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The costs and benefits of investing in a toilet

Views from Indian and Nigerian households and their policy implications

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The development field has put much emphasis on sanitation in recent years. Safe sanitation has been recognised to be an indispensable element of disease prevention and primary health care programmes (e.g. the Declaration of Alma-Ata, 1978).[2] It isolates faeces from the environment and, with that, breaks the faecal–oral transmission pathways associated with open defecation (OD) that would otherwise lead to significant disease burdens; see, for example, WHO (2014)[3] and Roma and Pugh (2012).[4] In addition to its importance for public and private health, safe sanitation benefits individual households on a wide range of other aspects, including time savings, comfort, increased productivity, greater safety and a higher social status.

In most developing countries, however, the gap that needs to be crossed to reach full sanitation coverage is substantial. Worldwide, 1.1 billion people still defecate in the open.[5] There is increasing government action to boost sanitation uptake –

[1] The authors gratefully acknowledge funding from the ESRC-DFID Grant ES/J009253/1. The research in India was funded by the Strategic Impact Evaluation Fund (SIEF), World Bank as well as FINISH and WASTE Netherlands, and research in Nigeria was funded by the Bill & Melinda Gates Foundation via WaterAid.

[2] See http://www.euro.who.int/__data/assets/pdf_file/0009/113877/E93944.pdf.

[3] 'Preventing diarrhoea through better water, sanitation and hygiene: exposures and impacts in low- and middle-income countries', https://extranet.who.int/iris/restricted/bitstream/10665/150112/1/9789241564823_eng.pdf.

[4] E. Roma and I. Pugh, 'Toilets for Health. A report by the London School of Hygiene and Tropical Medicine in collaboration with Domestos', 2012 (http://www.lshtm.ac.uk/newsevents/features/2012/toilets_for_health.pdf).

[5] Joint Monitoring Programme for Water Supply and Sanitation, 'Progress on drinking water and sanitation: 2012 update', Technical report, WHO/UNICEF, 2012 (http://www.wssinfo.org/fileadmin/user_upload/resources/JMP-2012-Annual-Report.pdf).

for instance, through subsidy programmes – but it is not clear whether this will be sufficient to tackle the tremendous sanitation challenge. Some rough back-of-the-envelope calculations suggest that the Government of India, for example, would have to construct 81 toilets per minute – day and night – starting 1 January 2015 to meet its goal of eliminating OD by the end of 2019, or 41 toilets per minute to meet the United Nation's goal of eliminating OD by 2025.[6]

Given the limits to public spending, many sanitation programmes aim to persuade households themselves to invest in the construction of a toilet. Put in economic jargon, these interventions assume that the expected private returns from investing in a private household toilet (e.g. better health, comfort, status, etc.) are at least as high as the costs the household is expected to incur. One comprehensive study on the costs and benefits of toilet construction was conducted by the Water and Sanitation Program (WSP), launched in 2007 and implemented in more than 20 countries in Asia and Africa. While the primary focus of this study was on attributing dollar amounts to a country's losses due to improper sanitation,[7] the study also reports findings at the individual level, confirming that private quality household sanitation is a worthwhile investment for households to make.[8]

Nonetheless, sanitation uptake is low and improvements in sanitation infrastructure in developing countries are slow. If it is indeed such a worthwhile investment, then why are the 1.1 billion people currently defecating in the open and not raising the funds to make this investment?

Researchers at the Institute for Fiscal Studies (IFS) are working on a number of sanitation evaluation studies, two of them in India (in the states of Maharashtra and Tamil Nadu) and one in Nigeria (in Enugu and Ekiti); these are two of the main

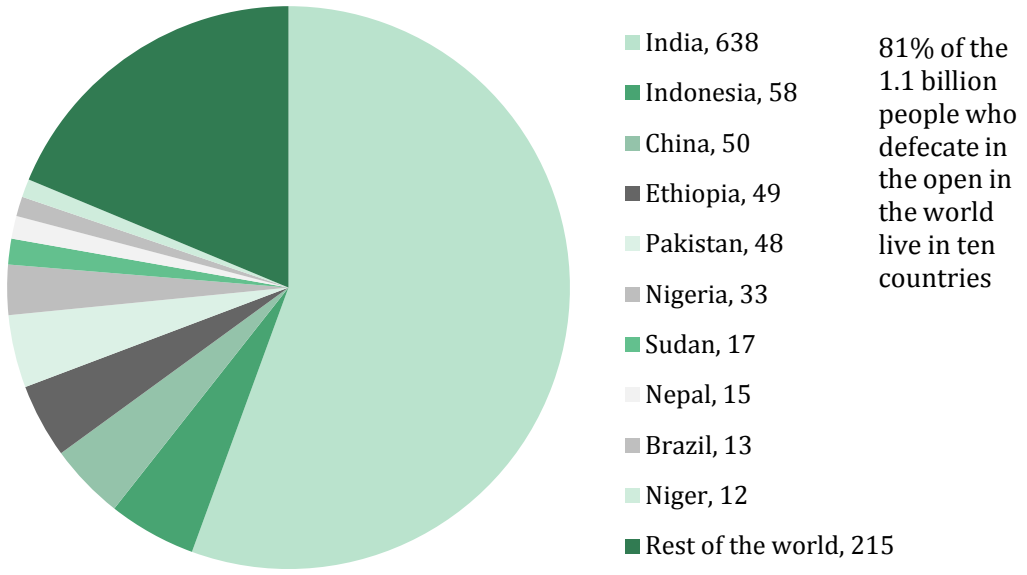
[6]This is based on the following rough back-of-the-envelope calculations: Current number of household (of on average 4.5 household members) without sanitation=194.1 million (assuming 70% OD), additional number of households projected by 2019=13.3million (2025=32.1 million), [194.1 million + 0.7*13.3million]/[5years(11years)*365days*24hours*60minutes].

[7] The results are startling: for example, 18 African countries are estimated to lose around US$5.5 billion a year due to poor sanitation, implying annual economic losses between 1 and 2.5 per cent of GDP.

[8] See, for example, WSP Research Brief, 'The economic returns of sanitation interventions in Indonesia', 2011. Another study concentrating on private returns is conducted in Maharashtra, India. The focus of this study is however on the estimating the economic value of the average "treatment effect" of a community demand-driven water and sanitation programme, rather than estimating the value of the sanitation systems more generally. (S.K.Pattanayak, C.Poulos, J.Yang & S.Patil (2010). "How valuable are environmental health interventions? Evaluation of water and sanitation programmes in India"
Bulletin of the World Health Organization 2010;88:535-542. doi: 10.2471/BLT.09.066050

countries where people still defecate in the open (see Figure 1). Below, we discuss the types of sanitation interventions that will be evaluated in the context of these studies. The percentage of people openly defecating ranges from 55 per cent in Tamil Nadu to 70 per cent in Maharashtra.[9] Taken together, 11,509 households were interviewed as part of these evaluation studies and a strong emphasis was placed on eliciting households' sanitation practices and beliefs.

Figure 1. Distribution of open defecators by country



Source: WHO, 2010[10]

In this note, we use data on households' perceptions about the costs and benefits of toilet uptake to better understand why toilet uptake remains low, despite the high returns to sanitation. Whereas perceived costs of toilet uptake can be reasonably approximated by households' expectations about how much they would spend if they were to construct a toilet, it is less straightforward to meaningfully monetise the benefits of toilet uptake. If, for example, a household believes that a toilet would increase its status in the village, we cannot say that this is worth a certain amount of dollars. However, understanding the possible returns as perceived by the households themselves will allow us to gauge whether a household's personal overall cost–benefit analysis is likely to be positive (and hence in line with the general idea that a toilet is a worthwhile investment) or

[9] OD rates are 61 per cent in Ekiti and 66 per cent in Enugu.
[10] 'A closer look at the ladders', in *Progress on Sanitation and Drinking-water: 2010 Update*, pp. 22–25, WHO, 2010.

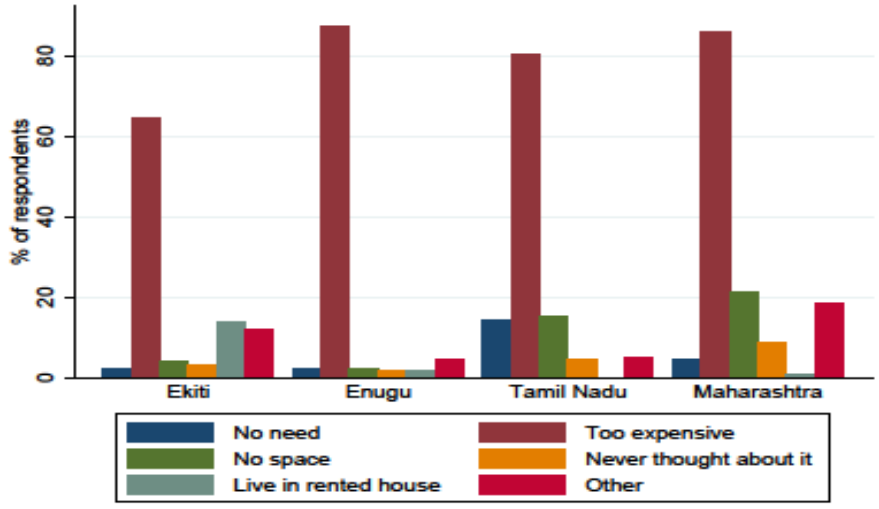
negative. Combining this then with the fact that households are not investing in toilets, we will be able to conclude with some policy recommendations on what type of sanitation interventions could be appropriate.

Understanding the reasons behind limited toilet ownership

We start by asking households themselves why they do not own a toilet.[11] Most people in India and Nigeria alike indicate that the main reason is the cost: in both countries, around 80 per cent of households report that they do not own a toilet because it is too expensive. These values are shown in Figure 2. Any other reason for not owning a toilet (such as insufficient space or the household never considered it) is never mentioned by more than 20 per cent of respondent households.

While this statement – the toilet being 'too expensive' – seems to convey a very clear message, as is, one cannot immediately induce from it what intervention would be the most appropriate.

Figure 2. Reason reported for not having a toilet



Source: Own data.

A toilet can be declared as 'too expensive' for one of two reasons (or a combination of both), as follows.

1. Households without a toilet understand the costs and gains of the investment but are not able to afford it (i.e. they are liquidity constrained).

[11] Throughout this note, we use the terms sanitation systems, toilet and latrine interchangeably.

2. Households without toilets underestimate returns or overestimate costs, and hence do not consider a toilet to be a worthwhile investment (even though they could potentially afford it).

Clearly, it is important for the design of sanitation interventions to understand which of the above points is the dominant reason for the observed non-uptake. If the cost of toilets is seen as appropriate given the expected returns (i.e. households would be willing to invest if they were able to; see point 1), then policy makers and development agencies should focus on interventions that alleviate liquidity constraints. If, however, households underestimate returns and/or overestimate costs (see point 2), then any intervention that aims at inducing sanitation uptake should provide households with information on the actual costs and benefits. In many cases, a combination of these two would be the appropriate way forward.

We use the very rich set of information on sanitation practices and habits, as well as beliefs and perceptions collected as part of the impact evaluation studies, to shed light on what drives households' prevailing view that toilets are too expensive. We start by discussing the expected costs and benefits from the perspective of the household. Then we weigh one against the other and relate our conclusions to findings from experimental sanitation impact evaluation studies, providing insight that can guide sanitation intervention design choices in the future.

Are households well informed about the costs of constructing a toilet?

What do households expect a toilet to cost and how do these expectations compare to actual costs (i.e. are beliefs about the costs of constructing a personal household toilet accurate)?

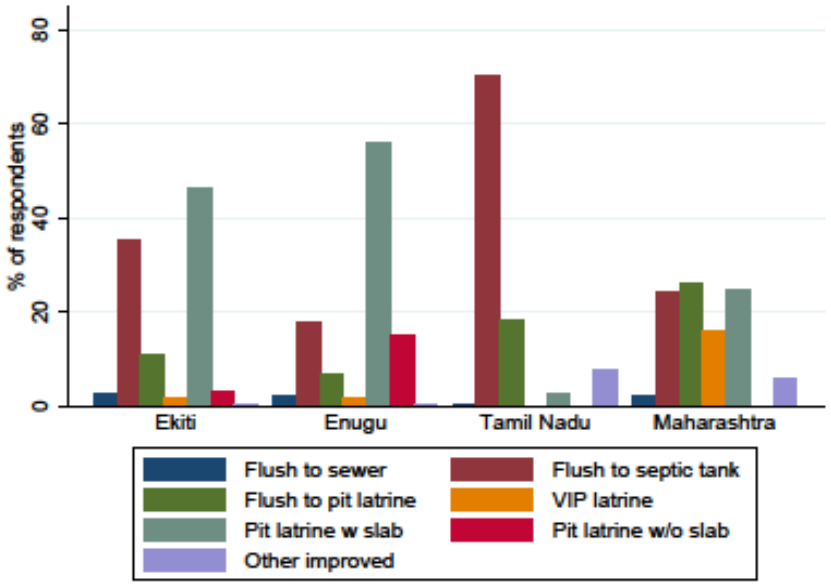
The most typical toilets in our study areas are pit latrines with slabs (in Nigeria) or septic tanks (in Tamil Nadu[12] and Ekiti), as shown in Figure 3. Maharashtra is the only state where no one model dominates, flush-to-pit latrines, septic tanks and pit latrines being most common. These most common models in all study states would be categorised as 'improved toilets' according to the definition of the Joint

[12] Households often believe that they have a septic tank while the model would most often rather fall into the category of a pit latrine, implying likely over-reporting in this category.

Monitoring Programme for Water Supply and Sanitation (2012),[13] implying that they hygienically separate human excreta from human contact.

To construct such a toilet, the household would, at a minimum, have to invest in digging a pit and constructing some version of a slab over this pit. The household can then improve on this most basic model by, for example, lining the pit, constructing a (strong) superstructure, adding a second pit to be used when the first is filled, etc. A household would typically need to invest not only in materials but also in labour, such as a mason, carpenter, bricklayer, etc. Indeed, in India for example, 92 per cent of households with a toilet report that they hired a mason for the toilet construction.

Figure 3. Types of toilets owned



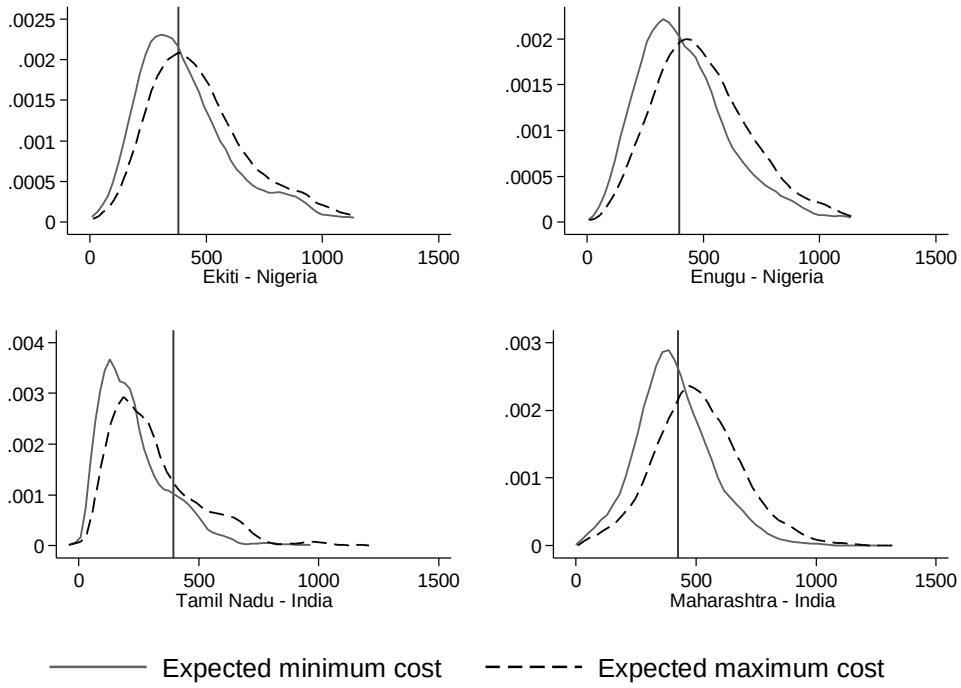
Source: Own data.

In our surveys, we asked households what they think they would have to spend at a minimum and at a maximum to construct a toilet. We asked them these two numbers for different toilet types observed in the study areas.[14] In Figure 4, we show the minimum (grey solid line) and maximum (dashed black line) expected

[13] Joint Monitoring Programme for Water Supply and Sanitation, 'Progress on drinking water and sanitation: 2012 update', Technical report, WHO/UNICEF, 2012.
[14] Pictures and descriptions of the models asked about were provided to the respondents. In Nigeria, four different models were asked about, and in India three, starting from a simple non-lined pit latrine and ending with a flush (sit-on) septic tank model with strong superstructure in both countries.

costs reported by households that do not own a toilet. We add to this information the amount that households with a toilet reported to have spent on their toilet construction (vertical line).

Figure 4. Expected minimum and maximum cost (2015 USD)



Note: The figure presents kernel density approximations of the expected values reported by the households.

The results are likely to come as a surprise for many: contrary to what is often believed, an average household, in both India and Nigeria, seems either to have a relatively accurate (Ekiti, Maharashtra) idea of the amount needed to invest in a private household latrine or to underestimate the costs (Enugu, Tamil Nadu). We see that, in both countries, the average expected minimum and maximum investment amounts lie respectively either just below and above, or both below, the actual costs incurred and reported by households that have already constructed a toilet.[15,16] At the same time, the graphs also reveal that a

[15] When taking the midpoint as the average expected cost in Maharashtra, households slightly overestimate the investment requirements. The average overestimated amount is USD 50, 11 per cent of the average reported costs. This could potentially be driven by the fact that the range of toilet models owned in this state is wider than in the other study states.

considerable number of households do still overestimate the costs of a toilet: 13 per cent of households in Tamil Nadu and 41–48 per cent in the other three states provide a minimum cost estimate that exceeds the average construction cost observed in their state.

In addition, one has to consider that these initial investment costs are not the only costs a household with a toilet incurs.[17] However, the evidence suggests that the average household in these states bases the statement that it does not own a toilet because it is 'too expensive' on fairly accurate cost assumptions.[18]

Are households aware of the benefits associated with toilet ownership?

Having looked at the cost side, the second relevant question is: what do households expect the returns to a toilet to be? How do these expectations compare to actual returns (i.e. are beliefs about returns accurate)?

Postulated benefits are manifold but we will concentrate on the 'immediate' and private benefits (i.e. those that the household itself can expect to enjoy within the first few years of the investment).[19] The evidence suggests that private benefits of sanitation in general, and improved sanitation in particular, are potentially very large (Andres et al. 2014).[20] These benefits can be roughly structured around three areas: health benefits, financial returns and other lifestyle improvements. There are now a number of studies that provide compelling evidence that sanitation

[16] We repeat the exercise looking only at the most commonly observed model in the respective states and come to the same conclusion.
[17] About a quarter of respondents in Maharashtra, India, for example, report that having a toilet reduces the amount of physical exercise and means that there is less time to socialise, and over 60 per cent of the women (compared to only 44 per cent of men) state that having a toilet means that the family has to spend more time fetching water.
[18] Households that state that the toilet is too expensive are hardly more likely to overestimate costs. Interestingly, it is households that say they never considered getting a toilet or those that provided other reasons that probably also led them to not enquire about toilets (such as not having space or living in rented accommodation) that are more likely to overestimate the cost of a toilet.
[19] The recent literature has produced increasing evidence that sanitation has positive externalities, such that it benefits not only the household owning the toilet but also their neighbours (who, for example, also experience less faecal matter in their environment). This argument – that a private toilet is a public good – supports the idea of public investment in sanitation.
[20] L. A. Andres, B. Briceño, C. Chase and J. A. Echenique, 'Sanitation and externalities: evidence from early childhood health in rural India', Policy Research Working Paper 6737, The World Bank South Asia Region Sustainable Development Unit and Sustainable Development Network Water and Sanitation Program, 2014.

interventions reduce diarrhoeal diseases (Fewtrell et al., 2005;[21] Cameron and Shah 2013;[22] Clasen et al. 2015[23]) and improve underweight conditions and stunting in children (Humphrey 2009;[24] Spears 2012[25]). Such malnourishment has been shown to have longer-term consequences on the accumulation of human capital and productivity (Victoria et al. 2008[26]), which might be avoided through improved sanitation.

While we are not aware of any study demonstrating direct health improvements for adults, the assumption is that looking after sick children and seeking their treatment affect the labour market participation of adults, and hence household income. Financial returns from improved sanitation (other than lost working days) are associated with increases in the dwelling value (if owned by the household) and, in places, with higher status in the village. Finally, other lifestyle improvements include more convenience, less exposure to uncomfortable environments (stinky areas), safety and less embarrassment when guests come to visit.[27]

We asked respondent households a set of questions about their sanitation beliefs. To give an example, households were asked the counterfactual question about whether a neighbouring household without a toilet would be feeling healthier if they had one.[28] Figure 5 shows that across countries, states and genders,[29] more

[21] L. Fewtrell, R. B. Kaufmann, D. Kay, W. Enanoria, L. Haller and J. M. Colford Jr, 'Water, sanitation, and hygiene interventions to reduce diarrhoea in less developed countries: a systematic review and meta-analysis', *The Lancet Infectious Diseases* 5 (1), 42–52, 2005.
[22] L. Cameron and M. Shah, 'Impact evaluation of rural sanitation in East Java, Indonesia', The World Bank, Water and Sanitation Program, Washington, DC, 2013.
[23] T. Clasen et al., 'Effectiveness of a rural sanitation programme on diarrhoea, soil-transmitted helminth infection, and child malnutrition in Odisha, India: a cluster-randomised trial', *The Lancet Global Health* 2(11), e645–e653, 2014.
[24] J. H. Humphrey, 'Child undernutrition, tropical enteropathy, toilets, and handwashing', *The Lancet* 374 (9694), 1032–1035, 2009.
[25] D. Spears, 'Height and cognitive achievement among Indian children', *Economics and Human Biology* 10 (2), 210–219, 2012.
[26] C. Victoria et al., 'Maternal and Child Undernutrition: consequences for adult health and human capital', *The Lancet* 371, 340–357, 2008.
[27] We asked households in Maharashtra what the main motivation was to construct a toilet and the three most commonly reported reasons were that females wanted a toilet (78 per cent), that it would be more convenient (65 per cent) and that there would be health improvements (51 per cent).
[28] The exact phrasing of the question, from the STS-Nigeria questionnaire, is: 'Imagine your neighbour never had a toilet/latrine. In the last month he/she completed construction of a toilet/latrine [as shown in picture]. Do you think this neighbour's family will be healthier because of the toilet/latrine?'

than 90 per cent of respondents agree or strongly agree with a (perceived) health improvement due to sanitation ownership. In line, the large majority of respondents also agree or strongly agree that due to a toilet, household members will be able to work more. Interestingly, while in India this percentage is again above 90 per cent, 20 percentage points fewer households agree in Nigeria.[30]

Figure 5. Expected health and productivity benefits

In terms of other lifestyle improvements, we similarly find very strong agreement amongst households without a toilet that the investment induces positive changes, as shown in Figure 6. Between 94 and 99 per cent of households in our study areas in India and Nigeria state that a toilet increases happiness in general, 91–98 per cent state that it reduces embarrassment and 90–99 per cent state that safety is increased. Interestingly, our data in Maharashtra, where we put these questions to both men and women, indicate that women are more likely to (strongly) agree with the lifestyle improvements experienced due to a toilet.

An interesting twist in the data is that some respondents were asked whether a household experiences the above benefits when constructing an improved toilet, and other respondents were asked about unimproved toilets.[31] What we find (presented in Figure 7) is that for any area asked about, the likelihood of expecting

[29] The respondent to these questions differed by survey. In Tamil Nadu, India, and Nigeria, they were asked to the main respondent, typically the male household head, whereas in Maharashtra they were asked separately to a male and a female household member.
[30] Another interesting difference observed between the two countries is that in India, a toilet is much more often reported to increase the household's status in the village (~90 per cent) than in Nigeria (~53 per cent).
[31] The decision concerning which respondent was asked about what toilet type was made randomly, implying that these two groups are observationally equivalent.

positive impacts is significantly lower for ownership of unimproved toilets than improved toilets.

These statistics provide strong evidence that most households perceive the benefits of owning a private household toilet along a wide range of margins, and that they also perceive these benefits to be more important for improved toilet types.

Figure 6. Expected other lifestyle benefits

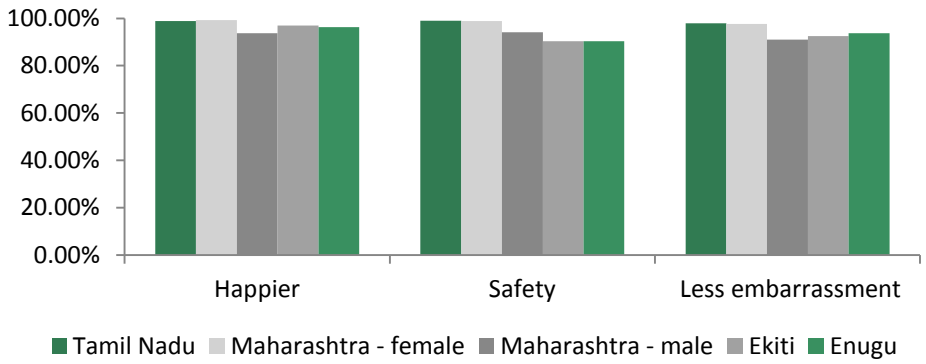
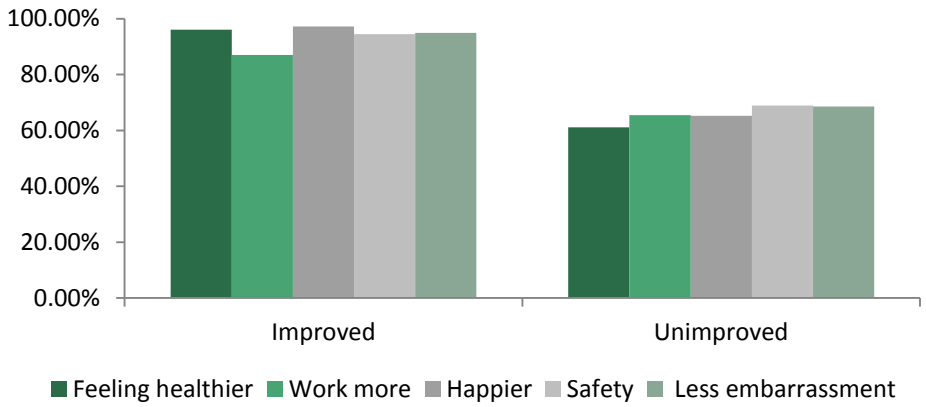


Figure 7. Expected benefits by type of latrine owned



Do households perceive private household sanitation to be a worthwhile investment?

Our data suggest that the average household in rural India (Maharashtra and Tamil Nadu) as well as rural and semi-rural areas in Nigeria (Enugu and Ekiti) hold a fairly accurate expectation of necessary investment amounts to construct a private household latrine and that they also believe that such an investment provides returns along a number of margins. These results suggest that the average household has, on the one side, a fairly accurate perception of the costs of

toilet construction and, on the other, a clear knowledge of the wide range of private benefits that toilet ownership carries. However, the conversion of these benefits into monetary gains (or savings) is a challenging exercise, and the cost–benefit calculation remains of unclear sign.

The overwhelming agreement by households on the gains from toilet construction seems to suggest, though, that their beliefs are in line with the general view that sanitation is a worthwhile (private) investment. The observed non-uptake of sanitation by a large part of the population in these two countries, must therefore be – at least partly – driven by liquidity constraints.

This should not come as a surprise when considering how substantial this investment is for a poor household. By relating the reported expenditures for latrine construction to annual average household income, we show that the average household in these study areas had to invest between 17 and 47 per cent of their annual household income for the construction of a private latrine (see Table 1). Households that do not own a toilet are, on average, poorer than those with a toilet. They would have to invest between 33 per cent (Tamil Nadu) and 77 per cent (Enugu) of their annual household income to construct a toilet of the kind typical in their area.[32] Not only is this a substantial investment amount, the means of raising it are also limited: 92 per cent of households in Maharashtra, for example, report that they financed their toilets with savings or transfers from family and friends, whereas 62 per cent of those without a toilet report that they are not able to save the required amount and most are not aware of any institution that would provide credit for such an investment.

What does this imply for the design of sanitation interventions?

The presented statistics provide compelling evidence that liquidity constraints for private latrine investments are a binding and substantial constraint to sanitation uptake. Any sanitation intervention that aims to increase household sanitation coverage needs to address these financial barriers.

Table 1. Toilet construction costs and household income (USD)

Country and state	Toilet construction	Average annual HH income	Cost/income

[32] In line, 59 per cent (64 per cent) of female (male) respondents in Maharashtra state that all community members struggle to fund the construction of a toilet, and 88 per cent (91 per cent) state that only the poor do so.

	costs[a]	with toilet	w/o toilet	with toilet	w/o toilet
Nigeria					
Ekiti	382	1,143	868	33%	44%
Enugu	396	844	516	47%	77%
India					
Tamil Nadu	394	2,335	1,196	17%	33%
Maharashtra	426	1,226	856	35%	50%

Note: [a] Toilet construction costs are reported by households with a toilet.

A number of approaches have been adopted to alleviate such financial constraints: provision of microcredit for sanitation, government subsidies or so-called 'sanitation marketing'.[33]

The evidence on whether these different approaches are effective or not is growing: the data presented from Tamil Nadu are from an IFS impact evaluation of an intervention that provides microfinance loans for sanitation. The uptake of sanitation *loans* was significant. However, this did not translate into an increased uptake of sanitation. This suggests that despite having an accurate perception of the investment required and the benefits of sanitation, targeted households still do not see it as a high priority investment.

One of the currently ongoing IFS evaluation studies digs deeper into the importance of providing more information and mobilisation alongside the provision of credit for sanitation. In collaboration with the WSP and the Financial INclusion Improves Sanitation and Health (FINISH) programme, IFS researchers are looking at the differential uptake of private household sanitation in Maharashtra when sanitation micro-credit is provided, and when this credit is combined with a sequence of 'soft activities', including information provision through meetings, flyers and theatre plays, as well as the training of masons.[34,35] The results of this study are expected by the end of 2016.

[33] Sanitation marketing includes approaches that reduce the costs of the investment, often by improving access to supply or by improving toilet design, and hence, for example, reducing the amount of materials needed.

[34] This training includes a focus on how much a toilet costs, because, more often than not, even masons overestimate the investment needed for construction of a toilet; this mirrors our findings in Maharashtra that cost expectations are slightly above the actual costs and that 42 per cent of households provide a minimum expected cost that exceeds the average actual cost.

The available evidence to date suggests that the provision of subsidies seems to be an effective approach for toilet uptake. Gertler et al. (2015)[36] show that an intervention by the Government of India in Maharashtra, which provided subsidies for poor households in combination with community mobilisation activities, increased sanitation uptake by 23.8 percentage points. This is complemented by the finding from an unrelated study by Hammer and Spears (2013),[37] implemented in the same state and analysing the same intervention, that the additional impact of community mobilisation on sanitation uptake is around 8.2 percentage points. Of similar magnitude are recent findings by Guiteras et al. (2015),[38] which show that a pure subsidy provision programme in Bangladesh increased sanitation uptake by 14 percentage points.

However, there is evidence to suggest that subsidies are not the most effective way of increasing toilet *usage*: 13.42 per cent of interviewed households in Tamil Nadu reportedly received subsidies for the construction of a toilet but we find that these households are significantly more likely to have a household member openly defecating despite owning the toilet.[39]

Instead of providing credit or subsidies, the third approach, which has an element of reducing costs and which has received a lot of attention in recent years, is that of sanitation marketing. This is a market-based approach, addressing both demand and supply of sanitation. The idea behind this approach is that stimulating both demand and supply allows households to afford a toilet or to upgrade their existing facilities, and also assures providers that their products will find customers.

The IFS, in collaboration with WaterAid, is currently undertaking research on such an approach in Enugu and Ekiti, Nigeria. In addition to the sanitation marketing demand creation component, a more intense community mobilisation

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[35] The programme implemented in Tamil Nadu had a small awareness creation component, which was, however, not very intense.
[36] P. Gertler, M. Shah, M. L. Alzua, L. Cameron, S. Martinez and S. Patil, 'How does health promotion work? Evidence from the dirty business of eliminating open defecation', NBER Working Paper no. 20997, 2015.
[37] J. Hammer and D. Spears, 'Village sanitation and children's human capital : evidence from a randomized experiment by the Maharashtra government', Policy Research Working Paper 6580, The World Bank Sustainable Development Network Water and Sanitation Program, 2013.
[38] R. Guiteras, J. Levinsohn and A. M. Mobarak, 'Encouraging sanitation investment in the developing world: a cluster-randomized trial', *Science* 348 (6237), 903–906, 2015.
[39] Further evidence is provided that this difference in usage rates is not exclusively driven by the fact that households which received subsidies are poorer and thus less likely to use the toilet.

(Community-Led Total Sanitation) is part of the study. Additional findings by Guiteras et al. (2015) suggest that such a combined approach is crucial. They find that the implementation of a pure supply-side intervention (as well as a pure community motivation intervention) was not successful in increasing sanitation uptake.

The results of these studies will contribute to our understanding of which interventions are effective at persuading households to invest in private sanitation. However, each of these typically targets only one part of the population: subsidies are more often than not targeted at the (very) poor, and micro-finance targets households that are able to repay a loan (i.e. the not-so-poor). Only sanitation marketing has a wider audience; however, it is an audience that might remain liquidity constrained and hence be unable to take up sanitation. It is important to be aware of such implicit targeting and remaining constraints, especially when the overall aim is to fully eliminate OD.