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Why don't households invest in latrines: health, prestige, or safety?

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Abstract

70 percent of the rural population in sub-Saharan Africa does not use adequate sanitation facilities. In rural Benin, as much as 95 percent of the population has no access to improved sanitation. This paper explores why households remain without latrines analyzing a representative sample of 2000 rural households. Our results show that wealth and latrine prices play the most decisive role for sanitation demand and ownership. At current income levels, sanitation coverage will only increase to 50 percent if costs for construction are reduced from currently $200 USD to $50 USD per latrine. Our analysis also suggests that previous sanitation promotion campaigns, which were based on prestige and modern lifestyle as motives for latrine construction, have had no success in increasing sanitation coverage. Moreover, improved public health, which is the objective of public policies promoting sanitation, is also difficult to achieve at low sanitation coverage rates. Fear at night, especially of animals, and personal harassment, are stated as the most important motivational factors for latrine ownership and the intention to build one. We therefore suggest that new low cost technologies should be introduced on rural markets and that social marketing strategies should be adjusted accordingly.

Keywords: Sanitation, Sanitation Demand, Willingness to pay, Motivational factors

JEL Classification: D12, O12, O31, O55

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Introduction

Only 40 percent of the population in sub-Saharan Africa (SSA) has access to improved sanitation facilities. The situation is better in urban areas, with a coverage rate of 55 percent, but remains severe in rural areas, where only 30 percent of the population has access to improved sanitation (World Bank, 2012; UNICEF/WHO, 2012). The situation in rural Benin and neighboring countries is even worse, with only 5 percent of the population using improved sanitation facilities in Benin, 11 percent in Burkina Faso, 4 percent in Niger, and 3 percent in Togo (UNICEF, 2013). Millennium Development Goal (MDG) 7c, which aims to halve the number of people without access to sanitation, will not be achieved by 2015 in SSA in general and in West Africa in particular (UNICEF/WHO, 2012).

The lack of improved sanitation in sub-Saharan Africa is a serious concern because of the related health threats in a pathogen-loaded environment (e.g. Fewtrell et al., 2007). The WHO (2009) estimates that 3.2 percent of worldwide deaths are related to unhygienic water and sanitation practices; the burden of unimproved water and sanitation is higher for Africa, accounting for approximately 12.5 percent of all deaths. Improper water, sanitation and hygiene (WASH) conditions are further estimated to contribute to 13 percent of the disease burden in Africa estimated in Disability Adjusted Life Years (DALYs). More than 80 percent of diarrheal deaths can be attributed to unsafe water, sanitation and hygiene (Prüss-Üstün et al., 2008). Frequent incidence of diarrhea in childhood causes stunting and pneumonia infections which can increase child mortality rates (e.g. Checkley et al., 2008; Schmidt et al, 2009; WHO, 2009; Spears et al., 2013). Even though great progress has been made in the last 20 years, diarrheal diseases are still the leading cause of child deaths in Africa and the second leading cause of child deaths globally (WHO, 2008b).

To overcome the high disease burden related to diarrhea, sanitation coverage must hence increase substantially. This paper analyzes who invests in private latrines and the underlying motivational and/or constraining factors for construction. We study a representative sample of 2000 rural households in Benin in 2010. We examine the individual characteristics of latrine adopters as well as factors influencing open defecators' willingness to pay (WTP) for private sanitation facilities in multivariate regression models. Health and prestige have been identified as major drivers of sanitation investment in the past, either as stated by users (prestige) or as stated by policy makers (health).

By scrutinizing self-reported reasons for (not) building latrines we identify important marketing mechanisms which could stimulate future investments in improved sanitation.

This study contributes to both, price setting for sanitation technologies and marketing messages to increase sanitation coverage in poor rural areas in sub-Saharan Africa in general and in Benin in particular. The ultimate objective of increased access to sanitation is to improve public health and decrease the disease burden of diarrhea. It is the first study that quantitatively assesses the drivers of sanitation demand and adoption in poor rural areas. Previous research on the topic of sanitation demand either employed qualitative methods (Jenkins and Scott, 2007; Jenkins, 2004; Jenkins and Curtis, 2005) on a very small sample of rural households, or quantitative methods but with a focus on urban areas (Whittington et al., 1993; Atlaf and Hughes, 1994; Arimah, 1996; Grimason et al., 2000; Santos et al., 2011). Few studies examine the effect of sanitation promotion campaigns on adoption rates (Cameron et al., 2013; Pattanayak et al. 2008) or health outcomes (Spears et al., 2013; Spears, 2013).

The remainder of the paper is structured as follows: Section 2 provides a literature review on earlier studies on sanitation demand. In section 3 a short overview of the sample, survey design

and analytical methods is given, before results are presented in section 4. Section 5 discusses the results and concludes.

Literature Review on Sanitation Demand

Although the evidence of the impact of sanitation on diarrhea reduction is not fully established yet, improved sanitation facilities are seen as favorable goods for a hygienic and unpolluted environment as well as the surroundings of living areas, which in the long run will accomplish public health goals. Increasing sanitation coverage remains a vital interest for policy makers and practitioners in achieving the MDG target of reducing, by half, the population without access to improved sanitation. The fact that the MDG target will not be achieved by 2015 and related health threats in a pathogen-loaded environment remain for the population in SSA, makes it all the more important to find out what works in increasing sanitation coverage rates.

Hence, questions concerning how the demand for improved sanitation facilities can be fostered in order to achieve higher or even universal rates of sanitation coverage are strongly related to the health debate. The difference between sanitation and water infrastructure in rural areas is the often private, decentralized nature of sanitation versus the public, centralized provision of water infrastructure. Due to the low density of rural areas and the high infrastructure costs of sewer systems, decentralized on-site sanitation systems – e.g. ventilated improved pit latrines - are currently recognized to be the suitable technology for developing countries. Sanitation is often a private investment in developing countries apart from the city centers. As a consequence, in order to raise sanitation coverage rates, private sanitation demand has to increase.

Concerning the health dimension, results of observational studies suggest that diarrhea incidence decreases by 26 to 32 percent with access to improved sanitation (Daniels et al., 1990; Esrey et al., 1991; Fewtrell, et al., 2005; Waddington et al., 2009). Recent research in India found that the Total Sanitation Campaign (TSC) reduces infant mortality and decreases stunting (Pattanayak et al., 2008; Spears et al., 2013, Spears, 2013). However, rigorous (experimental) studies measuring a significant positive effect on diarrhea are missing.

Earlier research using diarrhea incidence as outcome variable was often criticized as overestimating the impact of sanitation on health (Cairncross and Valdmanis, 2006). More recent evidence using large sample sizes and/or applying matching techniques find only low rates of diarrhea reduction of 2 to 13 percent due to households possessing an improved latrine (e.g. Jalan and Ravallion, 2003; Bose, 2009; Günther and Fink, 2010; Kumar and Vollmer, 2012). These studies found larger effects of sanitation in densely populated urban areas (Esrey, 1996; Günther and Fink, 2010) and for children living in wealthier quintiles having educated mothers (Kumar and Vollmer, 2012). It has been furthermore argued, that reductions in sanitation (and water) related diseases depend strongly on the level of sanitation within the targeted community (Eisenberg et al., 2007; Gundry, et al., 2004). Bateman and Smith (1991) argue that for a maximum health impact, a majority of about 75 percent of the households in a community should be using improved sanitation. Some studies have even suggested that the environmental fecal-oral pathogen contamination only decreases to a low or medium level when sanitation coverage rates of over 90 percent are achieved (e.g. Fewtrell et al., 2007).

Research approaches which analyze driving factors of sanitation demand and latrine adoption to achieve high sanitation coverage range from anthropological methods, like in-depth interviews (Jenkins and Curtis, 2005), to quantitative contingent valuation methods to estimate the willingness to pay (WTP) for improved sanitation (O'Loughlin et al., 2006; Whittington et

al., 1993), to qualitative and quantitative evaluations of sanitation programs (Atlaf and Hughes, 1994; Hadi, 2000; Waterkeyn and Cairncross, 2005; Cameron et al., 2013; Spears et al., 2013).

Quantitative WTP studies (e.g. Whittington et al., 1993; Atlaf and Hughes, 1994; Arimah, 1996; Grimason et al., 2000; Santos et al., 2011) often focus on urban areas where the need for improved sanitation is especially high because of the increased disease burden in densely populated areas. The findings of multivariate analyses indicate that WTP in urban areas mainly depends on the level of dissatisfaction with current practices and on wealth (income). Education and cultural factors are only minor drivers of demand (Whittington et al. 1993). The evidence for male versus female headed households is mixed (e.g. Fujita et al., 2005; Hadi, 2000; Whittington et al. 1993).

Another strand of literature concentrates on the effects of sanitation promotion projects on increasing sanitation coverage, but mostly without applying "rigorous" evaluation methods. Awareness or promotion campaigns try to influence sanitation preferences without offering support for construction. Hygiene campaigns through community health promotion programs were found to be an effective tool for increasing sanitation coverage (Waterkeyn and Cairncross, 2005; Cameron et al., 2013; Pattanayak et al., 2008). However, adoption rates remained low a year after the community health sessions (Waterkeyn and Cairncross, 2005). Only two quantitative impact studies focused on the effect of a Total Sanitation and Sanitation Marketing (TSSM) campaign on sanitation uptake in India (Cameron et al., 2013; Pattanayak et al., 2008). The studies found moderate effects of the sanitation campaign on open defecation (OD) reducing it by 17 to 25 percent.

Qualitative studies examine the motivation of households to construct latrines, and possibilities to increase sanitation demand with the help of social marketing campaigns. Jenkins and Scott (2007) explore a preference-intention-choice approach in peri-urban and rural areas in Ghana. More than 85 percent of the sample practiced OD, of which 60 percent had no intention of constructing a toilet. For households that were dissatisfied with OD, convenience and cleanliness were the major motivational factors for latrine construction. The major constraints for latrine construction were the high costs. The authors recommend an ex-ante program analysis by households' adoption-stage prior to the implementation of sanitation campaigns in order to target households with higher preferences and intention to construct and consequently achieve higher coverage through sanitation promotion projects. This seems to be a quite complex procedure given the limited resources of sanitation projects.

For Benin, conducting focus group discussions (FGD) with 40 households, Jenkins (2004) and Jenkins and Curtis (2005) have found that giving an impression of prestige to others and adopting an urban lifestyle is what matters most for latrine adopters. Furthermore, Jenkins and Cairncross (2010) analyze the correlation of village characteristics with sanitation coverage in a sample of 502 villages in the *Zou* department in Benin. The authors recommend that demand can be stimulated by sanitation programs in larger villages which are agricultural centers (20 percent of their sample). For remote villages that make up the majority of the analyzed sample (74 percent) and where latrine coverage is very low at only 3 to 4 percent, the study assumes (but does not test) that people have a greater need and demand for roads, water and education than for sanitation.

For our study design we use the findings of these former studies, especially on Benin, as a template for compiling our questionnaire instruments. The available data set allows a quantitative analysis of motivational and constraining factors influencing sanitation ownership and WTP in African rural areas, which has, to the best of our knowledge, not been done before.

Sample and survey

The survey regions cover the departments of Mono-Couffo (Southern Benin) and Collines (Central Benin). The sample size was set at 200 villages and 2000 households. Sampling of villages was based on the planning lists of the Regional Water Service Agencies (Service Eau) for 2009 to 2011 to evaluate the national rural water and sanitation program in Benin. Complete household lists were assembled in the selected villages to draw a random sample of 10 households per village. Villages of the sample benefit from the national water and sanitation program AEPA (Approvisionnement en Eau Potable et Assainissement) and the promotion campaign PHA (Promotion de l'Hygiène et de l'Assainissement). For an overview of the geographic diffusion of sampled villages, see Figure 1. Households were interviewed face-to-face in February 2009 and 2010 and the main respondent was usually the spouse of the household head (84 percent) or the female household head (16 percent). The questionnaire covered both water and sanitation practices. The analysis of water practices and related health outcomes is analyzed in previous papers (Gross et al., 2012; Günther and Schipper, 2013).

Figure 1: Geographic diffusion of sanitation projects
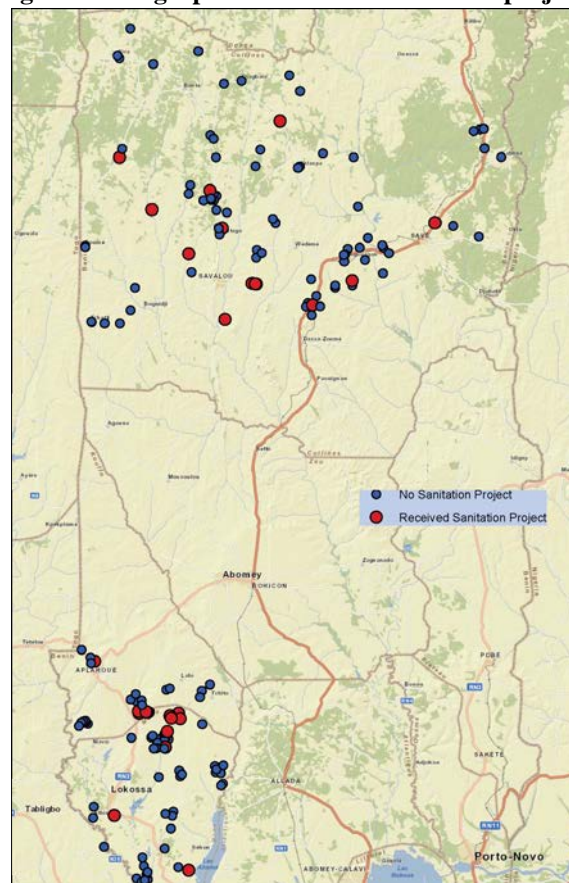
The Beninese hygiene promotion program PHA, is a follow-up program to previous national water and sanitation projects, and has been implemented in 2004. It focuses on promoting the advantages of improved sanitation through simple communication tools: door-to-door message delivery, community meetings, radio and picture materials (WSP, 2004). The national program in Benin promotes latrines as a prestige item and luxury good with slogans like *"A beautiful latrine: Privacy guaranteed for all the family"* or *"A latrine is better if you have visitors"* (WSP, 2004). These messages are – at least partly - based on previous research on sanitation coverage in rural Benin by Jenkins and co-authors (Jenkins, 2004; Jenkins and Curtis, 2005).

Based on the planning lists of the national water survey for 2009/2010, a random sample of 200 villages was drawn. Treatment villages were supposed to participate in AEPA before 2010 whereas control villages were supposed to participate only after 2010. In this paper we use the data of a survey in 2010 focusing on WTP and factors motivating sanitation demand.

Analytical strategy

We analyze the correlates of latrine ownership and determinants of the WTP of households practicing OD using a multivariate linear ordinary-least-squares (OLS) regression model. As an alternative and in order to control for robustness we also estimate a logistic regression and calculate average marginal effects for latrine ownership. The coefficients of both models are close to similarity and we therefore report OLS coefficients for easier comparison with the WTP model. As the occurrence of zeros for the latrine ownership variable is very high (90 percent open defecators, 10 percent latrine users), it is also possible to estimate a rare-events model (King and Zheng, 1999). This specification is again not different from the basic OLS results. Standard errors for all regressions are clustered at the village level to control for the clustered sample design and intra-cluster correlation.

In the results section we present the OLS model analyzing the socio-economic characteristics correlated with latrine ownership to understand differences between sanitation using and OD practicing households. Households are defined as latrines owners if they *possess an own latrine facility on their compound which is currently used by the members of the household.*

As most households in the sample (about 90 percent) do not use improved sanitation facilities, the second part of the analysis focuses on WTP for improved sanitation and correlated socio-economic factors of households currently practicing OD (including public latrine users, which only make up 4 percent of our sample). For analyzing households' sanitation demand we use stated willingness to pay (WTP) as variable of interest. The contingent valuation analysis defines WTP as an option price for a good prior to the realization or the purchase of that item (Boardman et al., 2005; Whittington, 2010). Households were asked about their WTP using a two-step approach: first, two dichotomous questions on bid levels were asked in a double-bounded approach (Hanemann, 1985). The first bid level was 60,000 FCFA, corresponding to two-thirds of the current average market price of an improved latrine. Contingent on the answer (NO/YES) of the first bid level, the second bid was then either 30,000 FCFA or 90,000 FCFA. Second, a final open question was asked on households' maximum WTP. One criticism of the open-end method is that many zero values are stated when used as a single measure of WTP (Bonato et al., 2001).The open-end approach in combination with the double-bounded approach avoids having many zero values (for our case only three percent) and is very similar to real market transactions. For the main analysis, the final open-end question is used. Aiming to reduce information bias and increase precision of our estimates, we referred households towards the type of latrines which are usually constructed at schools. In rural areas in Benin, the common school latrine is a ventilated improved pit (VIP) latrine with a concrete superstructure and a ventilation pipe which reduces odors and flies. Minimizing information bias reduces potential measurement error.

The household level characteristics used as controlling instruments are similar to Whittington et al. (1993). We use gender, education, off-farm/income oriented employment and age of household head as explanatory variables, assuming he or she is the main decision maker regarding investment in sanitation. Other household characteristics are a measure of wealth, household composition and the use of an improved main drinking water source. By including hand washing activities, soap use and mosquito bed net availability we want to measure health awareness. We refer to an improved water source (public standpipe, pump or a protected well)

according to the definition of the WHO (2008a) drinking water guidelines. The wealth measure is an asset index because income or expenditure data are not available. The index is constructed from 20 binary variables (sanitation facilities excluded) on improved housing (roof, wall, floor, electricity connection), asset ownership (furniture (bed, armchair, chair, table)), jewelry, livestock (chicken, pigs, goat/sheep), productive tools (sewing machine, mill, construction tools), TV, radio, bicycle, motorbike, and cell phones using a principal component analysis as recommended by Filmer and Pritchett (2001). The index is standardized to a range from zero to one.

As village-level control factors we use data on participation in the Beninese hygiene and basic sanitation promotion program as an indicator to measure any influence of sanitation and/or hygiene programs on latrine ownership and WTP for latrines (in case of OD).

The self-reported sanitation and hygiene project variables in the analysis indicate whether a sanitation and/or hygiene project took place in the village within the last five years. 16 percent of our sample villages indicate having participated in a sanitation project directly aimed at stimulating investments in latrines. Hygiene programs, aiming to raise awareness for hygienic issues related to water and sanitation, were implemented in 9 percent of villages. Within the scope of this study it is not possible to account for the selection strategy of villages into programs of donor organizations. Therefore, we cannot make causal inference on the impact of these programs on sanitation coverage, but only analyze the correlation between presence of programs and latrine ownership and/or WTP. Further we control for infrastructure related variables as roads and walking distances to markets and neighboring villages. Additionally, we include district fixed effects to measure heterogeneity between districts.

Household assertions about motivations and disincentives for latrine construction are qualitative indicators used to support the quantitative analysis of the WTP variable. The descriptive analysis can give insights into possible demand-stimulating mechanisms with the goal of designing future sanitation campaigns. Motivational factors as prestige and a modern lifestyle were identified as highly important in qualitative studies (Jenkins, 2004; Jenkins and Curtis, 2005).

In a last step, we analyze the correlation between health (diarrhea incidence) and improved sanitation access as well as sanitation promotion programs. This contributes to the discussion of the right elements of sanitation promotion campaigns.

Results

The proportion of households using a private latrine in our sample is 10.2 percent. Of these, 57 percent indicate that they have no problems with their latrine in use. The major problems reported by the remaining 43 percent are the smell (22 percent), the number of users (14 percent), and discharging the latrine (11 percent). On average, a private latrine has been in use for five years. 55 percent of latrine users indicate that they had the latrine built within the last three years. Only 26 percent of latrine owners reported having received support from a donor program for the construction of latrines. The average price paid for a private latrine is 94,000 FCFA (approx. $200 USD). Households that were supported by a program, paid, on average, a lower price (25,000 FCFA) compared to households without support (125,000 FCFA). The average price of a VIP latrine in our sample is $200 USD. This price lies in the middle of the range for pit latrines which is estimated to be $50-350 USD (WASHCost, 2012). Hence, the average of $200 USD paid by current latrine owners seems to be a representative market price for improved sanitation in rural Benin.

The descriptive statistics in Table 1 give some initial insights into the characteristics of the entire sample, separated by households practicing OD and households using private latrines. Column 4 shows p-values indicating whether the difference in characteristics between private latrine users and open defecators is statistically significant. Table 1 demonstrates that, on average, latrine users are wealthier, from larger families, better educated, and headed by older women. Interestingly, hygiene behavior in the sense of hand washing, presence of soap and usage of an improved water source does not differ between the two groups. Health outcomes, measured as diarrhea incidence cases in the last four weeks, also differ significantly between latrine users and households practicing OD (not controlling for any other factor). The difference in diarrhea incidence is 3 percentage points for all individuals and is statistically significant at the 1 percent level. Interestingly, this difference between groups results from differences between teenagers and adults and not children. Children below the age of five are the most deprived group concerning diarrhea and suffer most, but the difference between households using latrines and practicing OD is insignificant.

Table 1: Sample descriptive statistics

Household characteristics	(1) Sample Mean	(2) Nature users	(3) Latrine users	(4) p-value of the difference between (2) and (3)
Private latrine coverage	0,10			
Number of hand washing activities per day	2.38	2.37	2.42	0,35
Household uses improved water source	0.72	0.72	0.71	0,87
Use of mosquito bed net	0.60	0.58	0.81	0,00
Soap available in household	0.40	0.40	0.46	0,10
Household size	5.25	5.19	5.72	0,01
Number of women in household	2.55	2.53	2.81	0,03
Children below age 5	0.68	0.68	0.70	0,79
Age of household head	45.82	45.20	51.39	0,00
Female headed household	0.16	0.15	0.22	0,04
Head with no education	0.70	0.71	0.62	0,03
Head has income generating activity	0.22	0.20	0.38	0,00
Asset Index (0-1)	0.33	0.31	0.49	0,00
Poor household	0.33	0.36	0.11	0,00
Diarrhea incidence children below age 5	0.24	0.25	0.21	0,30
Diarrhea incidence 5 years and older	0.08	0.08	0.06	0,04
Diarrhea incidence 15 years and older	0.11	0.11	0.08	0,02
Diarrhea incidence all household members	0.12	0.12	0.09	0,00
Village characteristics				
Village size (number of households)	94.19	65.86	120.87	0,00
Electricity in village	0.20	0.05	0.33	0,00
Access via paved road	0.16	0.10	0.20	0,05
Primary school	0.82	0.71	0.92	0,00
Secondary School	0.42	0.22	0.62	0,00
Number of aid projects	2.20	1.77	2.60	0,00
Sanitation project last 5 years	0.16	0.11	0.19	0,11
Hygiene project last 5 years	0.09	0.08	0.09	0,90

Note: Significance levels: *** p<0.01, ** p<0.05, * p<0.1

Turning to village characteristics, it is obvious that households with latrines live in villages that are better endowed with infrastructure, i.e. with access to electricity, paved roads, primary and secondary schools. Also, we see that latrines are prevalent in larger villages. Latrine ownership

is only slightly correlated with the presence of a sanitation project (p-value=0.11), but not with the presence of a hygiene project (p-value =0.90). We use sets of household and village characteristics described in Table 1 to analyze factors influencing latrine ownership and WTP of open defecators. The first column of Table 2 shows the estimation for private latrine ownership. The household level factors positively influencing private latrine ownership are the gender of the household head, his/her income activity, and wealth measured by the asset index. Households with female heads have a 6 percent higher probability of owning a latrine, other factors held constant. However, wealth and income activities seem to be the most crucial determinants, with probability of latrine ownership increasing by 4.7 percent for each 10 percent increase in the asset index and 4 percent in case the household head practices an off-farm income activity. The variable uneducated household head was expected to be negative, as lower education should be correlated with a lower awareness of the advantages of improved sanitation. However, and similar to Whittington et al. (1993), education plays no role for latrine construction, once wealth is controlled for. Further factors included in our model are household size, number of children below the age of five, and women in the household, to account for the household composition. None of these variables turn out to be a significant factor for latrine ownership – once controlled for other factors. Additionally, proxies for households' general health and hygiene awareness are included in the analysis: households' use of improved water supply, soap availability and hand washing activities, approximating hygiene behavior. Use of improved water supply is not correlated with the presence of private sanitation facilities; neither is hand washing activities or soap availability.

At the village level, access to a paved road is (the only) positively correlated factor with latrine ownership. Access to the village via a paved road can mean many things: cost reduction, new norms and technologies, modernity and urban life style adoption. These factors can have a positive impact on sanitation coverage by making latrines more known and construction materials better available. There seems to be no effect of sanitation or hygiene projects on private latrine ownership, as both coefficients are insignificant. Note that one possibility for this unexpected finding is endogenous program placement, as organizations might target the villages where sanitation coverage is especially low. However, sanitation coverage is low all over the villages in Benin; hence, we can cautiously conclude that sanitation and hygiene promotion programs have not been successful in raising sanitation coverage. Focusing on promotion campaigns with an emphasis on prestige and latrines as luxury goods has not been effective in increasing sanitation coverage in rural Benin in the last five years.

The second step of the analysis is to examine village and household level factors influencing the WTP (measured in units of 1,000 FCFA) of households practicing OD. Colum 2 shows the coefficients of the multivariate OLS model. At the household level, and similar to our results for latrine ownership, only wealth is found to be positively correlated with higher WTP for improved sanitation. Wealthier households have a higher WTP for private improved sanitation, other factors held constant. Each 10 percent increase in the asset index augments WTP by 3,282 FCFA ($7 USD). The binary variable for the gender of the household head turns negative and significant, contrary to the results of the first regression. We suggest that the reason for this is that on average women tend to estimate a lower current price for improved sanitation than men (see discussion below), which then results into lower WTP. None of the health awareness proxies - use of an improved water source and/or mosquito net - seem to influence WTP for improved latrines. In contrast to the previous finding, education plays a role for the willingness of households to pay for sanitation facilities. When the household heads have no education, WTP decreases on average by 3,670 FCFA.

	(1) Private latrine ownership	(2) WTP in 1000 FCFA
Village sanitation project	0.04	-2.56
	(0.038)	(2.085)
Village hygiene project	-0.02	1.36
	(0.026)	(2.636)
Access to paved road	0.06**	-3.34
	(0.030)	(3.325)
Walking distance next village	0.00	-0.00
	(0.000)	(0.010)
Walking distance regional market	0.00	-1.22
	(0.023)	(1.953)
Village > 50 households	-0.03	3.86*
	(0.034)	(1.973)
Village has primary school	0.03	0.52
	(0.033)	(2.412)
Female headed household	0.06**	-4.78**
	(0.027)	(2.216)
Uneducated household head	0.00	-3.67**
	(0.018)	(1.862)
Age of household head	0.00***	0.04
	(0.000)	(0.047)
Household size	-0.00	0.26
	(0.004)	(0.540)
No. children <5 years	0.01	0.89
	(0.010)	(0.950)
No. of women in household	-0.00	0.40
	(0.007)	(0.724)
Asset index (0-1)	0.47***	32.82***
	(0.060)	(4.567)
Head off-farm income activity	0.04*	1.03
	(0.021)	(1.907)
Usage improved water source	0.02	0.92
	(0.026)	(1.980)
No. of handwashing activities per day	0.01	-2.53*
	(0.015)	(1.323)
Soap available	-0.00	6.24***
	(0.018)	(1.620)
District fixed effects	YES	YES
Constant	-0.35***	27.81***
	(0.071)	(9.975)
Observations	1,717	1,505
R^2	0.155	0.226

Note: Robust standard errors in parentheses clustered at the village level, *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Most interestingly, and in line with the analysis in column 1, sanitation or hygiene projects conducted in the five years previous to this study are not effective in increasing WTP for improved sanitation. Hence, the presence of a sanitation and/or hygiene project does not translate into latrine construction or increased demand for improved sanitary conditions.

The analysis on latrine usage and the WTP of those households that still practice OD reveals that wealth is the most decisive determinant for past and future latrine construction. Figure 2 below confirms these results more clearly, showing the relationship between wealth and latrine

infrastructure. The left-hand graph of figure 2 shows the distribution of latrine ownership over the deciles of the asset index. Within the highest decile we see that 30 percent of households possess a latrine, whereas in the lowest two deciles, only 2.5 percent of households own a latrine. The right-hand graph of figure 2 shows the average WTP distributed over the asset index for households not using improved sanitation facilities. WTP increases, as expected, with wealth. The richest decile of the asset index is willing to pay more than twice the amount of the poorest decile.

Overall, wealth seems to be the dominating factor for increasing the likelihood of latrine demand and ownership. Households in the highest two deciles of the asset index are those possessing a high quantity of the assets listed in the asset index above. The major difference between the poor (lowest two deciles of the asset index) and the better-off households lies in improved housing conditions in general, i.e. having a cemented floor, roof and walls, equipped with some furniture, a radio, mobile phone and motorbike. Households in the lowest deciles of the asset index are living without improved housing conditions, i.e. mud walls and floor, and no furniture; the only assets prevalent are goats and chickens. Hence, basic housing and living conditions, i.e. cemented floor and walls, tile roof and some furniture, are the important asset base that has to exist before people start to invest in latrines.

Figure 2: Sanitation demand and wealth
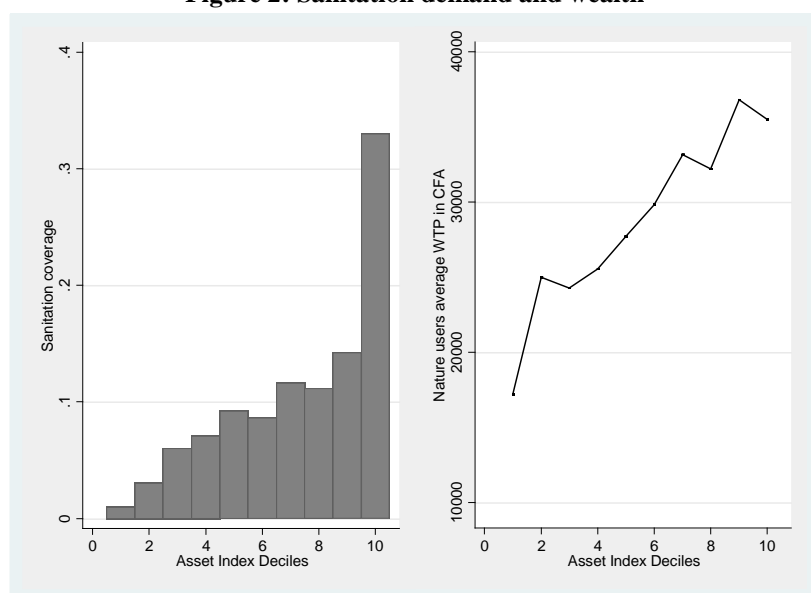
According to our estimates, sanitation and hygiene programs seem to have no impact on increasing demand for sanitation: households in villages with sanitation and hygiene projects in the last five years are neither more likely to own a latrine nor to have higher WTP for improved sanitation. Hence two questions remain: What should be the focus of future promotion campaigns in order to be more effective in increasing WTP and investment in latrines? And what would be an adequate price for improved sanitation in rural Benin?

The upper panel of Table 3 shows household-specific reasons for private latrine construction. This question was asked retrospectively to households already possessing private sanitation. Households practicing OD were asked for possible motivational factors to construct a latrine in the future.

65 percent of latrine using households indicate retrospectively that they installed a latrine to avoid dangers at night and/or to feel generally more secure. These hazards are especially snakes, insects or harassment from other people. Facilitating defecation and avoiding health risks are

the second most frequently indicated reasons. Making one's life more modern and gaining prestige in front of visitors, as argued in previous studies on Benin (Jenkins, 2004; Jenkins and Curtis, 2005), is only a minor reason for latrine construction. Further reasons mentioned less frequently (<8 percent) are recommendation (by a program) and the village becoming more populous. Interestingly, peer group effects do not seem to play a role either, as only two percent of households indicate that other households' construction of latrines was the motivation for them to install a latrine (results available from the authors).

Table 3: Reasons for (no) private latrine construction

	(1) Mean Latrine users	(2) Mean Open defecators
Motivational Factors		
Facilitate defecation	0,38	0,29
More discreet	0,08	0,09
Danger and Security (night, animals)	0,65	0,7
Avoid diseases	0,33	0,34
Maintain cleanliness around the house	0,21	0,17
Avoid seeing excrement of others	0,15	0,16
Time savings/Adjacency	0,24	0,17
Prestige in front of visitors	0,15	0,11
Make my life more modern	0,09	0,08
Reasons for not constructing a latrine		
No money		0,9
No need, satisfied with OD		0,07
Problems of construction		0,04

Note: Numbers do not necessarily add up to 100% as more than one answer per household is possible.

When households practicing OD are asked about potential advantages of and motives for possessing and using private sanitation, answers correspond to those of latrine users. The most frequently stated advantage of using a private latrine is security at night (70 percent), followed by the positive effects for health (34 percent), facilitating defecation (29), and cleanliness (17 percent). Again, prestige in front of visitors was only indicated by a minority of households practicing OD. Only 11 percent of households see prestige as a motivational argument for latrine construction, which is contradicting previous findings of anthropological studies that see prestige as the driving factor for sanitation construction (Jenkins, 2004; Jenkins and Curtis, 2005). Hence, the prestige argument does not seem to be the decisive argument for latrine construction in wider rural Benin.

Security, comfort, and health are ranked highest as persuasive arguments for the installation of improved sanitation; it is not prestige, which is, however, often used as a "selling argument" in current sanitation promotion campaigns. Security, comfort, and health can be featured by NGOs and other programs to convince people of the necessity of investing in sanitation. All of these motivational factors are easy to communicate and unambiguous keywords for social marketing

campaigns in the sanitation sector. However, we further argue that the emphasis should be on security and comfort, and not on health, for the following reason:

Increased security and comfort constitute private goods in the sense that a single household can improve its security and comfort by investing in a latrine for its household, with no positive externalities for other households. In contrast, an improved pathogen-environment is a public good. Not only do latrine investments have positive externalities for other households' health, but households' health can only be improved if a certain threshold of latrine coverage is achieved (Fewtrell et al., 2007), especially in rural areas (Bateman and Smith, 1991): analyzing the health impact of latrine use on diarrhea within the last four weeks in a multivariate analysis, Table 4 shows six regressions, differentiating the impact between children below the age of five, individuals older than four years, and all individuals. In column 1 to 3 of Table 4 we only control for the presence of sanitation in the household whereas in column 4 to 6 we additionally control for the presence of a sanitation or hygiene project in the past five years. Similarly to previous studies, we find no significant evidence for the effect of sanitation on diarrhea incidence. Diarrhea incidence is a self-reported indicator accounted for within the last 4 weeks prior to the survey. We control for other factor as in the previous models but include the presence of sanitation facilities in the household as independent variable. On village level, we find the expected result that higher population density (approximated by village size) is significantly increasing diarrhea incidence (Esrey, 1996; Fink et al., 2013). However, the coefficients for sanitation and hygiene promotion projects are insignificant. We have three possible explanations for this result: First, due to the relatively small sample size used in this study, we decided to use a recall period of four weeks which can cause measurement error because of downward recall bias and thus underestimation of the effect of sanitation on diarrhea. We note that this choice could have led to measurement error or underestimation and hence to insignificant results in Table 4. More importantly however, and as discussed earlier, sanitation coverage rates are very low all over the rural areas in Benin: 75 percent of households live in villages with 0 to 10 percent sanitation coverage, 23 percent in villages with coverage rates between 20 and 60 percent, and only 2 percent in villages with coverage rates of 80 percent and above. It is hence very unlikely that health effects occur: even if single households in our sample use a latrine, they are still exposed to a pathogen-loaded environment because other households defecate in the open. We therefore argue that security and comfort rather than health should be used as persuasive arguments in sanitation marketing promotion campaigns. Health improvements might not be visible to households or occur with a time lag, as it is also hard to measure them statistically, and especially when observation is not possible over time. Therefore households might get the opinion that sanitation, although expected to improve health, does not lead to better health outcomes. Because of undetected health improvements the population can consider health arguments for sanitation as not effective and consequently stop using latrines or not start to invest in one.

Table 4: Diarrhea incidence

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Diarrhea incidence children below age 5	Diarrhea incidence 5 to 14 years	Diarrhea incidence 15 years and older	Diarrhea incidence all household members	Diarrhea incidence children below age 5	Diarrhea incidence 5 to 14 years	Diarrhea incidence 15 years and older	Diarrhea incidence all household members
Private latrine ownership	-0.04	-0.02	0.01	-0.01	-0.04	-0.02	0.01	-0.01
	(0.044)	(0.019)	(0.014)	(0.013)	(0.045)	(0.019)	(0.014)	(0.013)
Village sanitation project					-0.03	-0.01	0.01	-0.00
					(0.034)	(0.016)	(0.014)	(0.012)
Village hygiene project					0.03	-0.00	0.02	0.00
					(0.052)	(0.019)	(0.020)	(0.020)
Access to paved road	-0.04	0.00	-0.01	-0.01	-0.04	-0.00	-0.01	-0.01
	(0.044)	(0.020)	(0.017)	(0.014)	(0.045)	(0.020)	(0.017)	(0.014)
Walking distance next village	0.00**	0.00	0.00	0.00	0.00**	0.00	0.00	0.00
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Walking distance regional market	0.06**	0.01	-0.01	0.01	0.06**	0.01	-0.01	0.01
	(0.030)	(0.017)	(0.014)	(0.012)	(0.030)	(0.017)	(0.014)	(0.012)
Village > 50 households	0.01	0.03**	0.02	0.03***	0.01	0.03**	0.02	0.03***
	(0.032)	(0.014)	(0.013)	(0.012)	(0.033)	(0.014)	(0.013)	(0.012)
Village has primary school	0.04	-0.01	0.01	0.00	0.04	-0.01	0.01	0.00
	(0.045)	(0.022)	(0.019)	(0.018)	(0.045)	(0.022)	(0.020)	(0.018)
Female headed household	-0.06	-0.01	0.00	-0.02	-0.06	-0.01	0.00	-0.02
	(0.042)	(0.026)	(0.013)	(0.014)	(0.042)	(0.026)	(0.013)	(0.014)
Uneducated household head	-0.01	0.03***	-0.01	0.01	-0.01	0.03***	-0.01	0.01
	(0.032)	(0.012)	(0.011)	(0.008)	(0.032)	(0.012)	(0.011)	(0.008)
Age of household head	-0.00***	-0.00	-0.00***	-0.00***	-0.00***	-0.00	-0.00***	-0.00***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)
Asset index (0-1)	-0.01	-0.03	-0.07**	-0.05*	-0.01	-0.02	-0.07**	-0.05*
	(0.083)	(0.033)	(0.028)	(0.024)	(0.083)	(0.034)	(0.028)	(0.024)
Household size	-0.01	0.00	-0.00	-0.00*	-0.01	0.00	-0.00	-0.00*
	(0.007)	(0.004)	(0.003)	(0.002)	(0.008)	(0.004)	(0.003)	(0.002)
No. children <5 years	-0.02	-0.00	-0.01**	0.00	-0.02	-0.00	-0.01**	0.00
	(0.015)	(0.006)	(0.005)	(0.004)	(0.015)	(0.006)	(0.005)	(0.004)
No. of women in household	0.02	0.00	0.01**	0.01*	0.02	0.00	0.01**	0.01*
	(0.013)	(0.005)	(0.004)	(0.004)	(0.013)	(0.005)	(0.004)	(0.004)
Head off-farm income activity	0.01	-0.00	-0.02	0.00	0.01	-0.00	-0.02	0.00
	(0.034)	(0.014)	(0.013)	(0.010)	(0.034)	(0.014)	(0.013)	(0.010)
Household uses improved water source	-0.00	0.01	-0.01	-0.01	-0.00	0.01	-0.01	-0.01
	(0.034)	(0.017)	(0.013)	(0.013)	(0.034)	(0.017)	(0.013)	(0.013)
No. of hand washing activities per day	0.01	0.01	0.02**	0.02***	0.01	0.01	0.02**	0.02***
	(0.022)	(0.010)	(0.009)	(0.006)	(0.022)	(0.010)	(0.009)	(0.006)
Soap available	0.02	-0.00	-0.01	-0.00	0.03	-0.00	-0.01	-0.00
	(0.030)	(0.012)	(0.011)	(0.009)	(0.031)	(0.013)	(0.011)	(0.010)
District fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Constant	0.19	0.04	0.14***	0.10**	0.20	0.04	0.13***	0.10**
	(0.128)	(0.067)	(0.045)	(0.048)	(0.128)	(0.066)	(0.045)	(0.049)
Observations	1,177	3,514	5,195	10,956	1,177	3,514	5,195	10,956
R²	0.063	0.018	0.019	0.017	0.063	0.018	0.019	0.017

Note: Robust standard errors in parentheses clustered at the village level, *** p<0.01, ** p<0.05, * p<0.1

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The lower panel of Table 3 also lists the main self-reported reasons for not having constructed a private latrine yet. About 90 percent of households defecating in the open indicate a lack of financial means as their reason for not possessing a latrine. This is consistent with the results of Table 2. Since the most basic needs are often not met, households argue that private sanitation is not affordable at current market prices. A latrine costing $200 USD is equivalent to about 10 percent of a rural household's annual expenditure. Rural household income was estimated at $2,150 USD by the national *Enquête Modulaire Intégrée sur les Conditions de Vie des Ménages* (INSAE, 2008) survey in 2007.

So what would be an adequate price for latrines to increase access to improved sanitation in rural Benin? Figure 3 outlines the estimated price and the WTP as demand curves for households practicing OD. Both curves slope downwards with increasing prices, as is expected by microeconomic demand theory. The left part of Figure 3 demonstrates that 50 percent of households estimate the price higher than the average market price, showing that there is a large information gap between markets and consumers. An additional explanation would be that prices vary strongly between different regions of Benin depending on accessibility. At the highest values, the estimated price is three times higher than the actual average price paid by current latrine owners (94,000 FCFA, approx. $200 USD). However, the price of sanitary facilities can also vary greatly depending on quality, the availability of construction material, tools and the soil condition. Interestingly, only 37 percent of female headed households overestimate the price for sanitation, which might lead to a lower WTP of female headed households as indicated in Table 2.

The right part of Figure 3 plots the distribution of the WTP for private sanitation facilities. At 3.29 percent, the sample has a very low proportion of zeros which supports the combination of the bid level closed-end with the open-end maximum willingness to pay approach. At the upper end of the WTP distribution, only 3.5 percent of households would be willing to pay the market price that private latrine owners have paid for construction. Hence, at current market prices, the low sanitation coverage will persist, or increase only very slowly. The median WTP is 25,000 FCFA ($53 USD), which represents about 25 percent of the current market price. At this price, it would be possible to increase coverage to more than 50 percent (given that 10 percent of the sample already uses a private latrine). The price elasticity of demand is smaller than -1 up to a price of 25,000 FCFA ($53 USD) of the demand curve, indicating that one percentage point change in the price leads to higher (larger than one) percentage changes in demand. Beyond 25,000 FCFA, the demand is inelastic ($0<\varepsilon<-1$); a unit change in price only leads to a weak change in demand for improved sanitation. Only a massive reduction in sanitation prices (from 94,000 to 25,000 FCFA) could increase sanitation demand drastically. Small price changes around the current market price of 94,000 FCFA will have almost no influence on coverage.

Figure 3: Nature user's estimated price and WTP for sanitation
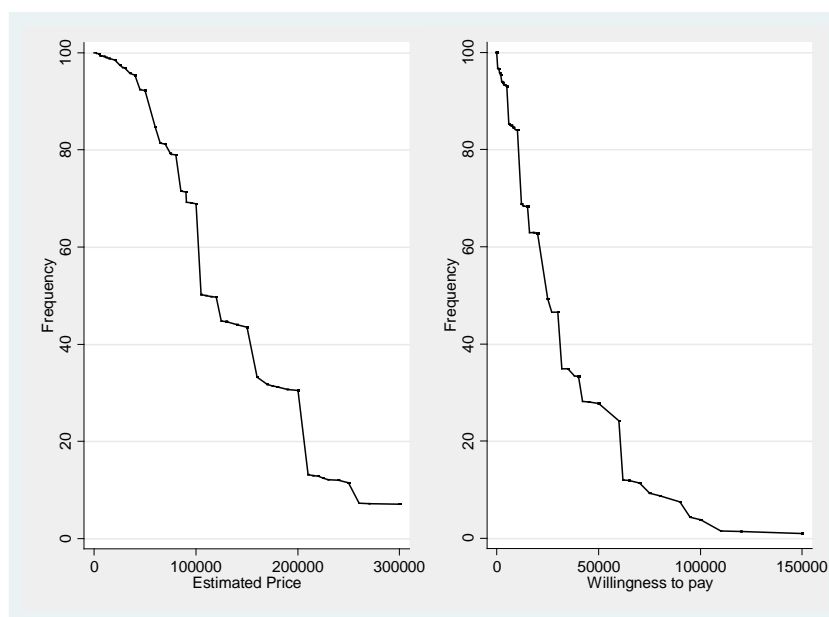
Discussion and Conclusion

Sanitation coverage is very low in SSA and the sub-goal MDG 7c on sanitation will not be achieved until 2015, especially in rural areas. This paper analyzes which socio-economic household and village level factors increase the likelihood of households investing in private latrines in rural Benin with the objective of contributing to the higher goal of public health by decreasing the disease burden of water related diseases. We further ask at what price level households would change from OD to private sanitation facilities.

Sanitation coverage is, at only 10 percent, very low in our sample, but very similar to other rural regions in Western Africa. Latrine ownership is highest among richer and female-headed households. Wealth is most important for latrine ownership as well as for demand as measured by WTP. Open defecators stated lack of resources as the major obstacle for latrine construction.

According to a contingent valuation analysis, the price for latrines has to fall to 25,000 FCFA ($53 USD), or about 25 percent of current market prices to achieve 50 percent sanitation coverage rates. Possible monetary drivers for increased sanitation coverage among poor households could be subsidies (used frequently to improve water access for the rural populations) or changes in technology that decrease the cost of sanitation construction. Otherwise, sanitation coverage will not increase much without substantial economic growth in remote and poor villages and consequently, public health improvements cannot be achieved.

Motivational factors for latrine construction are the avoidance of hazards at night, followed by facilitation of defecation and improvements in health– both for households that already own a latrine and for households that still practice OD. The ongoing national sanitation and hygiene program in Benin promotes latrines as a prestige item, partly because previous (qualitative) research (in selected villages of Benin) found prestige to be most relevant for rural households when considering investments into improved sanitation. According to our quantitative results (in 200 villages of Benin), these slogans are not persuasive. Households indicate that status and prestige considerations are only a minor motive for construction. In line with this result, our analysis suggests that previous sanitation programs played a rather minor role in increasing

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sanitation coverage in the villages studied. Sanitation projects may change awareness towards health and hygiene, but do not necessarily increase sanitation demand.

We argue that sanitation programs in remote rural areas should focus on security and hazards. Security can be considered as a basic need and is simple to communicate. Project slogans focusing on prestige will not stimulate households to construct a private latrine, because prestige and status are not associated with private latrines. Given that prestige is not a priority for poor people, it is unlikely that current marketing strategy can convince households in rural Benin to invest in sanitation. We further assert that promoting latrine ownership with health improvements might also be problematic given that no health effects on diarrhea incidence were found for our sample and many former studies. One reason might be measurement error, but also the very low sanitation coverage rate in villages which causes a very high pathogen contamination of the environment in general, irrespective of individual households investing in private sanitation.

Therefore, when sanitation coverage is at low levels, health effects can occur not at all or with a large time lag as seen in stunting rates of former studies. For persuading households to invest in sanitation, it is necessary to use improvements which are visible immediately. An alternative for rural areas are sanitation programs which install latrines for the whole population to increase coverage to 100 percent and thereby health to a maximum level possible under the given circumstances. An important incentive for latrine construction can be set by low market prices for construction.

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