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Can Micro-Credit Support Public Health Subsidy Programs?

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Abstract

The low take-up of cost-effective and highly subsidised preventive health technologies in low-income countries remains a puzzle. One under-studied reason is that the design of subsidy schemes is such that households remain financially constrained. In this paper we analyse whether, and how, micro-finance supports a large public health subsidy program in the developing world – the Swachh Bharat Mission – in achieving its aim of increasing uptake of individual household latrines. Exploiting a cluster randomised controlled experiment of a sanitation micro-finance program that coincided with the launch of the SBM program, and unique survey data matched to administrative data, we find that the complementarity runs on two levels: First, micro-credit allows households officially ineligible for the subsidy to invest in sanitation by alleviating credit constraints. Second, micro-credit also helps subsidy eligible households to overcome short-term liquidity constraints induced by the remuneration-post-verification subsidy design to invest in sanitation. Subsidy eligible households living in areas experiencing large delays in subsidy disbursement, or high toilet costs, are more likely to take a sanitation loan, but less likely to use the loan to construct a toilet. *(JEL* D14, G41, H24, I12, I38, O16)

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1 Introduction

Low-income countries continue to face major disease burdens from preventable and treatable communicable diseases. Not only are the poor disproportionately affected, but health care costs are increased and productivity and economic growth impeded. Although highly cost-effective preventive behaviours and investments are known, a persistent puzzle in international development, and particularly in global health, remains the low uptake of these technologies.

Since prices have been identified as key constraints (Cohen and Dupas, 2010), and given the positive health externalities associated with many health improving investments, government subsidies are often used in these contexts to promote the adoption of health technologies, aiming to bring their coverage to the socially optimal level. And indeed, evidence suggests that providing financial support can be effective in increasing coverage of essential, preventive health products, such as malarial bed nets (Dupas, 2014; Dizon Ross et al., 2017), improved cookstoves (Miller and Mobarak, 2013), and construction and use of improved sanitation facilities (Guiteras et al., 2015; Lipscomb and Schechter, 2018). However, even when financial constraints are eliminated, under-adoption of health technologies persists (Cohen and Dupas, 2010; Dupas, 2010).

In addition, financial support programs, and subsidies in particular, have been criticised to be expensive, not financially viable, and to create dependencies, even when targeted to specific socio-economic sub-groups in the population due to unavoidable (and often costly) trade-offs between accuracy and cost-effectiveness (Devereux et al., 2017). This dilemma has raised calls for alternative or complementary financing solutions. Private sector investments in particular are seen to carry significant potential in addressing inefficiencies inherent in a stand-alone subsidy program, whilst maintaining its benefits.

To inform these debates we build on a field experiment conducted in rural India, offering a new loan product: micro-credit for sanitation.[1] Not only was the intervention effective in inducing individual household toilet construction (Augsburg, Caeyers, Giunti, Malde and Smets - henceforth ACGMS 2019), providing us with exogenous variation in the adoption of this preventive health technology; but the start of the intervention also coincided with the launch of India's flagship rural sanitation program, the Swachh Bharat Mission (SBM), or 'Clean India' mission, an important component of which is the provision of subsidies for vulnerable households.[2] This unique set-up allows us to evaluate the extent to which micro-credit can support a public health program. In particular, by assessing whether the micro-credit intervention effectively raised overall sanitation coverage by reaching subsidy eligible households - and if so, how - and/or by reaching those (rightly or wrongly) classified as ineligible for the government subsidy, thereby directly complementing the policy and keeping its public expenditures low.

The SBM scheme and its interaction with micro-credit is a particularly interesting case to study. Acknowledging that inadequate sanitation is a leading cause of poverty, largely as a result of causing premature mortality and other negative health impacts (Bank, 2011; Geruso and Spears, 2012; Spears, 2013; Hammer and Spears, 2016; Augsburg and Rodriguez-Lesmes, 2018) and that, therefore, safe sanitation practices form a crucial element of future social development and economic prosperity (WSP, 2011),

[1] Micro-credit encompasses small microloans, typically extended to impoverished borrowers who lack collateral, steady employment, or a verifiable credit history.

[2] SBM runs two distinct sub-programs, one operating in rural areas - SBM (Gramin) - and one operating in urban areas - SBM (Urban). In this paper we focus on rural areas and therefore when we refer to SBM we are implicitly referring to SBM (Gramin).

the Indian government has made a strong commitment to eliminating open defecation through its SBM scheme. Despite a staggering program cost of US$9.3 billion, the largest share of which - 97 per cent in Financial Year 2015-2016 - has been used to cover the programme's subsidy component (Kapur and Deshpande, 2018), the subsidy is not universal. It is targeted at the most vulnerable of the approximately 600 million people who defecate in the open in India in 2015 (WHO/UNICEF), which in turn makes up 60% of the world population that open defecates.

Micro-credit on the other hand, has experienced phenomenal growth in terms of geographical spread and number of households reached across the developing world and particularly in India. The National Bank for Agriculture and Development alone reported linking over 11 million families to credit through their micro-finance program in 2018. At the same time, micro-credit has been shown to yield positive impacts on health investments (Devoto et al., 2012; Tarozzi et al., 2014; Yishay et al., 2017; ACGMS 2019) leading to international agencies such as the World Bank and USAID calling it a promising solution to (help) tackle the 'sanitation challenge'. However, despite growing policy interest in such models, at present there is no evidence available on how and to what extent micro-credit can supplement standard health subsidy programs.

In addition to the exogenous variation in access to sanitation loans and their simultaneously introduction with the SBM subsidy scheme, we have access to a combination of unique data sources, allowing us to address this policy relevant question. In particular, we make use of (i) official household level government administrative data on subsidy eligibility, receipts and toilet uptake, (ii) independently collected survey data which include detailed information on households' sanitation infrastructure and behaviour as well as information on borrowing, (iii) administrative MFI data on sanitation loan uptake from the micro-finance institution providing the newly introduced sanitation loan product as well as official administrative credit bureau data on the amount and date of all loans disbursed by all MFIs active in the study area.

The first key result of the paper is that the sanitation micro-loan is availed of by both subsidy eligible and ineligible households and the percentage uptake within these two groups is statistically equivalent at on average 19 percentage points. We however also observe that while the loan to new toilet conversion rate is about 86% for subsidy ineligible households it is, on average, only about half of this for those eligible for the government subsidy.

Turning to mechanisms, we combine predictions from a theoretical model outlined in ACGMS 2019 and the evidence available on changes in borrowing and investment behaviour, to conclude that sanitation loan uptake and investment of subsidy ineligible households is driven by the new loan product alleviating credit constraints for sanitation. We can conclude that one channel of micro-credit supporting the subsidy scheme is through encompassing *de facto* vulnerable households not included in the government scheme. However, our results also raise caution that the sanitation loans only partially lift financial constraints these households seem to be facing. We observe that the uptake of sanitation loans is accompanied by a decrease in uptake of education loans. Whether this substitution also leads to a reduction in education investments remains an important question for further research.

For subsidy eligible households, we are not able to identify the exact mechanisms through which the introduction of the sanitation loan induced a significant increase in sanitation loan uptake. However, we provide evidence consistent with micro-credit helping overcome features of the subsidy design which impose possible constraints to its effectiveness. In particular, to minimise misuse of funds, the scheme

is based on a remuneration after verification model (or, ex-post subsidies). To some extent, this feature may be counter-effective since it requires households, who may be liquidity constrained, to construct a toilet prior to subsidy receipt (Rama Mohan, 2017). Micro-credit could support the subsidy program by providing some bridge funding in this context. And indeed, we provide evidence that the credit mainly improves sanitation loan uptake amongst subsidy eligible households living in areas which experienced significant subsidy disbursement delays. However, loans seem to have converted into new toilets only in sites facing relatively small delays in subsidy disbursement.

Moreover, there remain open questions on how large the subsidy should be in order to motivate toilet construction. A subsidy that is too small (relative to the price of the types of toilets households want) will depress demand for toilets, while one that is too high will lead to wastage of resources. This is particularly relevant in rural India where it has been shown that households have an expensive taste for toilet quality relative to similarly poor households in other developing countries (Coffey and Spears, 2017). We find evidence that subsidy eligible households are more likely to take up a sanitation loan where average toilet construction costs are significantly above the subsidy amount. At the same time, conversion of the loan to new toilets seems only feasible where the subsidy-construction cost gap is low.

The paper proceeds as follows: We first provide an overview of the SBM subsidy program as well as the micro-credit intervention. We then discuss in Section 3 the Study design, data and our empirical strategy. Section 4 presents our main findings, followed by an analysis of possible mechanisms in Section 5. Section 6 concludes.

2 Context and interventions

2.1 Context

Our study took place in Latur and Nanded districts in the South-Eastern part of Maharashtra, one of the largest states in India. Though it is also one of the richest states in India, there is evidence of severe inequalities within the State, with Latur and Nanded districts regularly classed to be among the most deprived parts of Maharashtra. Data from the 2012-2013 District Level Household Survey (DLHS-4) indicate that around 21% (18.7%) of households in Latur and Nanded (rural India) owned a Below Poverty Line (BPL) card, 56.6% (46.25%) of households owned land, and that household heads had around 4.16 (3.98) years of education. Agriculture is the main economic activity in the rural areas of these districts, with over 70% of people engaged in the primary sector.

Latur and Nanded districts lag behind rural Maharastra and rural India on average in terms of sanitation coverage. The DLHS-4 data indicate that only around 24% of households owned a toilet on average in those districts, compared to 38% in rural Maharashtra and 56% in rural India. Our study focused specifically on clients of a large MFI, who came from relatively more deprived households in rural Latur and Nanded. Indeed, data from a baseline survey conducted in 2014/15 indicate that around 41.9% of client households had a BPL card, compared to 21% for Latur and Nanded in the DLHS-4 data, and only 44% of households owned land (relative to 56.6% in rural Latur and Nanded). Toilet coverage among these households was similar to that for rural parts of the districts: In 2014-15, our survey data indicate that around 27.5% of households with a client of the MFI had a toilet. Very few households reported using community toilets, meaning that over 70% of these households defecated in the open. This corresponds

well with toilet coverage recorded by Government officials at the SBM baseline for these district, collected in 2012-2013, which came to around 28% for the whole of rural Nanded and Latur.

As with other contexts in India and beyond [Augsburg et al., 2015], the vast majority of households – 83 percent – reported affordability or price as the key reason for not having a toilet. This is not surprising since building a toilet requires a significant expense: for instance, low-cost toilets recommended by SBM would account for around 20 percent of annual household income in our context. Thus, policies and interventions that target these financing and price constraints might influence toilet coverage.

2.2 SBM subsidy program

On 2 October 2014, the Government of India (GoI) launched its ambitious nationwide sanitation program called Swachh Bharat Mission (SBM), or 'Clean India' Mission. The program's key objective is for India to become Open Defecation Free (ODF) by 2 October 2019, the 150th birth anniversary of Mahatma Gandhi. A succession of government programs targeted at improving India's sanitation situation preceded the SBM. First efforts go back to the Central Rural Sanitation Program (CRSP) in 1986, replaced by the Total Sanitation Campaign (TSC) in 1999 and the Nirmal Bharat Abhiyan (NBA) in 2012, which in 2014 evolved into the current SBM. The programs evolved from a pure focus on constructing new private household latrines (under the CRSP), to the introduction of Information, Education and Communication (IEC) activities around sanitation and the provision of financial awards to Open Defecation Free (ODF) villages (under TSC). The NBA program further introduced the concept of community-led total sanitation (CLTS), as part of the education and communication activities on sanitation.[3]

Much like NBA, the SBM program involves two key components: (i) Information, Education and Communication activities on sanitation; and (ii) the provision of financial incentives to vulnerable groups (detailed below) to encourage the construction of private household toilets. The primary aim of the IEC activities is to increase demand for private household toilets. The financial incentive, henceforth subsidies, form the most important component of the SBM program: 97 percent of the SBM budget was spent on the subsidies in the Financial Year 2015-16; with the remaining 3% devoted to funding the IEC activities (Kapur and Deshpande, 2018). Relative to the NBA, the SBM program revised and expanded the subsidy program. In particular, the SBM brought in a change in the government funding structure and the subsidy amount was increased from Rs. 10,000 to Rs. 12,000 (USD 169) for every new latrine.[4,5] Monitoring and transparency mechanisms were significantly strengthened through the development of an online publicly available data portal which tracks progress towards India ODF status (see Section 3).

The aim of the subsidy is to encourage households to construct a toilet, rather than to cover the full cost of a toilet (SBM, 2017), which is why it is often rather referred to as an 'incentive'. The subsidy follows a 'renumeration after verification' model. Households are expected to bear the cost of toilet

[3]The NBA program in 2012 adopted a more systematic behavioral change and sanitation demand creation strategy, implemented through the information provision intervention 'Community-Led Total Sanitation'. The concept of CLTS was developed around the year 2000 in Bangladesh. CLTS became an established approach around 2011 and by 2015, 24 countries had adopted CLTS as their national strategy to eliminate open defecation (Musyoki, 2016).

[4]Specifically, 60% of the SBM subsidy costs are now to be covered by the central government and 40% are to be covered by the State government.

[5]We use an exchange rate of 1USD = 71.1840 Rs. throughout the paper when US$ amounts are reported, based on the following online currency converter, accessed on 10 Feb 2019:
https://www.xe.com/currencyconverter/convert/?Amount=12%2C000&From=INR&To=USD

construction, and can only avail of the subsidy once the toilet is fully constructed and verified as such by local district authorities.[6] Importantly, households can only avail of the subsidy once. SBM provides no financial support to households who want to repair or upgrade a toilet.

From an economic perspective, a renumeration post verification model is a solution to the imperfect commitment problem which exists in this setting. If the Government provided funds prior to construction, it has no commitment device to ensure that the money is indeed spent on toilet construction. However, such a model has a clear limitation: poor households might either not be able to access funds to construct a toilet, particularly in the presence of credit market imperfections; or might be unable to afford to construct a toilet at all. This weakness has been noted by a number of practitioners (e.g. Rama Mohan, 2017), with micro-credit proposed as a potential mechanism through which liquidity constrained households could obtain so-called bridge funding.

SBM officially defines households to be eligible for SBM subsidies if at the time of the SBM baseline survey in 2012-2013 (conducted by communities and verified by district and state officials) they were recorded (a) not to have a toilet, and (b) to be either Below Poverty Line (BPL) or to belong to any of the following marginalised Above Poverty Line (APL) groups (SBM, 2017): (i) Scheduled Castes/Scheduled Tribes (SC/ST), (ii) Persons with disability, (iii) Widow/old age pensioners, (iv) Landless labourers with homestead, (v) Small farmers, (vi) Marginal farmers, and (vii) Female headed households.

We will refer to BPL households and these vulnerable APL groups jointly as *Vulnerable Groups* (VGs). SBM's administrative data (see Section 3.2) suggest that overall in rural India, 63% of households were recorded as not having a toilet at 2012-13 SBM baseline. Most of these households were classified as either being BPL (46%) or vulnerable APL (49%), yielding an overall share of 60% of officially subsidy eligible households in rural India at SBM baseline. This study focuses on households residing in two districts of Maharashtra, Latur and Nanded. Whereas the share of subsidy eligible households in Maharashtra was lower than the national average (i.e. 52%) - driven by a higher baseline toilet coverage (45%), baseline toilet coverage in our study districts was particularly low. On average (including MF clients and non-clients), 72% of rural households were recorded as not having a toilet at SBM baseline and, adding to this the VG condition, almost 70% of all rural households in our study area were eligible for an SBM subsidy.

2.3 Sanitation micro-credit intervention

In this setting our implementing partner, a large MFI active in five states in India, pioneered micro-credit for sanitation. It started offering the new loan product to its exclusively female clients in February 2015 (shortly after the launch of the SBM) in five of their branches, covering rural and semi-urban areas in the districts of Nanded and Latur in Maharashtra.[7] Our estimate of the proportion of clients of our MFI

[6] As per the SBM guidelines, states have the authority to introduce variations in the subsidy provision, in particular to allow households to request a share of the subsidy amount prior to the completion of their toilet. This share is meant to be small though and only to be provided when the household can show that significant works have already been completed (e.g. by having dug a pit).

[7] Outside of the study area, the MFI first started offering sanitation loans to their clients in 2009. The MFI has (among other motives) a social mission, committing itself to strive to improve clients' health. To that end, it has introduced various health related programs, including emergency loans to support clients in meeting unexpected health expenditures among other unanticipated needs. Through customer surveys, which the MFI conducts to understand their clients' needs, they realized that there was strong demand for credit to construct toilets - 90% of clients expressed an interest in taking sanitation loans -, which most clients lacked. Understanding that such a loan product does not generate income directly and immediately, the MFI decided to meet their customers' demand and offer the product, but at a lower interest rate than income generating

in our study population is around 7%.[8] Although a number of MFIs provide credit to poor households in the study area, there are only few institutions providing credit specifically for non-income generating purposes and none provided credit for sanitation when the study started.

The sanitation loan offered amounts of up to Rs 15,000 (USD211), which is 25% higher than the SBM subsidy amount. Over the study period, it charged an average interest rate of 20 percent per annum at a declining balance with a 2-year maturity.[9] Even though clients had the choice of repaying on either a weekly or bi-weekly basis, in practice almost all chose to make weekly repayments. Compared to other non-productive loans offered by the MFI, the sanitation loan amount is higher and carries a similar or lower interest rate over a longer repayment period. Business loans are typically larger in size, but have a higher interest rate. All loans are provided based on a joint-liability principle (lending groups consist of 5 - 10 members) and there is no collateral requirement. Each client can obtain only one sanitation loan, and only if she has been a client of the MFI for at least one year. If these conditions are met, sanitation loans can be taken alongside other outstanding loans. However, any client wishing to take a sanitation loan must satisfy criteria set out by the Reserve Bank of India, which seeks to ensure that clients are not over-indebted, and can afford to repay their loans.[10] For more detailed information about the MFI and its sanitation loan product we refer to Augsburg et al. [2018]. The loan could be used to construct a new toilet, or to upgrade or repair an existing toilet. It was not linked to any specific toilet, and the MFI did not provide any advice or guidance on the construction of the toilet. Clients were free to construct the toilet of their own choice.

3 Study Design, Data and Empirical Strategy

3.1 Study design

The original evaluation exploited a planned expansion of the sanitation loans by the MFI to new areas. For evaluation purpose, the new loan product was initially introduced to clients living in 40 Gram Panchayats (GPs), randomly selected out of 81 GPs in which the MFI had operations at that time. Apart from the introduction of the new loan product, business continued as usual, with all clients, in both the GPs where the sanitation loan product was offered (treatment) and in GPs where it was not offered (control), continuing to have access to other loan products. These included income-generating loans, emergency loans, education and festival loans. The randomisation of GPs into treatment and control was stratified by MFI branch and village size. Figure 1 displays the geographical distribution of the study communities,

loans, thereby cross-subsidizing these special purpose loans. This was done on the understanding that a happier and healthier client would ultimately be better placed to pay back other loans.

[8] This estimate is obtained by dividing the number of clients recorded in the partner MFI administrative records in November 2014 (assuming one MFI client per household - as per the MFI's guidelines) by the number of households listed in the village during the 2011 Government of India population census.

[9] The MFI reduced the interest rate on the loan from an initial 22% to 20% and finally 18% while the experiment was ongoing.

[10] From October 2015 (pre-October 2015), the relevant criteria for clients are: (i) annual household income of at most Rs. 100,000 (Rs. 50,000) for rural customers; (ii) total indebtedness of at most Rs 100,000 (Rs 50,000) excluding education and medical expenses; (iii) Overall loan amount should not exceed Rs 60,000 (Rs 35,000) in the first cycle and Rs 100,000 (Rs 50,000) in subsequent cycles. There are additional criteria related to the tenure of large loans, and the composition of the MFI's portfolio of outstanding loans.

by treatment status.[11,12]

Importantly, the SBM program was similarly active in both our study arms throughout the study period. This is confirmed by SBM officials' reports on sanitation activities that took place in their communities between 2015-2017, shown in Table 1. The table compares reports between control and treatment villages, showing statistical balance across the board. The vast majority of SBM officials report that sanitation activities had taken place (79% of all officials), and out of those that report to have hosted such activities nearly all report SBM activities (76% of all officials). On average, SBM officials report that these activities were mainly carried out by the GP Sarpanch (i.e. the village leader). Community sanitation activities aimed primarily to create awareness about sanitation, with street plays and village meetings particularly popular. 40% of the village officials also reported that wall paintings or wall banners have been installed to promote improved sanitation practice, and most of these installations were also observed by the interviewer during the endline visit. Other than awareness creation activities and subsidy schemes, very few SBM officials report any other sanitation activities organised at the village level.

The experimental variation and the almost simultaneous introduction of the sanitation loans and the SBM subsidy allows us to gain an understanding whether and how micro-credit was successful in complementing the SBM subsidy program.

3.2 Data

3.2.1 Data sources

To assess the extent to which a micro-credit program can support the SBM subsidy program, we link together three different data sources which each contain unique information needed in our analysis: (i) SBM administrative data on household toilet ownership, subsidy receipts and official VG classification status (henceforth referred to as 'SBM data'); (ii) household survey data on toilet ownership, open defecation practice and various household socio-economic characteristics as well as borrowing data that were collected for the experimental impact study of the micro-credit intervention ('survey data'); and (iii) administrative MFI and credit bureau data.

SBM data

The SBM data were downloaded from the SBM data portal, a Management Information System (MIS) developed by India's Ministry of Drinking Water and Sanitation (MDWS) to monitor progress towards its ODF mission. In 2012-2013, prior to the launch of the SBM on 2 October 2014, the MDWS conducted a nationwide survey to assess SBM baseline levels of toilet coverage across the country and to identify households eligible for SBM subsidies (BPL households and vulnerable APL households, see Section 2.2). The SBM data portal encompasses these baseline data. In addition, States are required to update toilet ownership information on a continuous basis, the latest by April every year (SBM, 2017). Among the information uploaded is household level information on toilet ownership, subsidy receipts (since SBM

[11] There are 5 branches in total in the study area and village size could be either 'large' (villages with more than 480 households) or 'small'. A further 39 GPs received another intervention. In on-going work we study the impacts of this intervention separately.

[12] SBM had just been announced when the randomization of GPs was conducted.

baseline in 2012-13) and VG classification status, along with information on the name of the household head among other variables.[13]

What we refer to as the SBM data includes the SBM baseline information as well as a snapshot of the (continuously changing) live SBM dataset taken in September 2016, two years after the launch of SBM and the micro-credit interventions. SBM has since stopped making data available at the individual household level.

The incredible scope of the SBM data, covering every household in rural India, comes at a cost in terms of the information available. First, data on the date of toilet construction and subsidy receipt, needed to assess funding time gaps, is missing for most observations. Second, no information on the toilet, beyond its original existence is available. Once a household is recorded to have a toilet (the type of which is unknown) it continues to be recorded as such: usage, functionality and quality are among the dimensions not captured in the SBM data, but are critical to know in order to assess whether micro-credit complements SBM in affecting sanitation behaviour and open defecation.

Survey data

We are able to overcome these limitations by augmenting the SBM data with primary survey data that we collected from a sample of MF clients in our 81 study GPs in rural Maharashtra at two points in time, in Sept-Oct 2014 and Aug-Sept 2017. The first data collection round (referred to as the 'census data') was completed on 14 October 2014, one day before the announcement of the SBM policy by the Indian Prime Minister, Narendra Modi. The census data cover basic information (e.g. names, caste, toilet ownership, etc.) on a large representative sample of our study population (all households in relatively small villages and all households living in a representative sample of segments of villages in larger villages). The census population formed the sampling frame for our study. The second dataset used in this study (referred to as 'endline'), on a sample of households in our study area, was collected in August-September 2017, one year after the last SBM snapshot data was taken. This allows us to include a longer-term impact perspective. In October-December 2018, we also conducted a baseline survey of a sub-set of households in our study sample, which we use in robustness checks (not in the main analysis).

The surveys collected rich information on household socio-economic status, household toilet ownership (household self-reported and interviewer observed), toilet quality and usage, open defecation practice and self-reported subsidy receipts. Unlike the SBM data, the survey data contain information on subsidy receipts at *any* point in time, not just since the launch of SBM. Importantly, the surveys collected information on the timing of toilet construction and subsidy receipts.

MFI and credit bureau data

While the surveys also collect information on sanitation loan uptake and timing of loan receipt as well as borrowing from formal and informal sources beyond the partner MFI, we are able to get a more accurate measure on this outcome by linking our survey data to MFI and credit bureau administrative data, using the MFI's client identifier. Regulations introduced by the Reserve Bank of India in 2011 require all micro-finance institutions to report to a credit bureau on all loans outstanding for each client on a monthly

[13] http://swachhbharatmission.gov.in/SBMCMS/sbm-mis.htm

basis. This ensures not only good record keeping at the MFI level, but also provides the opportunity to access information on loans taken by sampled clients from all micro-finance providers in the study areas. We received the credit bureau reports for sample clients from a leading provider, used by the MFI partner when making decisions on loan applications. We obtained this information for around 88 percent of clients in our sample.[14] For more information on the source of the survey, MFI and credit bureau data we refer to ACGMS 2019.

Figure 2 provides an overview of the timeline of events, including the dates when the SBM data snapshots and survey data were collected, and how these relate to, the launch of the SBM program and the micro-credit intervention.

3.3 Matching result and sample description

Linking our survey data to the SBM data was done by matching full names of household heads, their spouses and their fathers provided in our survey data to full names of household heads and their fathers available in the SBM data.[15] After using a computer algorithm based on a combination of exact and fuzzy matching - where for the latter we used a conservative threshold such that the probability of including erroneous matches was higher than the probability of excluding true matches - we carefully checked each match, dropped obviously wrong matches and flagged matches for which there was some uncertainty. Uncertain matches concern cases for example where the first and last name of the household head uniquely matched between datasets but where the first name of the father did not match. In our regression analysis we control for whether or not there was some uncertainty about the matching accuracy, which was the case for 25% of all matched observations. Appendix A explains the matching process in more detail.

We were able to uniquely match 1,312 client households to the SBM data, 47% of the 2,772 clients interviewed for our endline survey. These live in 75 of the 81 study GPs (78 of which we were able to identify in the SBM data). There are a number of possible explanations for the achieved match rate. First, the matching was based on the name and surname of the head of the household and his/her father's name.[16] We encountered a number of duplicate name records in the SBM dataset, each of which had unique card identifiers and unique data on toilet ownership and subsidy uptake . This was the case for 7% of all SBM data observations in our study area. Since we would not be able to uniquely match these to our survey data, these observations were dropped from the SBM data sample before matching. Second, the survey data were collected at least 2-3 years after the SBM baseline. Households might have experienced a change in the head of household over this period, or have split or merged, undermining our ability to match them to the SBM data.

The matching result was balanced across treatment and control groups. Of the matched client households, 959 (73%) did not have a toilet at survey baseline. Our analysis focuses on this sample of households, as these are explicitly targeted by the SBM subsidy program (which does not cover toilet repairs or upgrade) and our objective is to assess the extent to which micro-credit can support SBM in its mission.

[14] It was not possible to obtain data for the remaining 12 percent of clients, since our partner MFI no longer had all the information required by the credit bureau in order to avail of these records.

[15] If household head had no spouse than the name of the eldest female household member was provided instead.

[16] In a minority of cases, where the father of the head of household was resident in the household during our endline survey, we were able to match based on three names - the head of household's name, the head's father's name and the surname.

In Appendix A we examine the determinants of matching success and conclude that the matched sample is not representative of our study sample. Matched households are more likely to be larger and their heads are more likely to be male, older, educated and to work in agriculture. The fact that the likelihood of being matched is not random will affect our ability to generalise findings to the general population and will therefore need to be kept in mind when interpreting our findings. Notwithstanding the differences between the matched and unmatched sample, the matched sample is balanced across treatment and control arms, both in terms of their socio-economic characteristics and in terms of their SBM subsidy eligibility criteria. This can be seen in Tables 2 and 3.

Table 2 focuses on socio-economic characteristics of client households and informs us that the matched MF client sample is largely hindu (73%), with the remaining client households being either muslim or buddhist. The average household is reported to have 5 members, with a male head aged 47 years, who is on average able to read or write (around 70%), having had less than 6 years of formal education.

Turning to Table 3 we describe households' official VG and subsidy eligibility status obtained from the SBM data. We find that 29% of the matched MF client sample (without a toilet at survey baseline) is officially classified as being BPL. An additional 51% is considered to be marginalised APL, so that overall 80% of MF client households without a toilet at survey baseline in our sample are officially categorised as VG. Given that we focus here on households without a toilet at survey baseline these VG households should in principle have all been eligible for a subsidy. However, the data reveal that 16% of VG households that do not have a toilet at the time of the survey baseline (which was conducted only a month after SBM was launched) are recorded to have one in the SBM data, classifying them officially subsidy in-eligible. We re-visit this matter in Section 5 where we discuss mechanisms of impacts of micro-credit. Overall in our sample of MF clients without a toilet at survey baseline, 64% was classified as being officially subsidy eligible.

We observe two notable imbalances between the treatment and control group, shown in Table 3. Matched MF client households in the sanitation credit treatment group are more likely to be small and marginal farmers and they are less likely to be a BPL household. Overall, however, MF client households in the treatment group are statistically speaking as likely as their counterparts in the control group to be categorised as SBM subsidy eligible. This means that even though we cannot generalise our findings to the population of all of our MF clients in Maharashtra (in light of the imbalances observed between the matched and unmatched sample), the results presented in this paper are internally consistent and strongly suggestive for what could be happening elsewhere.

3.4 Empirical Model

The randomisation discussed above was designed to identify the causal effects of the introduction of micro-credit for sanitation on outcomes of interest, in particular loan uptake, toilet ownership and sanitation behaviour. This analysis, reported in ACGMS 2019, reveals that, on average, sanitation loans were taken up in treatment areas and that a significant proportion were converted into new household toilets that would not have been constructed in the absence of the micro-credit program.

The main aim of this paper is to identify whether and, if so, how micro-credit is able to support the SBM subsidy program. In particular, we aim to test whether (i) the credit program enables those *ineligible* for subsidies to construct a toilet, potentially by alleviating financial constraints; and/or (ii)

whether the credit supports those *eligible* for the financial incentive provided by the government. To this end, we examine impact heterogeneity by subsidy eligibility status, thereby analysing whether impacts are concentrated amongst subsidy ineligible or subsidy eligible households, or both. Matching the household survey data to the SBM administrative records allows us to obtain households' official subsidy eligibility status, which is determined by both its VG classification and its official record of SBM baseline toilet ownership. Restricting the matched sample to MF client households that did not have a toilet at survey baseline (since these are the households targeted by the micro-credit and subsidy interventions) we estimate the following equation:

$$Y_{iv} = \alpha_0 + \alpha_1 SL_v * SubsidyEligible_{iv} + \alpha_2 SL_v * SubsidyIneligible_{iv} + \alpha_3 SubsidyEligible_{iv} + \beta X_{iv} + \theta_v + \epsilon_{iv} \quad (1)$$

where SL_v takes the value of 1 if the household lives in GP v that was randomly assigned to the treatment group, and 0 otherwise. Dichotomous variables $SubsidyEligible_{iv}$ and $SubsidyIneligible_{iv}$ denote whether or not household i is officially classified as being a subsidy eligible household. X_{iv} is a vector of household-level controls that helps to increase power and precision.[17] Vector X_{iv} also includes a dummy for whether or not a manual check revealed some uncertainty about the reliability of a particular match between a survey data record and an SBM administrative data record (see Section 3). We also control for a set of strata dummies θ_v for GP v. Standard errors are clustered at the GP level.

We estimate equation 1 for four main outcomes of interest Y_{iv}:(i) sanitation loan uptake, (ii) toilet ownership, (iii) toilet usage and open defecation, and (iv) subsidy uptake. Sanitation loan uptake is measured as a dichotomous variable using administrative data from the MFI. Toilet ownership is measured based on interviewer verified reports on toilet ownership by the survey respondent (usually the household head). Specifically, this variable takes a value of 1 if the respondent reports that the household owns a toilet, and the interviewer sees it; and 0 otherwise. We complement this measure with toilet ownership status captured in the 2016 SBM snapshot and use toilet construction date reported during the survey endline survey to compare consistency between these two data sources. The third outcome of interest – sanitation behaviour – is particularly relevant for policy. We measure this through two variables: an indicator for whether the toilets reported by households are in use, and an indicator for open defecation (as reported by the survey respondent for different demographic groups in the household). Finally, the fourth outcome of interest – subsidy uptake – is measured using data on subsidy receipts recorded in the September 2016 SBM snapshot.[18]

[17] The included covariates are chosen to be those that most explain the variation in toilet ownership among control households, and include a dummy for whether or not the household has a child aged 3 or 4, toilet uptake status at baseline, interviewer fixed effects, and village size. The baseline survey sampling strategy over-sampled households with children aged less than 2 years, which is why we control for whether the household had a child aged 3-4 years at endline. We control for village size since the endline sample of clients was (inadvertently) selected in a manner that correlates with village size. To control for toilet ownership pre-introduction of the loan product, we use reconstructed baseline toilet ownership, using respondent's endline report on the age of their toilet. We use reconstructed baseline toilet ownership instead of census data on toilet ownership because census was based on segmenting and therefore not available for all households in our sample. We nevertheless conduct robustness checks using actual baseline ownership data on the restricted panel sample and results remain qualitatively the same.

[18] The reason why we do not use subsidy receipt as reported in the household survey is because this was only asked of households that owned a toilet, whereas the SBM dataset records this for any household, irrespective of their toilet ownership

4 Does micro-credit support the subsidy program?

We present the findings from our analysis, which focus on differential impacts of the sanitation micro-credit intervention by subsidy eligibility, for our four main outcomes of interest - sanitation loan uptake, toilet uptake, toilet usage and subsidy uptake. For completeness, we also present the average impacts of the intervention on these outcomes for the sample of interest in this paper – households without a toilet at survey baseline.[19]

Sanitation loan uptake and toilet uptake We start by considering whether impacts of the sanitation micro-credit on sanitation loan uptake and toilet uptake vary across subsidy eligible and subsidy ineligible households. These findings, presented in columns 1-2 of Table 4, show that first, the new loan product was taken by 19% of the MF client households without a toilet at baseline. Second, Column 2 shows that subsidy eligible households were as likely as subsidy ineligible households to take up a sanitation loan.[20,21] At first sight, this latter finding might come as a surprise given that subsidy eligible households should, in principle, be able to access government subsidies to cover the costs of toilet construction. However, as already mentioned above, in this context even subsidy eligible MF client households might want to seek additional credit to construct a toilet, either as bridge financing or to supplement funding. We will explore these channels in more detail in Section 5.

Moreover, households could have taken the sanitation loan for reasons other than to invest in sanitation. As discussed in ACGMS 2019, the sanitation loans had a lower interest rate than most other loan products offered by the MFI, and loan use was only weakly monitored and not enforced. Therefore, uptake of the loan product does not necessarily represent the desire to construct a toilet. Indeed, ACGMS 2019 provide evidence that, on average, only about 50% of sanitation loans were converted into new toilets, with few of the other loans used for sanitation upgrade or repair. Thus, a significant proportion of sanitation loans were not used for making sanitation investments. It is therefore important to analyse whether, and in how far, sanitation loans were used by subsidy eligible and subsidy ineligible households to make actual sanitation investments, which we turn to next.

Columns 3-4 in Table 4 display impact estimates on toilet uptake as verified by the interviewer during the endline survey in August-September 2017.[22] In Column 3 we find that, overall for MF client households that did not own a toilet at survey baseline, access to sanitation loans improved toilet coverage by over 12 percentage points (statistically significant at the 1% level). This increase represents a 50% increase in toilet coverage in this group of households relative to similar households in the control group. Looking at

status reported during endline survey.

[19] ACGMS 2019 report the average impacts of the sanitation micro-credit intervention on sanitation loan uptake, sanitation investments and behavior and borrowing behavior for all MF clients, regardless of whether they had a toilet at baseline. Unlike the SBM subsidy, the sanitation micro-credit could have been taken by households with a toilet at survey baseline to upgrade or repair an existing toilet.

[20] Results on the pooled sample differ slightly in magnitude (not in statistical significance) from ACGMS 2019 because here we are using a different sample, that is, one that is restricted to surveyed observations that we managed to match to the SBM dataset and within those only those that did not have a toilet at survey baseline.

[21] Note that at the start of the intervention a few loans got disbursed to MF clients in control sites, as reflected in the control means provided at the bottom of Table 4. This contamination was immediately picked up through a monitoring process and measures were put in place to avoid this going forward. In total this concerns 5 MF clients in control sites in our study sample (1% of all control observations).

[22] Results are very similar when using toilet uptake as reported by the survey respondent. These are available upon request.

heterogeneity in impacts by subsidy eligibility status (Column 4 in Table 4), we see that, on average, the impact of the credit intervention on toilet uptake was most significant for households which were classified as ineligible for the government subsidy. By 2017, subsidy ineligible households residing in sites where micro-credit for sanitation was made available were 20 percentage points (pp) more likely to own a toilet compared to their counterparts in control areas. This is similar in magnitude to the impact on sanitation loan uptake that we observed in column 2 for this sub-category (22pp). In contrast, for the subsidy eligible group the significant impact on sanitation loan uptake of 18pp observed in column 2 does not translate into a similarly significant impact on toilet uptake. With a p-value equal to 0.126, the coefficient estimate of 8pp is nonetheless close to being significant at conventional statistical levels.

Following ACGMS 2019, in Table 5 we construct a loan-to-new toilet conversion rate, by regressing interviewer-observed toilet ownership on sanitation loan uptake, instrumenting the loan uptake indicator with the treatment assignment. Provided that the treatment improved toilet uptake only through sanitation loan uptake - which we believe to be credible in this context - this estimate essentially tells us the rate at which sanitation loans provided as part of the intervention translated into *new* toilets constructed *because of the intervention*. Interestingly, there is significant heterogeneity in the magnitude of the loan conversion rate by whether or not the household is officially eligible for a subsidy. For the subsidy ineligible group the estimated conversion rate is high at 86%, whereas for the subsidy eligible group it is estimated at only 45%.

It is essential to keep in mind that the loan-to-new toilet conversion rate indicates the extent to which the sanitation loans translated into *new* toilets in the treatment communities. That is, toilets that would not have been constructed in the absence of those loans. To interpret this statistic, it is therefore helpful to consider trends in toilet uptake in control areas. Using toilet ownership status and date of toilet construction reported during endline survey in August-Sept 2017, in Figure 3 we plot toilet coverage over time in our study area from 2010 up until 2018. We do this by treatment status (red lines for control and blue lines for treatment villages) and by officially classified VG status (solid lines for VG households and dotted lines for non-VGs). We use household's VG status here rather than SBM's eligibility status because we are interested in the time trend by subsidy eligibility irrespective of whether or not the household was classified as having a toilet at SBM baseline (prior to SBM baseline subsidy eligibility depended on VG status and not on the household's SBM baseline record on toilet ownership). The vertical red line depicts the launch of the micro-credit intervention at the beginning of 2015, which happened shortly after the start of SBM (October 2014). VG households without a toilet were in principle eligible to receive a sanitation subsidy, particularly under SBM.

Figure 3 clearly shows that sanitation coverage among our sample population had started increasing even before the introduction of the sanitation loan product. In 2010 virtually none of the MF clients owned a toilet, and by the time the intervention started in 2015, on average more than 20% did. Prior to the launch of the credit and SBM interventions, we do not observe any statistically significant differences in the level and the evolution of toilet coverage, neither between control and treatment GPs, nor between VG and non-VG households. This is confirmed through sample balance checks (available upon request). This pattern changes remarkably from around 2015 onwards, with two notable trends in particular: (i) In control sites - where SBM was active but where no micro-credit for sanitation was available - toilet construction among VG households accelerated. Toilet coverage among non-VG households, on the

other hand, continued along the same (slower) trajectory as before, leading them to fall behind the VG households; While we do not have any source of exogenous variation that enables us to identify the causal effect of the SBM program, this descriptive evidence is consistent with the hypothesis of SBM having induced a successful sanitation drive in our study areas among subsidy eligible households; Though, two years from the 2019 deadline to become open defecation free (ODF), toilet coverage among the MF client sample remains at less than 50% in control GPs in our study area; (ii) In treatment communities, in contrast, the provision of micro-credit for sanitation allowed households officially classified as non-VG to not only keep up with, but even exceed the upward toilet uptake trend observed among their VG counterparts. We also observe a higher trend in toilet coverage amongst treated VGs relative to those in control, but given the already higher trend for VGs in control from mid-2014 onwards, there was less scope for micro-credit to make a difference in terms of toilet uptake, on average. It is possible that VG households in treatment sites decided to use sanitation loans to cover the construction of toilets instead of using alternative funding sources (e.g. government funding) which they would have used otherwise (like their counterparts in the control group). This would be consistent with an increase in sanitation loan uptake, without an increase in toilet uptake even if VG households in treatment areas did use the loan to construct a toilet.

Sanitation behaviour An important policy concern is whether these newly constructed toilets are also used. We analyse intervention impacts on two related indicators, namely whether the household reports that the toilet is in use, and cross-checked by interviewer observation, and whether anyone in the households reportedly goes for open defecation. Impact estimates are shown in Table 6. We find that for both indicators, estimated coefficients are closely in line with the impact estimates on toilet uptake, implying that constructed toilets tend to be used by households and hence lead to an accompanied drop in open defecation.

Sanitation uptake and subsidy uptake in the SBM 2016 snapshot Finally, in Table 4 we verify the robustness of our results to a different, independently collected measure of toilet uptake – household toilet ownership as recorded by Government officials in the SBM September 2016 snapshot. In addition, we evaluate impacts over time and assess impacts on subsidy uptake. Results on toilet ownership as recorded in the SBM snapshot are presented in columns 3-4 of Table 4. To compare these results to our survey data, in columns 1-2 we present impacts on toilet ownership in September 2016, re-constructed based on the age of toilet construction reported during endline survey. Comparing column 1 to column 3 and column 2 to column 4, we find that results are strikingly similar between the two independently collected datasets.

Interestingly, comparing the longer term impact results in column 3 of Table 4 to the shorter term impact results in column 1 of Table 4 suggests that 84% of the impact on toilet uptake was achieved over the first 19 months of the intervention (February 2015 - September 2016). The more modest additional increase in toilet construction in treatment areas relative to control areas in 2017 could be due to a drought that took place in our study area and to demonetisation in November - December 2016, which greatly reduced MFI lending in the study areas.

Turning to columns 5-6 in Table 4, we look at impacts on subsidy uptake. Interestingly, for subsidy

eligible households the estimate of impact of micro-credit on subsidy uptake is very similar to that of impact on toilet uptake. Just as the impact that we observed for toilet uptake in column 4, the observed impact on subsidy uptake is close to being significant at conventional statistical levels (p-value of 0.105). Similarity in impacts on toilet uptake and subsidy uptake for subsidy eligible households suggests that subsidy eligible households that constructed a new toilet were able to obtain a subsidy. Therefore, lack of access to the subsidy scheme is unlikely to have been the only barrier, if one at all, of sanitation investments for subsidy eligible households in our study area. Unsurprisingly, we do not observe any impacts on subsidy uptake for the subsidy ineligible group.[23]

5 How does micro-credit support the subsidy program?

The findings thus far indicate that, first, both subsidy eligible and subsidy ineligible households took the sanitation loans. Second, this translated into a significant increase in toilet ownership and usage and a reduction in open defecation practice, mainly for the subsidy ineligible group, but to some extent also for the subsidy eligible group. Combined, these findings suggest that the sanitation micro-loan program was able to support the SBM program's over-arching goal of reducing open defecation. An important question for policy design is *how* the micro-credit program supported the subsidy program, which we address in this section.

5.1 Determinants of subsidy eligibility status

We first investigate whether the micro-credit supported households who are vulnerable but are erroneously classified as ineligible for the SBM subsidy since they were recorded as having a toilet at SBM baseline.[24,25] Comparing toilet ownership rates at SBM baseline and at survey baseline for VG households, we see in Table 8 that over half (83 out of 115) of vulnerable MF client households identified as owning a toilet in the 2012-2013 SBM data (making them ineligible for subsidy), did *not* own a toilet according to our survey data 1-2 years later, in 2014.[26,27]

To examine which type of subsidy ineligible households the sanitation micro-credit supported we estimate a version of equation 1, now allowing for heterogeneity in impacts by three different sub-groups:

[23] In total, 3 subsidies were disbursed to subsidy ineligible MF clients in each of the treatment and control groups (6 in total).

[24] It is also possible that some toilets became dysfunctional. However, our survey would have captured this since households were asked to report on ownership of toilets regardless of whether they were functional.

[25] We note that also vulnerability status might change over time and might entail a degree of mis-classification. However, our survey data does not allow us to re-construct vulnerability status, which is why we take it as given and time-invariant in our analysis.

[26] Table 8 uses reconstructed baseline toilet ownership derived from endline reports of the date of toilet construction. Results are almost identical when using actual baseline toilet ownership observations using the reduced panel sample (results available on request).

[27] Our surveys asked households to report on ownership of any toilet, regardless of whether it was functioning. Thus, it is unlikely that we are missing out on households with a non-functioning toilet. It is possible that some households under-reported actual toilet ownership at our survey, in the hope of being considered eligible for a subsidy or any other form of support. Given the significant efforts that were spent in confirming toilet ownership status during our survey (for example through interviewer observations, random re-visits, random spot-checks, monitoring, flagging of inconsistent responses between survey baseline and survey endline, etc.) we expect this not to be the key driver behind these results. It is also possible that our matching process was not perfect. Results presented here, however, are restricted to the sample of matches for which a manual check confirmed that the match was most certainly correct (dropping one out of four matches). Imperfect matching is therefore unlikely to explain the big discrepancy observed in Table 8.

(i) Non-VG; (ii) VG without toilet at SBM baseline; and (iii) VG with toilet at SBM baseline.

Table 9 displays these findings. Interestingly, impacts on sanitation loan uptake are significantly positive across the board and similar in magnitude, for each type of household, irrespective of their VG status or of their subsidy eligibility status determined by toilet ownership at SBM baseline. Results on toilet uptake, however, reveal that within the subsidy ineligible group, impacts are strongest among non-VG households. These households experienced an impact on toilet uptake of 28pp (significant at the 1% level). Importantly, the results show that there was no impact on toilet uptake for VG households with toilet recorded at SBM baseline, despite the observed impacts on sanitation loan uptake for this sub-group. This suggests that there are unobserved constraints specific to these VG households which do not allow them to translate the sanitation loan into new toilets. Possible reasons include lack of additional financing sources needed to complement micro-credit to cover the actual toilet cost over and above the loan amount; and/or differential perceptions about the benefits of improved sanitation.

Overall, results in Table 9 suggest that a significant portion of non-VG MF client households would benefit from financial support but are - unlike their VG counterparts - unable to access government subsidies. Appendix B compares VG and non-VG households in terms of a wide range of socio-economic characteristics collected during the endline survey, other than those on basis of which official VG status is defined (e.g. caste, female headed, etc.). At endline, non-VG MF client households without a toilet at survey baseline appear slightly better off in terms of some characteristics, particularly in terms of educational attainment of household head and some key productive assets such as agricultural equipment. Overall, however, they are not strikingly different than their VG counterparts, which is not very surprising given the poor settings in which these households reside. These results could explain why non-VG households turn to sanitation loans in the absence of getting access to government subsidies.[28]

5.2 Sanitation loan conditions and credit constraints

As formally shown in ACGMS 2019, the sanitation micro-loan program could have motivated sanitation loan and toilet uptake through three features: (i) relaxation of a credit constraint preventing households from borrowing to invest in a toilet; (ii) the lower interest rate on the sanitation micro-loan (as compared to other loans offered by the partner MFI and other MFIs in the area) reducing the cost of investing in a toilet; and/or (iii) the label attached to the loan allowing households who are sensitive to loan labels, to invest in a toilet.

While we do not have the experimental setup to identify the role played by each of these channels directly, we can use the predictions from the formal model laid out in ACGMS 2019 to see whether, based on different pieces of evidence available, we can favour one channel relative to another. To do so, we need to (in addition to impacts on sanitation loan uptake and impacts on toilet uptake) consider impacts on borrowing behaviour in terms of amounts borrowed and types of loans taken, and impacts on other investments. MF client households that decide to take up a sanitation loan have to necessarily change

[28] Note that our study sample consists of MF client households who, given the MFI's targeting rules, are on average worse off relative to other households in their villages. Table 1 in ACGMS 2019 provides a comparison of the average characteristics of the MFI client households and those for rural households in Latur and Nanded districts. It is nonetheless surprising that households that are officially classified as being VG appear not to be too dissimilar from non-VG households in terms of their economic status. This suggests that the MFI is good at targeting the most needy households and that it manages to serve households possibly mis-classified as being non-VG.

their borrowing behaviour in one of two ways: (i) increase overall borrowing, potentially accompanied by a change in the composition of borrowing, and/or (ii) not change overall borrowing, but change the composition of the borrowing portfolio.

Model predictions The model laid out in ACGMS 2019 predicts 5 possible cases, which are summarised in Figure 4. If households are insensitive to the loan label and the sanitation loan simply relaxes a credit constraint (case 1), we would expect the sanitation loan uptake to be accompanied by an increase in sanitation investments and/or other (business) investments. The sanitation loan would be taken in addition to other credit the household was already taking, resulting in an increase in overall borrowing. We would not expect to see a shift away from any other loan types. The impact on toilet impact is ambiguous if the credit constraint is not sufficiently relaxed to allow the household to make all the investments it wants to make.

The lower interest rate (in the absence of a strong effect of the loan label) would induce households to shift away from more expensive loans (e.g. business loan offered by the MFI) towards the sanitation loan, even if the household did not intend to alter its investments. Overall borrowing could increase or remain unchanged, depending on household investment decisions: if the interest rate reduction didn't induce households to change their investment decisions, we would expect to see no change in overall borrowing, though there should be a shift away from more expensive sources of credit to cheaper sources of credit (case 2). If the lower interest rate allowed or incentivised households to increase their investments, we would expect to see an increase in investments, accompanied by an increase in overall borrowing (case 3).

If instead households are sensitive to loan labelling (and are therefore credit constrained for sanitation in the absence of a sanitation loan), then we would expect to observe an increase in toilet uptake, combined with either an increase in overall borrowing (case 4), or a particular change in borrowing composition - a shift away from another loan type labelled for an investment that is less desired than sanitation (case 5). The latter would only happen if the household continues being overall credit constrained, in spite of the availability of additional credit.[29]

Whether or not we will be able to identify the underlying mechanism of impacts will depend on whether or not we find an increase in overall borrowing or a change in borrowing composition. If we observe an increase in overall borrowing, then that is not a sufficient condition for exclusion for any of the three possible mechanisms, as either case 1, case 2 or case 4 in Figure 4 could apply. If, there is no increase in overall borrowing, but there is a shift away from another loan type, then we can identify the channel by investigating the nature of the shift. In particular, while the lower interest rate can explain substitution away from more expensive loans (case 4), it cannot explain substitution away from loans with a similar or lower interest rate. The latter would be consistent with households responding to the loan label (case 5).

Results To examine changes in borrowing behaviour, we consider a number of dimensions of borrowing. First, we consider impacts on MFI loan uptake, overall from any MFI and from the implementing MFI in particular, using official credit bureau data and administrative data from the implementing MFI. Next, we assess impacts on borrowing from other formal institutions (including commercial banks, cooperatives,

[29] This is possible, for instance, because of the various loan caps imposed by the RBI and by the MFI.

NGOs, savings funds and self-help groups) and from informal sources (including money lenders, relatives, friends, acquaintances and work), using reports by the household survey respondent.[30]

Table 10 reports impacts on overall MFI borrowing, using the credit bureau data, while Table 11 considers impacts on the composition of the MF client's borrowing portfolio at our partner MFI, using MFI administrative data. We have information on the interest rates charged on all the loan products offered by the partner MFI, but not for the other MFIs reported in the credit bureau data.[31] Thus, the analysis on the borrowing portfolio for the partner MFI could offer insights that would allow us to differentiate between which of two features – interest rate and loan label – could explain our findings. Interestingly, in both tables we observe a very different pattern for subsidy eligible households relative to that for subsidy ineligible households.

We start by discussing our findings for subsidy ineligible households. Table 10 reveals that the average subsidy ineligible MF client household did not increase its overall borrowing from MFIs, either from the implementing MFI or from other MFIs operating in the area. However, in Table 11 we observe a significant shift in MF loan composition: the increase in sanitation borrowing is accompanied by a reduction in the amount borrowed through education loans.[32]

It could be possible that subsidy eligible households substitute away from other (more expensive) sources of (non-MFI) credit in response to the introduction of the sanitation loan. To assess whether this is the case, we consider impacts on formal borrowing from non-MFI sources (commercial banks, cooperatives, self-help groups, saving funds and NGOs) and informal borrowing (from relatives, friends, acquaintances and work).

Table 12 presents these findings. For each of these two aggregate outcomes, we consider three different specifications. In the first specification we use as the dependent variable the total loan amount obtained from the survey data as it is, without any corrections for possible mis-reporting on behalf of the respondent. Next, we add to the regression a control for whether or not we consider it likely that there is an inconsistency between the household respondent's report on borrowing and household's actual borrowing behaviour. To obtain an estimate of the household's tendency to mis-report, we compare official administrative credit bureau data on uptake of MFI loans over the study period (yes or no) to the household respondent's own report of MFI loan take up over the same period. We create an inconsistency indicator equal to one if we observe any inconsistency between the two measures and zero otherwise. We then add this indicator as a control to the regression models in Table 12 (columns 2-3 and columns 5-6). In addition, in columns 3 and 6, for households that report to have taken a positive loan amount (from other formal or informal sources, respectively) we use household's specific discrepancy between its respondent's report on MFI loan amounts and credit bureau data records on the same to construct a loan amount measure corrected for possible mis-reporting.[33] Overall, we do not find any impacts on borrowing from

[30]For the measures that rely on self-reported survey data, we conduct a set of robustness checks that take possible mis-reporting into account.

[31]This information is not reported in the credit bureau data. Information on the interest rates charged by other MFIs in the study area, obtained from their webpages after the endline survey, suggests that the interest rates charged by our partner MFI were similar or lower than those charged by other MFIs.

[32]This is a potentially disconcerting finding. To analyse the potential impact of this observed reduction on educational investments, we considered intervention impacts on school attendance and school attainment for school-aged children in our study sample. No statistically significant impacts are observed. However, since the study was not designed to look at such educational outcomes, we do not have sufficient statistical power to detect impacts on those sub-groups.

[33]Specifically, we divide the survey reported loan amount by the fraction of MFI loan amount as reported during endline

either other formal or informal sources and therefore conclude that the micro-credit intervention improved toilet uptake of subsidy ineligible households by removing overall credit constraints for sanitation.

Linking these results to the predictions laid out above, we are able to exclude the reduction in interest rate and a reduction of overall credit constraints as possible drivers for subsidy ineligible client households. If the reduction in interest rate was the main driver, then we would have expected to see a shift away from more expensive loans, of which one is the business loan offered by the MFI. However, we do not observe such a pattern. Instead, we see a reduction in take up of education loans from the MFI, which had a similar interest rate as the sanitation loan. If sanitation loans were able to reduce overall credit constraints, then we would have expected to see an increase in overall borrowing from micro-finance sources and/or from other formal or informal sources. However, we find no evidence of such a pattern.. Thus, given that subsidy ineligible households take the sanitation loans, increase their sanitation investments, but do not increase overall borrowing by substituting out of the education loan – which had a similar interest rate to the sanitation loan – we can conclude that the impacts on subsidy ineligible households can be explained by the labelling of the loan as a sanitation loan. This also explains the high loan-to-new toilet conversion rate that we observed in the previous section.

Importantly, however, note that the reduction in education loan uptake shows that the introduction of micro-credit was unable to remove overall credit constraints for subsidy ineligible households. If labelling indeed matters for subsidy ineligible households, then the fact that they took an education loan prior to the intervention signals their interest in taking such a consumption loan. If they were no longer credit constrained post-intervention then we would have expected overall borrowing to go up rather than seeing a shift away from education loans. In on-going research we are exploring possible reasons for why subsidy ineligible households appear to remain overall credit constraints in this context.

Our findings for subsidy eligible households are not as conclusive. While Table 10 reveals that the average subsidy eligible MF client household responded to the micro-credit intervention by significantly increasing its overall MFI borrowing, it did so without reducing its uptake of other types of loans (Table 11). This combination of findings does not allow us to identify whether these households decided to take up the sanitation loans in response to the favourable interest rate, and/or because the provision of additional credit relaxed constraints in obtaining sufficient credit to make other types of non-sanitation investments. In the next section we explore further the extent to which micro-credit relaxed credit constraints for subsidy eligible households.

5.3 Complementing subsidy support to subsidy eligibles

The results in the previous sections reveal that, on average, a significant portion of subsidy eligible households took up the sanitation loans, and that these loans were taken in addition to their existing loan portfolio, resulting in an increase in their overall borrowing. And yet, on average, this loan uptake did not translate into a significant number of new toilets. In this section we move beyond average numbers and explore whether micro-credit was able to support particular sub-groups of subsidy eligible households in making sanitation investments, and how. Specifically, we consider the potential use of micro-credit as a means to bridge the time gap between toilet construction and actual subsidy disbursement; before

survey over MFI loan amount as recorded in the credit bureau data. Note that here we inevitably assume that the respondent's misreporting behavior is the same across different types of lending sources.

considering whether it supplemented subsidies when toilet costs exceed the subsidy amount. We also discuss potential reasons behind the observed low loan-to-new-toilet conversion rate for this group of households.

Provision of bridge-funding to subsidy eligibles

Given that the bulk of the SBM subsidy amount is disbursed only after a toilet has been successfully constructed, households need funding up-front to cover toilet construction costs. The extent of this is visualised when we examine data on the time lag between toilet construction and subsidy receipt. Figure 5 plots the timing of subsidy disbursement reported in the endline survey and that reported for toilet construction. It shows that over 50% of households who had received the subsidy by the time of the endline survey received the subsidy after toilet construction, with the remaining households report receiving the subsidy either before, or at the same time as toilet construction.[34] Households that reported receiving the subsidy after toilet construction waited an average of 10 months after toilet construction to receive the subsidy, with over 10% waiting for over a year.

This finding can be cross-validated using SBM officials' report of delays in SBM disbursement, captured during a survey of GP SBM officials in December 2017: Consistent with the client reporting, half of 77 GP officials reported that the time between subsidy application and disbursement was at least 3 months.[35]

Overall, these descriptive results confirm that a significant percentage of households experienced a quite substantial time gap between toilet construction and subsidy receipt. This feature of government subsidies could possibly make sanitation loans, which are generally disbursed prior to toilet construction, attractive for financing the upfront costs of a toilet. They could allow households to alleviate short-run liquidity constraints to construct a toilet, and thereafter receive the subsidy. However, if the delay in subsidy disbursement is very long, households will face higher costs of investing in a toilet since they will need to pay higher interest charges since they cannot use the subsidy to repay the loan.[36] If subsidy disbursement delays become apparent after loan take-up, the household may have taken the sanitation loan, but may choose to make another investment in order to obtain funds to repay the loan. Thus, we hypothesise that both the extensive margin (i.e. whether a delay is expected or not)and the intensive margin (i.e. the length of the delay) will influence the loan uptake decision; but the length of the delay will also influence the sanitation loan to new toilet conversion decision if these are realised after loan take-up. In particular, if delays in subsidy disbursement turn out to be substantial, households will be less likely to translate these loans into new sanitation investments.

To examine this, we use variations in average experienced delays in subsidy disbursements across communities. We use reports by community SBM officials during the endline survey on delays in subsidy disbursements experienced by the average household living in their community over the study period. We focus on villages in which SBM officials reported either delays of 1-3 months ('Small delay') or delays of 3-6 months ('Large delay'). Because of coding errors during data collection, we cannot distinguish

[34]Part of the subsidy could have been received before the completion of toilet construction under SBM. However, this observation of subsdiy receipt before toilet construction could be due to recall errors, or due to subsidy receipt for an older toilet that was later replaced.

[35]This information is missing for one GP.

[36]In addition, households might face a higher risk of default or repayment difficulties, risking the longer-term engagement with the MFI.

villages that reported delays up to 1 month from those that reported delays more than 6 months. These villages are therefore dropped from this analysis.[37] Table C in the Appendix compares characteristics of villages by reported delay intensity. With the caveat of having only a very small sample of villages (58 in total), overall, villages that experienced large delays in subsidy disbursement (27 in total) do not appear to be statistically significantly different from villages with smaller delays (31 in total). Interestingly, notable exceptions are significant differences in terms of variables related to experience of the Sarpanch (i.e. village leader). Villages that experienced larger delays are significantly more likely to be headed by a leader who was elected more recently and who had not been in politics prior to becoming the village leader. Although recent elections and/or lack of political experience might have influenced delays in subsidy disbursement (which, in fact, is something we would expect), this pattern does not seem to have led to similarly significant differences between villages with large delays and villages with small delays in terms of other observable village characteristics. We therefore tentatively conclude that reports on experienced subsidy delays over the study period are exogenous to other factors impacting loan uptake and toilet uptake, including the village's treatment status. This is confirmed through balance checks, showing that treated villages are as likely as control villages to report small or large delays.

Table 13 displays impact estimates on loan uptake and toilet uptake for subsidy eligible households without a toilet at survey baseline. We control for the SBM official's estimate of number of households that applied for a subsidy since baseline to address the fact that higher demand for subsidies might influence subsidy disbursement speed. In light of the results in Table C, to account for observed imbalances we also control for whether or not the Sarpanch has been in office for less than 2 years and for whether or not he/she had been in politics prior to becoming Sarpanch. The first two columns of Table 13 show that the impacts of the credit intervention on sanitation loan uptake of subsidy-eligible households are significantly larger in villages where households experienced a large delay in subsidy disbursement, which is consistent with micro-credit providing bridge funding. At the same time, considering impacts of micro-credit on toilet uptake in Column 4 we find that conversion of sanitation loans into new toilets only happened in areas where experienced delays in subsidy disbursement are relatively small. In those villages we observe an impact on toilet uptake for subsidy eligibles of 28 percentage points.[38] We do not see any impact on toilet uptake for subsidy eligibles living in areas with large delays in subsidy disbursement. This is in line with the hypothesis that delays in subsidy disbursement make sanitation investments financed by micro-credit more expensive and less attractive relative to investments with more immediate and higher monetary returns (e.g. business investments).[39]

A question that remains is why subsidy eligible households living in areas with large delays in subsidy disbursement are relatively more likely to take up sanitation credit, despite them being less likely to use

[37] We are in the process of working with the data collection firm to rectify these coding errors, which would allow us to then also look at non-linearities in terms of impacts by subsidy disbursement delay status.

[38] The coefficient estimate of impact of micro-credit on sanitation loan uptake in areas with small delays (column 2), 0.125 is not statistically different from the coefficient estimate of impact on toilet uptake (column 4), 0.267. The latter has a confidence interval of (0.0556-0.478).

[39] Note that the results in Table 13 suggest that subsidy eligible households that live in areas with large delays in subsidy disbursement are more likely to own a toilet than those in areas with less delays, even in control sites (see the significance of the coefficient estimate of 'Subsidy eligible'). A likely reason for this is that delays in subsidy disbursement might have triggered some changes in household behaviour and/or contextual changes which in turn lead to an increase in toilet coverage; For instance, the larger the delays, the more likely households are to actively look for alternative means to bridge the funding gap (e.g. NGO funding, personal savings, etc.), making them more likely to effectively construct a toilet. Or, villages with larger delays in subsidy disbursement might attract more NGO support, which could help boost toilet uptake.

this credit for sanitation investments. This could be explained by differences in availability of information at different times in their sequential decision making process. The household needs to make two sequential decisions. First, they need to decide whether or not to take up a sanitation loan. Second, they need to decide whether or not to use the loan for sanitation investment. The former decision is made before the start of the toilet construction works, at a time when the household does not necessarily have full information about either the true costs of toilet construction and/or about the actual delay in subsidy disbursement that it will face. The decision therefore depends on the household's ex-ante beliefs about these benefits and costs, and on the risks they take by taking up micro-credit whilst potentially getting these beliefs wrong. The latter risk depends, in turn, on the extent to which the household expects to be penalised if it ends up using the loan for non-sanitation purpose. In a context where loan use is not strictly monitored and not enforced, households might decide to apply for the sanitation loan - and more so if larger delays in subsidy disbursement are expected to allow for bridge funding - with the prospect to give up on their plans if the actual sanitation investment costs (toilet costs and interest payments) turn out to be high relative to the perceived benefits. This could explain the finding of (i) relatively high impacts on sanitation loans and (ii) zero impacts on toilet uptake in areas with short delays in subsidy disbursement. In the next section, we explore the extent to which variation in toilet prices confirm these results.

Provision of supplementary funding to subsidy eligibles

The second channel we consider for eligible households relates to the fact that most Indian households prefer to construct expensive toilet types, typically sceptic tanks and toilets with a nearby bathroom (Coffey et al., 2014, Coffey and Spears, 2017). Coffey et al. find that the typical household in their survey of 5 Northern Indian states would like to invest in a toilet costing Rs 21,000 on average, which is substantially higher than the maximum subsidy amount of Rs 12, 000. Figure 6 shows a similar pattern in our data. This figure plots toilets costs and subsidy amounts taken over time, as reported by households survey respondents. Since 2010, though the median reported subsidy amount has been fluctuating around Rs. 12,000, the median reported toilet cost has been steady around Rs. 26,000.

If micro-credit was used by subsidy eligible households to cover the funding gap between the subsidy amount and the actual toilet construction costs, then we would expect impacts on sanitation loan uptake to be higher in areas where toilet costs are generally higher. On the other hand, for similar reasons as for delays in sanitation subsidy disbursement that we described in the previous section, we would expect to see a reduction in the loan to new toilet conversion rate if the toilet turns out to be more expensive than anticipated when taking the sanitation loan, as higher toilet costs make sanitation investments less attractive relative to other investments.

To look at this, we make use of some unique data we collected from one mason in each village on the minimum and maximum cost of constructing the same twin pit and septic tank toilet. We take the average of the minimum and maximum costs reported by masons to calculate an average cost over the different toilet types. We construct an indicator for 'high GP toilet cost' if the mason reported an average toilet cost in his/her community that was higher than or equal to the median toilet cost across villages, and 'low GP toilet cost' otherwise.

Table D in the Appendix compares these two different village types in terms of a set of observable

village characteristics derived from reports by SBM officials during endline survey. As expected, toilet prices are highly correlated with various village characteristics. Villages with high toilet costs are less likely to report farming to be the most important economic activity, less likely to be OD free, and less likely to report sanitation activities to have taken place in their communities. Interestingly, villages with low toilet costs are much more likely to be headed by a female Sarpanch and one that has not been in politics prior to be elected to office. Given these imbalances, average toilet costs are most likely not exogenously determined relative to sanitation loan and toilet uptake. We therefore have to be careful not to interpret our results as necessarily being causal. It is nevertheless interesting to use these results to consider whether or not our findings are consistent with micro-credit being used as supplementary funding.

Table 14 displays the results. We find, indeed, that impacts on sanitation loan uptake are highest in areas where mean toilet costs are generally higher. Moreover, impacts on toilet uptake are only significant in areas with relatively low toilet costs. In those areas, micro-credit led to an increase in toilet uptake of 17 percentage points, significant at the 5% level. We do no observe any impacts on toilet uptake for subsidy eligible households residing in villages with high toilet costs. Just as we observed for delays in subsidy disbursement in the previous section, this is consistent with the hypothesis that increased investment costs - here caused by relatively high toilet construction costs - lead to deferrals of sanitation loans to non-sanitation investments.

Overall, the results discussed in this section are consistent with micro-credit being taken up by subsidy eligible households to bridge funding in light of expected delays in subsidy disbursement and to cover relatively more expensive toilet costs. However, we also highlight that households residing in areas with substantial delays in subsidy disbursement and/or in areas with substantially high toilet costs are not likely to convert these loans into new toilets.

6 Concluding remarks

The use of public funds for preventive private health investment has been subject to heated debates - individual household toilet construction subsidies being no exception. Especially because those who lack access are in many cases the extremely poor, coupled with the public health benefits of universal access to sanitation, few disagree that allocating public funds is an appropriate policy response (Hall and Lobina, 2009). However, critics argue that subsidies merely serve as a drop in the bucket in addressing the sanitation crisis (Mehta, 2003) and that many subsidy programs have failed to create demand (Foster et al., 2000; Brook and Smith, 2001; Cairncross, 2004; Lenton et al., 2005). The former argument has led to calls for alternative, innovative financing mechanisms. The issue has received increased attention in the context of many Financing Ministries developing strategies that enable their countries to meet the ambitious targets set out in Sustainable Development Goal 6.

Leveraging private investment in sanitation and blending these with other approaches has been postulated as a particular promising solution. A position paper for a finance minister's meeting in 2017, prepared by several international organisations working in the sector, jointly with the Ministry of Foreign Affairs in the Netherlands, states for example "Governments should encourage their financial sectors to prioritise socially-oriented micro-loan products via regulations to enable larger proportions of low-income

populations to access WASH. This allows governments to more efficient use of their limited budgets." (Fonseca and Pories, 2017).[40]

Such recommendations however draw on only very limited empirical analysis. As Evans et al. [2009] point out, robust evidence on impacts of sanitation subsidies is extremely limited and none of the cited exceptions considers their interaction with alternative financing, such as micro-credit. To the best of our knowledge, it remains to date, that the merit of a model combining government subsidies and private sector micro-credit to promote investments that inhibit positive externalities has not yet been rigorously considered and is not yet understood.

This paper contributes to this knowledge gap in the context of Swachh Bharat Mission (SBM), the Government of India's flagship sanitation program, launched in October 2014 with the aim of making India ODF by October 2019. A prominent feature of the SBM is the provision of financial incentives to vulnerable households without a toilet recorded by government officials at the time of SBM baseline. We exploit the RCT design of a sanitation micro-credit intervention in rural Maharashtra, which started shortly after the SBM was launched, to consider the complementary role that micro-credit can play alongside subsidies in government's efforts to stimulate private health investments.

Our findings support the popular claim that innovative combinations of financing tools can indeed increase sanitation investments of poor households. We show that micro-credit complements the GoI's subsidy scheme in two ways: For one, the micro-credit complements the subsidy program targeting mechanism in that it allows credit constrained households ineligible for sanitation to make the desired investment. Second, micro-credit can help subsidy eligible households overcome constraints they face in availing the subsidy.

More specifically, the new sanitation loan product was taken up by more than one in five subsidy *ineligible* households that did not have a toilet at the start of the experiment. Most of these loans translated into a new toilet, yielding toilet coverage amongst subsidy ineligibles in 2017 that was 20 percentage points higher – a 50% increase – relative to how it would have been in the absence of the micro-credit. This impact on toilet construction led to an equivalent increase in toilet usage and reduction in Open Defecation Practice. The main enabling factor that triggered loan take up by these households was not the lower interest rate or the additional credit that was made available, but the fact that the loan was specifically earmarked for use of sanitation investment. However, the study also flags the finding that the uptake of sanitation loans was accompanied by a decrease in uptake of education loans. This substitution away from other non-productive loans combined with the finding of no increase in overall borrowing suggests that the sanitation loan was able to only partially lift financial constraints. Whether this substitution also leads to a reduction in education investments remains an important question for further research.

The sanitation loans were also taken up by subsidy *eligible* households, particularly those living in areas that experienced large delays in subsidy disbursement or where high toilet costs prevail. This evidence is consistent with micro-credit being attractive for subsidy eligible households as a means to bridge fund or to supplement funds to cover more expensive toilets. The median reported toilet cost in the study area was around Rs. 26,000 (USD 366), which is almost double the available subsidy amount. Further, households in the study that received a subsidy after toilet construction reported to have waited

[40] WASH stands for Water Sanitation and Hygiene.

an average of 10 months after toilet completion to receive the subsidy, with over 10% waiting for over a year. This is consistent with reports by village officials, half of whom reported that the average time between subsidy application and disbursement was at least 3 months.

However, in contrast to the trend observed for sanitation *loan* uptake, only in villages with relatively short delays in subsidy disbursement and with low toilet prices are these loans used to construct new toilets. Overall, these results are consistent with micro-credit being taken up by subsidy eligible households to bridge fund in light of expected delays in subsidy disbursement or high toilet costs, but that extensive delays in subsidy disbursement eventually make sanitation investments funded by micro-credit more expensive and less attractive relative to investments with more immediate and higher monetary returns.

We conclude that a two-tiered financing approach allows governments, in this context the Government of India, to target its scarce resources to incentivise the most vulnerable, whilst micro-credit can support households to effectively make the necessary investments. Our study shows that the different financing mechanisms can complement design features of a single approach that are reasonably chosen but lead to unintended consequences. The post-construction subsidy design is one such example. Chosen to avoid misuse of funds, it excludes particularly vulnerable households accessing the subsidy. On the other hand, the knowledge of receiving subsidy post construction can induce risk-averse, poor households to take-up credit for initial financing – ultimately leading to more vulnerable households being able to make the health investment.

While our study highlights opportunities, a purposeful and thoughtful integration of financing approaches could potentially lead to an even more effective financing model. There are several alternative models for purposeful Government-MFI collaboration that could be explored.

For example, the Government could provide incentives to encourage more MFIs to provide sanitation micro-credit. This could be done through, for example, a partial loss guarantee where the Government would cover part of any losses incurred by MFIs in making this type of income-enhancing loan.

Second, the subsidy could be used as sanitation micro-loan collateral, allowing the MFI to take more risk when selecting their clients in terms of repayment capacity, ultimately expanding the pool of poor households receiving access to sanitation credit. Robust procedures remain of essence to ensure that those without repayment capacity, even under these relaxed conditions, are not targeted, as well as to ensure proper loan use. While micro-finance institutions might show a certain degree of lenience in terms of loan use when clients repay their loans in a timely manner, the government would have strong interest in subsidies being disbursed only when toilets are indeed constructed. A joint approach to loan use monitoring, potentially engaging local officials and/or members of village sanitation committees alongside loan officers, could ultimately lead to higher loan to toilet conversion rates.

Third, and in a similar vein, the Government could use some of the funds set aside to finance subsidies for poor households to subsidize the cost of capital for MFI funds for on-lending as sanitation loans. The cost of capital comprises a significant proportion of the MFI's costs of delivering the sanitation program. Reducing these could allow the MFI to provide sanitation loans at a lower interest rate, thereby making them more affordable for poor households. The loan program could thus reach more people than it currently does. A careful consideration of this intervention is warranted given that a lower interest rate will make the loan more attractive for other purposes (than sanitation) and might call for more stringent

monitoring mechanisms to ensure that such loans are not diverted to other uses.

Overall, we know very little about how these and potential other alternative suggestions would work in practice and what challenges and potential unintended consequences they might entail. These remain open questions and avenues for future research.

Figures and Tables

Figure 1: Geographical focus

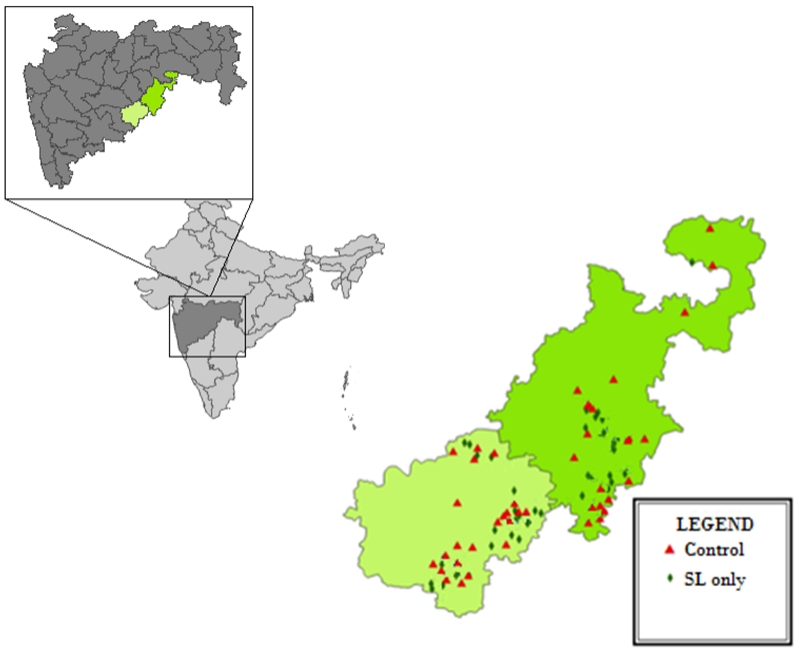

Figure 2: Timeline

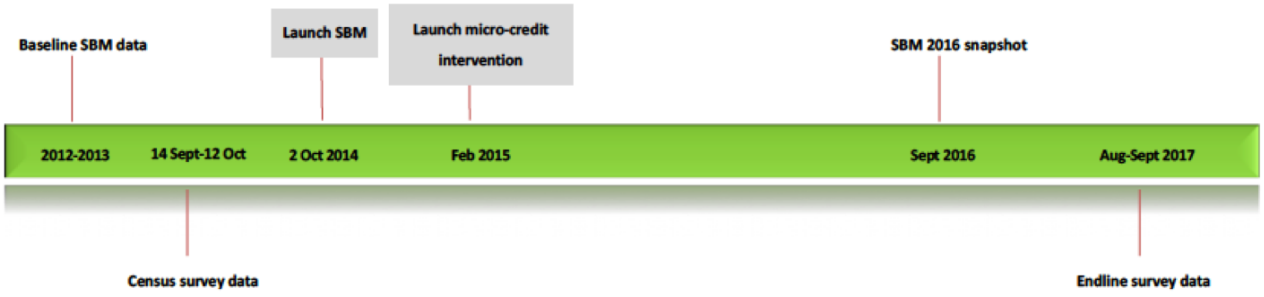

Table 1: Sanitation activities carried out in study villages over the 3 year study period

	All	N	Control	N	Treatment	N
Sanitation activities have taken place in the last 3 years	0.79	81	0.80	41	0.78	40
	(0.41)		(0.062)		(0.066)	
Any SBM activities around sanitation took place in the GP in the last 3 years	0.76	81	0.80	41	0.72	40
	(0.43)		(0.062)		(0.073)	
GP organised sanitation activities other than awareness creation and subsidies	0.16	81	0.20	41	0.13	40
	(0.37)		(0.062)		(0.054)	
Any sanitation activities carried out in last 3 years by: Government	0.25	81	0.24	41	0.25	40
	(0.43)		(0.067)		(0.069)	
Any sanitation activities carried out in last 3 years by: NGOs	0.17	81	0.15	41	0.20	40
	(0.38)		(0.056)		(0.064)	
Any sanitation activities carried out in last 3 years by: Sarpanch	0.65	81	0.73	41	0.57	40
	(0.48)		(0.070)		(0.079)	
Any sanitation activities carried out in last 3 years by: MFI	0	81	0	41	0	40
	(0)		(0)		(0)	
Any sanitation activities carried out in last 3 years by: Other villagers	0.15	81	0.15	41	0.15	40
	(0.36)		(0.056)		(0.057)	
Any sanitation activities carried out in last 3 years by: Trained medical staff	0	81	0	41	0	40
	(0)		(0)		(0)	
Streetplays around sanitation took place in the last 3 years	0.56	81	0.51	41	0.60	40
	(0.50)		(0.079)		(0.078)	
Film showings around sanitation took place in the last 3 years	0.17	81	0.12	41	0.23	40
	(0.38)		(0.051)		(0.066)	
Village meetings around sanitation took place in the last 3 years	0.63	81	0.59	41	0.68	40
	(0.49)		(0.077)		(0.075)	
Flyers around sanitation were distributed in the last 3 years	0.074	81	0.073	41	0.075	40
	(0.26)		(0.041)		(0.042)	
Wall painting/banner around sanitation was installed in the last 3 years	0.40	81	0.37	41	0.42	40
	(0.49)		(0.076)		(0.079)	
Interviewer observed any wall painting around sanitation in the village	0.33	81	0.29	41	0.38	40
	(0.47)		(0.072)		(0.077)	
Radio shows around sanitation took place in the last 3 years	0.012	81	0	41	0.025	40
	(0.11)		(0)		(0.025)	
Any other activities around sanitation took place in the last 3 years	1.54	81	1.59	41	1.50	40
	(0.82)		(0.13)		(0.13)	

Notes: Standard deviations in parenthesis in first column (All); Standard Errors in parenthesis in other columns; *, **, *** indicates significance at the 10, 5 and 1 percent level.

Table 2: Matched sample balance: Socio-economic characteristics (survey data)

	. **All**	**N**	**Control**	**N**	**Treatment**	**N**
Muslim	0.13	959	0.13	551	0.12	408
	(0.34)		(0.038)		(0.035)	
Hindu	0.73	959	0.73	551	0.73	408
	(0.45)		(0.041)		(0.040)	
Buddhist	0.14	959	0.13	551	0.15	408
	(0.35)		(0.032)		(0.032)	
HH size	5.11	959	5.09	551	5.13	408
	(1.98)		(0.10)		(0.11)	
Female headed household	0.078	959	0.076	551	0.081	408
	(0.27)		(0.012)		(0.014)	
Age HH head	46.6	959	46.5	551	46.7	408
	(10.3)		(0.57)		(0.57)	
Head able to read	0.68	959	0.68	551	0.67	408
	(0.47)		(0.020)		(0.022)	
Head able to write	0.71	959	0.71	551	0.70	408
	(0.45)		(0.021)		(0.020)	
Years of education HH head	5.70	959	5.50	551	5.98	408
	(4.77)		(0.25)		(0.25)	

Note: Standard deviations in parenthesis in first column (All);

Standard Errors in parenthesis in other columns, clustered at the gram panchayat;

** p <0.10, ** p <0.05, *** p <0.01*

Table 3: Matched sample balance: SBM subsidy eligibility criteria (SBM data)

	. All	N	Control	N	Treatment	N
HH owns BPL card	0.29	959	0.34	551	0.23**	408
	(0.45)		(0.037)		(0.035)	
Landless with homestead	0.076	959	0.094	551	0.051	408
	(0.27)		(0.032)		(0.017)	
Physical disability	0.0021	959	0.0036	551	0	408
	(0.046)		(0.0025)		(0)	
Scheduled Caste	0.34	959	0.33	551	0.36	408
	(0.47)		(0.049)		(0.059)	
Scheduled Tribe	0.030	959	0.033	551	0.027	408
	(0.17)		(0.014)		(0.015)	
Small and Marginal Farmers	0.23	959	0.19	551	0.29*	408
	(0.42)		(0.031)		(0.050)	
Female Headed	0.014	959	0.0091	551	0.020	408
	(0.12)		(0.0044)		(0.0072)	
VG	0.80	959	0.77	551	0.85	408
	(0.40)		(0.052)		(0.038)	
HH owns a toilet at SBM baseline	0.22	959	0.20	551	0.25	408
	(0.41)		(0.044)		(0.037)	
SBM eligible	0.64	959	0.63	551	0.66	408
	(0.48)		(0.058)		(0.046)	

Note: Standard deviations in parenthesis in first column (All);

Standard Errors in parenthesis in other columns, clustered at the gram panchayat;

** p <0.10, ** p <0.05, *** p <0.01*

Table 4: Impacts on sanitation loan uptake and toilet uptake (survey data 2017)

	(1) Sanitation loan	(2) Sanitation loan	(3) Toilet	(4) Toilet
SL	0.194***		0.124***	
	(0.0476)		(0.0432)	
SL - Subsidy eligible		0.176***		0.0796
		(0.0504)		(0.0515)
SL - Subsidy ineligible		0.220***		0.198***
		(0.0566)		(0.0581)
Subsidy eligible		0.0542**		0.0592
		(0.0270)		(0.0513)
Strata FE	Yes	Yes	Yes	Yes
Household covariates	Yes	Yes	Yes	Yes
F_interaction		0.388		0.102
controlmean	0.00907		0.254	
controlmean_notel		0		0.233
controlmean_el		0.0145		0.267
N	959	959	959	959

Notes: SL stands for sanitation loan treatment arm. Sample restricted to matched client households not having a toilet at survey baseline. Standard errors clustered at the village level are shown in parentheses. *, **, *** indicate significance at the 10, 5 and 1 percent level. Dependent variables: (1)-(2) Indicator equal to 1 if MF client took a sanitation loan between Feb 2015 and August 2017, as per MFI admin data; (3)-(4) Indicator equal to 1 if household owns a toilet as observed by interviewer during endline survey in August-Sept 2017; Covariates: Toilet ownership at baseline, indicator for presence of a child aged 0 - 2 at baseline, ratio of number of sampled clients to village size, indicator for whether there is any uncertainty around the matching quality; Strata and interviewer fixed effects included.

Table 5: Loan-to-new toilet conversion

	Toilet ownership Subsidy ineligible HHs		Toilet ownership Subsidy eligible HHs	
	(1)	(2)	(3)	(4)
	OLS	IV	OLS	IV
Second stage				
Sanitation loan uptake	-0.001	0.8595***	0.2478***	0.4462***
	(0.1037)	(0.3322)	(0.0783)	(0.1657)
Strata FE	Yes	Yes	Yes	Yes
Interviewer FE	Yes	Yes	Yes	Yes
Household covariates	Yes	Yes	Yes	Yes
Ratio sample clients/GP size	Yes	Yes	Yes	Yes
First stage				
SL - First stage		0.2288***		0.2040***
		(0.0633)		(0.0469)
F-stat		13.07		18.88
N	343	343	616	616

Notes: OLS = Ordinary Least Squares regression; IV = Instrumental Variable regression; First stage = OLS results for the first stage of the IV regression; Second Stage = OLS results for the second stage of the IV regression; SL stands for sanitation loan treatment arm. Sample restricted to matched client households not having a toilet at survey baseline. Standard errors clustered at the village level are shown in parentheses. *, **, *** indicate significance at the 10, 5 and 1 percent level. Dependent variable: Toilet ownership as observed by interviewer observation during endline survey in August-Sept 2017; Covariates: Toilet ownership at baseline, indicator for presence of a child aged 0 - 2 at baseline, ratio of number of sampled clients to village size, indicator for whether there is any uncertainty around the matching quality. Strata and interviewer fixed effects included.

Figure 3: Toilet coverage over time

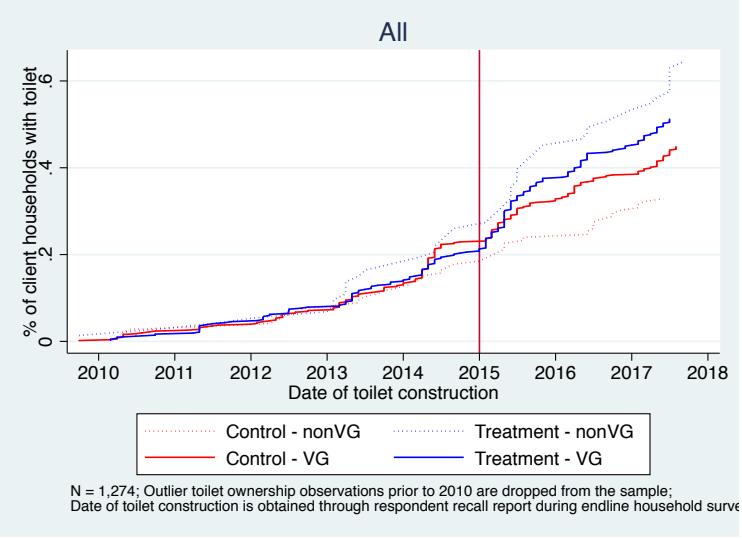

Table 6: Impacts on toilet usage and OD practice by subsidy eligibility status

	(1) Toilet in use	(2) OD	(3) Toilet in use	(4) OD
Treatment	0.125***	-0.138***		
	(0.0418)	(0.0442)		
SL - Subsidy eligible			0.0760	-0.0712
			(0.0478)	(0.0491)
SL - Subsidy ineligible			0.210***	-0.253***
			(0.0527)	(0.0565)
Subsidy eligible			0.0277	-0.0466
			(0.0405)	(0.0428)
Strata FE	Yes	Yes	Yes	Yes
Household covariates	Yes	Yes	Yes	Yes
F_interaction			0.0270	0.00532
control_mean	0.227	0.759		
controlmean_noteligible			0.228	0.772
controlmean_eligible			0.226	0.751
N	959	959	959	959

Notes: Sample restricted to matched households not having a toilet at survey baseline. The dependent variable in (1) and (3) is an indicator equal to one if the household reports to own a toilet that is in use at endline survey August-Sept 2017; The dependent variable in (2)-(4) is an indicator equal to one if the household respondent reported during endline survey that at least one household member defecates in the open; SL stands for sanitation loan treatment arm; Robust standard errors clustered at the village level are shown in parentheses; *, **, *** indicates significance at the 10, 5 and 1 percent level; F-interaction stats show p-value of F-test of equality of subsidy eligible/non-eligible interactions with SL; Covariates: Indicator for presence of a child aged 0-2 at baseline, ratio between number of sampled clients and village size, indicator for whether there is any uncertainty around the matching quality; Strata and interviewer fixed effects included.

Table 7: Impacts on toilet uptake and subsidy uptake by September 2016

	(1) Toilet (survey)	(2) Toilet (survey)	(3) Toilet (SBM)	(4) Toilet (SBM)	(5) Subsidy	(6) Subsidy
SL	0.104***		0.116**		0.0814**	
	(0.0329)		(0.0542)		(0.0381)	
SL - Subsidy eligible		0.0677		0.0781		0.0866
		(0.0446)		(0.0483)		(0.0546)
SL - Subsidy ineligible		0.168***		0.241***		0.0426
		(0.0458)		(0.0694)		(0.0477)
Subsidy eligible		0.0197		-0.354***		0.185***
		(0.0442)		(0.0540)		(0.0537)
Strata FE	Yes	Yes	Yes	Yes	Yes	Yes
Household covariates	Yes	Yes	Yes	Yes	Yes	Yes
F_interaction		0.135		0.0434		0.563
controlmean	0.185		0.341		0.113	
controlmean_notel		0.175		0.585		0.0150
controlmean_el		0.190		0.193		0.172
N	935	935	935	935	935	935

Notes: Sample restricted to households not having a toilet at survey baseline. We drop 24 observations for which we do not have toilet ownership data available in the SBM dataset; The dependent variable in (1)-(2) is an indicator equal to one if the household owned a toilet in September 2016 as per the age of toilet constructed reported at endline survey; The dependent variable in (3)-(4) is an indicator equal to one if the household owned a toilet as per the SBM September 2016 snapshot; The dependent variable in Column (5)-(6) is subsidy uptake as recorded in the September 2016 SBM snapshot; SL stands for sanitation loan treatment arm; Robust standard errors clustered at the village level are shown in parentheses; *, **, *** indicates significance at the 10, 5 and 1 percent level; F-interaction stats show p-value of F-test of equality of subsidy eligible/non-eligible interactions with SL; Covariates: Indicator for presence of a child aged 0-2 at baseline, ratio between number of sampled clients and village size, indicator for whether there is any uncertainty around the matching quality; Strata and interviewer fixed effects included.

Table 8: Baseline toilet ownership of VG households

	No toilet at SBM baseline	Toilet at SBM baseline	N
No toilet at survey baseline	460 (58.5%)	115 (14.6%)	575
Toilet at survey baseline	129 (16.4%)	83 (10.5%)	212
N	589	198	787

Notes: Sample restricted to matched households for which there was almost zero uncertainty about the quality of the match and for which SBM data was not missing.

Table 9: Heterogeneity in impacts by VG status and by SBM baseline toilet ownership

	(1) Sanitation loan	(2) Sanitation loan	(3) Toilet	(4) Toilet
SL	0.194***		0.124***	
	(0.0476)		(0.0432)	
SL - Non-VG (1)		0.246***		0.280***
		(0.0636)		(0.0739)
SL - VG without toilet at SBM baseline (2)		0.176***		0.0756
		(0.0503)		(0.0515)
SL - VG with toilet at SBM baseline (3)		0.204**		0.0578
		(0.0789)		(0.0780)
VG		0.0517		0.146***
		(0.0375)		(0.0489)
HH owns a toilet at SBM baseline		0.00254		0.0260
		(0.0397)		(0.0696)
VG HH with toilet at SBM baseline		-0.0626		0.0448
		(0.0474)		(0.0834)
Strata FE	Yes	Yes	Yes	Yes
Household covariates	Yes	Yes	Yes	Yes
F_1vs2		0.200		0.0165
F_2vs3		0.723		0.846
F_1vs3		0.633		0.0396
controlmean_none		0		0.156
controlmean_vg		0.0145		0.267
controlmean_both		0		0.359
N	959	959	959	959

Notes: The dependent variable in (1)-(2) is an indicator equal to one if the MF client had taken a sanitation loan by August 2017 as per the MFI administrative data; The dependent variable in (3)-(4) is an indicator equal to one if a toilet was observed by the interviewer during endline survey in August 2017; SL stands for sanitation loan treatment arm; Robust standard errors clustered at the village level are shown in parentheses; *, **, *** indicates significance at the 10, 5 and 1 percent level; The F_1vs2 stat shows the p-value of the F test of equality between the coefficient estimate of SL - Non-VG (1) and the coefficient estimate of SL - VG without a toilet at SBM baseline (2). Similar definitions apply to F_2vs3 and F_1vs3; Covariates: Indicator for presence of a child aged 0-2 at baseline, ratio between number of sampled clients and village size, indicator for whether there is any uncertainty around the matching quality; Strata and interviewer fixed effects included.

Figure 4: Overview of possible mechanisms behind the observed increase in sanitation loan uptake

Mechanism	Case	Increase in overall borrowing	Shift away from other loans	Change in toilet uptake	Other condition
Relaxing overall credit constraints	1	Yes	No	Increase/No change	
Low interest rate	2	No	Shift away from most expensive loan	No change	
	3	Yes	No	Increase/No change Depends on whether HH finds toilet worthwhile at new interest rate, relative to other investments	
Loan labelling	4	Yes	No	Increase	
	5	No	Shift away from any other loan type that is less desired than sanitation loan	Increase	Household continues being credit constrained even after the introduction of the sanitation loan

Table 10: Impacts on overall MFI borrowing (credit bureau data)

	(1) Amount from any MFI	(2) Amount from partner MFI	(3) Amount from other MFIs
SL - Subsidy eligible	10665.6*	7106.4*	3559.2
	(6040.8)	(4254.5)	(3622.8)
SL - Subsidy ineligible	-767.6	109.3	-876.9
	(6583.9)	(4975.2)	(4600.7)
Subsidy eligible	503.6	1657.8	-1154.2
	(5846.6)	(3666.7)	(4040.4)
Strata FE	Yes	Yes	Yes
F_interaction	0.210	0.249	0.450
controlmean_notel	82820.6	47361.7	35458.9
controlmean_el	83322.1	50388.5	32933.6
N	865	865	865

Notes: Sample restricted to matched MF client households not having a toilet at baseline survey and for which credit bureau data is available; Dependent variables are total amounts borrowed (1) from any MFI, (2) from our partner MFI in particular, and (3) from all MFIs other than our partner MFI; Amounts are in Indian Rupees (1 USD = Rs. 71.2); SL stands for sanitation loan treatment arm; Robust standard errors clustered at the village level are shown in parentheses; *, **, *** indicates significance at the 10, 5 and 1 percent level; F interaction stats show p-value of F-test of equality of subsidy-eligible/ineligible interactions with SL; Covariates: Indicator for presence of a child aged 0-2 at baseline, ratio between number of sampled clients and village size, indicator for whether there is any uncertainty around the matching quality; Strata and interviewer fixed effects included;

Table 11: Impacts on partner MFI borrowing for different loan types (MFI admin data)

	(1) Sanitation	(2) Business	(3) Education	(4) Emergency	(5) Consumption
SL - Subsidy eligible	2464.8***	2853.4	1375.6	323.6**	161.0
	(717.3)	(3210.4)	(1114.9)	(153.7)	(153.8)
SL - Subsidy ineligible	3198.5***	600.5	-3581.3***	-122.0	-51.89
	(828.0)	(4011.0)	(1314.2)	(215.5)	(134.5)
Subsidy eligible	802.4**	1192.8	-1353.8	-215.2	-13.24
	(397.0)	(2956.0)	(1059.3)	(157.9)	(127.6)
Strata FE	Yes	Yes	Yes	Yes	Yes
F_interaction	0.336	0.608	0.00255	0.0308	0.254
controlmean_notel	0	36034.1	8024.4	775.6	775.6
controlmean_el	218.7	39317.8	7148.7	586.0	586.0
N	954	954	954	954	954

Notes: Sample restricted to matched MF client households not having a toilet at survey baseline; Data missing for 5 observations; Dependent variables are amounts borrowed for different purposes, coming from MFI administrative data; Amounts are in Indian Rupees (1 USD = Rs. 71.2); SL stands for sanitation loan treatment arm; Robust standard errors clustered at the village level are shown in parentheses; *, **, *** indicates; significance at the 10, 5 and 1 percent level; F-interaction stats show p-value of F-test of equality of subsidy eligible/ineligible interactions with SL; Covariates: Indicator for presence of a child aged 0-2 at baseline, ratio between number of sampled clients and village size, indicator for whether there is any uncertainty around the matching quality; Strata and interviewer fixed effects included

Table 12: Impacts on borrowing from sources other than MFI (survey data)

	(1) Other formal	(2) Other formal	(3) Other formal (corr)	(4) Informal	(5) Informal	(6) Informal (corr)
SL - Subsidy eligible	-1398.2	-906.3	-2205.6	-1115.7	-1076.4	-980.6
	(1964.2)	(1906.7)	(2049.2)	(1053.9)	(1013.3)	(1412.5)
SL - Subsidy ineligible	38.16	855.2	1941.0	-1492.6	-1427.3	2534.8
	(2858.9)	(2724.6)	(3378.9)	(1341.3)	(1366.2)	(3004.9)
Subsidy eligible	3078.4	3094.0	3286.2	-1475.8	-1474.6	-1973.5
	(2023.1)	(1966.8)	(2079.5)	(1267.8)	(1274.7)	(1478.0)
Strata FE	Yes	Yes	Yes	Yes	Yes	Yes
Control for inconsistency	No	Yes	Yes	No	Yes	Yes
F_interaction	0.655	0.565	0.282	0.842	0.855	0.340
controlmean_notel	17847.3	17847.3	18485.6	3310.3	3310.3	3359.0
controlmean_el	17138.6	17138.6	17912.9	2587.5	2587.5	3068.7
N	856	856	856	856	856	856

Notes: Sample restricted to matched MF client households not having a toilet at survey baseline; Dependent variables are (1)-(3) amounts borrowed from formal sources other than MFIs (banks, NGOs, self-help groups, savings funds and cooperatives) and amounts borrowed from informal sources (money lender, relatives, friends, acquaintances, work); Amounts are in Indian Rupees (1 USD = Rs. 71.2); Columns (2) and (5) control for an indicator equal to 1 if there is an inconsistency between official credit bureau data and survey respondent report in terms of whether or not the household borrowed any money from an MFI; Columns (3) and (6) apply a correction to the reported amount, based on the extent of misreporting between the self-report and the credit bureau data; SL stands for sanitation loan treatment arm; Robust standard errors clustered at the village level are shown in parentheses; *, **, *** indicates; significance at the 10, 5 and 1 percent level; F-interaction stats show p-value of F-test of equality of subsidy eligible/ineligible interactions with SL; Covariates: Indicator for presence of a child aged 0-2 at baseline, ratio between number of sampled clients and village size, indicator for whether there is any uncertainty around the matching quality; Strata and interviewer fixed effects included

Figure 5: Timing subsidy uptake versus timing toilet construction

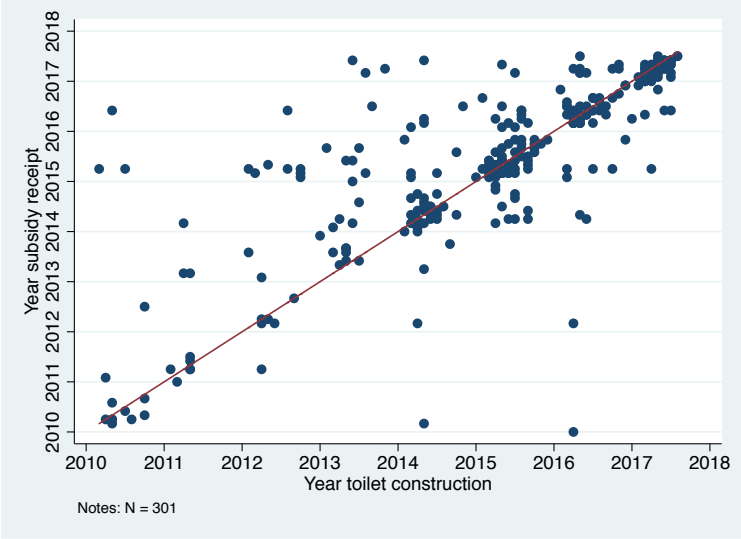

Table 13: Impacts on sanitation loan uptake and toilet uptake by official's report on delays in subsidy disbursement

	(1) Sanitation loan	(2) Sanitation loan	(3) Toilet	(4) Toilet
Credit	0.242***		0.149**	
	(0.0698)		(0.0713)	
Credit - Small delay		0.125**		0.267**
		(0.0485)		(0.105)
Credit - Large delay		0.337***		0.0549
		(0.104)		(0.0937)
Large delay		-0.0358		0.195*
		(0.0604)		(0.100)
Household covariates	Yes	Yes	Yes	Yes
F_interaction		0.0629		0.119
controlmean	0.0153		0.280	
controlmean_nodelay				0.218
controlmean_delay				0.353
N	462	462	462	462

Notes: Sample restricted to matched SBM subsidy eligible MF client households without a toilet at survey baseline; GPs with no subsidy disbursements are dropped from the sample (no such GPs in control sites); We only keep GPs where there were delays of either 36 months (Large delay) or 13 months (Small delay); The dependent variable in (1)-(2) is an indicator equal to one if the MF client had taken a sanitation loan by August 2017; The dependent variable in (3)-(4) is an indicator equal to one if a toilet was observed by the interviewer during endline survey in August 2017; SL stands for sanitation loan treatment arm; Robust standard errors clustered at the village level are shown in parentheses; *, **, *** indicates significance at the 10, 5 and 1 percent level; The F interaction stat shows the p-value of the F-test of equality between the coefficient estimate of SL - Small delay and the coefficient estimate of SL - Large delay; Covariates: Indicator for presence of a child aged 02 at baseline, ratio between number of sampled clients and village size, indicator for whether there is any uncertainty around the matching quality, number of subsidy applications made in the GP since survey baseline (as per SBM official report), indicator for whether or not the Sarpanch has been in office for less than 2 years and an indicator for whether or not the Sarpanch had been in politics prior to becoming a sarpanch; Strata and interviewer fixed effects included; Toilet uptake comes from household survey; Sanitation loan uptake comes from administrative data.

Figure 6: Toilet cost and subsidy amount over time for subsidy eligible households

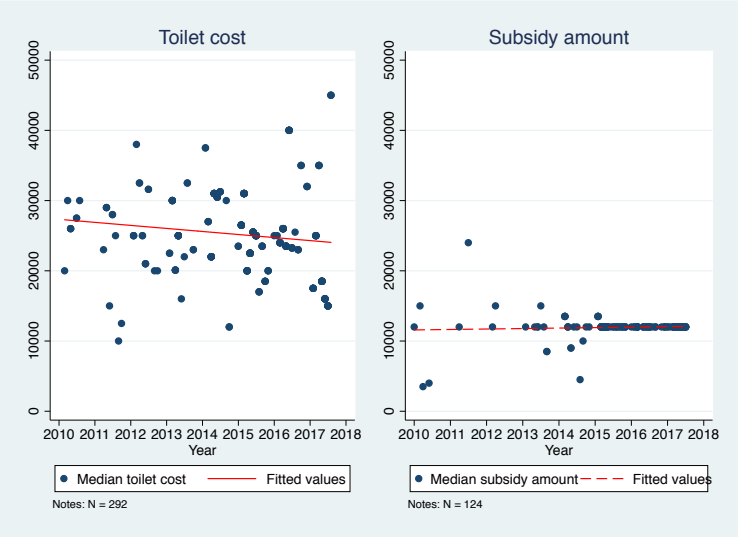

Table 14: Heterogeneity in impacts by average level of toilet costs in GP as reported by masons

	(1) Sanitation loan	(2) Sanitation loan	(3) Toilet	(4) Toilet	(5) Subsidy	(6) Subsidy
SL	0.178***		0.0633		0.0781	
	(0.0516)		(0.0525)		(0.0484)	
SL - Low GP toilet costs		0.0969*		0.140*		0.174**
		(0.0555)		(0.0813)		(0.0810)
SL - High GP toilet costs		0.250***		-0.00499		-0.00643
		(0.0780)		(0.0710)		(0.0675)
High GP toilet costs		-0.0216		0.0721		0.0428
		(0.0630)		(0.0819)		(0.0793)
Strata FE	Yes	Yes	Yes	Yes	Yes	Yes
Household covariates	Yes	Yes	Yes	Yes	Yes	Yes
F_interaction		0.104		0.195		0.112
controlmean	0.0145		0.267		0.168	
controlmean_low		0.0231		0.266		0.173
controlmean_high		0.00581		0.267		0.163
N	616	616	616	616	616	616

Notes: Sample restricted to matched subsidy eligible MF client households without a toilet at survey baseline; The dependent variable in (1)-(2) is an indicator equal to one if the MF client had taken a sanitation loan by August 2017 (as per MFI admin data); The dependent variable in (3)-(4) is an indicator equal to one if a toilet was observed by the interviewer during endline survey in August 2017; SL stands for sanitation loan treatment arm; Robust standard errors clustered at the village level are shown in parentheses; *, **, *** indicates significance at the 10, 5 and 1 percent level; The F interaction stat shows the p-value of the F-test of equality between the coefficient estimate of SL - Low toilet costs and the coefficient estimate of SL - High toilet costs; Covariates: Indicator for presence of a child aged 0-2 at baseline, ratio between number of sampled clients and village size, indicator for whether there is any uncertainty around the matching quality; Strata and interviewer fixed effects included;;

A Matching process

The process we used to match the list of clients provided by the MFI to our survey data and to the SBM dataset was based on name matching, using the guide to international names and naming practice

provided by the British government UK [2016]. Most Indian names in Maharashtra follow a traditional naming convention. Their full name usually consists of three names. Personal name + Middle name + Family name. Men and unmarried women traditionally take their father's personal name as their middle name. For instance, Sanjav Bharat Vadgama. On marrying, a woman traditionally drops her father's name and family name and takes on her husband's personal name and his family name in its place. There are some exceptions (e.g. for people who reject the caste system) which we took into consideration when matching.

Our census survey asked for the full names of every household head and his spouse. If there was no spouse available, then we asked for the full name of the eldest female member in the household. After census, we matched the full names provided in the census survey to the list of full names of female MF clients and their husbands provided by the implementing MFI. From the matched list of clients, we randomly drew a sample of clients for our study. The baseline and endline survey of sampled clients included a household roster, where the first and last name of all household members were listed. Those clients whom we did not match using census survey (either because the household had not been listed - given that in larger villages we only listed random segments - or because the client was not the head or the spouse of the head) were matched to the endline sample using the first and last names provided in the household roster.

Table 15 investigates the determinants of matching success, showing the marginal effects of a Probit regression of an indicator of having been matched on a set of household level and village level characteristics. These results indicate that the matched client sample is not representative of our study sample.

Table 15: Determinants of matching success(Probit regression)

	(1) Matched
Age HH head	0.00617***
	(0.00103)
Muslim (d)	-0.0418
	(0.111)
Hindu (d)	0.0614
	(0.110)
Buddhist (d)	0.0847
	(0.122)
Scheduled castes/tribes (d)	0.201
	(0.149)
Backward castes/tribes (d)	0.0617
	(0.144)
General caste (d)	0.0743
	(0.145)
Female headed household (d)	-0.114***
	(0.0326)
HH size	0.0186***
	(0.00672)
Head able to write (d)	0.00783
	(0.0505)
Head able to read (d)	-0.0130
	(0.0452)
Years of education HH head	0.00318
	(0.00307)
HH owns BPL card (d)	-0.00521
	(0.0219)
Primary economic activity is agriculture (d)	0.0607**
	(0.0280)
HH owns agricultural land (d)	0.00123
	(0.0251)
HH owns bicycle (d)	-0.0106
	(0.0247)
HH owns motorcycle/scooter (d)	0.0360*
	(0.0215)
HH owns TV (d)	-0.0295
	(0.0257)
HH owns livestock (d)	0.0369
	(0.0258)
HH owned a toilet at baseline (d)	0.0198
	(0.0241)
N	2772

Standard errors clustered at the village level in parenthesis
Marginal effects reported; 'd' indicates discrete variables

B Comparison VG and non-VG households

Table 16: Comparison endline characteristics VG versus non-VG households

	All	N	Non-VG	N	VG	N
Age HH head	47.0	1319	47.3	260	46.9	1059
	(10.2)		(0.72)		(0.38)	
HH size	5.23	1319	5.19	260	5.24	1059
	(2.04)		(0.12)		(0.084)	
Head able to write	0.73	1319	0.78	260	0.72*	1059
	(0.44)		(0.025)		(0.015)	
Head able to read	0.70	1319	0.75	260	0.69*	1059
	(0.46)		(0.029)		(0.015)	
Years of education HH head	5.91	1319	6.30	260	5.82	1059
	(4.78)		(0.38)		(0.18)	
Primary economic activity is agriculture	0.59	1319	0.56	260	0.59	1059
	(0.49)		(0.037)		(0.031)	
HH owns agricultural land	0.37	1319	0.37	260	0.36	1059
	(0.48)		(0.042)		(0.022)	
HH assets: Bicycle	0.25	1319	0.31	260	0.23*	1059
	(0.43)		(0.044)		(0.019)	
HH assets: Four wheeler	0.034	1319	0.038	260	0.033	1059
	(0.18)		(0.0086)		(0.0064)	
HH assets: Chairs	0.55	1319	0.58	260	0.54	1059
	(0.50)		(0.037)		(0.026)	
HH assets: Tables	0.40	1319	0.39	260	0.40	1059
	(0.49)		(0.028)		(0.025)	
HH assets: Chairs/tables	0.60	1319	0.63	260	0.59	1059
	(0.49)		(0.041)		(0.026)	
HH assets: Beds	0.47	1319	0.52	260	0.46	1059
	(0.50)		(0.039)		(0.020)	
HH assets: Cupboard	0.41	1319	0.42	260	0.41	1059
	(0.49)		(0.036)		(0.016)	
HH assets: Refrigerator	0.12	1319	0.16	260	0.11*	1059
	(0.33)		(0.022)		(0.012)	
HH owns TV	0.64	1319	0.68	260	0.63	1059
	(0.48)		(0.034)		(0.023)	
HH assets: Radio	0.051	1319	0.065	260	0.047	1059
	(0.22)		(0.017)		(0.0063)	
HH assets: Phone	0.91	1319	0.91	260	0.91	1059
	(0.28)		(0.020)		(0.011)	
HH assets: Sewing Machine	0.16	1319	0.20	260	0.16	1059
	(0.37)		(0.030)		(0.013)	
HH assets: Fans	0.79	1319	0.79	260	0.79	1059
	(0.41)		(0.025)		(0.016)	
HH assets: Electric appliances	0.79	1319	0.79	260	0.79	1059
	(0.41)		(0.025)		(0.016)	
HH assets: Jewellery	0.48	1319	0.52	260	0.47	1059
	(0.50)		(0.034)		(0.033)	
HH owns livestock	0.24	1319	0.23	260	0.24	1059
	(0.42)		(0.034)		(0.018)	
HH assets: Agricultural equipment (e.g. tractor etc.)	0.039	1319	0.065	260	0.033**	1059
	(0.19)		(0.019)		(0.0091)	

Note: Standard deviations in parenthesis in first column (All);
Standard Errors in parenthesis in other columns, clustered at the gram panchayat;
* $p<0.10$, ** $p<0.05$, *** $p<0.01$

C Comparison villages by whether or not there were large delays in subsidy disbursement

Table 17: Comparison villages by whether or not they faced large delays

	All	N	Delay 1-3 months	N	Delay 3-6 months	N
Size village population	4061.7	58	4406	31	3666	27
	(2924.2)		(575.5)		(482.3)	
Farming MOST important activity families in village are engaged in	0.64	58	0.68	31	0.59	27
	(0.48)		(0.085)		(0.095)	
Sarpanch of village is female	0.71	58	0.68	31	0.74	27
	(0.46)		(0.085)		(0.085)	
Previous sarpanch of village was female	0.54	58	0.50	31	0.59	27
	(0.50)		(0.092)		(0.095)	
Sarpanch belongs to scheduled or backward caste	0.55	58	0.61	31	0.48	27
	(0.50)		(0.088)		(0.097)	
Previous sarpanch belongs to scheduled or backward caste	0.60	58	0.65	31	0.56	27
	(0.49)		(0.087)		(0.096)	
Last sarpanch elections took place after 2015	0.30	58	0.20	31	0.41*	27
	(0.46)		(0.074)		(0.095)	
Sarpanch in position for less than 2 years	0.29	58	0.19	31	0.41*	27
	(0.46)		(0.072)		(0.095)	
First time that sarpanch is in sarpanch position	0.89	58	0.83	31	0.96	27
	(0.31)		(0.069)		(0.037)	
Sarpanch has been in politics prior to becoming sarpanch	0.21	58	0.30	31	0.11*	27
	(0.41)		(0.084)		(0.061)	
Sarpanch belongs to a political party	0.63	58	0.57	31	0.70	27
	(0.49)		(0.091)		(0.089)	
Level of support for sarpanch from villagers is high	0.75	58	0.77	31	0.74	27
	(0.43)		(0.078)		(0.085)	
In last 6 months there has been at least one GP level complaint filed by men	0.47	58	0.50	31	0.44	27
	(0.50)		(0.092)		(0.096)	
In last 6 months there has been at least one GP level complaint filed by women	0.40	58	0.37	31	0.44	27
	(0.49)		(0.089)		(0.096)	
Approximate number HHs in village with piped water connection: All	0.40	58	0.35	31	0.44	27
	(0.49)		(0.087)		(0.096)	
GP currently OD free	0.16	58	0.16	31	0.15	27
	(0.37)		(0.067)		(0.069)	
It is common in community to open defecate	0.67	58	0.65	31	0.70	27
	(0.47)		(0.087)		(0.089)	
GP expects to be ODF by 2019	0.48	58	0.45	31	0.52	27
	(0.50)		(0.090)		(0.097)	
The village has at least one community toilet	0.16	58	0.23	31	0.074	27
	(0.37)		(0.076)		(0.051)	
Prop of households in GP that have constructed a new toilet	0.35	58	0.35	31	0.35	27
	(0.27)		(0.041)		(0.061)	
Prop of HHs in GP that have applied for sanitation subsidy in last 3 years	0.37	58	0.34	31	0.41	27
	(0.29)		(0.041)		(0.065)	
Prop of HHs in GP that have received sanitation subsidy in last 3 years	0.30	58	0.28	31	0.31	27
	(0.24)		(0.035)		(0.054)	
GP ever applied to Nirmal Gram Puraskar prize	0.28	58	0.23	31	0.33	27
	(0.45)		(0.076)		(0.092)	
GP ever wan Nirmal Gram Puraskar prize	0.052	58	0.032	31	0.074	27
	(0.22)		(0.032)		(0.051)	
At least 50percent of people in GP care about improving sanitation facilities	0.78	58	0.74	31	0.81	27
	(0.42)		(0.079)		(0.075)	
At least 50 percent of people in GP participated in sanitation activities	0.79	58	0.81	31	0.78	27
	(0.41)		(0.072)		(0.081)	
At least 50 percent of people in GP would like to improve sanitation	0.76	58	0.81	31	0.70	27
	(0.43)		(0.072)		(0.089)	
Sanitation activities have taken place in the last 3 years	0.84	58	0.84	31	0.85	27
	(0.37)		(0.067)		(0.069)	
Any SBM activities around sanitation took place in the GP in the last 3 years	0.82	58	0.83	31	0.81	27
	(0.38)		(0.069)		(0.075)	
GP organised sanitation activities other than awareness creation and subsidies	0.16	58	0.23	31	0.074	27
	(0.37)		(0.076)		(0.051)	
Any sanitation activities carried out in last 3 years by: Government	0.29	58	0.32	31	0.26	27
	(0.46)		(0.085)		(0.085)	
Any sanitation activities carried out in last 3 years by: NGOs	0.19	58	0.26	31	0.11	27
	(0.40)		(0.079)		(0.061)	
Any sanitation activities carried out in last 3 years by: Sarpanch	0.67	58	0.58	31	0.78	27
	(0.47)		(0.089)		(0.081)	

Note: Standard deviations in parenthesis in first column (All);
Standard Errors in parenthesis in other columns, clustered at the gram panchayat;
** p <0.10, ** p <0.05, *** p <0.01*

D Comparison villages by whether or not average toilet construction costs are high

Table 18: Comparison villages by whether or not toilet construction costs are relatively high

	All	N	Low toilet cost	N	High toilet cost	N
Size village population	3902.3	75	3874	41	3937	34
	(2764.1)		(405.6)		(506.4)	
Farming MOST important activity families in village are engaged in	0.67	75	0.76	41	0.56*	34
	(0.47)		(0.068)		(0.086)	
Sarpanch of village is female	0.69	75	0.56	41	0.85***	34
	(0.46)		(0.078)		(0.061)	
Previous sarpanch of village was female	0.54	75	0.58	41	0.50	34
	(0.50)		(0.081)		(0.086)	
Sarpanch belongs to scheduled or backward caste	0.57	75	0.56	41	0.59	34
	(0.50)		(0.078)		(0.085)	
Previous sarpanch belongs to scheduled or backward caste	0.59	75	0.56	41	0.62	34
	(0.50)		(0.078)		(0.084)	
Last sarpanch elections took place after 2015	0.31	75	0.26	41	0.35	34
	(0.46)		(0.072)		(0.083)	
Sarpanch in position for less than 2 years	0.29	75	0.24	41	0.35	34
	(0.46)		(0.068)		(0.083)	
First time that sarpanch is in sarpanch position	0.89	75	0.84	41	0.94	34
	(0.32)		(0.060)		(0.041)	
Sarpanch has been in politics prior to becoming sarpanch	0.19	75	0.29	41	0.088**	34
	(0.40)		(0.074)		(0.049)	
Sarpanch belongs to a political party	0.60	75	0.61	41	0.59	34
	(0.49)		(0.080)		(0.085)	
Level of support for sarpanch from villagers is high	0.76	75	0.76	41	0.76	34
	(0.43)		(0.069)		(0.073)	
In last 6 months there has been at least one GP level complaint filed by men	0.40	75	0.34	41	0.47	34
	(0.49)		(0.078)		(0.086)	
In last 6 months there has been at least one GP level complaint filed by women	0.33	75	0.37	41	0.29	34
	(0.47)		(0.079)		(0.079)	
Approximate number HHs in village with piped water connection: All	0.40	75	0.44	41	0.35	34
	(0.49)		(0.078)		(0.083)	
GP currently OD free	0.16	75	0.24	41	0.059**	34
	(0.37)		(0.068)		(0.041)	
It is common in community to open defecate	0.68	75	0.66	41	0.71	34
	(0.47)		(0.075)		(0.079)	
GP expects to be ODF by 2019	0.51	75	0.41	41	0.62*	34
	(0.50)		(0.077)		(0.084)	
The village has at least one community toilet	0.13	75	0.12	41	0.15	34
	(0.34)		(0.051)		(0.061)	
Prop of households in GP that have constructed a new toilet	0.38	75	0.36	41	0.41	34
	(0.29)		(0.044)		(0.052)	
Prop of HHs in GP that have applied for sanitation subsidy in last 3 years	0.37	75	0.33	41	0.41	34
	(0.28)		(0.047)		(0.043)	
Prop of HHs in GP that have received sanitation subsidy in last 3 years	0.32	75	0.31	41	0.34	34
	(0.27)		(0.045)		(0.043)	
GP ever applied to Nirmal Gram Puraskar prize	0.27	75	0.24	41	0.29	34
	(0.45)		(0.068)		(0.079)	
GP ever wan Nirmal Gram Puraskar prize	0.067	75	0.073	41	0.059	34
	(0.25)		(0.041)		(0.041)	
At least 50percent of people in GP care about improving sanitation facilities	0.73	75	0.78	41	0.68	34
	(0.45)		(0.065)		(0.081)	
At least 50 percent of people in GP participated in sanitation activities	0.72	75	0.71	41	0.74	34
	(0.45)		(0.072)		(0.076)	
At least 50 percent of people in GP would like to improve sanitation	0.68	75	0.63	41	0.74	34
	(0.47)		(0.076)		(0.076)	
Sanitation activities have taken place in the last 3 years	0.81	75	0.80	41	0.82	34
	(0.39)		(0.062)		(0.066)	
Any SBM activities around sanitation took place in the GP in the last 3 years	0.78	75	0.78	41	0.79	34
	(0.41)		(0.065)		(0.072)	
GP organised sanitation activities other than awareness creation and subsidies	0.15	75	0.17	41	0.12	34
	(0.36)		(0.060)		(0.056)	
Any sanitation activities carried out in last 3 years by: Government	0.27	75	0.27	41	0.26	34
	(0.45)		(0.070)		(0.076)	
Any sanitation activities carried out in last 3 years by: NGOs	0.17	75	0.24	41	0.088*	34
	(0.38)		(0.068)		(0.049)	
Any sanitation activities carried out in last 3 years by: Sarpanch	0.67	75	0.66	41	0.68	34
	(0.47)		(0.075)		(0.081)	

Note: Standard deviations in parenthesis in first column (All);
Standard Errors in parenthesis in other columns, clustered at the gram panchayat;

References

B. Augsburg and P.A. Rodriguez-Lesmes. Sanitation and child health in india. *World Development*, 107: 22–39, 2018.

B. Augsburg, B. Caeyers, and F. Oteiza. The costs and benefits of investing in a toilet. Technical report, The Institute for Fiscal Studies, https://www.ifs.org.uk/uploads/publications/research2015.

B. Augsburg, B. Caeyers, S. Giunti, and B. Malde. Labelled loans, credit constraints and sanitation investments. Working paper, Institute for Fiscal Studies, 2018.

World Bank. Economic impacts of inadequate sanitation in india (english). Water and sanitation program. washington, dc: World bank., 2011. URL `http://documents.worldbank.org/curated/en/820131468041640929/Economic-impacts-of-inadequate-sanitation-in-India`.

P. Brook and W. Smith. Improving access to infrastructure services by the poor: Institutional and policy responses. Technical report, The World Bank, Washington D.C., USA, 2001.

S. Cairncross. The case for marketing sanitation. Technical report, WSP-Africa, Nairobi, Kenya, 2004.

D. Coffey and D. Spears. *Where India goes: Abandoned Toilets, Stunted Development and the Costs of Caste*. Harper Collins, 2017.

D. Coffey, P. Gupta, N. Hathi, N. Khurana, D. Spears, N. Srivastav, and S. Yvas. Revealed preferences for open defecation. *Economic and Political Weekly*, 49(38):43, 2014.

J. Cohen and P. Dupas. Free distribution or cost sharing? evidence from a randomized malaria prevention experiment. *The Quarterly Journal of Economics*, 125:1–45, 2010.

S. Devereux, E. Masset, R. Sabates-Wheeler, M. Samson, AM. Rivas, and D. te Lintelo. The targeting effectiveness of social transfers. *Journal of Development Effectiveness*, 9:162–211, 2017. doi: https://doi.org/10.1080/19439342.2017.1305981.

F. Devoto, E. Duflo, P. Dupas, W. Pariente, and V. Pons. Happiness on tap: Piped water adoption in urban morocco. *American Economic Journal: Economic Policy*, 4:58–99, 2012. doi: http://dx.doi.org/10.1257/pol.4.4.68.

R. Dizon Ross, P. Dupas, and J. Robinson. Governance and the effectiveness of public health subsidies: Evidence from ghana, kenya and uganda. *Journal of Public Economics*, 156:150–169, December 2017. doi: https://doi.org/10.1016/j.jpubeco.2017.09.005.

P. Dupas. Free distribution of cost-sharing? evidence from a randomized malaria prevention experiment. *The Quarterly Journal of Economics*, CXXV, February 2010.

P. Dupas. Shortrun subsidies and longrun adoption of new health products: Evidence from a field experiment. *Econometrica*, 82:197–228, 2014. doi: https://doi.org/10.3982/ECTA9508.

B. Evans, C. van der Voorden, and A. Peal. *Public Funding for Sanitation - The Many Faces of Sanitation Subsidies.* Water Supply and Sanitation Collaborative Council, 2009.

C. Fonseca and L. Pories. Financing wash: how to increase funds for the sector while reducing inequities. Position paper for the sanitation and water for all finance ministers meeting, IRC, water.org, Ministry of Foreign Affairs of the Netherlands, Simavi, April 2017.

V. Foster, A. Gomez-Lobo, and J. Halpern. Designing direct subsidies for the poor. A water and sanitation

case study. note no.211. public policy for the private sector., The World Bank, Washington D.C., USA, 2000.

M. Geruso and D. Spears. Neighborhood sanitation and infant mortality. *American Economic Journal: Applied Economics*, 10:125–62, 2012.

R. Guiteras, J. Levinsohn, and A.M. Mobarak. Encouraging sanitation investment in the developing world: A cluster-randomized trial. *Science*, 348(6237), 2015.

D. Hall and E. Lobina. Sewerage works public investment in sewers saves lives. Technical report, Public Services International Research Unit and UNISON, London, UK, 2009.

J. Hammer and D. Spears. Village sanitation and child health: Effects and external validity in a randomized field experiment in rural india. *Journal of Health Economics*, 2016.

A. Kapur and D. Deshpande. Swachh bharat mission-gramin (sbm-g). Budget brief, Centre for Policy Research, 2018. URL `http://www.cprindia.org/research/reports/budget-brief-2018-19swachh-bharat-mission-gramin-sbm-g`.

R. Lenton, A. M. Wright, and K. Lewis. Health, dignity and development: what will it take? Technical report, United Nations Millennium Project. Task Force on Water and Sanitation. Earthscan, London, UK., 2005.

M. Lipscomb and L. Schechter. Subsidies versus mental accounting nudges: Harnessing mobile payment systems to improve sanitation. *Journal of Development Economics*, 135:235–254, November 2018. doi: https://doi.org/10.1016/j.jdeveco.2018.07.007.

M. Mehta. Meeting the financing challenge for water supply and sanitation. Technical report, WSP, World Bank, Washington D.C., USA, 2003.

G. Miller and M. Mobarak. Learning about new technologies through social networks: Experimental evidence on nontraditional stoves in bangladesh. *Marketing Science*, 34, 2013. doi: https://doi.org/10.1287/mksc.2014.0845.

SM Musyoki. Chapter 10: Roles and responsibilities for post odf engagement: building an enabling institutional environment for clts sustainability. Technical report, July 2016.

SBM. Guidelines for swachh bharat mission (gramin). Technical report, Ministry of Drinking Water and Sanitation, 2017.

D. Spears. Policy lessons from implementing india's total sanitation campaign. 2013.

A. Tarozzi, A. Mahajan, B. Blackburn, D. Kopf, L. Krishnan, and J. Yoong. Micro-loans, insecticide-treated bednets and malaria: Evidence from a randomized controlled trial in orissa (india). *American Economic Review*, 104:1909–1941, 2014.

UK. A guide to names and naming practices. 2016.

WHO/UNICEF. Who/unicef joint monitoring programme 2017 report. Technical report, https://washdata.org/report/jmp-2017-report-launch-version0.

Ariel Ben Yishay, Andrew Fraker, Raymond Guiteras, Giordano Palloni, Neil Buddy Shah, Stuart Shirrell, and Paul Wang. Microcredit and willingness to pay for environmental quality: Evidence from a randomized-controlled trial of finance for sanitation in rural Cambodia. *Journal of Environmental Economics and Management*, 86:

121–140, 2017. ISSN 0095-0696. doi: https://doi.org/10.1016/j.jeem.2016.11.004. URL http://www.sciencedirect.com/science/article/pii/S0095069616304405. Special issue on environmental economics in developing countries.