effect of water- and health-related development projects. We collect information from 1.8 million individuals from DHS clusters (*Demographic and Health Surveys*) in 38 developing economies between 1986 and 2017. By geocodes, we combine cluster information with over 14,000 sub-national projects from the *World Bank*. We then investigate the impact of the projects employing fixed-effects estimation techniques. Our findings indicate that the time to gather water and the number of dead children decreases when projects are realized. The quality of drinking water and sanitation facilities are positively affected too. Our data allows us to account for cluster heterogeneity, which is a significant extension to the cross-country literature. Numerous robustness checks, covering data and methodological refinements, supports our main findings.

JEL-Classification: xxx

Keywords: evaluation, development projects, drinking water, sanitation, child mortality

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I. INTRODUCTION

More than 2 billion people live with high water stress and about 4 billion people suffer from severe water scarcity at least one month per year (UNESCO, 2019). Improvements of access to clean water are often considered priorities when it comes to development. Improved sanitation and improved drinking water are argued to have a global average benefit-cost ratio of 5.5 and 2.0 respectively (see e.g., Hutton, 2013, Whittington et al., 2012). The poor in South Asia and Sub-Saharan Africa can particularly benefit from investments in Water, Sanitation and Health (WASH) as they lead to declining mortality and gains towards global equity (see e.g. Jeuland et al., 2013). Support for WASH from international institutions and development agencies gains importance. We suggest a new cross-project and micro-based approach to evaluate their effectiveness and investigate mediating factors.

Macro-level studies (mostly cross-country) have analyzed the effectiveness of aid on growth and economic outcomes.[1] A growing literature turns away from the macro-perspective and follows a micro-based approach to evaluate development interventions (Cameron et al., 2016). Economists such as Esther Duflo and Abhijit Banerjee (e.g., in Banerjee and Duflo, 2012, Duflo et al., 2013) are strong agents for this micro-based approach and randomized control trials (RCT)[2] to identify causal effects and assess the effectiveness of development projects. Nevertheless, it has been criticized that findings of RCTs have limited external validity (even if single projects are successful, this does not ensure success on the macro-level, in other countries etc.) and unless large sums are invested, the approach is hardly scalable (e.g., Deaton, 2010 and Deaton and Cartwright, 2018). In addition, due to the experimental design of RCTs, they are not suitable for evaluation after a project has been finished.

We present an approach that allows ex-post evaluations of multiple development projects worldwide from a micro perspective. Following efforts that investigated the effectiveness of development work in the WASH sector where data availability is particularly good and readily

[1] This literature offers contradicting results: overall aid has been found to have a negative (e.g., Burnside and Dollar, 2000, 2004, Rajan and Subramanian, 2008, 2011), a positive (e.g., Clemens et al., 2012, Roodman, 2007), or an insignificant (e.g., C.-J. Dalgaard and Hansen, 2001, Hansen and Tarp, 2001) impact on growth. Even a number of meta-studies (e.g., Doucouliagos and Paldam, 2009, Mekasha and Tarp, 2013), looking at around 100 econometric studies, was also unable to resolve this ambiguity.

[2] Its principle consists in randomly assigning individuals to a treatment and a control group, which guarantees that unobservable characteristics are not reflected in the assignment and therefore any differences can be attributed to the impact of the treatment.

available (Botting et al., 2010, Gopalan and Rajan, 2016, Wayland, 2017, Wolf, 2007), we focus on the effect of development projects on the following four indicators: access to and quality of drinking water, toilet types and child mortality. We investigate the impact of a large number of projects on welfare of individuals from across the world. This allows us to account for regional heterogeneity and highlight that our evaluation approach is scalable. To elaborate our approach, we use data from the *World Bank*[3] and combine it with data from various *Demographic and Health Surveys* by geocode references. Thereby, we link *World Bank* projects with welfare outcomes of individuals in the vicinity of such projects and compare these individuals to others that could not have profited from them. We obtain a dataset that contains information on water and health-related questions for 1.8 million individuals from 38 countries. One third of these individuals had access to the services of 14,301 *World Bank* projects.[4] To our knowledge our dataset is the largest ever employed to evaluate effects of multiple development projects on individual welfare. Our approach can also be extended to other agencies and national programs.

The structure of our dataset allows us to account for time specific unobservables with fixed-effects at the level of clusters, which are a small geographical unit of a few square kilometers from the *Demographic and Health Surveys*. This fixed-effects approach reduces bias resulting from omitted variable bias, which could not be avoided in cross-country or even cross-regional studies.

Our empirical results show that the current and sector-independent presence of the *World Bank* through its projects has a negative and statistically significant effect on the time that individuals need to walk to the next drinking water source as well as the mortality of children in comparison to individuals that did not live in the vicinity of such projects. Projects also have a positive impact on the quality of drinking water and the quality of toilet facility. Effects are stronger for *World Bank* projects in the water and sanitation sector. All results are robust to fixed effects strategies and various robustness tests. Regarding mechanisms, *World Bank* projects are more effective in relatively low developed clusters and if individuals are more educated. However,

[3] We use data from *World Bank* projects, due to the institution's importance and its publicly available and transparent project descriptions. We do not aim to evaluate the *World Bank* as such.
[4] Projects are counted by a unique identification number, which is a reference to the project type as well as the region it is conducted in. In most cases a project is planned to be conducted in a number of sub-national regions, whereas every regional project (even though the setup is identical) has its own ID.

projects might lack sustainability as the effect of past projects is mostly dominated by the effect of current projects.[5]

The remainder of this paper is organized as follows: Section II presents the related literature, Section III describes data and methodology, Section VI lists all results of baseline regressions and robustness test as well as mechanisms and Section V offers concluding remarks.

II. LITERATUR REVIEW

By combining data from the *World Bank* and *Demographic and Health Surveys*, we are able to provide a new cross-project and micro-based evaluation approach for a large collection of developing projects in different countries. Regarding our application, we extend the existing literature on the evaluation of development projects, in the field of water, sanitation and child health.

The UNESCO 2019 World Water Development Report states that "access to water supply and sanitation services are essential to overcoming poverty and addressing various other social and economic inequities" (UNESCO, 2019). The World Health Organization and UNICEF (2017) suggest that severe economic damage due to health problems can be caused by a lack of safely managed drinking water services (for 29% of the global population) and safely managed sanitation services (39% of global population). A large array of studies have analyzed the effects of water and sanitation quality as well as their reachability on health indicators, such as diarrhea or maternal mortality (e.g., Benova et al., 2014, Norman et al., 2010, Wang and Hunter, 2010). Often, evidence is derived within regions or countries: (Bhalotra et al. (2017) for Mexico; Boone et al. (2011) for Madagascar; Duflo et al. (2015) and Dwivedi et al. (2018) for India; Gross et al. (2017) for rural Benin; Koolwal and van de Walle (2013) for a range of developing countries; Zhang (2012) for rural China). Special attention was attracted by the economic effects of a reduction in water collection time on women (e.g., Gross et al., 2017, Ilahi and Grimard, 2000, Koolwal and van de Walle, 2013, Ray, 2007, Sorenson et al., 2011). Given the huge past research effort, recent meta studies still suggests a higher tendency of water sources in low-income countries and rural areas to contain fecal contamination (see the review by Bain et al. (2014)) but a substantially lower risk of diarrheal morbidity if interventions promote point-of-use filters, high-quality piped water to

[5] RCTs cannot perform this type of ex-post analysis for past projects.

premises, sewer connections or hand-washing with soap (see the reviews by Wolf et al., 2014, 2018).

Potentially due to financial, political or institutional insufficiencies in low-income countries, non-governmental organizations as well as supra-national organizations gain importance. Edwards (2015) and Quibria (2014) provide comprehensive overviews of literature dealing with the effectiveness of development aid in general. Studies are split over their findings on whether aid is effective (e.g., Asteriou, 2009, Clemens et al., 2012, Dalgaard et al., 2004, Fayissa and El-Kaissy, 1999, Karras, 2006, Mekasha and Tarp, 2013, Minoiu and Reddy, 2010, Roodman, 2007, etc.), ineffective (Burnside and Dollar, 2000, 2004, Easterly, 2003, Liew et al., 2012, Malik, 2008, Moyo, 2010, Rajan and Subramanian, 2008, etc.) or irrelevant (Bhattarai, 2016, C.-J. Dalgaard and Hansen, 2001, Doucouliagos and Paldam, 2009, Ekanayake and Chatrna, 2010, Hansen and Tarp, 2001, etc.) for long-term growth. In response to such ambiguous results, Banerjee and Duflo (2012) emphasized the need to conduct randomized control trials (RCTs) to evaluate the effectiveness of specific policy and development interventions. They state that RCTs are the only meaningful evaluation method as they take all project-specific circumstances into account and aid can be adapted accordingly. Due to limited external validity, project success cannot be guaranteed if circumstances change. Moreover, it is expensive and for the case of past projects impossible to evaluate development projects on a larger scale with RCTs. Thus, alternative evaluation methods are relevant. We suggest an alternative approach between macro evaluations and RCTs, which is informed and inspired by the latter.

Amongst the vast literature on the evaluation of aid in general, there are various efforts that assess sector-specific aid, such as improvements in the WASH sector, on a cross-project basis: Botting et al. (2010) find that access to safe water is 4 to 18 times more likely in countries that receive higher Official Development Aid (ODA); Hopewell and Graham (2014) find that 60-80% of the targeted 31 cities in Sub-Sahara Africa experienced an increasing access to improved water supply and improved sanitation.; results from Wayland (2017) indicate that households located near WASH aid projects are significantly more likely to use improved sources of drinking water and sanitation and are therefore exposed to a lower risk of water-related illnesses; Salami et al. (2014) stress the importance of development aid (from the African Development Bank (AfDB)) for the provision of water and sanitation facilities for Kenya, Burkina Faso, Madagascar and

Uganda; results from Gopalan and Rajan (2016) suggest that development aid produces a significantly positive effect on improved access to water supply and sanitation; and Wolf (2007) finds a positive association between aid volatility and outcomes in water and sanitation. Rutstein (2000), Woldemicael (2000), Gunther and Fink (2010), Fink et al. (2011), and Ezeh et al. (2014) find a negative association between the quality of sanitation and water facilities and the mortality of children. Among others, Kremer et al. (2011) and Njuguna (2019) argue that health effects can be realized through investments in spring protection and sanitation facilities in Kenya. We focus on development projects financed by the *World Bank* and on outcomes related to the WASH sector.

The *World Bank*, being the largest financier of development aid,[6] and its project were evaluated by few independent impact evaluations:[7] Dreher et al. (2013) examine the ex-post performance ratings of (politically motivated) *World Bank* projects; Dollar and Svensson (2000) analyze the causes of success or failure of adjustment programs, using a new database on 220 reform programs; Kaufmann and Wang (1995) investigate the relationship between economy-wide policies and the performance of investment projects in education and health sectors; Isham and Kaufmann (1999) test how country characteristics and policies affect *World Bank*-funded investment productivity; Kareiva et al. (2008) evaluate biodiversity-focused *World Bank* projects with regards to poverty reduction and private sector development; Newman et al. (2002) conducted an impact evaluation of small-scale rural infrastructure projects in health, water, and education financed by the Bolivian Social Investment Fund; Wagstaff and Yu (2007) and Zhang (2012) investigate the effect of a health reform in China and of a major water quality improvement program in rural China on the health of adults and children. By combining information on *World Bank* projects with individual responses to water- and health-related questions from worldwide *Demographic and Health Surveys* (DHS), we contribute to better understanding whether projects were successful or not.[8]

[6] Federal Ministry for Economic Cooperation and Development Germany (2019)

[7] The *World Bank* Group itself has an independent evaluation function, which assesses the performance of the institution's policies, projects and processes (IEG Methodology, 2019). Most certainly, this body has more insights into projects than the external observer, nevertheless we believe in the benefits of a purely independent view from an outside perspective.

[8] The DHS data is frequently used to analyze health- and water-related questions. E.g. Capuno et al. (2015), Fotso et al. (2007), Doherty et al. (2016), Liwin and Houle (2019), Harttgen et al. (2019), Li et al. (2019) and Wang (2002) look at child mortality in the Philippines, South Africa, Ethiopia, Sierra Leone, Asian and Sub-Saharan countries, African countries and low-income countries.

III. DATA AND METHODOLOGY

DATA AND MATCHING

We combine data from various *Demographic and Health Surveys* (DHS) with *World Bank* projects based on the geographical proximity of their latitudinal and longitudinal coordinates, i.e. we perform matching by geo-codes.

The DHS program is implemented by ICF International and is mainly funded by the *United States Agency for International Development* (USAID). Since 1984 it collects nationally-representative household survey data through more than 400 surveys, in more than 90 countries.[9] Usually, sample size per country and year lies between 5,000 and 30,000 respondents and surveys are conducted about every 5 years to allow comparisons over time (see ICF International (2019b) for more information). Their surveys are complemented with a variety of geographic information from the *Geographic Information System* (GIS), which makes it possible to merge DHS data with other datasets.

For our analysis we use existing DHS grouping of individual respondents into geographical clusters, which are a representative selection of (segments of large) *Enumeration Areas* (EA), a statistical unit created as a counting unit for a census. For every survey year, DHS selects a number of EAs by probability proportional to size and a number of households by equal probability systematic sampling (see ICF International (2012) for more information). Clusters are consecutively numbered, and their center is indicated through the specification of latitude and longitude.[10] For instance, in the case of Senegal, DHS conducted nine surveys between 1992 and 2016. The country is separated into a maximum of 14 gapless and non-overlapping regions (which resemble Senegal's current political regions) and further divided into 258 to 428 clusters for which between 6,310 and 19,441 interviews were conducted. On average this corresponds to around 50 respondents per cluster. The selection process of clusters and households allows for a theoretically non-biased statistical analysis and the DHS provides arguably one of the largest, thoroughly

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[9] DHS data is extensively used in literature on drinking water quality, water collection time, toilet types and child mortality (see, e.g. Doherty et al., 2016, Liwin and Houle, 2019, Harttgen et al., 2019, Li et al., 2019 and other literature mentioned above).

[10] Due to changing EAs or reasons to protect the privacy of respondents (e.g., displacement of up to 10 km; see ICF International (2019a)) cluster coordinates might deviate from the coordinates of the respective cluster in the first survey year. In a robustness check we create a cluster sub-sample that allows for a maximum latitude deviation of 10% to account for such changes in EAs.

conducted surveys in the field of demographics and health. We will employ data of about 1.8 million individual answers from 153 surveys in 38 countries.

The focus of our analysis is the effectiveness of *World Bank* projects, which services aim at reaching individuals in a certain geographic area. Similar to the established literature, we use the following four dependent variables to evaluate the effectiveness of *World Bank* projects. Firstly, we have created an index variable called *Quality of drinking water* which recodes individual qualitative responses to the question “What is your main source of drinking water” into numerical values reflecting the quality of drinking water. It ranges between 1 and 5.[11] *Quality of drinking water* is positively correlated (0.29) with a composite for nightlights, which can be seen as a proxy for the development state of the area (see e.g., Henderson et al., 2012). We also capture individual responses to the question “How many minutes does it take you to get to the water source for drinking water?”, called *Time to water*. Thirdly, we introduce another index variable called *Type of toilet*, which is also recoded from a qualitative description of the used toilet facility into numeric values ranging from 0 to 5.[12] Lastly, we want to explore the effect of the presence of the *World Bank* on child health. We employ a variable called *No of dead kids* that summarizes answers to the following question: “How many of your own children (boys and girls) have died?”.

In addition to our four dependent variables we add various control variables linked to geographic conditions (such as rainfall, temperature, distance to rivers/sea and borders, droughts, malaria prevalence, nightlight composite and a dummy for whether the cluster is considered to be urban or rural), population, average education level and age, religious shares and the relation to and gender of the household head. Further data descriptions, descriptive statistics and sources can be found in table A.1 in the appendix as well as in table I in the supplementary material.

For our analysis we use individual data for countries, for which we found ongoing or past *World Bank* activities and where we have at least two DHS survey years available. We end up with data for 38 countries, 20 of them are lower-income, 13 are lower-middle income and 5 are upper-

[11] For example, rainwater is of low quality (integer equals 1) and drinking water that is piped into the dwelling is of high quality (integer equals 5).

[12] Similarly to *Quality of drinking water*, a qualitative description of the toilet facility was transformed into a numeric value. For example, a flush toilet is reflected by the integer 5 and therefore qualitatively higher than a pit latrine reflected by the integer 3.

middle-income countries according to the *World Bank* classification, from 153 surveys, containing 1,793,783 individual responses to water and health specific questions.

We merge individual responses from the DHS with data on *World Bank* projects between 1986 and 2017[13], based on their geocodes. In order to match every *World Bank* project with at least one DHS selected cluster, we allow for small deviations in their latitude and longitude coordinates.[14] An illustrative example for the matching procedure for Angola in the survey year 2015 can be found in the Appendix (Illustration 1). In the example we were able to identify 12 clusters to have access to one of the three *World Bank* projects at that time.[15] Clusters with access to *World Bank* projects will serve as the treated group while the remainder serves as the non-treated group. Performing our geographic based matching, we can analyze 14,301 ongoing and 4,231 past *World Bank* projects on individuals welfare within DHS clusters.

We code a dummy variable whether a *World Bank* project is currently running in a cluster, i.e whether it is ongoing or started at least one year before a survey was conducted, such that an individual could benefit from it. For further investigations we also code past *World Bank* projects i.e. projects that have ended at the latest in the same year than the respective survey in the cluster. By this, we find that on average 26% of our respondents had access to ongoing projects and about 8% to past projects. Further, we distinguish between projects in the water sector and all other sectors (such as infrastructure, health, energy etc.).[16] Lastly, we not only track the presence of a project (dummy variable), but also the number of ongoing and past projects, their budgets in U.S. Dollars[17] and the number of years that lie between the completion of a past project and the respective survey.

IDENTIFICATION STRATEGY

We analyze whether an individual, living in a geographic DHS cluster that is close to a *World Bank* project, experiences improvements in the access to and the quality of drinking water, in

[13] More information can be found at *World Bank* (2018).
[14] Differences start from 0.05 degrees and gradually increase in 0.01 steps until at least one match is obtained. A 0.05 degree change in latitude always corresponds to a change of 5.6 km. Depending on the latitude, a 0.05 degree change of longitude corresponds to a change of 0 to 5.6km.
[15] We also added an example of a location map of a cluster (see illustration 2).
[16] Usually, *World Bank* budgets are not 100% dedicated to a single sector. We therefore choose the sector with the highest percentage for our classification (find further details on sector allocation in table II of the supplementary material).
[17] The *World Bank* reports budgets on country-level only. Therefore, we need to assume that the budget is split equally among regions, which leaves us with a low variation.

sanitation facilities and in child mortality, compared to an individual not living in the vicinity of a *World Bank* project.

Given our data, the empirical strategy is straightforward and follows a conventional Ordinary Least Squares model. Our baseline setting allows us to account for cluster- and time-specific heterogeneity by the inclusion of corresponding fixed effects. Our estimation equation to predict LIFE_QUALITY[18] of individual i in cluster c at time t is specified as follows:

$$(\text{LIFE\_QUALITY})_{i,\text{c},t} = \beta(WBcurrent)_{\text{c},t} + \gamma\boldsymbol{X}_{\boldsymbol{i},\mathbf{c},\boldsymbol{t}} + \omega_c + \pi_t + \epsilon_{i,\text{c},t} \qquad (1)$$

where *WBcurrent* is a dummy variable, which is 1 if individual i was interviewed in a cluster which is in the vicinity of an ongoing *World Bank* project and 0 if not. $\boldsymbol{X}_{\boldsymbol{i},\boldsymbol{c},\boldsymbol{t}}$ represents the vector of control variables and ω_c and π_t introduce cluster- and time-fixed effects, respectively. Cluster-fixed effects account for any constant cluster-specific unobservables (e.g., cluster-specific culture that promotes business acumen, strong village leaders promoting development rather than nepotism etc.) whereas time-fixed effects account for contemporary global phenomena. As clusters are nested within countries, cluster-fixed effects capture automatically all country-specific time-invariant variables. As such, we are able to identify the effect of *World Bank* projects by comparing the *ceteris-paribus* situation before and after the project. Basically, we have a *Diff-in-Diff* setting which analyses the differential effect of a treatment (i.e., *World Bank* project) on a treatment group (i.e., access to *World Bank* project) versus a control group (i.e., no access to *World Bank* project). We use a large amount of observational study data with the intention to come close to the experimental research. $\epsilon_{i,c,t}$ is an error term.[19]

IV. THE INFLUENCE OF *WORLD BANK* PROJECTS ON INDIVIDUAL WELFARE

MAIN EMPIRICAL RESULTS

In table 1 we present the results for equation (1) which estimates the effect of current *World Bank* projects on the water collection time, quality of drinking water, type of toilets and number of

[18] LIFE_QUALITY is either time to water, quality of drinking water, quality of toilets or the number of late children.
[19] If not indicated differently, we apply robust standard errors clustered at the (geographical) cluster level.

late children, separately. We always account for a full set of fixed-effects to exclude potentially distorting cluster- or time-specific effects.

In regressions without control variables (specifications (1), (3), (5), (7)) we find that the presence of a *World Bank* project reduces the average walking time to the next drinking water source by 5 minutes and the average number of late children by 0.1. In addition, the presence of a *World Bank* project improves the quality of drinking water as well as the type of toilet that is being used by around 0.5 to 0.6 (which reflects an increase of about 10%). In all specifications the coefficients of interest are statistically significant. Thus, the presence of a *World Bank* project positively affects the quality of life of near-by individuals in comparison to an individual in a control cluster which did not see any *World Bank* project.

In specifications (2), (4), (6) and (8) we account for a set of geography-, religion- and household-specific control variables which are increasing the explanatory power of our model. They also contribute to further reducing potential omitted variable bias. We face a relevant reduction of observations, as not all control variables are available for all observations. Our main findings remain qualitatively similar and statistically significant. Regarding the magnitudes of the coefficients, we observe that *World Bank* projects contribute to a reduction of time to water (3 minutes) and late children (0.02 children) and an increase of the quality of drinking water (0.11) and the type of toilet (0.06).

Given our evaluation approach and the size of our dataset, we briefly refer to some potentially interesting covariates. There are a few covariates that seem to have a significant influence on our variables in question: nightlights composite seems to be an indicator for the development status of the cluster, as higher nightlights reduce time to water and the number of dead children and increases the quality of drinking water and the type of toilet. Same correlation holds for individuals living in urban areas. Higher malaria prevalence (linked to humidity of the area), lower average yearly temperature and a male head of the household (potentially linked to a higher income) are related to a lower walking time to the next drinking water source. Higher education is negatively related to the number of diseased children and positively related to the quality of drinking water and the type of toilet, pointing to potential selection effects of the educated. Religious affiliations of the questioned individuals show effects on all four dependent variables.

Table 1: Baseline regressions for the effect of current *World Bank* projects on time to water, quality of drinking water, type of toilet and number of dead children when accounting for cluster and time fixed effects and control variables

Dependent variable	(1) Time to water	(2) Time to water	(3) Quality of drinking water	(4) Quality of drinking water	(5) Type of toilet	(6) Type of toilet	(7) No of dead kids	(8) No of dead kids
Current World Bank Project Dummy	**-4.810*** (0.297)**	**-2.962*** (0.716)**	**0.596*** (0.018)**	**0.114*** (0.033)**	**0.533*** (0.016)**	**0.056* (0.031)**	**-0.107*** (0.004)**	**-0.017** (0.007)**
Nightlights_Composite		-0.128** (0.061)		0.033*** (0.003)		0.021*** (0.004)		-0.003*** (0.001)
All_Population_Count		0.000 (0.000)		0.00000*** (0.000)		0.00000*** (0.000)		-0.00000*** (0.000)
All_Population_Density		0.0002** (0.0001)		-0.00001*** (0.000)		0.00002*** (0.00001)		-0.00000* (0.000)
Drought_Episodes		-0.079 (0.139)		-0.001 (0.006)		0.009* (0.005)		0.002* (0.001)
Malaria_2000_2015		-2.918** (1.322)		-0.09 (0.067)		0.212*** (0.05)		-0.014 (0.011)
Proximity_to_National_ Borders		0.000 (0.000)		-0.00000** (0.000)		0.000 (0.000)		-0.00000*** (0.000)
Proximity_to_Water		0.000 (0.000)		-0.00000*** (0.000)		-0.00000*** (0.000)		0.00000*** (0.000)
Rainfall_1985_2015		-0.001 (0.001)		-0.0003*** (0.00004)		0.0001*** (0.00004)		-0.00002** (0.00001)
Jan_Dec_Temp		0.667*** (0.134)		0.036*** (0.007)		-0.041*** (0.006)		0.004** (0.001)
Urban		-7.248*** (0.625)		1.275*** (0.037)		0.932*** (0.034)		-0.148*** (0.007)
Years_educ		0.115*** (0.034)		0.007*** (0.001)		0.012*** (0.001)		-0.014*** (0.001)
Age		-0.008 (0.007)		0.002*** (0.0003)		0.005*** (0.0003)		0.032*** (0.0003)

Table 1 continued: Baseline regressions for the effect of current *World Bank* projects on time to water, quality of drinking water, type of toilet and number of dead children when accounting for cluster and time fixed effects and control variables

Dependent variable	(1) Time to water	(2) Time to water	(3) Quality of drinking water	(4) Quality of drinking water	(5) Type of toilet	(6) Type of toilet	(7) No of dead kids	(8) No of dead kids
Relation_Household_ head		-0.048*		0.008***		0.022***		0.002***
		(0.028)		(0.001)		(0.001)		(0.0004)
Gender_household_ head		-0.417**		-0.037***		0.073***		0.028***
		(0.172)		(0.006)		(0.007)		(0.003)
Christian		1.042***		-0.055***		-0.049***		0.029***
		(0.325)		(0.011)		(0.01)		(0.005)
Muslim		0.156		0.026		0.008		0.089***
		(0.445)		(0.018)		(0.018)		(0.007)
No_religion		1.717**		-0.275***		-0.436***		0.084***
		(0.808)		(0.033)		(0.03)		(0.013)
Traditional		1.787*		-0.245***		-0.457***		0.158***
		(0.958)		(0.045)		(0.051)		(0.029)
Cluster FE	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1,368,255	244,498	1,596,132	284,508	1,742,308	293,810	1,793,783	301,728
R2	0.329	0.374	0.459	0.585	0.417	0.444	0.091	0.228
Residual Std. Error	25.406 (df=1,338,244)	27.836 (df=235,659)	1.184 (df=1,562,440)	1.027 (df=275,419)	1.334 (df=1,708,031)	1.115 (df=284,715)	0.845 (df=1,759,504)	0.657 (df=292,631)
F Statistic	21.83***	15.95***	39.29***	42.79***	35.69***	25.04***	5.128***	9.508***

Note: The regressions estimate the effect of the existence of a current World Bank Project on four dependent variables: time to water, quality of drinking water, type of toilet, number of dead kids. Regressions are run with the full dataset without and with the full set of control variables as well as cluster and time fixed effects. Robust clustered standard error estimates (Cluster-level) are presented below the coefficients. The omitted category for the religious denomination is "Other". Significance levels are indicated by *p<0.1; **p<0.05; ***p<0.01.

In addition to the presence of a *World Bank* project (indicated by a dummy variable), we conduct the same set of regressions as in table 1 for the number of current *World Bank* projects. Table 2 shows that the number of projects has a statistically significant effect on the quality of life of individuals.[20] For every additional project in the cluster, time to water is reduced by 1 minute, the quality of drinking water and the quality of toilet is increased by 0.16 and the number of late children is reduced by 0.03 when no additional controls apart from fixed effects are added. The case with control variables still shows significant results (except for the number of dead children) but with a smaller magnitude. Thus, more projects are associated with higher outcomes. The reduced magnitude of the coefficients in comparison to table 1 suggests that not only the number of projects is of relevance in a cluster but potentially the pure presence of the *World Bank* with one project can help to induce positive effects. Under the assumption that our fixed-effects strategy captures all relevant confounding factors, *World Bank* projects causally affect the time to water sources, the quality of drinking water and the type of toilets, while there is no statistically significant relationship with the number of dead children once additional controls are included.

Our general results are largely consistent with the literature (see, e.g. Botting et al., 2010, Gopalan and Rajan, 2016 and Wayland, 2017 who all run country-level analyses for individual instead of cluster level analyses[21]). We systematically extend and refine existing analyses by looking at the cluster-level with a large set of fixed-effects and show that past results are upheld in a conservative setting. Therefore, existing results from the country-level are largely confirmed. For now, we looked at all *World Bank* projects – independent of their target sector e.g., water and sanitation, infrastructure, health, etc. The fact that our findings are sector-independent suggests that the pure presence and visibility of the *World Bank* in certain clusters may have strong spillover effects on the four water and health related indicators we are interested in.

[20] A full table with all covariates can be found in the appendix (Table A.2).
[21] The country-level perspective of these studies limits their observations to a few hundred. Due to our cluster focus we are able to include close to 2 million observations which is a multiple of several thousands.

Table 2: Baseline regressions for the effect of the number of *World Bank* projects on time to water, quality of drinking water, type of toilet and number of dead children when accounting for cluster and time fixed effects and control variables

Dependent variable	(1) Time to water	(2) Time to water	(3) Quality of drinking water	(4) Quality of drinking water	(5) Type of toilet	(6) Type of toilet	(7) No of dead kids	(8) No of dead kids
No of Current World Bank Projects	**-1.043***** **(0.079)**	**-0.760***** **(0.231)**	**0.164***** **(0.006)**	**0.037***** **(0.012)**	**0.164***** **(0.005)**	**0.031***** **(0.012)**	**-0.027***** **(0.001)**	**0.001** **(0.003)**
Cluster FE	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Control variables	NO	YES	NO	YES	NO	YES	NO	YES
Observations	1,368,255	244,498	1,596,132	284,508	1,742,308	293,810	1,793,783	301,728
R2	0.328	0.374	0.457	0.585	0.418	0.445	0.09	0.228
Residual Std. Error	25.423 (df=1,338,244)	27.841 (df=235,658)	1.186 (df=1,562,440)	1.027 (df=275,419)	1.334 (df=1,708,031)	1.115 (df=284,715)	0.845 (df=1,759,504)	0.657 (df=292,631)
F Statistic	21.74***	15.93***	38.99***	42.77***	35.78***	25.05***	5.104***	9.506***

Note: The regressions estimate the effect of the number of current World Bank Projects on four dependent variables: time to water, quality of drinking water, type of toilet, number of dead kids. Regressions are run with the full dataset without and with the full set of control variables as well as cluster and time fixed effects. Robust clustered standard error estimates (Cluster-level) are presented below the coefficients. Control variables are: Nightlights_Composite, All_Population_Count, All_Population_Density, Drought_Episodes, Malaria_2000_2015, Proximity_to_National_Borders, Proximity_to_Water, Rainfall_1985_2015, Jan_Dec_Temp, Urban, Years_educ, Age, Relation_Household_head, Gender_household_head, Christian, Muslim, No_religion, Traditional. The omitted category for the religious denomination is "Other". Significance levels are indicated by *p<0.1; **p<0.05; ***p<0.01.

ROBUSTNESS TESTS

In table 3 we present the results for different robustness tests. They provide overall support for the previously found links between the presence of the *World Bank* and our four dependent variables for individual welfare.

From survey year to survey year clusters do not have precisely the same latitude and longitude in some instances. Such deviations are small and can be associated with small changes in sub-national administration units or the protection of the privacy[22] of respondents and household members by DHS. For a first robustness test presented in row (1), we create a subsample that contains only those clusters that deviate to a maximum of 10% from the latitude of the first survey year. Our results are robust for this reduced set of comparable clusters with a small decrease of magnitude for the case without controls (1) and an even smaller change in coefficients for the case with controls (2).

Next, we substitute the cluster fixed effects with administrative region-time (row 2) and country-time (row 3) fixed effects, respectively. The empirical results reveal again a robust negative relationship between *World Bank* projects and time to water and number of dead children and a positive relationship with quality of drinking water and type of toilet. Quantitatively, coefficients tend to be slightly reduced in the setting with region-time fixed effects but increased in the setting with country-time fixed effects.

In row (4), we are looking at the influence of the target sector the *World Bank* operates in. All previous results have shown that any project, independent of its sector, has an effect on individual welfare. We now investigate if this also holds when investigating only water related projects (e.g. building reservoir dam, installing sewage systems etc.). Coefficients are statistically significant in estimations without additional controls. The effect of water projects in regressions without controls is higher than in our baseline regressions. Thus, *World Bank* projects tend to achieve their aims. As we also find effects on individual welfare of projects independently of the sector in which the *World Bank* is active, there might be a possibility for spillover effects, i.e.

[22] Through the displacement of EAs in urban areas by up to two kilometers and up to five kilometers for rural EAs, with one percent of randomly selected rural clusters displaced a distance up to ten kilometers, DHS ensures that neither the individual nor the household can be identified.

projects which are not directly targeted at water outcomes may also help improve individual welfare in domains which are usually more closely related to the water sector.

We also explore whether results vary if we consider answers of female respondents only (row 5). The literature argues that women often tend to be a target group and therefore might benefit more from water-related development projects. We are looking at surveys that questioned only women, assuming that the effect of projects for female respondents might be higher. Especially in the case of time to water, we expect a stronger reduction of minutes for women, as they are assumed to be the primary fetchers of water (e.g., Gross et al., 2017, Ilahi and Grimard, 2000, Koolwal and van de Walle, 2013, Ray, 2007, Sorenson et al., 2011). We observe a relevant drop in the number of observations, as the DHS data does not provide gender information on a respondent's basis. Instead, we can distinguish only between the fact that the survey targets both sexes (dummy equals 0) or women only (dummy equals 1). Our previous results emerge in cases without additional control variables. Thus, our results do not allow us to conclude that women or men profit more from *World Bank* projects.

The same table for the number of *World Bank* projects can be found in the appendix (table A.3).

Table 3: Summary of robustness tests for the effect of current *World Bank* projects on four selected water and health indicators

	Test	Description	Variable	Results for Current World Bank (Water) Project Dummy	
				(1) **FE and no controls**	**(2)** **FE and all controls**
(1)	Comparable Clusters	Some cluster's latitude and longitude (e.g., cluster number 1 in Egypt) show a significant deviation from the latitude and longitude reported in the first survey year (due to change of borders, protection of exact individual's location etc.). We create a subsample with clusters that deviate to a maximum of 10% from the first survey year in order to have a set of comparable clusters and conduct baseline regressions with cluster fixed effects and clustered standard errors on cluster-level.		**Confirmed**	
			Time to water	*-3.296*** (0.415)*	*-2.812** (1.217)*
				895,014	143,255
				Confirmed	
			Quality of drinking water	*0.496*** (0.024)*	*0.084* (0.048)*
				1,062,392	164,609
				Confirmed for the case without controls	
			Type of toilet	*0.481*** (0.023)*	*0.042 (0.044)*
				1,166,117	169,372
				Confirmed	
			No of dead kids	*-0.101*** (0.005)*	*-0.026*** (0.010)*
				1,200,319	173,530
(2)	Region-time fixed effects	We conduct baseline regressions with region-time fixed effects and clustered standard errors on region-level.		**Confirmed**	
			Time to water	*-3.549*** (0.498)*	*-3.120*** (0.664)*
				1,368,255	244,498
				Confirmed	
			Quality of drinking water	*0.423*** (0.027)*	*0.147*** (0.039)*
				1,596,132	284,508
				Confirmed	
			Type of toilet	*0.389*** (0.027)*	*0.052* (0.028)*
				1,742,308	293,810
				Confirmed	
			No of dead kids	*-0.069*** (0.006)*	*-0.014*** (0.004)*
				1,793,783	301,728
(3)	Country-time fixed effects	We conduct baseline regressions with country-time fixed effects and clustered standard errors on country-level.		**Confirmed**	
			Time to water	*-5.015*** (1.085)*	*-2.894*** (0.923)*
				1,368,255	244,498
				Confirmed	
			Quality of drinking water	*0.669*** (0.071)*	*0.166*** (0.058)*
				1,596,132	284,508
				Confirmed	
			Type of toilet	*0.599*** (0.062)*	*0.070* (0.038)*
				1,742,308	293,810
				Confirmed	
			No of dead kids	*-0.109*** (0.013)*	*-0.014*** (0.005)*
				1,793,783	301,728

Table 3 continued: Summary of robustness tests for the effect of current *World Bank* projects on four selected water and health indicators

	Test	Description	Variable	Results for Current World Bank (Water) Project Dummy (1) FE and no controls	(2) FE and all controls
(4)	Water World Bank Projects	Previous regressions consider the sector-independent presence of a World Bank project. Here, we conduct baseline regressions with current World Bank projects in the field of water, sanitation and sewage. We include cluster fixed effects and clustered standard errors on cluster-level.		**Confirmed**	
			Time to water	*-5.605*** (0.428)*	*-5.609*** (0.930)*
				1,368,255	244,498
				Confirmed for the case without controls	
			Quality of drinking water	*0.624*** (0.028)*	*0.009 (0.045)*
				1,596,132	284,508
				Confirmed for the case without controls	
			Type of toilet	*0.525*** (0.026)*	*-0.037 (0.046)*
				1,742,308	293,810
				Confirmed for the case without controls	
			No of dead kids	*-0.115*** (0.006)*	*-0.010 (0.010)*
				1,793,783	301,728
(5)	Women	We create a subsample with with surveys that report answers of female interviewees only and conduct baseline regressions with cluster fixed effects and clustered standard errors on cluster-level.		**Confirmed** for the case without controls	
			Time to water	*-2.721*** (0.611)*	*-1.370 (2.785)*
				296,306	32,598
				Confirmed for the case without controls	
			Quality of drinking water	*0.484*** (0.048)*	*-0.007 (0.092)*
				426,161	50,251
				Confirmed for the case without controls	
			Type of toilet	*0.438*** (0.040)*	*0.107 (0.074)*
				467,137	52,215
				Confirmed for the case without controls	
			No of dead kids	*-0.063*** (0.008)*	*-0.019 (0.016)*
				481,511	53,132

Note: The regressions estimate the effect of the existence of a current World Bank (water) project on four dependent variables (time to water, quality of drinking water, type of toilet, number of dead kids) for a number of robsutness checks including fixed effects and robust clustered standard error estimates; Coefficients (Clustered Std. Errors) for specifications without controls are reported in columns (1), whereas coefficients (Clustered Std. errors) for specifications with all control variables are reported in columns (2); The number of observations is listed below the respective coefficient (Clustered Std. Error). Control variables are: Nightlights_Composite, All_Population_Count, All_Population_Density, Drought_Episodes, Malaria_2000_2015, Proximity_to_National_Borders, Proximity_to_Water, Rainfall_1985_2015, Jan_Dec_Temp, Urban, Years_educ, Age, Relation_Household_head, Gender_household_head, Christian, Muslim, No_religion, Traditional. The omitted category for the religious denomination is "Other". Significance levels are indicated by *p<0.1; **p<0.05; ***p<0.01.

MECHANISMS

Past literature has outlined that the effectiveness of aid is dependent on the general state of development in the considered area (see, e.g. Burnside and Dollar, 2000, Collier and Dollar, 2002, Chauvet and Guillaumont, 2003, etc.). Assuming that the effectiveness of *World Bank* projects is also dependent on the state of development, we explore potential mechanisms for three different development indicators (education, nightlights and income) in table 4.

We start by separating our sample into highly educated individuals (years of schooling equal or above sample mean) and individuals with low education in rows (1) and (2) of table 4 respectively. All previous results emerge for individuals with low and high education. Comparing the coefficients suggests that individuals with a higher education may benefit more from *World Bank* projects as they tend to have significantly shorter ways to the next drinking water source than less educated individuals. For the other three variables, quality of drinking water, type of toilet and number of dead children, we find no tangible difference, whereas results for the latter are mostly insignificant in the presence of control variables.

Next, we explore whether *World Bank* projects are more beneficial for individuals living in clusters with a high (equal or above sample mean) or a low nightlights composite in rows (3) and (4), respectively. We have to allow for a significant drop in observations in high-nightlights-regressions, as DHS surveys are mostly conducted in areas with lower development. Nevertheless, we see a strong tendency for all our four variables, that *World Bank* projects tend to be more successful in “darker” clusters as their coefficients are higher or at least significant.

These results are also confirmed when we go from the development state of clusters (expressed in terms of nightlights) to the development state of countries and distinguish between low- and middle-income countries. In all regressions without controls we find higher coefficients for individuals living in low income countries, indicating that projects can have a bigger effect in those countries.

The same table for the number of *World Bank* projects can be found in the appendix (table A.4).

Table 4: First mechanism testing the effect of current *World Bank* projects on four selected water and health indicators for clusters in different development states (expressed in terms of education, nightlights and income)

	Test	Description	Variable	Results for Current World Bank Project Dummy	
				(1) **FE and no controls**	**(2)** **FE and all controls**
(1)	High education	We create a subsample with individuals that have year's of schooling equal to or above the mean for the entire sample and conduct baseline regressions with cluster fixed effects and clustered standard errors on cluster-level.	Time to water	**Confirmed**	
				*-5.851*** (0.415)*	*-3.071*** (0.880)*
				408,493	109,593
			Quality of drinking water	**Confirmed**	
				*0.586*** (0.021)*	*0.106*** (0.039)*
				469,265	129,501
			Type of toilet	**Confirmed** for the case without controls	
				*0.422*** (0.017)*	*0.059 (0.037)*
				519,513	134,329
			No of dead kids	**Confirmed** for the case without controls	
				*-0.052*** (0.004)*	*-0.006 (0.009)*
				536,597	137,991
(2)	Low education	We create a subsample with individuals that have year's of schooling below the mean for the entire sample and conduct baseline regressions with cluster fixed effects and clustered standard errors on cluster-level.	Time to water	**Confirmed**	
				*-4.944*** (0.291)*	*-2.664*** (0.740)*
				529,181	134,905
			Quality of drinking water	**Confirmed**	
				*0.608*** (0.020)*	*0.115*** (0.035)*
				598,501	155,007
			Type of toilet	**Confirmed**	
				*0.483*** (0.018)*	*0.048 (0.032)*
				676,336	159,481
			No of dead kids	**Confirmed**	
				*-0.065*** (0.003)*	*-0.030*** (0.008)*
				699,450	163,737
(3)	High nightlights	We create a subsample with individuals that have a nightlights composite equal to or above the mean for the entire sample and conduct baseline regressions with cluster fixed effects and clustered standard errors on cluster-level.	Time to water	**Not confirmed**	
				-0.848 (0.777)	*3.700 (5.419)*
				216,283	34,085
			Quality of drinking water	**Confirmed** for the case without controls	
				*0.108*** (0.033)*	*0.167 (0.285)*
				303,185	40,083
			Type of toilet	**Confirmed** for the case without controls	
				*0.215*** (0.042)*	*0.169 (0.288)*
				348,980	43,200
			No of dead kids	**Confirmed** for the case with controls	
				-0.014 (0.009)	*-0.124* (0.067)*
				360,103	44,373

Table 4 continued: First mechanism testing the effect of current *World Bank* projects on four selected water and health indicators for clusters in different development states (expressed in terms of education, nightlights and income)

Test		Description	Variable	Results for Current World Bank Project Dummy (1) FE and no controls	(2) FE and all controls
(4)	Low nightlights	We create a subsample with individuals that have a nightlights composite below the mean for the entire sample and conduct baseline regressions with cluster fixed effects and clustered standard errors on cluster-level.	Time to water	**Confirmed** *-4.119*** (0.381)* 1,056,378	*-3.478*** (0.846)* 210,413
			Quality of drinking water	**Confirmed** *0.416*** (0.021)* 1,206,379	*0.096** (0.037)* 244,425
			Type of toilet	**Confirmed** for the case without controls *0.344*** (0.019)* 1,293,699	*-0.024 (0.033)* 250,610
			No of dead kids	**Confirmed** *-0.081*** (0.005)* 1,331,145	*-0.014* (0.007)* 257,355
(5)	Lower middle income and higher middle income	We create a subsample with countries that are classified as lower-middle or higher-middle-income-countries and conduct baseline regressions with cluster fixed effects and clustered standard errors on cluster-level.	Time to water	**Confirmed** *-3.435*** (0.617)* 424,488	*-2.056* (1.132)* 90,869
			Quality of drinking water	**Confirmed** *0.427*** (0.028)* 527,653	*0.271*** (0.072)* 92,670
			Type of toilet	**Confirmed** *0.513*** (0.031)* 616,716	*0.308*** (0.072)* 100,262
			No of dead kids	**Confirmed** for the case without controls *-0.079*** (0.007)* 635,145	*-0.006 (0.013)* 103,134
(6)	Low-income countries	We create a subsample with countries that are classified as low-income-countries and conduct baseline regressions with cluster fixed effects and clustered standard errors on cluster-level.	Time to water	**Confirmed** *-5.366*** (0.371)* 801,309	*-3.348*** (0.908)* 153,629
			Quality of drinking water	**Confirmed** for the case without controls *0.692*** (0.023)* 920,341	*0.031 (0.036)* 191,838
			Type of toilet	**Confirmed** for the case without controls *0.557*** (0.019)* 935,642	*-0.009 (0.029)* 193,548
			No of dead kids	**Confirmed** *-0.126*** (0.005)* 961,519	*-0.022*** (0.008)* 198,594

Note: The regressions estimate the effect of the existence of a current World Bank project on four dependent variables (time to water, quality of drinking water, type of toilet, number of dead kids) for a number of subsets including fixed effects and robust clustered standard error estimates; Coefficients (Clustered Std. Errors) for specifications without controls are reported in columns (1), whereas coefficients (Clustered Std. errors) for specifications with all control variables are reported in columns (2); The number of observations is listed below the respective coefficient (Clustered Std. Error). Control variables are: Nightlights_Composite, All_Population_Count, All_Population_Density, Drought_Episodes, Malaria_2000_2015, Proximity_to_National_Borders, Proximity_to_Water, Rainfall_1985_2015, Jan_Dec_Temp, Urban, Years_educ, Age, Relation_Household_head, Gender_household_head, Christian, Muslim, No_religion, Traditional. The omitted category for the religious denomination is "Other". Significance levels are indicated by *p<0.1; **p<0.05; ***p<0.01.

In a second mechanism we explore the relevance of already completed *World Bank* projects, i.e., projects that ended at the latest in the year of the respective DHS survey. We augment our estimation equation as follows:

$$(\text{LIFE\_QUALITY})_{i,\text{c},t} = \beta_1(WBcurrent)_{i,\text{c},t} + \beta_2(WBpast)_{i,\text{c},t} + \\ + \beta_3(WBcurrent)_{i,\text{c},t} \cdot (WBpast)_{i,\text{c},t} + \gamma \boldsymbol{X}_{\boldsymbol{i},\mathbf{c},\boldsymbol{t}} + \omega_c + \pi_t + \epsilon_{i,\text{c},t} \qquad (2)$$

With β_2 capturing the lasting effect of past projects. β_3 is an interaction term between current and past projects and reflects whether current projects have an even larger effect if there already has been a past project in the same geographic area. Thereby, we investigate whether the quality of life of individuals is rather influenced in the short-term (i.e., the effect of an ongoing project is dominant), in the long-term (i.e., the effect occurs a few years after a project was completed) or in circumstances where a past project is followed up by a new project. The interest lies in contributing to the question of the sustainability of development projects (see e.g., Gary and Maurel, 2015, Easterly, 2014, Moyo, 2010). Note that potential effects of past projects can hardly be uncovered through standard field experiments.

Table 5 summarizes the results for four different specifications for each of our for different dependent variables. Columns (1), (5), (9) and (13) show regressions for the dummy variable for past projects without any covariates and without the control for current projects. Coefficients for past projects have the same sign as coefficients for current projects in earlier specifications. They suggest a statistically significant effect of past projects on our four indicators. However, except for the variable time to water, all coefficients reflecting the influence of past *World Bank* projects lose their significance as soon as control variables are included (columns (2), (6), (10) and (14)). Columns (3), (7), (11) and (15) now also add the dummy variable current projects. Current projects have a statistically significant effect on our welfare indicator but now the coefficient for past projects becomes statistically insignificant in most cases. Only the variable time to water seems to benefit from current and past projects, whereas the latter's effect is twice as strong. The remaining columns show the results for the interaction term between current and past projects, which is never statistically significant and also makes the coefficient for past projects statistically insignificant in all specifications. Current *World Bank* projects continue to exert a positive and statistically significant influence on individual welfare, i.e. current projects decrease the time to water, increase the quality of drinking water, improve the reported toilet type and decrease child mortality.

Overall, the results in table 5 can be interpreted in the following way: The effect of past projects is likely to subside over time. Only current projects seem to have an effect on individual welfare. Consequently, the long-term sustainable effects of *World Bank* projects might be questioned.

Table 5: First mechanism testing the effect of current and past *World Bank* projects on four selected water and health indicators

Dependent variable	(1) Time to water	(2) Time to water	(3) Time to water	(4) Time to water	(5) Quality of drinking water	(6) Quality of drinking water	(7) Quality of drinking water	(8) Quality of drinking water
Past World Bank Projects Dummy	-4.478***	-5.868***	-4.986***	-2.159	0.421***	0.047	-0.001	0.081
	(0.437)	(1.011)	(1.002)	(2.098)	-0.028	-0.051	(0.054)	(0.128)
Current World Bank Projects Dummy			-2.099***	-1.862**			0.114***	0.121***
			(0.717)	(0.741)			(0.035)	(0.036)
Current World Bank Projects Dummy x Past World Bank Projects Dummy				-3.455				-0.104
				(2.267)				(0.137)
Cluster FE	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Control variables	NO	YES	YES	YES	NO	YES	YES	YES
Observations	1,368,255	244,498	244,498	244,498	1,596,132	284,508	284,508	284,508
R2	0.327	0.375	0.375	0.375	0.449	0.585	0.585	0.585
Residual Std. Error	25.431 (df=1,338,244)	27.831 (df=235,659)	27.827 (df=235,658)	27.826 (df=235,657)	1.195 (df=1,562,440)	1.028 (df=275,419)	1.027 (df=275,418)	1.027 (df=275,417)
F Statistic	21.7***	15.96***	15.98***	15.98***	37.74***	42.73***	42.78***	42.78***

Table 5 continued: First mechanism testing the effect of current and past *World Bank* projects on four selected water and health indicators

Dependent variable	(9) Type of toilet	(10) Type of toilet	(11) Type of toilet	(12) Type of toilet	(13) No of dead kids	(14) No of dead kids	(15) No of dead kids	(16) No of dead kids
Past World Bank Projects Dummy	0.393*** (0.024)	-0.055 (0.045)	-0.083* (0.047)	-0.034 (0.083)	-0.091*** (0.005)	0.001 (0.011)	0.008 (0.011)	-0.002 (0.023)
Current World Bank Projects Dummy			0.068** (0.032)	0.072** (0.034)			-0.018*** (0.007)	-0.019*** (0.007)
Current World Bank Projects Dummy x Past World Bank Projects Dummy				-0.062 (0.096)				0.013 (0.025)
Cluster FE	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Control variables	NO	YES	YES	YES	NO	YES	YES	YES
Observations	1,742,308	293,810	293,810	293,810	1,793,783	301,728	301,728	301,728
R2	0.411	0.444	0.444	0.444	0.090	0.228	0.228	0.228
Residual Std. Error	1.342 (df=170,8031)	1.115 (df=284,715)	1.115 (df=284,714)	1.115 (df=284,713)	0.845 (df=1,759,504)	0.657 (df=292,631)	0.657 (df=292,630)	0.657 (df=292,629)
F Statistic	34.71***	25.04***	25.05***	25.05***	5.068***	9.506***	9.507***	9.506***

Note: The regressions estimate the effect of the existence and the number of a past and a current World Bank Project (and their interaction) on four dependent variables: time to water, quality of drinking water, type of toilet, number of dead kids. Regressions are run with the full dataset without and with the full set of control variables as well as cluster and time fixed effects. Robust clustered standard error estimates (Cluster-level) are presented below the coefficients. Control variables are: Nightlights_Composite, All_Population_Count, All_Population_Density, Drought_Episodes, Malaria_2000_2015, Proximity_to_National_Borders, Proximity_to_Water, Rainfall_1985_2015, Jan_Dec_Temp, Urban, Years_educ, Age, Relation_Household_head, Gender_household_head, Christian, Muslim, No_religion, Traditional. The omitted category for the religious denomination is "Other". Significance levels are indicated by *p<0.1; **p<0.05; ***p<0.01.

ANECTODAL EVIDENCE FROM WORLD BANK REPORTS

Our cross-project, micro-based evaluation approach follows a bottom-up perspective and tries to bring observational data as closely to an experimentally inspired setting as possible. It allows to investigate a large number of projects ex-post using readily available information. It is easily extendable to other settings. Doing our evaluations ex-post, we can also compare our results with analyses of a specific country and compare it with the project evaluation performed by the *World Bank* itself in a number of cases. Thereby our broad quantitative approach may also enrich more qualitative reports and evaluations. We perform one such country specific evaluation and comparison below as an illustration.

We choose Senegal, as it passed through the highest number of DHS surveys, each with a large number of respondents, and as it was a popular target of *World Bank* water projects. To be concrete, our analysis for Senegal estimates the effect of eight different *World Bank* water projects[23] on the answers from more than 100.000 individuals collected by nine DHS rounds. Table 6 shows us similar results to our baseline regressions from table 1 for regressions without control variables. Results are sensitive towards the inclusion of covariates and turn insignificant.

Our results suggest a certain level of effectiveness of *World Bank* projects. Comparing these quantitative results with the corresponding reports from the *World Bank* for their own water projects, we find an accordance between both. We would like to outline three projects, which we believe to have a direct effect on the improvement of drinking water and sanitation[24]. Firstly, the "Water and Sanitation Millennium Project" (P109986), which aims at (among others) facilitating the rehabilitation of boreholes, water storage facilities, and pumping equipment. The *World Bank* evaluated the project as highly satisfactory as 654,520 people directly benefitted and the targets of increasing the number of people with access to improved water sources and households with new water and sewerage connections were surpassed. Secondly, the "Senegal Urban Water and Sanitation Project" (P150351 and P162537 for additional financing) encompassed the improvement of water services and access to safe drinking water, the rehabilitation of water

[23] Three projects had a second phase with additional financing (recorded under a different project ID)

[24] The five other *World Bank* projects in the water sector are assumed to have a more indirect impact on our target variables and are therefore not described in this paper: "Senegal River Basin Multi-purpose Water Resources Development Project" (P093826), "Stormwater Management and Climate Change Adaptation Project" (P122841 and P152150 for additional financing), "Building Resilience through Innovation, Communication and Knowledge Services" (P130888), "Senegal River Basin Climate Change Resilience Development Project" (P131323 and P131353 for additional financing), and "Senegal River Basin Integrated Water Resources Management Project" (P153863).

infrastructure, the increased access to improved sanitation and sewerage services and the institutional strengthening and project management. It was rated as satisfactory, as the targets for new piped household water connections and for the number of people in urban areas with access to improved water sources were met, but it failed to provide the targeted number of people with access to enhanced water supply services, the targeted water production and water storage capacity and the targeted construction of new household sewer connections. Thirdly, the "Senegal Rural Water and Sanitation Project" (P164262) aimed at improving rural water supply, water services and access as well as sanitation and the adequate disposal of wastewater and sludge. Alike the "Senegal Urban Water and Sanitation Project" it was rated satisfactory as more progress is needed to reach targets for improved community water points, piped water systems with chlorination devices, for bacterial standards in water sample tests and for household latrines and sewer connections.

As in the Bank's goal attainment reports, our analysis would concur that there is a positive impact of the *World Bank* on water access, water quality and sanitation facilities.

Table 6: Baseline regressions for the effect of current *World Bank* projects on time to water, quality of drinking water, type of toilet and number of dead children for Senegal

Dependent variable	(1) Time to water	(2) Time to water	(3) Quality of drinking water	(4) Quality of drinking water	(5) Type of toilet	(6) Type of toilet	(7) No of dead kids	(8) No of dead kids
Current World Bank Project Dummy	**-3.796*** (1.028)**	**-0.221 (1.759)**	**0.306*** (0.055)**	**-0.027 (0.081)**	**0.625*** (0.050)**	**-0.067 (0.086)**	**-0.110*** (0.009)**	**-0.004 (0.012)**
Cluster FE	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Control variables	NO	YES	NO	YES	NO	YES	NO	YES
Observations	96,636	9,914	125,741	18,271	129,714	18,756	134,314	19,372
R2	0.104	0.274	0.211	0.563	0.158	0.359	0.036	0.172
Residual Std. Error	31.552 (df=96,200)	21.655 (df=9,512)	1.287 (df=125,304)	0.947 (df=17,859)	1.583 (df=129,277)	1.241 (df=18,344)	0.810 (df=133,877)	0.413 (df=18,960)
F Statistic	25.7***	8.954***	77.08***	56.04***	55.48***	25.04***	11.43***	9.615***

Note: The regressions estimate the effect of the existence of a current World Bank Project in Senegal on four dependent variables: time to water, quality of drinking water, type of toilet, number of dead kids. Regressions are run with the data for Senegal without and with the full set of control variables as well as cluster and time fixed effects. Robust clustered standard error estimates (Cluster-level) are presented below the coefficients. Control variables are: Nightlights_Composite, All_Population_Count, All_Population_Density, Drought_Episodes, Malaria_2000_2015, Proximity_to_National_Borders, Proximity_to_Water, Rainfall_1985_2015, Jan_Dec_Temp, Urban, Years_educ, Age, Relation_Household_head, Gender_household_head, Christian, Muslim, No_religion, Traditional. The omitted category for the religious denomination is "Other". Significance levels are indicated by *p<0.1; **p<0.05; ***p<0.01.

V. CONCLUDING REMARKS

This paper suggests a new micro-based approach to evaluate the effect of water- and health-related development projects. To do so, we extracted around 1.8 million responses from 153 *Demographic and Health Surveys* on distance to drinking water and its quality, toilet types and the number of late children. Through a geocode-matching, we combine these data with the presence of *World Bank* projects. Thereby, we obtain a new dataset which allows us to investigate the relevance of *World Bank* projects on individual welfare. Our setting allows us to employ different fixed effects strategies. Thus, we can evaluate whether individual welfare within the same cluster of the DHS where a project took place improved over time in comparison to a control group with no project.

We find that the presence of the *World Bank* and the number of projects are improving our selected water and health indicators. The results are robust towards changes in the estimation equation and data refinements. Our fixed-effects accounts for all variation across clusters. However, we also find that past *World Bank* projects do not seem to systematically influence outcomes, highlighting the importance of analyzing the long-term sustainability in future studies which can, indeed, be done using our approach. In addition, our results suggest that projects are generally more successful in relatively under-developed areas and in environments with better educated individuals. There is a potential for future research to investigate whether different project targets and project setups yield different results. Certainly, it would be interesting to investigate the effect of specific projects or types of projects. Finally, we believe that also different target groups benefit differently from development projects, such as it has been explored for women and water collection time.

Our research effort encompasses a new approach for micro-based ex-post evaluation of specific projects employing individual level data. Our approach might serve as an alternative to standard macro-level cross-country studies. At the same time it serves as a complement to standard RCTs. By matching readily available survey data with information on development project through geo codes, we can evaluate a large number of projects ex-post and at very low costs.[25] While the

[25] Assuming that a standard RCT in a developing country costs only USD 50.000, investigating 14,301 ongoing *World Bank* projects would have cost USD 715 million. The costs of our approach comprised only the salary of a PhD student for a year which would have occurred in any case.

precision of such an evaluation is potentially lower than a specifically targeted RCT for a single project, the possibility to investigate a large number of development projects ex-post may make our approach attractive for other researchers who wish to complement the insights of field experiments and explore the long-term impacts of projects.

VI. LITERATURE

Asteriou, Dimitrios. 2009. “Foreign Aid and Economic Growth: New Evidence from a Panel Data Approach for Five South Asian Countries.” *Journal of Policy Modeling* 31 (1): 155–61.

Bain, Robert, Ryan Cronk, Jim Wright, Hong Yang, Tom Slaymaker, and Jamie Bartram. 2014. “Fecal Contamination of Drinking-Water in Low- and Middle-Income Countries: A Systematic Review and Meta-Analysis.” *PLOS Medicine* 11 (5): e1001644.

Banerjee, Abhijit, and Esther Duflo. 2012. *Poor Economics: A Radical Rethinking of the Way to Fight Global Poverty*. Reprint edition. New York: PublicAffairs.

Benova, Lenka, Oliver Cumming, and Oona M. R. Campbell. 2014. “Systematic Review and Meta-Analysis: Association between Water and Sanitation Environment and Maternal Mortality.” *Tropical Medicine & International Health: TM & IH* 19 (4): 368–87.

Bhalotra, Sonia R, Alberto Diaz-Cayeros, Grant Miller, Alfonso Miranda, and Atheendar S Venkataramani. 2017. “Urban Water Disinfection and Mortality Decline in Developing Countries.” Working Paper 23239. National Bureau of Economic Research.

Bhattarai, Keshab. 2016. “Impact of Foreign Aid on Growth and Trade.” *Journal of Economics and Development Studies* 4 (3): 41–55.

Boone, Christopher, Peter Glick, and David E. Sahn. 2011. “Household Water Supply Choice and Time Allocated to Water Collection: Evidence from Madagascar.” *The Journal of Development Studies* 47 (12): 1826–50.

Botting, Marianne J., Edoye O. Porbeni, Michel R. Joffres, Bradley C. Johnston, Robert E. Black, and Edward J. Mills. 2010. “Water and Sanitation Infrastructure for Health: The Impact of Foreign Aid.” *Globalization and Health* 6 (1): 12.

Burnside, Craig, and David Dollar. 2000. “Aid, Policies, and Growth.” *The American Economic Review* 90 (4): 847–68.

———. 2004. “Aid, Policies, and Growth: Revisiting the Evidence.” *American Economic Review* 90 (April).

Cameron, Drew B., Anjini Mishra, and Annette N. Brown. 2016. “The Growth of Impact Evaluation for International Development: How Much Have We Learned?” *Journal of Development Effectiveness* 8 (1): 1–21.

Capuno, Joseph J., Carlos Antonio R. Tan, and Vigile Marie Fabella. 2015. “Do Piped Water and Flush Toilets Prevent Child Diarrhea in Rural Philippines?” *Asia Pacific Journal of Public Health* 27 (2): NP2122–32.

Chauvet, Lisa, and Patrick Guillaumont. 2003. “Aid and Growth Revisited: Policy, Economic Vulnerability and Political Instability.” 200327. Working Papers. CERDI.

Clemens, Michael A., Steven Radelet, Rikhil R. Bhavnani, and Samuel Bazzi. 2012. “Counting Chickens When They Hatch: Timing and the Effects of Aid on Growth*.” *The Economic Journal* 122 (561): 590–617.

Collier, Paul, and David Dollar. 2002. “Aid Allocation and Poverty Reduction.” *European Economic Review* 46 (8): 1475–1500.

Dalgaard, Carl-Johan, Henrik Hansen, and Finn Tarp. 2004. “On The Empirics of Foreign Aid and Growth*.” *The Economic Journal* 114 (496): F191–216.

Dalgaard, C.-J., and H. Hansen. 2001. “On Aid, Growth and Good Policies.” *The Journal of Development Studies* 37 (6): 17–41.

Deaton, Angus. 2010. “Instruments, Randomization, and Learning about Development.” *Journal of Economic Literature* 48 (2): 424–55.

Deaton, Angus, and Nancy Cartwright. 2018. “Understanding and Misunderstanding Randomized Controlled Trials.” *Social Science & Medicine*, Randomized Controlled Trials and Evidence-based Policy: A Multidisciplinary Dialogue, 210 (August): 2–21.

Doherty, Tanya, Sarah Rohde, Donela Besada, Kate Kerber, Samuel Manda, Marian Loveday, Duduzile Nsibande, et al. 2016. “Reduction in Child Mortality in Ethiopia: Analysis of Data from Demographic and Health Surveys.” *Journal of Global Health* 6 (2).

Dollar, David, and Jakob Svensson. 2000. “What Explains the Success or Failure of Structural Adjustment Programmes?” *The Economic Journal* 110 (466): 894–917.

Doucouliagos, Hristos, and Martin Paldam. 2009. “The Aid Effectiveness Literature: The Sad Results of 40 Years of Research.” *Journal of Economic Surveys* 23 (3): 433–61.

Dreher, Axel, Stephan Klasen, James Raymond Vreeland, and Eric Werker. 2013. “The Costs of Favoritism: Is Politically Driven Aid Less Effective?” *Economic Development and Cultural Change* 62 (1): 157–91.

Duflo, Esther, Abhijit Banerjee, Rachel Glennerster, and Cynthia G Kinnan. 2013. "The Miracle of Microfinance? Evidence from a Randomized Evaluation." Working Paper 18950. National Bureau of Economic Research.

Duflo, Esther, Michael Greenstone, Raymond Guiteras, and Thomas Clasen. 2015. "Toilets Can Work: Short and Medium Run Health Impacts of Addressing Complementarities and Externalities in Water and Sanitation." Working Paper 21521. National Bureau of Economic Research.

Dwivedi, Laxmi Kant, Kajori Banerjee, Nidhi Jain, Mukesh Ranjan, and Priyanka Dixit. 2018. "Child Health and Unhealthy Sanitary Practices in India: Evidence from Recent Round of National Family Health Survey-IV." *SSM - Population Health*, October.

Easterly, William. 2003. "Can Foreign Aid Buy Growth?" *The Journal of Economic Perspectives* 17 (3): 23–48.

———. 2014. *The Tyranny of Experts: Economists, Dictators, and the Forgotten Rights of the Poor*. Basic Books.

Edwards, Sebastian. 2015. "Economic Development and the Effectiveness of Foreign Aid: A Historical Perspective." *Kyklos* 68 (3): 277–316.

Ekanayake, E. M., and Dasha Chatrna. 2010. "The Effect of Foreign Aid on Economic Growth in Developing Countries." *Journal of International Business and Cultural Studies* 3 (1): 1–13.

Ezeh, Osita K., Kingsley E. Agho, Michael J. Dibley, John Hall, and Andrew N. Page. 2014. "The Impact of Water and Sanitation on Childhood Mortality in Nigeria: Evidence from Demographic and Health Surveys, 2003–2013." *International Journal of Environmental Research and Public Health* 11 (9): 9256–72.

Fayissa, Bichaka, and Mohammed I. El-Kaissy. 1999. "Foreign Aid and the Economic Growth of Developing Countries (LDCs): Further Evidence." *Studies in Comparative International Development* 34 (3): 37–50.

Federal Ministry for Economic Cooperation and Development Germany. 2019. "*World Bank* Group." Federal Ministry for Economic Cooperation and Development. 2019. http://www.bmz.de/en/ministry/approaches/multilateral_cooperation/players/WorldBankGroup/index.html.

Fink, Günther, Isabel Günther, and Kenneth Hill. 2011. "The Effect of Water and Sanitation on Child Health: Evidence from the Demographic and Health Surveys 1986–2007." *International Journal of Epidemiology* 40 (5): 1196–1204.

Fotso, Jean-Christophe, Alex Chika Ezeh, Nyovani Janet Madise, and James Ciera. 2007. "Progress towards the Child Mortality Millennium Development Goal in Urban Sub-Saharan Africa: The Dynamics of Population Growth, Immunization, and Access to Clean Water." *BMC Public Health* 7 (1): 218.

Gary, Aurore, and Mathilde Maurel. 2015. "Donors' Policy Consistency and Economic Growth." *Kyklos* 68 (4): 511–51.

Gopalan, Sasidaran, and Ramkishen Rajan. 2016. "Has Foreign Aid Been Effective in the Water Supply and Sanitation Sector? Evidence from Panel Data." *World Development* 85 (C): 84–104.

Gross, Elena, Isabel Günther, and Youdi Schipper. 2017. "Women Are Walking and Waiting for Water: The Time Value of Public Water Supply." *Economic Development and Cultural Change* 66 (3): 489–517.

Gunther, Isabel, and Gunther Fink. 2010. "Water, Sanitation and Children's Health : Evidence from 172 DHS Surveys." WPS5275. The *World Bank*.

Hansen, Henrik, and Finn Tarp. 2001. "Aid and Growth Regressions." *Journal of Development Economics* 64 (2): 547–70.

Harttgen, Kenneth, Stefan Lang, Judith Santer, and Johannes Seiler. 2019. "Modelling Under-Five Mortality through Multilevel Structured Additive Regression with Varying Coefficients for Asia and Sub-Saharan Africa." *The Journal of Development Studies* 0 (0): 1–30.

Henderson, J. Vernon, Adam Storeygard, and David N. Weil. 2012. "Measuring Economic Growth from Outer Space." *The American Economic Review* 102 (2): 994–1028.

Hopewell, Mike R., and Jay P. Graham. 2014. "Trends in Access to Water Supply and Sanitation in 31 Major Sub-Saharan African Cities: An Analysis of DHS Data from 2000 to 2012." *BMC Public Health* 14 (1): 208.

Hutton, Guy. 2013. "Global Costs and Benefits of Reaching Universal Coverage of Sanitation and Drinking-Water Supply." *Journal of Water and Health* 11 (1): 1–12.

ICF International. 2012. “DHS Sampling Manual.” 2012. https://www.dhsprogram.com/publications/publication-DHSM4-DHS-Questionnaires-and-Manuals.cfm.

———. 2019a. “The DHS Program - Protecting the Privacy of DHS Survey Respondents.” 2019. https://dhsprogram.com/What-We-Do/Protecting-the-Privacy-of-DHS-Survey-Respondents.cfm.

———. 2019b. “The DHS Program - What We Do.” 2019. https://dhsprogram.com/What-We-Do/index.cfm.

“IEG Methodology.” 2019. 2019. http://ieg.worldbankgroup.org/methodology.

Ilahi, Nadeem, and Franque Grimard. 2000. “Public Infrastructure and Private Costs: Water Supply and Time Allocation of Women in Rural Pakistan.” *Economic Development and Cultural Change* 49 (1): 45–75.

Isham, Jonathan, and Daniel Kaufmann. 1999. “The Forgotten Rationale for Policy Reform: The Productivity of Investment Projects.” *The Quarterly Journal of Economics* 114 (1): 149–84.

Jeuland, Marc A., David E. Fuente, Semra Ozdemir, Maura C. Allaire, and Dale Whittington. 2013. “The Long-Term Dynamics of Mortality Benefits from Improved Water and Sanitation in Less Developed Countries.” *PloS One* 8 (10): e74804.

Kareiva, Peter, Amy Chang, and Michelle Marvier. 2008. “Development and Conservation Goals in *World Bank* Projects.” *Science* 321 (5896): 1638–39.

Karras, Georgios. 2006. “Foreign Aid and Long-Run Economic Growth: Empirical Evidence for a Panel of Developing Countries.” *Journal of International Development* 18 (1): 15–28.

Kaufmann, Daniel, and Yan Wang. 1995. “Macroeconomic Policies and Project Performance in the Social Sectors: A Model of Human Capital Production and Evidence from LDCs.” *World Development* 23 (5): 751–65.

Koolwal, Gayatri, and Dominique van de Walle. 2013. “Access to Water, Women’s Work, and Child Outcomes.” *Economic Development and Cultural Change* 61 (2): 369–405.

Kremer, Michael, Jessica Leino, Edward Miguel, and Alix Peterson Zwane. 2011. “Spring Cleaning: Rural Water Impacts, Valuation, and Property Rights Institutions*.” *The Quarterly Journal of Economics* 126 (1): 145–205.

Li, Zehang, Yuan Hsiao, Jessica Godwin, Bryan D. Martin, Jon Wakefield, Samuel J. Clark, and with support from the United Nations Inter-agency Group for Child Mortality Estimation and its technical advisory Group. 2019. “Changes in the Spatial Distribution of the Under-Five Mortality Rate: Small-Area Analysis of 122 DHS Surveys in 262 Subregions of 35 Countries in Africa.” *PLOS ONE* 14 (1): e0210645.

Liew, Chung-Yee, Masoud Rashid Mohamed, and Said Seif Mzee. 2012. “The Impact of Foreign Aid on Economic Growth of East African Countries.” *Journal of Economics and Sustainable Development* 3 (12): 129–38.

Liwin, Lilipramawanty Kewok, and Brian Houle. 2019. “The Effects of Household and Community Context on Mortality among Children under Five in Sierra Leone: Evidence from the 2013 Demographic and Health Survey.” *Demographic Research* 40 (11): 279–306.

Malik, Girijasankar. 2008. “Foreign Aid and Economic Growth: A Cointegration Analysis of the Six Poorest African Countries.” *Economic Analysis and Policy* 38 (2): 251–60.

Mekasha, Tseday Jemaneh, and Finn Tarp. 2013. “Aid and Growth: What Meta-Analysis Reveals.” *The Journal of Development Studies* 49 (4): 564–83.

Minoiu, Camelia, and Sanjay Reddy. 2010. “Development Aid and Economic Growth: A Positive Long-Run Relation.” *The Quarterly Review of Economics and Finance* 50 (1): 27–39.

Moyo, Dambisa. 2010. *Dead Aid: Why Aid Makes Things Worse and How There Is Another Way for Africa*. Penguin.

Newman, John, Menno Pradhan, Laura B. Rawlings, Geert Ridder, Ramiro Coa, and Jose Luis Evia. 2002. “An Impact Evaluation of Education, Health, and Water Supply Investments by the Bolivian Social Investment Fund.” *The World Bank Economic Review* 16 (2): 241–74.

Njuguna, John. 2019. “Progress in Sanitation among Poor Households in Kenya: Evidence from Demographic and Health Surveys.” *BMC Public Health* 19 (1): 135.

Norman, Guy, Steve Pedley, and Bahi Takkouche. 2010. “Effects of Sewerage on Diarrhoea and Enteric Infections: A Systematic Review and Meta-Analysis.” *The Lancet. Infectious Diseases* 10 (8): 536–44.

Quibria, M. G. 2014. “Aid Effectiveness: Research, Policy and Unresolved Issues.” *Development Studies Research* 1 (1): 75–87.

Rajan, Raghuram, and Arvind Subramanian. 2008. “Aid and Growth: What Does The Cross-Country Evidence Really Show?” *The Review of Economics and Statistics* 90: 643–65.

———. 2011. “Aid, Dutch Disease, and Manufacturing Growth.” *Journal of Development Economics* 94 (1): 106–18.

Ray, Isha. 2007. “Women, Water, and Development.” *Annual Review of Environment and Resources* 32 (1): 421–49.

Roodman, David. 2007. “The Anarchy of Numbers : Aid, Development, and Cross-Country Empirics.” *The World Bank Economic Review* 21 (2 (May 2007)): 255–77.

Rutstein, S. O. 2000. “Factors Associated with Trends in Infant and Child Mortality in Developing Countries during the 1990s.” *Bulletin of the World Health Organization* 78 (10): 1256–70.

Salami, Adeleke O., Marco Stampini, Abdul B. Kamara, Caroline A. Sullivan, and Regassa Namara. 2014. “Development Aid and Access to Water and Sanitation in Sub-Saharan Africa.” *Water International* 39 (3): 294–314.

Sorenson, Susan B., Christiaan Morssink, and Paola Abril Campos. 2011. “Safe Access to Safe Water in Low Income Countries: Water Fetching in Current Times.” *Social Science & Medicine* 72 (9): 1522–26.

UNESCO. 2019. “World Water Development Report 2019 - Leaving No One Behind.”

Wagstaff, Adam, and Shengchao Yu. 2007. “Do Health Sector Reforms Have Their Intended Impacts?: The *World Bank*’s Health VIII Project in Gansu Province, China.” *Journal of Health Economics* 26 (3): 505–35.

Wang, Limin. 2002. *Health Outcomes in Poor Countries and Policy Options: Empirical Findings from Demographic and Health Surveys*. Policy Research Working Papers. The *World Bank*.

Wang, Xia, and Paul R. Hunter. 2010. “A Systematic Review and Meta-Analysis of the Association between Self-Reported Diarrheal Disease and Distance from Home to Water Source.” *The American Journal of Tropical Medicine and Hygiene* 83 (3): 582–84.

Wayland, Joshua. 2017. “Constraints on Foreign Aid Effectiveness in the Water, Sanitation, and Hygiene (WaSH) Sector.” *Journal of Water Sanitation and Hygiene for Development* 8 (November).

Whittington, Dale, Marc Jeuland, Kate Barker, and Yvonne Yuen. 2012. "Setting Priorities, Targeting Subsidies among Water, Sanitation, and Preventive Health Interventions in Developing Countries." *World Development* 40 (8): 1546–68.

Woldemicael, Gebremariam. 2000. "The Effects of Water Supply and Sanitation on Childhood Mortality in Urban Eritrea." *Journal of Biosocial Science* 32 (2): 207–27.

Wolf, Jennyfer, Paul R. Hunter, Matthew C. Freeman, Oliver Cumming, Thomas Clasen, Jamie Bartram, Julian P. T. Higgins, et al. 2018. "Impact of Drinking Water, Sanitation and Handwashing with Soap on Childhood Diarrhoeal Disease: Updated Meta-Analysis and Meta-Regression." *Tropical Medicine & International Health* 23 (5): 508–25.

Wolf, Jennyfer, Annette Prüss-Ustün, Oliver Cumming, Jamie Bartram, Sophie Bonjour, Sandy Cairncross, Thomas Clasen, et al. 2014. "Systematic review: Assessing the impact of drinking water and sanitation on diarrhoeal disease in low- and middle-income settings: systematic review and meta-regression." *Tropical Medicine & International Health* 19 (8): 928–42.

Wolf, Susanna. 2007. "Does Aid Improve Public Service Delivery?" *Review of World Economics* 143 (4): 650–72.

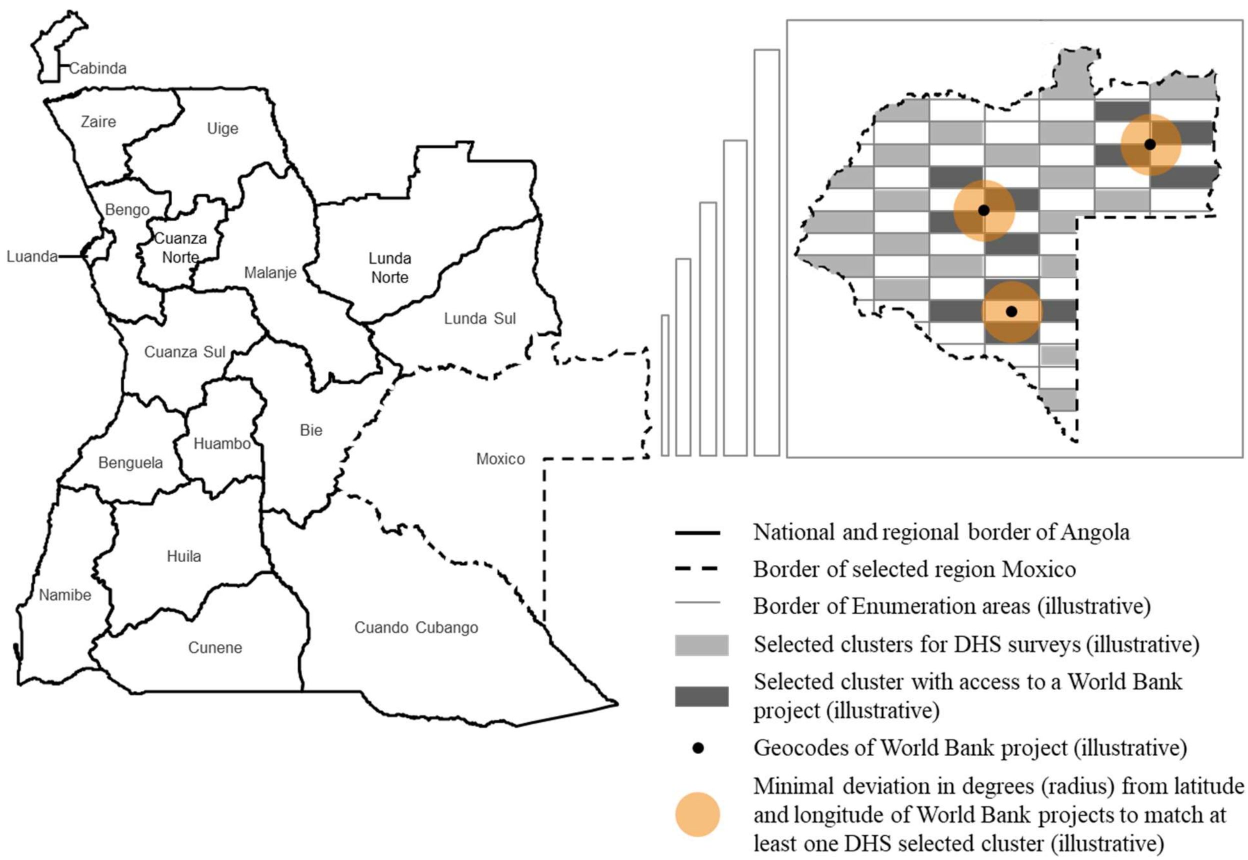
World Bank. 2018. "*World Bank* Projects & Operations | Data Catalog." 2018. https://datacatalog.worldbank.org/dataset/world-bank-projects-operations.

World Health Organization, and UNICEF. 2017. "Progress on Drinking Water, Sanitation and Hygiene: 2017 Update and SDG Baselines." Geneva.

Zhang, Jing. 2012. "The Impact of Water Quality on Health: Evidence from the Drinking Water Infrastructure Program in Rural China." *Journal of Health Economics* 31 (1): 122–34.

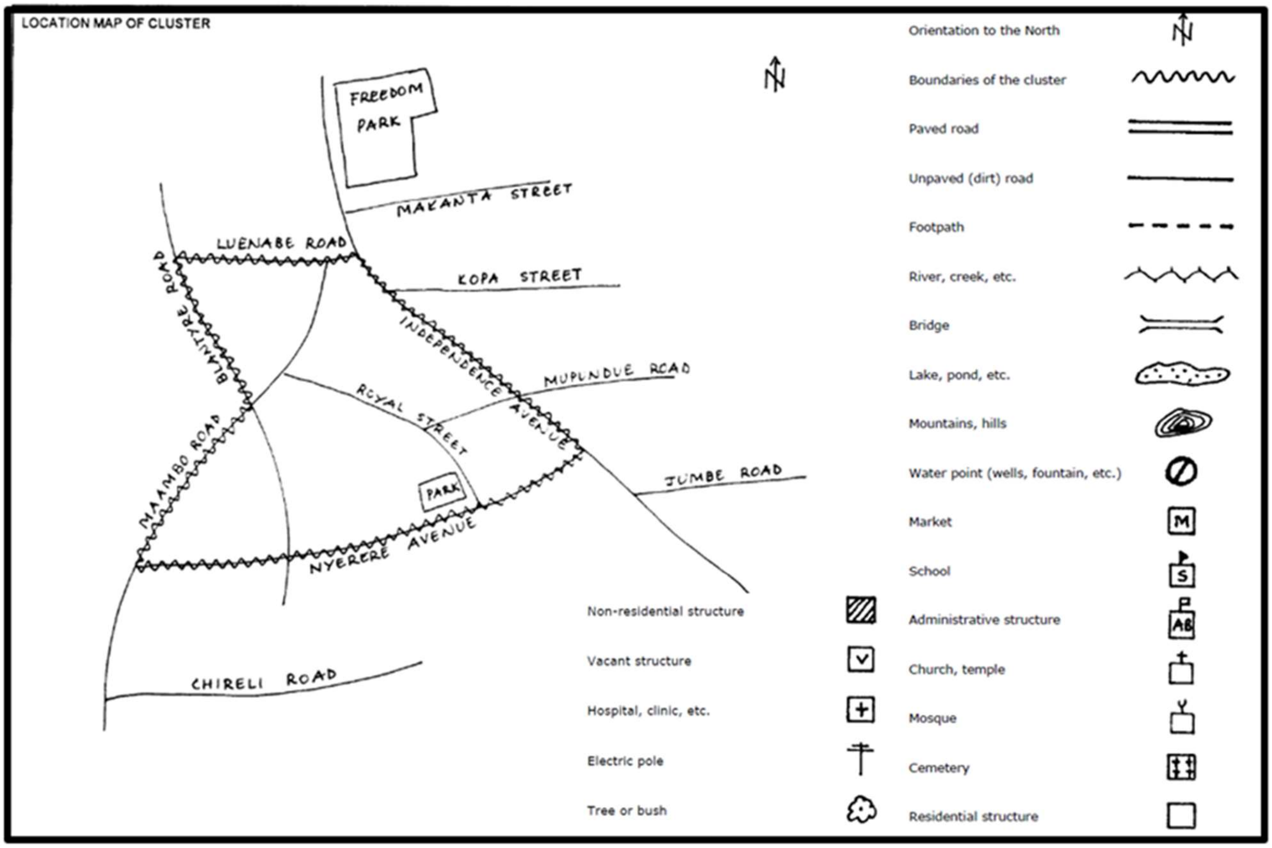
VII. APPENDIX

Illustration 1: Example for a DHS survey in Angola in 2015, with 18 regions. In the exemplary region Moxico DHS selected 32 clusters and we identified 12 clusters to have access to one of the three *World Bank* projects



Source: Own illustration with support of DHS Data and ICF International (2012)

Illustration 2: Location map of cluster (example)



Source: ICF International (2012)

Table A.1: Descriptive statistics

Variable	Description	Median	Mean	Std. Dev.	Min	Max	Observations	Source
Quality of drinking water	Main source of drinking water for household members. Variable was recoded from a qualitative description into numeric values ranging from 1.1 (e.g., river, canal) to 5.4 (e.g., piped water into dwelling). The integer captures the quality of drinking water and the first decimal number captures how easily this source can be reached.	4.0	3.5	1.6	1.0	5.0	1,596,132.0	DHS Surveys
Time to water	Time taken to get to the source of drinking water (in minutes).	1.0	13.6	30.7	0.0	995.0	1,368,255.0	DHS Surveys
Type of toilet	Type of toilet facility in the household. Variable was recoded from a qualitative description into numeric values ranging from 0 (e.g., no facility) to 5.4 (e.g., flush to piped sewer system), capturing the quality of the toilet facility and its reachability.	3.0	2.8	1.7	0.0	5.0	1,742,308.0	DHS Surveys
No of dead kids	Total number of sons and daughters who have died.	0.0	0.4	0.9	0.0	20.0	1,793,783.0	DHS Surveys
Current World Bank Project Dummy	Dummy variable equals 1 if individuals in the respective cluster have access to the services of any ongoing World Bank project; 0 otherwise (requirement: project is running for at least 1 year before the survey was conducted).	0.0	0.3	0.4	0	1	1,793,783.0	Own calculation based on DHS Surveys; World Bank
Number of Current World Bank Projects	Number of ongoing World Bank projects to which the individuals in the respective cluster have access.	0.0	0.6	1.5	0.0	27.3	1,793,783.0	Own calculation based on DHS Surveys; World Bank
Current World Bank Water Project Dummy	Dummy variable equals 1 if individuals in the respective cluster have access to the services of an ongoing World Bank Water project; 0 otherwise (requirement: project is running for at least 1 year before the survey was conducted).	0.0	0.1	0.3	0	1	1,793,783.0	Own calculation based on DHS Surveys; World Bank
Number of Current World Bank Water Projects	Number of ongoing World Bank Water projects to which the individuals in the respective cluster have access.	0.0	0.1	0.6	0.0	11.0	1,793,783.0	Own calculation based on DHS Surveys; World Bank
Past World Bank Project Dummy	Dummy variable equals 1 if individuals in the respective cluster have access to the services of any past World Bank project; 0 otherwise (requirement: project is completed at the latest in the same year the respective survey was conducted).	0.0	0.1	0.3	0	1	1,793,783.0	Own calculation based on DHS Surveys; World Bank
Number of Past World Bank Projects	Number of ongoing World Bank projects to which the individuals in the respective cluster have access.	0.0	0.1	0.7	0.0	26.6	1,793,783.0	Own calculation based on DHS Surveys; World Bank

Table A.1 continued: Descriptive statistics

Variable	Description	Median	Mean	Std. Dev.	Min	Max	Observations	Source
Rainfall_1985_2015	The average annual rainfall (in millimeters per year) within the 2 km (urban) or 10 km (rural) buffer surrounding the DHS survey cluster. The data is averaged for 1985, 1990, 1995, 2000, 2005, 2010 and 2015.	1,068.1	1,156.4	753.6	0.0	5,262.6	1,669,102.0	DHS Surveys
Drought_Episodes	The average number of drought episodes (categorized between 1 (low) and 10 (high)) for the areas within the 2 km (urban) or 10 km (rural) buffer surrounding the DHS survey cluster.	5.0	5.1	3.4	0.0	35.0	1,256,872.0	DHS Surveys
Jan_Dec_Temp	The average monthly temperature (in degree Celsius) within the 2 km (urban) or 10 km (rural) buffer surrounding the DHS survey cluster for the months January to December. The data was averaged for the respective year.	24.5	281.6	7,916.2	-1.9	1,317,091	1,655,272.0	DHS Surveys
Proximity_to_Water	The geodesic distance to either a lake or the coastline.	72,880.6	113,802.8	113,172.4	0.0	702,150.2	1,692,667.0	DHS Surveys
Proximity_to_National_ Borders	The geodesic distance to the nearest international borders.	41,052.0	70,801.4	79,452.8	0.0	594,383.4	1,692,667.0	DHS Surveys
Malaria_2000_2015	The average parasite rate of plasmodium falciparum in children between the ages of 2 and 10 years within the 2 km (urban) or 10 km (rural) buffer surrounding the DHS survey cluster. The data is averaged for 2000, 2005, 2010 and 2015 and ranges between 0 and 1.	0.0	0.2	0.4	0.0	1.0	1,099,719.0	DHS Surveys
Nightlights_Composite	The average nighttime luminosity (in hours) of the area within the 2 km (urban) or 10 km (rural) buffer surrounding the DHS survey cluster.	0.1	5.0	13.4	0.0	140.9	1,691,248.0	DHS Surveys
Urban	Dummy variable equals 1 if place of household residence was qualified as urban; 0 if rural.	0.0	0.4	0.5	0	1	1,785,184.0	DHS Surveys
All_Population_Count	The average number of individuals living within the 2 km (urban) or 10 km (rural) buffer surrounding the DHS survey cluster in 2005, 2010, 2015.	34,522.3	95,586.4	194,266.6	0.0	6,407,341	1,689,641.0	DHS Surveys
All_Population_Density	The average number of people in 2000, 2005, 2010, 2015 in clusters whose centroid falls within a radius of 10 km (for rural points) or 2 km (for urban points). That average was then divided by the area of those clusters.	55.8	1,029.6	3,579.2	0.0	59,297.6	1,163,962.0	DHS Surveys

Table A.1 continued: Descriptive statistics

Variable	Description	Median	Mean	Std. Dev.	Min	Max	Observations	Source
Years_educ	Highest year of education gives the years of education completed.	4.0	4.2	2.4	0.0	19.0	1,236,047.0	DHS Surveys
Age	Age of interviewed individual at the time of the survey.	28.0	29.1	9.6	11.0	64.0	1,793,783.0	DHS Surveys
Christian	Dummy variable equals 1 if interviewed person states to be a Christian; 0 otherwise.	0.0	0.4	0.5	0	1	1,524,191.0	DHS Surveys
Muslim	Dummy variable equals 1 if interviewed person states to be a Muslim; 0 otherwise.	0.0	0.4	0.5	0	1	1,524,191.0	DHS Surveys
No_religion	Dummy variable equals 1 if interviewed person states to be an atheist; 0 otherwise.	0.0	0.0	0.2	0	1	1,524,191.0	DHS Surveys
Traditional	Dummy variable equals 1 if interviewed person states to be a traditionalist; 0 otherwise.	0.0	0.0	0.1	0	1	1,524,191.0	DHS Surveys
Other	Dummy variable equals 1 if interviewed person states to be non of the before stated religion (e.g., buddhist, jewish etc.); 0 otherwise.	0.0	0.2	0.4	0	1	1,524,191.0	DHS Surveys
Relation_Household_head	Relationship to the head of the household ranging between 1 (head) and 14 (not related at all, e.g. maid).	2.0	3.6	3.0	1.0	14.0	1,785,042.0	DHS Surveys
Gender_household_head	Dummy variable equals 1 if household head is a man; 0 otherwise.	1.0	0.8	0.4	0	1	1,785,180.0	DHS Surveys

Table A.2: Baseline regressions for the effect of the number of *World Bank* projects on time to water, quality of drinking water, type of toilet and number of dead children when accounting for cluster and time fixed effects and control variables (full version)

Dependent variable	(1) Time to water	(2) Time to water	(3) Quality of drinking water	(4) Quality of drinking water	(5) Type of toilet	(6) Type of toilet	(7) No of dead kids	(8) No of dead kids
Number of Current World Bank Projects	**-1.043***** **(0.079)**	**-0.760***** **(0.231)**	**0.164***** **(0.006)**	**0.037***** **(0.012)**	**0.164***** **(0.005)**	**0.031***** **(0.012)**	**-0.027***** **(0.001)**	**0.001** **(0.003)**
Nightlights_Composite		-0.114* (0.062)		0.032*** (0.003)		0.020*** (0.004)		-0.003*** (0.001)
All_Population_Count		0.000 (0.000)		0.00000*** (0.000)		0.00000*** (0.000)		-0.00000*** (0.000)
All_Population_Density		0.0002** (0.0001)		-0.00001*** (0.000)		0.00002*** (0.00001)		-0.00000* (0.000)
Drought_Episodes		-0.098 (0.138)		-0.0001 (0.006)		0.009* (0.005)		0.002* (0.001)
Malaria_2000_2015		-2.889** (1.318)		-0.094 (0.067)		0.207*** (0.049)		-0.014 (0.011)
Proximity_to_ National_Borders		0.000 (0.000)		-0.00000** (0.000)		0.000 (0.000)		-0.00000*** (0.000)
Proximity_to_Water		0.000 (0.000)		-0.00000*** (0.000)		-0.00000** (0.000)		0.00000*** (0.000)
Rainfall_1985_2015		-0.001 (0.001)		-0.0003*** (0.00004)		0.0001*** (0.00004)		-0.00002*** (0.00001)
Jan_Dec_Temp		0.685*** (0.134)		0.035*** (0.007)		-0.042*** (0.006)		0.004** (0.001)
Urban		-7.647*** (0.611)		1.287*** (0.036)		0.931*** (0.034)		-0.153*** (0.007)
Years_educ		0.116*** (0.034)		0.007*** (0.001)		0.012*** (0.001)		-0.014*** (0.001)
Age		-0.008 (0.007)		0.002*** (0.0003)		0.005*** (0.0003)		0.032*** (0.0003)

Table A.2 continued: Baseline regressions for the effect of the number of *World Bank* projects on time to water, quality of drinking water, type of toilet and number of dead children when accounting for cluster and time fixed effects and control variables (full version)

Dependent variable	(1) Time to water	(2) Time to water	(3) Quality of drinking water	(4) Quality of drinking water	(5) Type of toilet	(6) Type of toilet	(7) No of dead kids	(8) No of dead kids
Relation_Household_		-0.049*		0.008***		0.022***		0.002***
head		(0.029)		(0.001)		(0.001)		(0.0004)
Gender_household_		-0.415**		-0.037***		0.073***		0.028***
head		(0.172)		(0.006)		(0.007)		(0.003)
Christian		1.050***		-0.055***		-0.049***		0.029***
		(0.326)		(0.011)		(0.01)		(0.005)
Muslim		0.154		0.026		0.008		0.089***
		(0.445)		(0.018)		(0.018)		(0.007)
No_religion		1.717**		-0.275***		-0.436***		0.084***
		(0.807)		(0.033)		(0.03)		(0.013)
Traditional		1.833*		-0.246***		-0.457***		0.158***
		(0.954)		(0.044)		(0.051)		(0.029)
Cluster FE	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1,368,255	244,498	1,596,132	284,508	1,742,308	293,810	1,793,783	301,728
R2	0.328	0.374	0.457	0.585	0.418	0.445	0.09	0.228
Residual Std. Error	25.423	27.841	1.186	1.027	1.334	1.115	0.845	0.657
	(df=1,338,244)	(df=235,658)	(df=1,562,440)	(df=275,419)	(df=1,708,031)	(df=284,715)	(df=1,759,504)	(df=292,631)
F Statistic	21.74***	15.93***	38.99***	42.77***	35.78***	25.05***	5.104***	9.506***

Note: The regressions estimate the effect of the number of current World Bank Projects on four dependent variables: time to water, quality of drinking water, type of toilet, number of dead kids. Regressions are run with the full dataset without and with the full set of control variables as well as cluster and time fixed effects. Robust clustered standard error estimates (Cluster-level) are presented below the coefficients. The omitted category for the religious denomination is "Other". Significance levels are indicated by *p<0.1; **p<0.05; ***p<0.01.

Table A.3: Summary of robustness tests for the effect of current *World Bank* projects on four selected water and health indicators

	Test	Description	Variable	Results for Number of Current World Bank (Water) Projects	
				(1) **FE and no controls**	**(2)** **FE and all controls**
(1)	Comparable Clusters	Some cluster's latitude and longitude (e.g., cluster number 1 in Egypt) show a significant deviation from the latitude and longitude reported in the first survey year (due to change of borders, protection of exact individual's location etc.). We create a subsample with clusters that deviate to a maximum of 10% from the first survey year in order to have a set of comparable clusters and conduct baseline regressions with cluster fixed effects and clustered standard errors on cluster-level.		**Confirmed**	
			Time to water	*-0.573*** (0.082)*	*-0.746* (0.399)*
				895,014	143,255
				Confirmed	
			Quality of drinking water	*0.109*** (0.006)*	*0.030** (0.016)*
				1,062,392	164,609
				Confirmed	
			Type of toilet	*0.122*** (0.006)*	*0.029* (0.016)*
				1,166,117	169,372
				Confirmed for the case without controls	
			No of dead kids	*-0.019*** (0.001)*	*-0.003 (0.004)*
				1,200,319	173,530
(2)	Region-time fixed effects	We conduct baseline regressions with region-time fixed effects and clustered standard errors on region-level.		**Confirmed**	
			Time to water	*-0.857*** (0.198)*	*-0.745** (0.337)*
				1,368,255	244,498
				Confirmed	
			Quality of drinking water	*0.123*** (0.016)*	*0.047*** (0.014)*
				1,596,132	284,508
				Confirmed	
			Type of toilet	*0.122*** (0.013)*	*0.028*** (0.016)*
				1,742,308	293,810
				Confirmed for the case without controls	
			No of dead kids	*-0.018*** (0.003)*	*-0.00005 (0.002)*
				1,793,783	301,728
(3)	Country-time fixed effects	We conduct baseline regressions with country-time fixed effects and clustered standard errors on country-level.		**Confirmed** for the case without controls	
			Time to water	*-1.195*** (0.388)*	*-0.618 (0.497)*
				1,368,255	244,498
				Confirmed	
			Quality of drinking water	*0.196*** (0.038)*	*0.054*** (0.016)*
				1,596,132	284,508
				Confirmed	
			Type of toilet	*0.191*** (0.024)*	*0.038** (0.018)*
				1,742,308	293,810
				Confirmed for the case without controls	
			No of dead kids	*-0.030*** (0.005)*	*-0.001 (0.002)*
				1,793,783	301,728

Table A.3 continued: Summary of robustness tests for the effect of current *World Bank* projects on four selected water and health indicators

Test		Description	Variable	Results for Number of Current World Bank (Water) Projects	
				(1) FE and no controls	**(2) FE and all controls**
(4)	Water World Bank Projects	Previous regressions consider the sector-independent presence of a World Bank project. Here, we conduct baseline regressions with current World Bank projects in the field of water, sanitation and sewage. We include cluster fixed effects and clustered standard errors on cluster-level.		**Confirmed**	
			Time to water	*-2.320*** (0.208)*	*-2.848*** (0.549)*
				1,368,255	244,498
				Confirmed for the case without controls	
			Quality of drinking water	*0.275*** (0.014)*	*0.011 (0.022)*
				1,596,132	284,508
				Confirmed for the case without controls	
			Type of toilet	*0.262*** (0.012)*	*-0.035 (0.023)*
				1,742,308	293,810
				Confirmed for the case without controls	
			No of dead kids	*-0.045*** (0.002)*	*-0.003 (0.006)*
				1,793,783	301,728
(5)	Women	We create a subsample with with surveys that report answers of female interviewees only and conduct baseline regressions with cluster fixed effects and clustered standard errors on cluster-level.		**Confirmed** for the case without controls	
			Time to water	*-1.370*** (0.306)*	*-0.554 (0.944)*
				296,306	32,598
				Confirmed for the case without controls	
			Quality of drinking water	*0.169*** (0.014)*	*-0.013 (0.027)*
				426,161	50,251
				Confirmed for the case without controls	
			Type of toilet	*0.162*** (0.013)*	*0.038 (0.028)*
				467,137	52,215
				Confirmed for the case without controls	
			No of dead kids	*-0.019*** (0.003)*	*0.004 (0.006)*
				481,511	53,132

Note: The regressions estimate the effect of the number of current World Bank (water) projects on four dependent variables (time to water, quality of drinking water, type of toilet, number of dead kids) for a number of robsutness checks including fixed effects and robust clustered standard error estimates; Coefficients (Clustered Std. Errors) for specifications without controls are reported in columns (1), whereas coefficients (Clustered Std. errors) for specifications with all control variables are reported in columns (2); The number of observations is listed below the respective coefficient (Clustered Std. Error). Control variables are: Nightlights_Composite, All_Population_Count, All_Population_Density, Drought_Episodes, Malaria_2000_2015, Proximity_to_National_Borders, Proximity_to_Water, Rainfall_1985_2015, Jan_Dec_Temp, Urban, Years_educ, Age, Relation_Household_head, Gender_household_head, Christian, Muslim, No_religion, Traditional. The omitted category for the religious denomination is "Other". Significance levels are indicated by *p<0.1; **p<0.05; ***p<0.01.

Table A.4: First mechanism testing the effect of current *World Bank* projects on four selected water and health indicators for clusters in different development states (expressed in terms of education, nightlights and income)

	Test	Description	Variable	Results for Number of Current World Bank Projects	
				(1) **FE and no controls**	**(2)** **FE and all controls**
(1)	High education	We create a subsample with individuals that have year's of schooling equal to or above the mean for the entire sample and conduct baseline regressions with cluster fixed effects and clustered standard errors on cluster-level.	Time to water	**Confirmed** *-1.169*** (0.090)* 408,493	*-0.912*** (0.287)* 109,593
			Quality of drinking water	**Confirmed** *0.153*** (0.007)* 469,265	*0.031** (0.014)* 129,501
			Type of toilet	**Confirmed** *0.128*** (0.005)* 519,513	*0.025* (0.014)* 134,329
			No of dead kids	**Confirmed** for the case without controls *-0.013*** (0.001)* 536,597	*0.002 (0.003)* 137,991
(2)	Low education	We create a subsample with individuals that have year's of schooling below the mean for the entire sample and conduct baseline regressions with cluster fixed effects and clustered standard errors on cluster-level.	Time to water	**Confirmed** *-1.014*** (0.074)* 529,181	*-0.599** (0.240)* 134,905
			Quality of drinking water	**Confirmed** *0.150*** (0.007)* 598,501	*0.040*** (0.012)* 155,007
			Type of toilet	**Confirmed** *0.143*** (0.005)* 676,336	*0.036*** (0.013)* 159,481
			No of dead kids	**Confirmed** for the case without controls *-0.015*** (0.001)* 699,450	*-0.002 (0.003)* 163,737
(3)	High nightlights	We create a subsample with individuals that have a nightlights composite equal to or above the mean for the entire sample and conduct baseline regressions with cluster fixed effects and clustered standard errors on cluster-level.	Time to water	**Not confirmed** *-0.103 (0.146)* 216,283	*-1.137 (0.776)* 34,085
			Quality of drinking water	**Confirmed** for the case without controls *0.020*** (0.006)* 303,185	*0.012 (0.046)* 40,083
			Type of toilet	**Confirmed** *0.036*** (0.009)* 348,980	*0.142*** (0.048)* 43,200
			No of dead kids	**Confirmed** for the case with controls *-0.002 (0.002)* 360,103	*-0.022* (0.014)* 44,373

Table A.4 continued: First mechanism testing the effect of current *World Bank* projects on four selected water and health indicators for clusters in different development states (expressed in terms of education, nightlights and income)

Test		Description	Variable	Results for Number of Current World Bank Projects (1) FE and no controls	(2) FE and all controls
(4)	Low nightlights	We create a subsample with individuals that have a nightlights composite below the mean for the entire sample and conduct baseline regressions with cluster fixed effects and clustered standard errors on cluster-level.	Time to water	**Confirmed** *-1.154*** (0.132)* 1,056,378	*-0.954*** (0.320)* 210,413
			Quality of drinking water	**Confirmed** *0.163*** (0.010)* 1,206,379	*0.037** (0.016)* 244,425
			Type of toilet	**Confirmed** for the case without controls *0.155*** (0.007)* 1,293,699	*0.010 (0.014)* 250,610
			No of dead kids	**Confirmed** for the case without controls *-0.027*** (0.002)* 1,331,145	*0.004 (0.003)* 257,355
(5)	Lower middle income and higher middle income	We create a subsample with countries that are classified as lower-middle or higher-middle-income-countries and conduct baseline regressions with cluster fixed effects and clustered standard errors on cluster-level.	Time to water	**Confirmed** *-0.762*** (0.111)* 424,488	*-0.680* (0.358)* 90,869
			Quality of drinking water	**Confirmed** *0.113*** (0.008)* 527,653	*0.052** (0.024)* 92,670
			Type of toilet	**Confirmed** *0.156*** (0.010)* 616,716	*0.056** (0.024)* 100,262
			No of dead kids	**Confirmed** for the case without controls *-0.017*** (0.002)* 635,145	*0.006 (0.005)* 103,134
(6)	Low-income countries	We create a subsample with countries that are classified as low-income-countries and conduct baseline regressions with cluster fixed effects and clustered standard errors on cluster-level.	Time to water	**Confirmed** *-1.315*** (0.122)* 801,309	*-0.680** (0.312)* 153,629
			Quality of drinking water	**Confirmed** *0.219*** (0.010)* 920,341	*0.027** (0.013)* 191,838
			Type of toilet	**Confirmed** *0.192*** (0.006)* 935,642	*0.035*** (0.013)* 193,548
			No of dead kids	**Confirmed** *-0.035*** (0.002)* 961,519	*-0.006* (0.003)* 198,594

Note: The regressions estimate the effect of the number of current World Bank projects on four dependent variables (time to water, quality of drinking water, type of toilet, number of dead kids) for a number of robsutness checks including fixed effects and robust clustered standard error estimates; Coefficients (Clustered Std. Errors) for specifications without controls are reported in columns (1), whereas coefficients (Clustered Std. errors) for specifications with all control variables are reported in columns (2); The number of observations is listed below the respective coefficient (Clustered Std. Error). Control variables are: Nightlights_Composite, All_Population_Count, All_Population_Density, Drought_Episodes, Malaria_2000_2015, Proximity_to_National_Borders, Proximity_to_Water, Rainfall_1985_2015, Jan_Dec_Temp, Urban, Years_educ, Age, Relation_Household_head, Gender_household_head, Christian, Muslim, No_religion, Traditional. The omitted category for the religious denomination is "Other". Significance levels are indicated by *p<0.1; **p<0.05; ***p<0.01.

VIII. SUPPLEMENTARY MATERIAL

Table I: Other summary statistics

Country	World Bank classification	No of respondents	Available survey years	No of Regions	No of Clusters	Individuals with access to an ongoing World Bank project	Individuals with access to a past World Bank project	Perc of Individuals with access to an ongoing World Bank project	Perc of Individuals with access to a past World Bank project
Angola	Lower-middle-income	2,972	2007	4	115	163	-	5.5%	0.0%
Angola	Lower-middle-income	8,589	2011	4	238	4,120	-	48.0%	0.0%
Angola	Lower-middle-income	14,379	2016	18	625	3,619	606	25.2%	4.2%
Armenia	Upper-middle-income	5,922	2010	11	308	5,865	-	99.0%	0.0%
Armenia	Upper-middle-income	6,116	2016	11	313	5,727	5,696	93.6%	93.1%
Bangladesh	Lower-middle-income	10,544	2000	6	341	-	-	0.0%	0.0%
Bangladesh	Lower-middle-income	11,440	2004	6	361	3,100	-	27.1%	0.0%
Bangladesh	Lower-middle-income	10,996	2007	6	361	4,788	-	43.5%	0.0%
Bangladesh	Lower-middle-income	17,842	2011	7	600	11,881	-	66.6%	0.0%
Bangladesh	Lower-middle-income	17,863	2014	7	600	11,680	6,484	65.4%	36.3%
Benin	Lower-income	5,491	1996	6	200	-	-	0.0%	0.0%
Benin	Lower-income	6,219	2001	6	247	-	-	0.0%	0.0%
Benin	Lower-income	16,599	2012	12	750	6,503	2,648	39.2%	16.0%
BurkinaFaso	Lower-income	6,354	1993	5	230	-	-	0.0%	0.0%
BurkinaFaso	Lower-income	6,445	1999	5	210	-	-	0.0%	0.0%
BurkinaFaso	Lower-income	12,477	2003	14	400	238	-	1.9%	0.0%
BurkinaFaso	Lower-income	17,087	2010	13	573	4,085	-	23.9%	0.0%
BurkinaFaso	Lower-income	8,111	2014	13	252	2,039	1,199	25.1%	14.8%
Burundi	Lower-income	9,389	2011	5	376	4,174	-	44.5%	0.0%
Burundi	Lower-income	5,149	2013	5	200	2,658	1,189	51.6%	23.1%
Burundi	Lower-income	17,269	2017	17	554	5,585	6,807	32.3%	39.4%
Cambodia	Lower-middle-income	15,352	2000	24	471	-	-	0.0%	0.0%
Cambodia	Lower-middle-income	16,823	2006	19	557	2,411	-	14.3%	0.0%
Cambodia	Lower-middle-income	18,753	2011	19	611	4,791	-	25.5%	0.0%
Cambodia	Lower-middle-income	17,578	2014	19	611	2,477	3,663	14.1%	20.8%
Cameroon	Lower-middle-income	3,871	1991	5	149	-	-	0.0%	0.0%
Cameroon	Lower-middle-income	10,656	2004	12	466	-	-	0.0%	0.0%
Cameroon	Lower-middle-income	15,426	2011	12	578	4,729	-	30.7%	0.0%
CotedIvoire	Lower-middle-income	8,099	1994	10	246	-	-	0.0%	0.0%
CotedIvoire	Lower-middle-income	3,040	1999	3	140	-	-	0.0%	0.0%
CotedIvoire	Lower-middle-income	10,060	2012	11	351	3,200	197	31.8%	2.0%
DominicanRepublic	Upper-middle-income	27,195	2007	32	1,428	27	-	0.1%	0.0%
DominicanRepublic	Upper-middle-income	9,372	2013	9	524	2,436	-	26.0%	0.0%
DRCongo	Lower-income	9,995	2007	11	300	4,941	-	49.4%	0.0%
DRCongo	Lower-income	18,827	2014	11	536	7,605	3,486	40.4%	18.5%
Egypt	Lower-middle-income	9,864	1993	5	546	-	-	0.0%	0.0%
Egypt	Lower-middle-income	14,779	1996	6	934	-	-	0.0%	0.0%
Egypt	Lower-middle-income	15,573	2000	6	1,000	10	-	0.1%	0.0%
Egypt	Lower-middle-income	9,159	2003	5	976	1,862	-	20.3%	0.0%
Egypt	Lower-middle-income	19,474	2005	6	1,359	3,212	-	16.5%	0.0%
Egypt	Lower-middle-income	16,527	2008	6	1,264	2,254	-	13.6%	0.0%
Egypt	Lower-middle-income	21,762	2014	6	1,828	7,841	592	36.0%	2.7%
Ethiopia	Lower-income	14,070	1997	11	535	3,688	-	26.2%	0.0%
Ethiopia	Lower-income	15,367	2000	11	539	-	-	0.0%	0.0%
Ethiopia	Lower-income	16,515	2003	11	596	6,913	-	41.9%	0.0%
Ethiopia	Lower-income	15,683	2016	11	643	6,389	6,396	40.7%	40.8%
Ghana	Lower-middle-income	4,562	1994	10	400	-	-	0.0%	0.0%
Ghana	Lower-middle-income	4,843	1999	10	400	-	-	0.0%	0.0%
Ghana	Lower-middle-income	5,691	2003	10	412	-	-	0.0%	0.0%

Table I continued: Other summary statistics

Country	World Bank classification	No of respondents	Available survey years	No of Regions	No of Clusters	Individuals with access to an ongoing World Bank project	Individuals with access to a past World Bank project	Perc of Individuals with access to an ongoing World Bank project	Perc of Individuals with access to a past World Bank project
Ghana	Lower-middle-income	4,916	2008	10	411	2,496	-	50.8%	0.0%
Ghana	Lower-middle-income	9,396	2014	10	427	5,560	2,978	59.2%	31.7%
Ghana	Lower-middle-income	5,150	2016	10	200	216	3,191	4.2%	62.0%
Guinea	Lower-income	6,753	1999	5	293	-	-	0.0%	0.0%
Guinea	Lower-income	7,954	2005	8	295	1,807	-	22.7%	0.0%
Guinea	Lower-income	9,142	2012	8	300	4,938	-	54.0%	0.0%
Haiti	Lower-income	10,159	2000	10	317	-	-	0.0%	0.0%
Haiti	Lower-income	10,757	2006	10	339	-	-	0.0%	0.0%
Haiti	Lower-income	14,287	2012	11	445	9,342	1,096	65.4%	7.7%
Jordan	Upper-middle-income	6,006	2002	3	498	582	-	9.7%	0.0%
Jordan	Upper-middle-income	10,876	2007	3	928	1,354	-	12.4%	0.0%
Jordan	Upper-middle-income	11,352	2012	3	806	3,929	-	34.6%	0.0%
Kenya	Lower-middle-income	8,195	2003	8	400	-	-	0.0%	0.0%
Kenya	Lower-middle-income	8,444	2009	8	398	3,221	-	38.1%	0.0%
Kenya	Lower-middle-income	31,079	2014	8	1,593	10,898	3,451	35.1%	11.1%
Kenya	Lower-middle-income	5,394	2015	8	245	3,385	1,001	62.8%	18.6%
Lesotho	Lower-middle-income	7,095	2005	10	405	-	-	0.0%	0.0%
Lesotho	Lower-middle-income	7,624	2010	10	400	1,463	-	19.2%	0.0%
Lesotho	Lower-middle-income	6,621	2014	10	399	2,246	802	33.9%	12.1%
Liberia	Lower-income	5,239	1986	4	156	-	-	0.0%	0.0%
Liberia	Lower-income	7,092	2007	6	298	14	-	0.2%	0.0%
Liberia	Lower-income	4,397	2009	6	150	2,123	-	48.3%	0.0%
Liberia	Lower-income	3,939	2011	6	150	2,075	-	52.7%	0.0%
Liberia	Lower-income	9,239	2013	5	322	4,120	2,190	44.6%	23.7%
Liberia	Lower-income	4,290	2016	6	150	2,741	1,994	63.9%	46.5%
Madagascar	Lower-income	7,060	1997	6	269	-	-	0.0%	0.0%
Madagascar	Lower-income	17,375	2009	21	594	5,233	-	30.1%	0.0%
Madagascar	Lower-income	8,169	2011	21	267	3,032	-	37.1%	0.0%
Madagascar	Lower-income	8,045	2013	4	274	2,960	1,579	36.8%	19.6%
Madagascar	Lower-income	10,655	2016	21	358	1,412	2,250	13.3%	21.1%
Malawi	Lower-income	13,220	2000	3	559	-	-	0.0%	0.0%
Malawi	Lower-income	11,698	2005	3	521	-	-	0.0%	0.0%
Malawi	Lower-income	23,020	2010	3	849	4,376	-	19.0%	0.0%
Malawi	Lower-income	2,906	2012	3	140	1,642	126	56.5%	4.3%
Malawi	Lower-income	2,897	2014	3	140	1,751	1,161	60.4%	40.1%
Malawi	Lower-income	24,562	2016	3	850	8,859	6,485	36.1%	26.4%
Malawi	Lower-income	3,860	2017	3	150	2,737	1,955	70.9%	50.6%
Mali	Lower-income	9,704	1996	8	300	-	-	0.0%	0.0%
Mali	Lower-income	12,849	2001	9	402	-	-	0.0%	0.0%
Mali	Lower-income	14,583	2006	9	407	2,303	-	15.8%	0.0%
Mali	Lower-income	10,424	2013	6	413	4,555	1,738	43.7%	16.7%
Mali	Lower-income	7,758	2015	6	177	4,852	1,633	62.5%	21.0%
Mozambique	Lower-income	11,212	2009	10	270	3,877	-	34.6%	0.0%
Mozambique	Lower-income	13,745	2011	10	610	7,151	-	52.0%	0.0%
Mozambique	Lower-income	7,749	2015	10	306	4,236	2,094	54.7%	27.0%
Namibia	Upper-middle-income	6,755	2000	13	259	-	-	0.0%	0.0%
Namibia	Upper-middle-income	9,804	2007	13	500	673	-	6.9%	0.0%
Namibia	Upper-middle-income	10,018	2013	13	549	689	1,145	6.9%	11.4%
Nepal	Lower-income	8,726	2001	5	251	-	-	0.0%	0.0%
Nepal	Lower-income	10,793	2006	5	260	3,547	-	32.9%	0.0%
Nepal	Lower-income	12,674	2011	3	289	7,042	-	55.6%	0.0%
Nepal	Lower-income	12,862	2016	7	383	6,059	4,164	47.1%	32.4%

Table I continued: Other summary statistics

Country	World Bank classification	No of respondents	Available survey years	No of Regions	No of Clusters	Individuals with access to an ongoing World Bank project	Individuals with access to a past World Bank project	Perc of Individuals with access to an ongoing World Bank project	Perc of Individuals with access to a past World Bank project
Nigeria	Lower-middle-income	8,781	1990	4	298	-	-	0.0%	0.0%
Nigeria	Lower-middle-income	7,620	2003	6	362	207	-	2.7%	0.0%
Nigeria	Lower-middle-income	33,385	2008	6	886	3,888	-	11.6%	0.0%
Nigeria	Lower-middle-income	6,344	2010	6	239	5,206	-	82.1%	0.0%
Nigeria	Lower-middle-income	38,948	2013	6	896	18,724	2,338	48.1%	6.0%
Nigeria	Lower-middle-income	8,034	2015	6	326	5,512	1,307	68.6%	16.3%
Peru	Upper-middle-income	27,843	2000	24	1,414	-	-	0.0%	0.0%
Peru	Upper-middle-income	41,648	2008	25	1,851	-	-	0.0%	0.0%
Peru	Upper-middle-income	24,212	2009	25	1,132	4,974	-	20.5%	0.0%
Philippines	Lower-middle-income	13,633	2003	17	819	2,514	-	18.4%	0.0%
Philippines	Lower-middle-income	13,594	2008	17	792	9,365	-	68.9%	0.0%
Philippines	Lower-middle-income	25,074	2017	17	1,248	5,424	-	21.6%	0.0%
Rwanda	Lower-income	11,321	2005	11	462	-	-	0.0%	0.0%
Rwanda	Lower-income	7,313	2008	5	249	778	-	10.6%	0.0%
Rwanda	Lower-income	13,671	2011	5	492	4,713	-	34.5%	0.0%
Rwanda	Lower-income	13,497	2015	5	492	6,081	5,403	45.1%	40.0%
Senegal	Lower-income	6,310	1993	4	258	-	-	0.0%	0.0%
Senegal	Lower-income	8,593	1997	4	320	-	-	0.0%	0.0%
Senegal	Lower-income	14,602	2005	11	376	2,439	-	16.7%	0.0%
Senegal	Lower-income	19,441	2009	11	320	9,384	-	48.3%	0.0%
Senegal	Lower-income	15,688	2011	14	391	7,927	-	50.5%	0.0%
Senegal	Lower-income	17,272	2013	14	200	5,098	6,672	29.5%	38.6%
Senegal	Lower-income	16,976	2014	14	400	4,680	7,788	27.6%	45.9%
Senegal	Lower-income	17,702	2015	14	214	9,474	10,820	53.5%	61.1%
Senegal	Lower-income	17,730	2016	14	428	6,490	6,292	36.6%	35.5%
SierraLeone	Lower-income	7,374	2008	4	353	2,132	-	28.9%	0.0%
SierraLeone	Lower-income	16,658	2013	4	435	5,211	-	31.3%	0.0%
SierraLeone	Lower-income	8,501	2016	4	336	2,521	1,827	29.7%	21.5%
Tanzania	Lower-income	4,029	1999	22	176	-	-	0.0%	0.0%
Tanzania	Lower-income	12,522	2004	21	345	32	-	0.3%	0.0%
Tanzania	Lower-income	16,318	2008	26	475	4,759	-	29.2%	0.0%
Tanzania	Lower-income	10,139	2010	26	475	3,337	-	32.9%	0.0%
Tanzania	Lower-income	19,319	2012	28	583	8,984	1,173	46.5%	6.1%
Tanzania	Lower-income	13,266	2016	28	608	5,565	3,345	41.9%	25.2%
TimorLeste	Lower-middle-income	13,137	2010	13	455	2,525	-	19.2%	0.0%
TimorLeste	Lower-middle-income	12,607	2016	13	455	4,830	3,041	38.3%	24.1%
Togo	Lower-income	3,360	1988	5	153	-	-	0.0%	0.0%
Togo	Lower-income	8,569	1998	6	288	-	-	0.0%	0.0%
Togo	Lower-income	9,480	2014	6	330	3,772	184	39.8%	1.9%
Togo	Lower-income	4,674	2017	6	171	2,260	643	48.4%	13.8%
Uganda	Lower-income	7,246	2001	4	297	-	-	0.0%	0.0%
Uganda	Lower-income	8,531	2006	9	368	903	-	10.6%	0.0%
Uganda	Lower-income	4,108	2009	10	169	1,237	-	30.1%	0.0%
Uganda	Lower-income	8,700	2011	10	404	5,213	-	59.9%	0.0%
Uganda	Lower-income	5,322	2015	10	210	3,711	3,219	69.7%	60.5%
Uganda	Lower-income	18,506	2016	15	696	9,387	6,496	50.7%	35.1%
Zambia	Lower-middle-income	7,146	2007	9	319	2,203	-	30.8%	0.0%
Zambia	Lower-middle-income	16,411	2014	10	721	5,448	2,119	33.2%	12.9%
Zimbabwe	Lower-income	5,907	1999	10	230	-	-	0.0%	0.0%
Zimbabwe	Lower-income	8,907	2006	10	398	-	-	0.0%	0.0%
Zimbabwe	Lower-income	9,171	2011	10	406	28	-	0.3%	0.0%
Zimbabwe	Lower-income	9,955	2015	10	400	1,014	70	10.2%	0.7%

Table II: Sector allocation of *World Bank* Water projects

Sector names in World Bank dataset that were allocated to the Water sector
(Historic)Hydro
(Historic)Other water supply and sanitation
(Historic)Pollution control / waste management
(Historic)Rural water supply and sanitation
(Historic)Urban water supply
(Historic)Water supply and sanitation adjustment
Other Water Supply
Sanitation and Waste Management
Water
Sanitation
Public Administration - Water Sanitation and Waste Management
Public Administration - Water
Sewerage
Waste Management
Water resource management
Water Supply

Note: Only a few project budgets are dedicated to one sector only (100%). Therefore we took the sector with the highest budget allocation percentage (independent of whether all percentages for budget allocation add up to 100% or not). If the highest percentage has no given sector then sector was treated as not available (n/a) and if several sectors are listed with the same budget allocation percentage then we allocated the sector that was mentioned first.

Table III: Transformation of descriptive variables into numerical values

Transformation of descriptive variables into numerical values for the variable
Quality of drinking water

Description	Value
Canal; Covered spring; Dam; Dam/lake/pond; Developed spring; Improved spring; Improved stream; Lake, pond; Lake/pond/river/channel/irrigation channel; Nile, canal; Nile/canals; Ocean/lake; Open spring; Other spring; Pond, lake; Pond, River, Stream; Pond,lake; Pond/lake; Pond/lake/dam; Pond/tank/lake; Pretected source; Protected source; Protected spring; Public fountain; Puits, forage; Resevoir; Rier/dam/lake/ponds/stream/canal/irrigation channel; River; River or stream; River, lake, sea; River, stream; River, stream, pond, lake; River,spring,pond /ma; River,spring,surf. w; River,stream; River/dam/lake/pond/stream/canal/irrigation channel; River/dam/lake/ponds/stream/canal/irirgation channel; River/dam/lake/ponds/stream/canal/irrigation channel; River/stream; River/stream not protected; River/stream/pond/lake; River/stream/pond/lake/dam; RiviŠre; Sea, lake; Souce not protected; Source; Spring; Spring water unprotected; Spring, Not improved; Sprong/kuwa; Surface water (river/dam); Surface water (River/Dam/Lake/Pond/Stream/Canal/Irrigation channel); Surface water(river/dam/lake/pond/stream/canal/irrigation channel; Surface well/other well; Surface/other well; Undeveloped spring; Unprotected spring; Other rainwater; Pluie; Rainwater; Rainwater cistern; Rainwater in a cistern	1
Borehole public; Dug - well unprotected; Dugout; Gravity flow scheme; Gravity flow water; Non protected well; Open dug well; Open public well; Open well; Open well /Hole/Cesspool in residence; Open well /hole/cesspool outside residence; Public and others Unprotected well; Public borehole; Public well; Public well, cement, not covered; Public well, traditional; Spring - protected; Spring water protected; Tubed/Piped public well or borehole; Unprotectd well; Unprotected dug well; Unprotected public well/spring; Unprotected well; Well without cover; Neighbor's open well; Neighbour's open well; Open well in yard; Open well in yard/compound; Open well in yard/plot; Unprotected well to yard; Unprotected well/spring in yard/plot; Open well in compound/plot; Open well in dwelling; open well in dwelling/yard; Well in residence/yard/plot	2
Covered public well; Covered well; Dug well - protected; Manual pumped water; Others Protected well; Protected dug well; protected public dug well; Protected public well; Protected public well/spring; Protected well; Protected without pump; Protected/covered well; Public well, cement, covered; Semi-protected well; Well equipped with pump; Well outside residence; Well with cover; Well with handpump; Well with pump; Well without handpum; Well without hndpump; Protected well in someone else's yard/plot; Public/neighbor's tubewell; Public/neighbor's well; Protected well to yard; Protected well in yard/ compound; Protected well in yard/plot; Protected well/spring in yard/plot; Well in yard/plot; Covered well in compound/plot; protected dug well in dwelling/yard/plot; Protected well in dwelling; Well in compound; Well in dwelling; Well in house/yard/plot; Well in residence; Well in residence/yard/compound; Well inside dwelling; Well into dwelling/yard/plot	3
Borehole; Borehole /Pump; Borehole or tubewell; Borehole with pump; Borehole with pump outside residence; Borehole/ tubewell; Deep tubewell; Forage; Hand pump / Tube well or borehole; Shallow tubewell; Tube well; Tube well or borehole; Tubewell; Tubewell or borehole; Neighbor's borehole; Borehole in yard/plot; Tubewell in yard/plot; Borehole with pump in residence	4
Borne fontaine; Community stand pipe; Community standpipe; Eau courante; Piped - public; Piped - public tap / standpipe; Piped outside dwel.; Piped outside dwelling; Piped outside residence; Piped public tap; Public tab/standpipe; Public tap; Public tap / neighbors house; Public tap/standpipe; Public to neighborhood; Public/nieghbor's tap; Stone tap/dhara; Neighbor's house; Neighbor's tap; Neighbor's Tap, NAWASA (others recode); Neighbor's Tap, Source Unknown (others recode); Neighbor's tap/standpipe; Neighbour's tap; Of a neighbor; Piped from the neighbor; Piped into neighbour's yard/plot; Piped into someone else's yard/plot; Piped to neighbor; Piped to neighbour's house; Piped water elsewhere; Private tap/neighbor; In the courtyard; Outside house; Outside pipe; Piped - into yard/plot; Piped into tap in yard/plot; Piped into yard; Piped into yard /plot; Piped into yard/plot; Piped into yard/plot/building; Piped outside compound; Piped outside dwelling but within buikding; Piped to yard/plot; Tubed/piped well or bore hole in dwelling/yard; In the house; Pipe into dwelling (own artesian); Piped - into dwelling; Piped in dwelling; Piped in dwelling/yard/plot; Piped inside dwel.; Piped inside dwelling; Piped into compound; Piped into compound/plot; Piped into dwelling; Piped into house; Piped into house/yard/plot; Piped into own dwelling; Piped into residence; Piped water into residence; Piped water into residence/yard/compound; Tap in compound; Tap in dwelling; Water in house	5
Autre vendeur; Bicycle with jerrycans; Bottled water; Bottled water or sachets; Bottled water/refilling station; Buy water from a car; Camion, citerne; Cart with small tank; Mineral water in sachet; Motorcycle with three wheels; Sachet water; Sachet water (in a bag); Sales Company of water; Satchel water; Tanker truck; Tanker truck/ cistern; Tanker truck/bowser; Tanker truck/peddler; Tanker,truck,other v; Vendor; Vendor = Cart with small tank; Vendor: Cart with small tank; Water from vendor; Water in plastic bag; Water in sachet; Water sachets; Water sachets (pure water); Water sale by company; Water vender; Water vendor; Other; Along the road; Autre; Marigot; Other; Others	Other

Note: We listed all entries irrespective of identical meanings but variant forms of spelling. Descriptions that are transformed into "Other" are not included in our regressions.

Table III continued: Transformation of descriptive variables into numerical values

Transformation of descriptive variables into numerical values for the variable	
Description	**Value**
No facilities; No facilities, bush; No facility; No facility / bush / field; No facility, bush; No facility, bush, field; No facility,bush; No facility/ bush/ field; No facility/ bush/ field/ river; No facility/bush; No facility/bush/field; No facility/Field; No facility/outdoors/bush; No service; No toilet facility, nature; No toilet/field/bush; No toilet/field/forest; Not facility; Open air; River; River, canal; River/canal	0
Bucket; Bucket latrine; Bucket toilet; Bucket, pan; Bucket/Pan; Bucket/pan toilet; Bucket/potty/other container; Bush; Bush/field; Dans la nature; Stream/river	1
Latrine over river/lake	2
Pit latrine without slab/open pit; Basic Pit; Close pit; Covered pit latrine - without slab / open pit; Covered pit latrine no slab; Covered pit latrine, no slab; Fosse etanche; No flush toilet, where; Non covered latrine; Non-VIP pit latrine with slab; Non-VIP pit latrine without slab; Not improved latrine; Open pit; Own traditional pit toilet; Pit; Pit latrine - without slab; Pit latrine - without slab/open pit; Pit latrine (traditional); Pit latrine without slab / open pit; Pit latrine without slab non-wahable; Pit latrine without slab/ open pit; Pit latrine, without slab/open pit; Pit toilet latrine; Pit toilet, latrine; Pit toilet/latrine; Pit toilet/Open borehole; Pit toilet\latrine; Pour flush latrine; Private latrine without slab; Puits perdu; Rudimentary pit toilet latrine; Share latrine without slab; Share pit toilet/letrine; Shared traditional pit toilet; Simple latrine; Slit latrine; Toilet without flush; Trad. pit toilet; Trad. w bucket flush; Trad. w tank flush; Traditional bucket flush; Traditional latrine; Traditional pit latrine; Traditional pit toilet; Traditional Pit/Latrine unconnected to sewer/without septic; Traditional with bucket flush; Traditional with tank flush; Uncovered pit latrine - without slab; Uncovered pit latrine no slab; Uncovered pit latrine, no slab; Uncovered pit-latrine; Without cement sink; Pit latrine; Pit latrine - without slab / open pit; Open latrine; Pit latrine - with slab; Cemented with sink; Covered hole; Covered pit latrine - with slab; Covered pit latrine with slab; Covered pit latrine, with slab; Pit latrine with non-washable slab; Pit latrine with slab (not washable); Pit latrine with slab (washable); Pit latrine with slab no washable; Pit latrine with slab that can not be washed; Pit latrine with washable slab; Pit latrine, with slab; Private latrine with slab; Share latrine with slab; Uncovered pit latrine - with slab; Uncovered pit latrine with slab; Uncovered pit latrine, with slab; Pit latrine with slab; Ventilated Improved Pit latrine (VIP); (VIP) Latrine/Blair Toilet; Improved (ventilated) pit latrine; Improved latrine; Improved pit latrine; Improved pit toilet latrine; Outside dwelling; Own pit toilet/latrine; Pit latrine - ventilated improved; Pit latrine - ventilated improved pit (VIP); Pit latrine (outside); Pit latrine ventilated improved pit latrine; Pit latrine, ventilated improved; Septic hole; Septic well; Traditional improved latrine; Unventilated latrine; Vent. imp. pit latr.; Vent. imp. pit latrine; Vent.imp.pit latrine; Vented improved pit latrine; Ventilated improved (VIP); Ventilated improved pit; Ventilated improved pit (VIP) latrine; Ventilated improved pit lat; Ventilated improved pit latrine; Ventilated improved pit latrine (LAA); Ventilated improved pit toilet; Ventilated improved pit/latrine (VIP Blair toilet); Ventilated improved pit-latrine; Ventilated latrine; Ventilated/improved pit latrine; VIP latrine; Inside dwelling	3
Covered latrine; Covered pit-latrine; Latrine; Latrine (ciego o negro); Latrine with manual flush; Inside yard: Latrine to open pit (ditch or river); Out of yard: Latrine to open pit (ditch or river); Indoors: Latrine to septic tank; Inside yard: Latrine to septic tank; Latrine connected to sewer/with septic tank; Mobile chemical toilet; Out of yard: Latrine to septic tank; Indoors: Latrine to piped public system; Inside yard: Latrine to piped public system; Out of yard: Latrine to piped public system	4
Flush, don't know where; Flush to somewhere else; Flush - to somewhere else; Flush - don't know where; Avec chasse d'eau; Flush; Flush - ; Flush - where; Flush don't know where; Flush or pour flush toilet; Flush other; Flush to vault (Bayara); Flush toileet; Flush toilet; Flush toilet to somewhere else; Flush toilet: own; Flush toilet: shared; Flush unconnected to sewer/without septic tank; Flush, where; Flust to pipe connected to canal; Modern flush; Modern flush toilet; Out/public; Own flush toilet; Own flush toilet outsite/yard; Personal toilet; Public flush toilet; Public toilet; Share toilet; Shared flush toilet; Toilet in common; Toilet with flush; W.C.; Water flow do not know where; Flush - to pit latrine; Hanging latrine; Drop/Hanging toilet; Drop/overhang; Flush to latrine; Flush toilet to pit latrine; Hanging toilet; Hanging toilet / hanging latrine; Indoors: Flush to open pit (ditch or river); Inside yard: Flush to open pit (ditch or river); Out of yard: Flush to open pit (ditch or river); Toilet hanging (on stilts); Traditional tank flush; Water sealed/slab latrine; Flush to pit latrine; Hanging toilet/latrine; Water sealed/slab la; Flush to septic tank; Flush - to septic tank; Barrel, tank; Composting toilet; Composting toilet / ECOSAN; Composting toilet/Arbo loo; Composting toilet/ecosan; Ecosan; Flush - to septic tank; Flush connected to sewer/with septic tank; Flush to pipe connected to ground water; Flush toilet to septic tank; Indoors: Flush to septic tank; Inside yard: Flush to septic tank; Out of yard: Flush to septic tank; Out/private; Septic pit; Septic tank; Share flush toilet outside/yard; Septic tank/toilet; Septic tank/modern toilet; Flush - to piped sewer system; Flush toilet to piped sewer system; Flushed to piped sewer system; Indoors: Flush to piped public system; Inside yard: Flush to piped public system; Out of yard: Flush to piped public system; Own flust toilet into residence; Piped sewage system; Private toilet; Share flush toilet into residence; Flush to piped sewer system	5
Delete; Non de jure resident; Not a de jure resident; Other; Other place; Other; Autre	Other

Note: We listed all entries irrespective of identical meanings but variant forms of spelling. Descriptions that are transformed into "Other" are not included in our regressions.

Table III continued: Transformation of descriptive variables into numerical values

Transformation of descriptive variables into numerical values for the variable

Description	Value
Head	1
Co-spouse; Co-wife; Spouse; Wife; Wife or husband	2
Mother; Parent; Parent/ parent-in-law; Parents/ parent-in-law	3
Daughter; Son /daughter; Son/daughter	4
Brother /sister; Brother/sister; Sister	5
Grandchild; Granddaughter; Grand-daughter; Grand-son/daughter	6
Niece; Niece by blood; Niece/nehew by blood; Niece/nephew; Niece/nephew by blood; Niece/nephew by blood*	7
Mother-in-law; Parent-in-law	8
Daughter-in-law; Son /daughter-in-law; Son/daughter-in-law	9
Brother or sister-in-law; Brother/Sister in law; Niece by marriage; Niece/nephew by marriage; Niece/nephew by marriage*; Sister in law; Sister-in-law	10
Other relative; Uncle/Aunt/Other relative	11
Adopted /foster child; Adopted/ foster/ stepchild; Adopted/foster child; Adopted/foster child/stepchild; Adopted/foster daughter; Adopted/foster/step child; Stepson/daughter; Step-son/daughter; Step-son/step-daughter	12
Not related	13
Domestic employee; Domestic employee (CS); Domestic service; House maid; Maid	14

Note: We listed all entries irrespective of identical meanings but variant forms of spelling.