Labelled Loans, Credit Constraints and Sanitation Investments

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Abstract

Credit constraints are considered to be an important driver of low adoption of preventive health investments among low-income households in developing countries. However, it is not obvious whether, and the extent to which, the provision of micro-credit for such investments will boost human capital investments, particularity when it is not bundled with the investment, and is characterized by other attractive attributes. We study a sanitation microloan program in rural India, which provided microfinance loans for sanitation that were not bundled with a specific sanitation investment. Using a cluster randomized controlled trial, we provide evidence that the loan program was effective in increasing sanitation ownership. A simple theoretical framework indicates that these impacts could have been achieved through three channels - relaxation of credit constraints, salience of the loan label, or a lower interest rate for the sanitation loan. Empirically, we find that the sanitation investment is not accompanied by an increase in household borrowing, ruling out the credit constraints channel. Credit based interventions are thus a viable strategy to improve uptake of lumpy preventive health investments, though there is significant room for improvement in the design of such interventions.

Keywords: Microfinance, Labeling, Credit Constraints, Sanitation

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1 Introduction

Credit constraints have been shown to be an important driver of low adoption of preventive health investments among low-income households in developing countries. Studies over the past decade have shown that relaxing credit constraints through the provision of cash, with and without conditions, (e.g. Benhassine et al., 2015) or credit bundled with the investment (Tarozzi et al., 2014, Devoto et al., 2012), can boost health investments. A preventive health investment that is characterized by significant under-investment in many developing countries is that of sanitation. Safe sanitation has been recognized to be an indispensable element of disease prevention and primary healthcare programmed (e.g. the Declaration of Alma-Ata, 1978) and is included in both the Millennium and Sustainable Development Goals (MDGs and SDGs). High rates of open defecation have been linked to poor health and higher morbidity (Augsburg and Rodriguez-Lesmes, 2018; Spears, 2012; Kumar and Vollmer, 2013; Pickering et al., 2015 and Dickinson et al., 2015), worse human capital outcomes (Spears and Lamba, 2015); and also constrain economic growth (WHO/UNICEF, 2014). At the same time, an estimated 2.3 billion people do not have access to basic sanitation services, and 4.5 billion people do not have access to safely managed sanitation (WHO/UNICEF JMP, 2017); hence the scale of the problem is urgent.

Microcredit has been postulated as a promising solution to support households in making such a significant and lumpy health investment. And indeed, Yishay et al. [2017] show that demand can be boosted significantly when offering microcredit for the product. However, the credit product they analyses was bundled with the delivery of toilet construction materials to the doorstep of the borrower household. This mirrors the approach generally taken when targeting specific investments, e.g. distributing bed nets, agricultural seeds, etc., rather than providing households with the cash, either in terms of a grant or a loan. Little is known about the effectiveness of providing credit for health investments when the new loan product is not bundled with the investment, but is associated with it only through the label attached to the loan. Poor households face numerous demands on household budgets and a new loan product, especially when characterized by attractive attributes (such as a lower price), may be taken up without the intended investment being made.

In this paper, we draw on a cluster randomized controlled trial of a sanitation loan program to study whether sanitation microcredit can boost the adoption of household toilets in rural India. The trial, conducted among clients of a leading microfinance institution, made available microloans for sanitation in randomly selected communities in rural Maharashtra. The loans, offered at a lower interest rate relative to other loans, were to be used for the construction of a new toilet; or the repair or upgrade of an existing toilet. Importantly however, the loans were not bundled with a specific toilet or materials, and households were left to their own devices to source materials and arrange construction. Moreover, the implementing microfinance institution did not closely monitor loan use, nor did it incentivize or enforce use of this loan product for sanitation investment. Thus the loan was linked to sanitation only through the label attached to it.

Rural India is a particularly apt context in which to study the adoption of household toilets. Ac-

cording to the WHO-UNICEF Joint Monitoring Program, around 57 percent of households in rural India practiced open defecation in 2015.[1] Lack of access to safe sanitation is even more pronounced in our study context – Latur and Nanded districts in Maharashtra. Only around 27 percent of households in study villages had a private household toilet before the roll-out of the sanitation loan program.[2] Interestingly, households in this context typically identify the financial cost and affordability as the key reason for not having a toilet: 83 percent of households that do no own a toilet report that they are not able to afford one (Augsburg et al., 2015); making the sanitation loan program particularly policy relevant.

We show that, in this context, households demand the newly available loan product, with 18 percent of eligible households taking a sanitation loan. Given the lower interest rate, smaller installments and longer maturity than those of most other available loan products, coupled with weak monitoring and no enforcement, the loan uptake in itself is not a surprising finding. Households might avail the loan and at the same time shift away from other - less favorable - credit sources. However, studying the impacts of the program on sanitation investments, we find that the program increases the uptake of new toilets by 9 percentage points. This increase is over and above a large increase in toilet uptake in the control areas, which might be a result of the Government of India's Swacch Bharat Mission (SBM) policy. We find little evidence that the loans were used to upgrade or repair existing toilets. Importantly for policy, the vast majority of constructed toilets are safe, high-quality toilets. Triangulating the impact on loan uptake with those on toilet uptake, we find that only around half of the sanitation loans were converted to new toilets.[3]

Our analysis then considers how these impacts were realized. To guide this analysis, we develop a simple theoretical model of household investment in lumpy goods, where households can access loans with different interest rates, and different labels attached to them. The model indicates that the impacts on loan uptake and sanitation uptake could be driven by three channels. First, the sanitation loan program could have relaxed credit constraints, by allowing households to borrow more in order to make the desired sanitation investments. In this case, the loan and sanitation uptake should be accompanied by an increase in overall household borrowing.

Second, the label attached to the loan could have also influenced sanitation loan uptake and toilet uptake. We show that when the label attached to a loan matters, a household's borrowing and investment decisions are distorted toward the investment associated with the loan label. Money will no longer be fungible. As a consequence, in the absence of a loan specifically labeled as a sanitation loan, a household might not be able to borrow for sanitation, even though it has access to credit. The household is thus *sanitation credit constrained*. Introducing a sanitation loan will relax this constraint and motivate sanitation take-up. Interestingly, this could happen without an increase in overall household borrowing.

[1] Source: UNICEF-WHO JMP, www.washdata.org. Last accessed June 2018.

[2] Community toilets are rarely available in the study area; and it is very uncommon to share neighbors toilets in rural India.

[3] Given that we find little evidence of loans being used to upgrade or repair toilets, our calculation of the loan-to-sanitation investment ratio concentrates primarily on toilet ownership as the sanitation investment.

Finally, a lower interest rate will also induce sanitation loan uptake; though it might do so without altering the household's investment choices. Households could substitute away from more expensive loans to the cheaper loan, without altering their investment choice, particularly when the label attached to the loan doesn't matter.

We then consider whether these predictions hold empirically. First, we consider the intervention impacts on overall household borrowing, as well as borrowing from various sources. Our analysis indicates that households do not borrow more on average following the introduction of the sanitation loan program, with a small, negative, coefficient associated with the treatment impact. Further analysis of impacts by borrowing source provides some suggestive evidence that households might have substituted away from other formal and informal credit sources following the introduction of the sanitation loan program. The estimates are however, very imprecise, so this evidence is only suggestive and should be interpreted with caution.

We then provide descriptive evidence that both loan attributes highlighted in the model are driving loan uptake and sanitation investment in our study context. In line with the idea that the loan label matters, we find that 62 percent of clients who were eligible for a sanitation loan took a (more expensive) business loan instead. We also find no evidence that clients take more expensive business loans only after exhausting the cheaper sanitation loan: 31 percent of clients, who could have taken this combination of loans thereby reducing overall borrowing costs, choose to take a more expensive business loan only.Supporting that the interest rate matters, we find that not all sanitation loans are used for sanitation investment. We estimate that only around half of the sanitation loans resulted in a new toilet, with repairs and upgrades to existing toilets would account for a very small proportion of the remainder. Indeed, one third of clients report using the sanitation loan for a non-sanitation purpose.

The fact that the intended loan use is objectively verifiable in our context allows us to make an important contribution to the literature. Very few studies have attempted to measure compliance with expected use of microfinance loans, particularly those that are not bundled with a specific product – as was the case here. Though part of the lower loan-to-toilet conversion rate could be explained by other constraints (e.g. absence of complementary investments or additional funds), this evidence also suggests that the loan effect might not have been sufficiently strong for at least a sub-set of households to induce use of the sanitation loan for sanitation investment purposes. In line with this, we note that 28 percent of clients that took a sanitation loan already had a toilet before the roll-out of the intervention, and 9 percent of clients who took a sanitation loan and reported using it for sanitation did not have a toilet at the time of our endline survey. Thus, this evidence suggests that the label effect is likely to be heterogeneous across households. With this evidence, we are unfortunately unable to disentangle the relative importance of the interest rate and the loan label in explaining our findings on loan uptake and toilet uptake.

Our study contributes to a number of literatures. First, it relates to the literature on credit constraints and human capital investments. A wide range of methodologies have been used to assess

the importance of credit constraints in explaining education outcomes in developed and developing countries (Lochner and Monge-Naranjo, 2012; Solis, 2017 among others); and health investments (Dupas and Robinson, 2013; Guiteras et al., 2016). Within this, a small, but growing, literature uses randomized experiments to assess the scope for microcredit loans to boost investments in preventive health products such as water connections (Devoto et al., 2012), bednets (Tarozzi et al., 2014), water filters (Guiteras et al., 2016) and sanitation construction materials (Yishay et al., 2017). In all of these cases, the loans are provided in conjunction with a specific product, which contrasts with our study of an unbundled, but labeled, loan. Moreover, in contrast to many of these studies, we analyze a particularly lumpy investment that constitutes a much larger share of households' wealth than in most other studies.

It also contributes to a growing literature studying the role of labeling, and of the fungibility of money. Numerous studies show that individuals do not adjust other spending in response to the provision of vouchers earmarked for specific spending items (Abeler and Marklein, 2017; Hastings and Shapiro, forthcoming); while other contributions show that labeled cash transfers and benefits are disproportionately spent on the named expenditure category (Beatty et al., 2014;Benhassine et al., 2015). We contribute to this literature by studying labeled loans, and showing theoretically that loan labels can matter for credit constraints.

Finally, our study links to a growing literature studying the adoption of safe sanitation in developing countries. Rigorous evidence is now available on the effectiveness of a number of sanitation interventions in different contexts, many of which entail (contrary to the setting in this study) an informational component, most often in the form of the widely adopted community led total sanitation approach, which seeks to motivate communities to come together to improve their sanitation situation following a 'triggering' session that relies on shame and disgust. Many of these find larger effects than we do, but they only do so when the intervention is very intense and/or combined with relaxing other, often financial constraints. Pickering et al. [2015] for example found that 18 months after a CLTS campaign with intense follow-ups in Mali, toilet ownership increased by 30pp. Clasen et al. [2014] find an increase of 28 percentage points (pp) in ownership of functioning toilets, up to two years after the implementation of CLTS-like promotion activities combined with the delivery of toilet construction subsidies in rural India. An evaluation of the same program but in rural Madhya Pradesh, rather than Odisha, estimated that 21 months after the intervention was delivered, toilet ownership increased by 19pp (Patil et al., 2014). On the other hand, evidence from a CLTS-inspired intervention conducted in Bangladesh found no significant impacts on toilet ownership one and a half years after the intervention, unless it was paired with subsidy provision (Guiteras et al., 2015) in which case the uptake was 7 percentage points. Similarly, an evaluation of CLTS implemented at a large-scale in East Java, Indonesia, found an increases in toilet ownership of only 3 percentage points 24 months after the intervention (Cameron et al., 2013). This impact is in line with the impacts found in a pure CLTS implementation in Nigeria (Abramovsky et al., 2018).

The rest of the paper is structured as follows. The next section describes the context of the study and the sanitation loan product. Section 3 discusses the experimental design, followed by the

empirical strategy in Section 4 and a presentation of our key impact estimates in Section 5. Section 6 presents the exposition of a simple theoretical model which forms the basis for our analysis of driving mechanisms behind the key findings. The section provides empirical support for the model's predictions.We conclude the paper in Section 7.

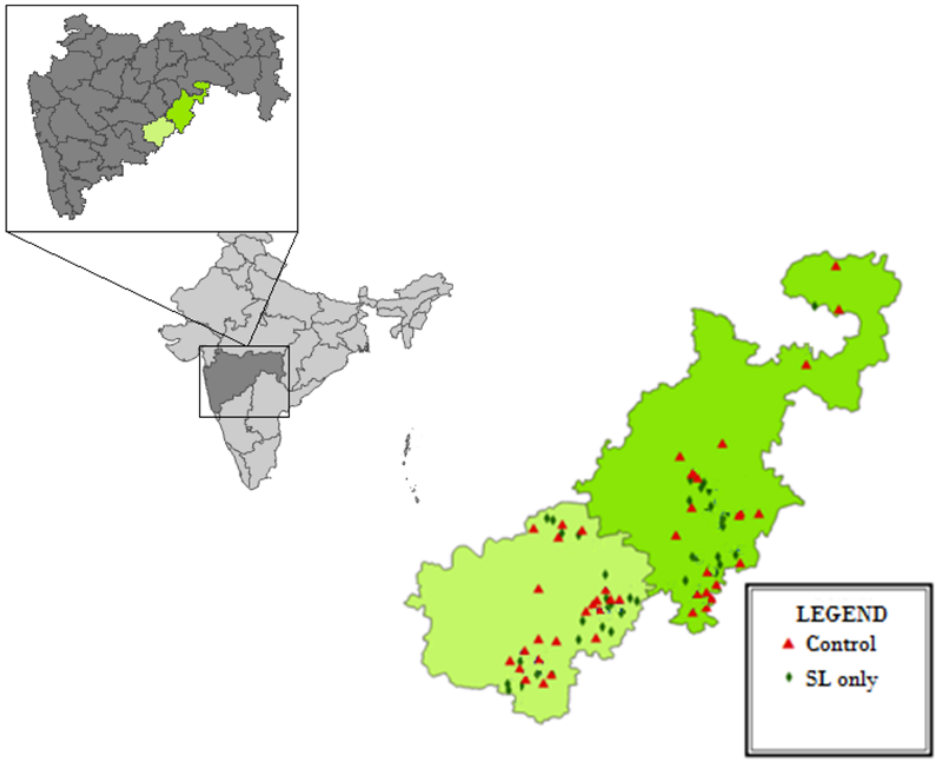
2 Context and intervention

2.1 Context

Our study concentrates on 5 blocks of 2 districts, Latur and Nanded, in the South-Eastern area of the Maharashtra, India (see Figure 1). Maharashtra, with its capital Mumbai, is one of the largest Indian states, counting approximately 100 million people living in almost 44,000 villages (GoI, 2011a). While this is the second richest state in the country in terms of per capita income, incidence of poverty remains close to the national average, implying severe inequalities within the state (GoM, 2012). This is exemplified by the 2011 Human Development Index, which had an average of 0.752 for the state, different districts however ranging from 0.604 to 0.841, with Latur and Nanded falling among the low-ranked district with an HDI of 0.663 amd 0.657 respectively (GoM, 2018). Other indicators confirm that Latur and Nanded are among the most deprived parts of Maharashtra. The total literacy rate in 2011 was 76.9 percent in Nanded and 79 percent in Latur, both below the state-level average of 82.9. Agriculture is the main economic activity in this area, with 72.3 percent of people in Nanded (GoI, 2011c) and 71.5 percent of people in Latur (GoI, 2011b) engaged in it and other primary activities.

We show in Table 1 some key statistics comparing our study context, i.e. the districts of Latur and Nanded (column 2), to rural Maharashtra (column 3) and rural India (column 4). We also show related statistics for our specific study population (column 1). Our main purpose in showing these statistics is however to provide the reader with a better understanding of how the study context compares more broadly. Using data from the most recent District Level Household survey 4 (DLHS-4), collected in 2012-13, we find that our study districts compare to the rural Maharashtra and rural India average in terms of percentage of people owning a BPL card with 21 percent in Latur and Nanded compared to 20 percent in rural Maharashtra and 19 percent in rural India. Somewhat less households are female headed (8 percent) than in the state (10 percent) and significantly less than in the country as a whole (14 percent). Age and education levels are on the other hand comparable across contexts. We note that our study sample, a very specific group of microfinance clients within the two study districts, are significantly more likely to own a BPL card (42 percent) while at the same time with somewhat more education (6 years compared to on average 4 in rural Maharashtra and rural India). This might be driven by the selected sample but also due to the fact that our data was collected two years after the DLHS-4. The Table further provides information on the distribution of caste and religion. Latur and Nanded have a somewhat smaller percentage of the population classified as either SC, ST or OBC than rural Maharashtra and India as a whole, which is

Figure 1: Study location



Notes: Figure shows location of Latur and Nanded within Maharasthra (left) and of study GPs within the two districts (right).

also reflected in our study sample. The distribution of religions followed is comparable in our study states to the Indian context more generally. Our sample on the other hand has a larger percentage of Muslims.

Finally, access to sanitation facilities is very poor in the study area. Toilet ownership rates in 2012-13 were 24 percent in Latur and Nanded, compared to 48 percent in rural Maharashtra and 56 percent in rural India. Our study population was with a coverage rate of 27.5 percent, sligthly above the average in the study districts two years later, when our pre-intervention data was collected. Most of these were private household toilets. Financing was reported as the major constraint for not having a toilet: 83 percent of households in our study reported affordability or price as the key reason for not having a toilet. This is unsurprising since a toilet comprises of a significant outlay for households. The typical cost of a toilet recommended by the Government of India's Swachh Bharat Mission - Gramin[4] is 20 percent of annual income of the average household in our sample. Setting aside such a significant sum would be challenging for poor rural households, particularly given other

[4]We refer to 2014 guidelines for Swachh Bharat Mission - Gramin by the Ministry of Drinking Water and Sanitation, Government of India.

more pressing demands on household budgets. Formal financial services are generally available in the study areas, with a number of microfinance institutions providing credit to poor households. However, few institutions provided credit specifically for non-income generating purposes including human capital investments; and none provided credit for sanitation when the experiment took place.

Table 1: Key statistics comparing our sample to our study context

	Our sample (2014-15)	DLHS - 4 (2012-13)		
Variables		Latur and Nanded (rural)	Rural Maharashtra	Rural India
BPL card (%)[b]	41.89	21.39	19.83	18.68
Female headship (%)[l]	9.06	7.66	9.93	14.68
Age HH head[l]	47.76	50.13	50.08	49.36
Education HH head[b]	6.02	4.16	4.11	3.98
HH owns land (%)[b]	44.45	56.59	53.01	46. 25
Caste (%)[l]				
SC	23.53	26.48	18.7	23.97
ST	4.66	8.85	17.15	23.33
OBC	36.77	33.23	40.41	30.05
Other	33.96	20.96	18.42	18.21
Don't know	0.67	10.48	5.32	4.44
Religion (%)[b]				
Hindu	75.77	83.88	86.77	67.64
Muslim	13.69	6.84	5.07	5.78
Christian	0	0	0.22	14.19
Sikh	0	0	0.03	7.1
Buddhist	10.49	9.24	7.25	3.22
other	0.06	0.04	0.67	2.08
Toilet uptake (any) (%)[l]	27.50	23.74	37.99	55.82

Notes: Our sample data come from listing survey (l) of our population and household survey pre intervention roll-out (b). For Nanded and Latur districts, rural Maharashtra and India we refer to the District Level Household Survey - 4.

Government efforts to improve sanitation coverage in rural India comprise of two core approaches: encouraging household demand for toilets through a one-off behavioral change campaign, modeled roughly on the widely used Community Led Total Sanitation approach, and alleviation of financial constraints for specific targeted households through the provision of subsidies. The subsidy is worth about Rs 12,000 in the study area; an amount that is insufficient to cover the cost of toilets desired by households. Given concerns of leakage, under the Total Sanitation Campaign and Nirmal Bharat Abhiyan policies, subsidies were made available post-construction from local village authorities. Under the SBM-G scheme, implemented around the same time as the intervention we study, part

of the subsidy can be availed once construction preparation has started with the rest available post-construction. We analyse the potential complementary role of the credit product and the GoI sanitation subsidy in a companion paper, Augsburg et al. [2018].

2.2 Intervention

It is in this context that our implementing partner, a large microfinance institution (MFI, hereon) active in 5 states in India, introduced a sanitation loan product for their existing clients. The MFI provides financial (primarily microcredit and micro-insurance) and non-financial services to groups of women from low-income households in rural and semi-urban areas.[5] It offers a wide range of loans including income generating loans, emergency loans, festival loans, and education loans. It started providing microfinance loans for sanitation in 2009, introducing these in our study area from 2014 onwards. At the time of the intervention roll-out, the partner MFI was the only provider of sanitation loans in the study area.

The sanitation loan offered by the MFI covers a maximum amount of Rs 15,000, incurring 18-22 percent interest rate per annum at a declining balance over a 2-year repayment period.[6] The loan amount is sufficient to cover the costs of a low-cost safe toilet of the type recommended by the SBM Guidelines. However, Indian households have been documented to spend much more on toilet construction – for example, households in the control group report an average toilet construction cost of around Rs 25,000 – suggesting the need for supplementary funds to construct the types of toilets these households desire. In addition to the interest, loan costs include a processing fee of 1.1 percent of total amount and a Rs 306 life insurance premium. Clients repay the loans through regular weekly or bi-weekly payments. In practice, all clients chose to repay the loan on a weekly basis.

The loan amount is higher than that for other non-productive loans offered by the MFI, and carries a similar or lower interest rate and a longer repayment period.[7] The extended loan maturity implies that the weekly installment amount is lower than for other loans of comparable size; making it appealing to liquidity constrained borrowers, despite the overall cost of the loan being substantially higher.[8] Business loan products are of a similar or larger size, but have a higher interest rate. There is no collateral requirement but loans are provided through joint-liability lending groups of 5 - 10 members. Only women that have been clients of the MFI for at least one year are eligible to take a sanitation loan. Each client can obtain only one sanitation loan. The MFI requires clients interested

[5] As of February 2017, the MFI reported a gross loan portfolio of Rs. 3,025.62 Crore. As of March 31, 2017, they had 1,450,298 total borrowers compared to 1,205,974 in the previous year.

[6] At the onset of the experiment, the interest rate was set at 22 percent, but this was subsequently reduced to 20 and then 18 percent. This was a general policy change by the implementing MFI, reflecting an overall reduction in the cost of capital it faced. In our sample, 35 percent of loans taken were at a rate of 22 percent, 49 percent at a rate of 20 percent and 16 percent at a rate of 22 percent.

[7] Information on main loan products offered by the MFI is provided in Appendix A (Table A.1)

[8] The weekly installment amount of a sanitation loan is between Rs. 179 and 173 depending on the interest rate. The weekly instalment amount for a Rs. 10,000 education loan varies between Rs. 218 and 214 over the intervention period.

in applying for a sanitation loan to obtain agreement from their spouses before the application is processed. A credit bureau check is conducted for all loan applications, and applications are rejected if the client doesn't satisfy the criteria set out by the Reserve Bank of India (RBI).[9] [10]

Table 2 summarizes the sanitation loan characteristics.

Table 2: Sanitation loan characteristics

Amount:	Up to Rs 15,000
Interest rate:	22% (later 18%) per annum on a declining balance
Loan maturity:	2 years
Payment Frequency:	Weekly/Bi-weekly basis
Collateral:	None, but joint-liability
Cost of the loan:	19.9% - 24.1% of the amount disbursed depending on interest rate
Other costs:	Processing fee of 1.1% of principal and Rs 306 for life insurance premium

This sanitation loan, as with other loan products provided by the MFI, can be classified as a 'labelled' loan. The reason for this is threefold: First, while the MFI provides loans for many different purposes – income generation, education, festival, etc – none of the loans is bundled with a specific product related to the intended investment purpose and all funds are disbursed directly to the client. This is also the case for the sanitation loan: loans were not bundled with any specific toilet model or material for the construction, and the MFI did not provide any advice or guidance on the construction of a toilet, available masons, types of toilet, etc. Clients were free to install a toilet of their own choice. This is in contrast with other studies of microcredit loans for health investments, such as Yishay et al. [2017] who study the effects of microcredit on the willingness to pay for a low-cost toilet, where the toilet construction materials were delivered to the client's door-step; Tarozzi et al. [2014] who study the uptake of a specific type of mosquito bednets with and without microcredit loans, and Guiteras et al. [2016] who study the effects of microcredit and microsavings on the willingness to pay for a ceramic water filter product.

The second aspect that makes this loan a labelled loan, is that the actual use is not closely monitored by the MFI in that, when monitoring is conducted, most checks rely on the reporting of the client or group members. 15 percent of clients that took a sanitation loan report that no monitoring check whatsoever was done, either at application stage or after loan disbursement; 53 percent report that monitoring was done through asking herself or a group member; 30 percent of clients report that

[9] The Reserve Bank of India imposes the following requirements on microfinance customers from October 2015 (pre-October 2015): (1) Annual household income of at most Rs. 100,000 (Rs. 60,000) for rural customers; (2) Total indebtedness of at most Rs. 100,000 (Rs. 50,000) excluding education and medical expenses; (3) 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; (4) Tenure of loan should not be less than 24 months for any loan amount in excess of Rs. 30,000 (Rs. 15,000). In addition, at least 50 percent (75 percent) of the MFI's portfolio should be comprised of loans provided for income generation.

[10] Other sources of sanitation and home improvement loans were available in our study area. From credit bureau records we know that clients in our sample have taken loans from 27 microfinance providers before and during the intervention. .

loan officers visited their home to check whether they owned a toilet when applying or to check its use. Moreover, loan officers' loan use checks are not monitored or incentivized by the MFI. To give some supportive statistics from our context: 26 percent of clients that took a sanitation loan reported using it for the construction of a new toilet, despite already owning one (verified by survey interviewers) before the intervention began.

This links to the third aspect important for our classification of labelled loans, namely that the MFI does not enforce or incentivize loan use in any specific manner, such as through larger loan sizes or lower interest rates; or through incentives and sanctions for loan officers. As with many other MFIs, senior management's core focus is on minimizing default and late repayment. Conversations with the top management of the MF partner, and staff involved in loan approval – which occurs in the head office – indicated to us that past loan use is not taken into consideration when approving a loan application. By contrast, new loans are not approved if a client is late in repaying an existing loan/has a past loan that is in default. In line with this, we find that 34 percent of clients who took a sanitation loan and did not have a toilet either atthe roll-out of the sanitation loan program or at the time of our endline survey took a subsequent loan over the course of our experiment.[11]

3 The Experiment

3.1 Experimental Design

Our study covers 81 Gram Panchayats (GPs) within Latur and Nanded districts in rural Maharashtra, India. GPs are the smallest administrative unit in India, and are charged with the delivery of a number of programs, including the Government's flagship Swacch Bharat Mission (SBM) policy. The study GPs were selected based on two criteria: (i) the MFI had existing operations and (ii) no sanitation activities had been undertaken by the MFI in the GP.[12] A total of 133 GPs satisfied this criterion. Of these, 120 were randomly selected to be part of the study. 39 of these GPs were randomly selected to receive another program, and are studied in a companion research paper.

Study GPs were randomized into the treatment and control groups through stratified randomization, with 40 selected to receive the sanitation credit program and 41 selected as controls. Stratified randomization was used in order to boost power. Strata were defined based on the Branch of the MFI and size of the village (specifically, a village was classified as 'small' if it had fewer than 480 households and large otherwise). Figure 1 shows the locations of each of the study GPs, with an indication of their 'treatment' status in the study.

[11] More strikingly, 89 percent of clients who took a sanitation loan and had a toilet before intervention implementation also took a subsequent loan from the same MFI. Though these clients could have used the sanitation loans to repair or upgrade their toilets, as we show in Section 5.2 this form of sanitation investment makes up only a small part of sanitation investments. Clients typically report tusing the sanitation loans for the construction of new toilets.

[12] Note also that the set of GPs in which the MFI is operational is a result of a careful selection exercise by MFI head quarters (e.g. to be selected a GP has to be politically stable, have a certain number of women, etc) and can therefore not be considered representative for the state of Maharashtra, nor for Nanded and Latur districts.

All study GPs, including control GPs, continued to receive all other activities from the MFI. The intervention began in February 2015. Care was taken throughout the study period to ensure that the integrity of the research design was preserved. Authors conducted briefing sessions with the branch staff of the MFI before the start of the intervention, provided a pictorial reminder of the GPs where sanitation credit could not be offered, and monitored the disbursement of sanitation credit to control GPs using the MFI's administrative monitoring system. As a result, contamination of the control group was very limited: a small number of loans was given out in the control group a few months after intervention roll-out, but this was swiftly stopped once noticed by the research team.

3.2 Data

Our analysis draws on three sources of data. The first is an extensive household survey collected by the authors. This is linked with administrative loan data from the MFI partner. The final source of data is credit bureau reports, providing information on loans taken by sampled clients from all microfinance providers in the study areas.

3.2.1 Primary Survey Data

A survey on a sample of clients that had been active at the time of the roll-out in February 2015, and their households, was conducted in the period August to September 2017, about 2.5 years after sanitation loans were made available. 2,841 clients (on average 24 per GP) were interviewed by a survey company (with interviewers blind to the outcome of the randomization): 1,253 in the treatment and 1,588 in the control group.[13,14] Overall, we sampled around 75 percent of all clients active at the time of the intervention launch. Our sampling strategy focused on including clients from the same lending centre (kendra), in order to allow us to collect information on joint liability groups. Though it is not a random sample of clients, our high sampling rate ensures that the obtained sample is mostly representative of clients active in February 2015.[15]

The household survey, asked of the household head, collected detailed information on household demographics, labour supply, and borrowing from formal and informal sources. In addition, a separate client survey elicited information on a number of different dimensions of her joint liability group, and interactions with the microfinance provider. Detailed information on sanitation investment was also collected, including that on type of toilet, construction date and costs, and toilet usage. The information on the construction date allows us to obtain a retrospective measure of toilet ownership

[13]For a sub-sample of these households, we have baseline data collected before the intervention began. We use this data to verify sample balance pre-intervention as discussed in detail in the project's baseline report (available on request).

[14]Around 6 percent of sampled households, balanced across treated and control GPs, could not be interviewed because of refusals or lack of availability, and were replaced with back-up respondents.

[15]Simple t-tests comparing the characteristics of the obtained sample with the population of active clients reveal that the samples are similar on most observed characteristics other than small differences in the proportion of clients from backward castes, and age of the client. In particular, the sample includes fewer clients from backward castes and younger clients than the population of active clients. These results are available on request.

before the start of the intervention, which we will refer to as baseline toilet ownership.[16] For households who reported having a toilet, survey enumerators verified it directly and made observations on its appearance, overground quality, and cleanliness.

3.2.2 Administrative Data

In addition to the primary endline survey of clients and their households, we rely on two sources of administrative data in our analysis. The first is detailed loan data from our lending partner on all clients residing in the study areas. In particular, we have available information on all loans taken from the partner MFI by any client residing in our study GPs during the study period, including amount borrowed, repayment amount, the date of disbursement, tenure, purpose of the loan and default. This provides us with reliable information on the disbursement of sanitation loans and other loans, and allows us to track trends for loan uptake over time.

The second source of administrative data is credit bureau data from a leading provider, used by the MFI partner when making decisions on loan applications. Following new regulations introduced by the Reserve Bank of India in 2011, all microfinance institutions are required to report on all loans outstanding for each client on a monthly basis. We obtained this information for around 88 percent of clients in our sample.[17] Reassuringly, the sample for whom we have credit bureau information is balanced on observable characteristics across treatment and control, as shown in Table A.3 in Appendix A.[18] As a result, this data allows us to construct a more accurate measure of household borrowing from microfinance institutions that is free from recall and measurement error.

3.3 Sample Descriptives and Sample Balance

Table 3 presents summary statistics for the main characteristics of clients and their households. These variables have been constructed from survey data collected at endline. We thus concentrate on variables that are unlikely to have been affected by the intervention itself. For each variable we present, in Column 1 of Table 3, the mean for the control group when the experiment started.

The table also tests for systematic differences in these characteristics between the control and treatment groups, with the difference in means between the control and treatment group, and the p-value for a t-test of equality of these means presented in Columns 3 and 4 respectively. As the allocation of the sanitation loan program was random across GPs, we expect no systematic differences between the two groups at the time of the intervention roll-out.[19]

[16] This retrospective measure of toilet ownership matches well with baseline data available for a sub-sample of households. Specifically, the two measures are identical in 78% of cases, with a mismatch in 22% of cases, which could be due to misreporting, or from recall error.

[17] 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.

[18] We do detect some differences in the characteristics of clients for whom we obtained credit bureau data, relative to the full sample of clients. Specifically, those for whom we obtained credit bureau data are more likely to be married,

Table 3: Sample descriptives and sample balance

	(1) Control	(2) SL - Control	(3) P-value	(4) N
HH head religion: Hinduism (%)	67.6	-2.27	0.669	2841
	(3.56)	(5.28)		
HH head religion: Islam (%)	18.6	3.63	0.520	2841
	(3.89)	(5.61)		
HH head religion: Buddism (%)	12.8	-1.03	0.755	2841
	(2.39)	(3.31)		
Nr of HH members	5.02	0.032	0.774	2841
	(0.084)	(0.11)		
HH head caste: Backward (%)	33.9	-2.34	0.665	2841
	(4.08)	(5.38)		
HH head caste: Scheduled (%)	41.6	-1.42	0.816	2841
	(4.16)	(6.07)		
HH head caste: General (%)	24.1	3.32	0.572	2841
	(4.04)	(5.85)		
Gender of HH head - male (%)	89.7	1.65	0.239	2841
	(1.04)	(1.39)		
Age of HH head in years	45.3	0.18	0.769	2841
	(0.48)	(0.60)		
Years of education of HH head	5.85	0.16	0.569	2841
	(0.20)	(0.28)		
HH head is married (%)	91.4	1.13	0.359	2841
	(0.93)	(1.22)		
Dwelling owned by HH members (%)	96.1	0.63	0.621	2841
	(1.03)	(1.27)		
Dwelling structure: Pucca House (%)	17.8	2.51	0.431	2841
	(2.46)	(3.18)		
Dwelling structure: Semi-pucca house (%)	65.6	-0.73	0.858	2841
	(3.10)	(4.09)		
HH owns a BPL card (%)	59.0	-0.98	0.769	2841
	(2.08)	(3.34)		
HH owns an APL card (%)	28.0	-1.38	0.653	2841
	(1.90)	(3.06)		
Primary activity HH: agriculture (%)	52.1	3.17	0.551	2841
	(4.13)	(5.29)		
Primary activity HH: Waged employment (%)	27.5	-1.58	0.637	2841
	(2.35)	(3.34)		
HH owned a toilet at baseline (reconstructed) (%)	25.1	3.37	0.260	2841
	(2.06)	(2.97)		

Notes: SL equals sanitation loan arm. Standard errors clustered at the village level are shown in parentheses. *, **, *** indicate significance at the 10, 5 and 1 percent level. HH stands for household. Column 2 reports mean and standard deviation (in parenthesis) for each variable in the control group. Column 3 reports differences in means between SL and Control arms. Toilet ownership at baseline is reconstructed from toilet construction dates reported at endline. If a toilet was in the dwelling when household moved in we consider number of years HH head lived in the household as a proxy of construction date.

The table indicates that the typical study household is Hindu (68 percent), has on average five household members, and is headed by a male household member (91 percent). Household heads are almost always married (92 percent), are 45 years old on average and have 6 years of education on average. 41 percent of household heads belong to Scheduled castes/tribes, while General Caste and Other Backward Castes represent 26 and 33 percent of the sample respectively. The vast majority of households (96 percent) live in a dwelling they own. Dwellings are of moderate to high quality, with 65 percent of households living in a dwelling constructed with a mix of high-quality and low-quality materials (semi-pucca) and for 19 percent living in a dwelling constructed from high quality materials (pucca). Around 59 percent of the MF client sample holds a Below Poverty Line (BPL) card, while 26 percent has an Above Poverty Line (APL) card. The typical household's earnings come to a very large extent from agriculture-related activities, with 52 percent of the sample reporting receiving wages from agricultural labour and/or from cultivation or allied agricultural activities. Another important source of income (27 percent) are wages from employment outside agriculture.

Using toilet construction date, we create an indicator of toilet ownership before the start of the intervention.[20] We observe that only 25 percent of control group households owned a toilet at baseline. Remarkably, this matches closely with the 2012 baseline survey conducted by the Indian Ministry of Drinking Water and Sanitation, which shows that on average 27.4 percent of households in the study GPs reported to have a toilet in 2012 (SBM and Sanitation, 2014). Sanitation interventions are ultimately interested in safe toilet uptake, not just any type of latrine ownership. Following the guidelines provided in WHO/UNICEF [2017] to define a safe toilet, we find that 99.6 percent of all reported toilets in our study area belong to any of these categories.[21,22] Therefore, the measure of toilet ownership (as reported by head of household and by interviewer observation) can be interpreted as equivalent to safe toilet ownership in our study context.

Columns 3 and 4 indicates at most small, and statistically insignificant differences in the means of these variables across the treatment and control group. This confirms that the randomization was successful in creating observationally equivalent groups. Importantly, we find no significant difference in toilet ownership between the treatment and control groups prior to intervention roll-out.

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and less likely to live in female-headed households. Household heads also tend to have more years of education.

[19] Reassuringly, we also find no systematic differences in observed characteristics between the two groups when we repeat the same exercise with baseline data collected prior to the intervention roll-out for a sub-sample of clients and their households. These results are available on request.

[20] This retrospective measure of toilet ownership at baseline matches well with data collected in a baseline survey for a sub-sample of households.

[21] The guidelines define a toilet to be safe when is is an improved facility for which excreta is safely disposed of in situ or off-site. Based on this definition, in our data we consider the following types of toilets safe: Flush/pour flush to piped sewer system, septic tank, pit latrine, VIP, pit latrine with slab, composting toilet, biogas system, urine diversion dehydration.

[22] We can use the pre-intervention data available for a sub-set of clients as well as the endline data for this exercise).

4 Empirical Model

Our empirical strategy builds on the cluster randomized controlled trial to estimate impacts of the intervention on a number of dimensions of household borrowing, and investments including sanitation investments. The experimental design allows us to assess the impact of the provision of sanitation micro-loans, by comparing the outcomes of the treatment group ('SL' hereon) with the outcomes of the 'Control' group.

Specifically, we estimate specifications of the following form using Ordinary Least Squares:

$$Y_{iv} = \alpha_0 + \alpha_1 Treatment_v + \beta X_{iv} + \theta_v + \varepsilon_{iv}$$

where Y_{iv} is the outcome for household i in GP v, $Treatment_v$ takes value of 1 if the sanitation loan was introduced in GP v and 0 otherwise; X_{iv} are household-level controls that help to increase power and precision and θ_v are strata dummies for GP v.

In terms of outcome variables, we focus on the uptake of sanitation loans, overall household borrowing from microfinance institutions, formal sources and informal sources; and household sanitation investments. The control variables X_{iv} are chosen according to those that most explain variation in toilet ownership among control households at endline. The key variable satisfying this criterion is toilet ownership before intervention roll-out. Accounting for toilet ownership pre-intervention implies that we are in fact estimating an ANCOVA specification when estimating impacts on toilet ownership.[23] In addition to this, we add controls for whether a household had a child aged less than 2 years at the time of the intervention roll-out and for ratio between number of sampled clients and village size, to account for potential distortions due to the sampling strategy. See Appendix B for more details on the sampling procedure. Finally, we also include interviewer fixed effects.[24] Standard errors are clustered at the GP level, given the cluster-RCT design. Strata dummies are included in the specification to take into account sample stratification for the randomization at branch of the partner organization and village size.

The key parameter of interest is α_1, which provides the intention-to-treat (ITT) estimator, comparing the outcomes in the treatment group for all clients active at the time of the intervention roll-out, regardless of whether or not they took a sanitation loan; with those for similar clients in the control group. An advantage of this approach is that we can interpret the experimental intervention as a policy and learn about the impact on the population that the implementing MFI

[23] An alternative would be to estimate a difference-in-difference specification. However, McKenzie [2012] shows that when analyzing an RCT experiment with two survey rounds, ANCOVA provides greater improvements in power relative to differences-in-differences, particularly when the autocorrelation in the dependent variable is low. In analysis available on request, we estimated the impacts on toilet ownership using a differences-in-differences specification for the sub-sample for whom baseline data is available and found very similar impacts as with the ANCOVA specification. Toilet ownership is the only variable for which we have pre-intervention information for the whole sample. We discuss in Section 3.2 how this variable was constructed.

[24] One motivation to do so is Karlan and Zinman [2008], who show that under-reporting is linked to interviewer characteristics, particularly when the respondent is female.

serves. The focus on clients active during the intervention roll-out ensures that the estimates are not biased by households that are particularly motivated to invest in a toilet joining the MFI to obtain a sanitation loan. We note that this design allows us to estimate the impact of introducing sanitation loans over and above any other ongoing, parallel activities promoting sanitation. This is important in this context given the Government of India's SBM-G scheme. An accompanying paper (Augsburg et al., 2018) analyses the complementarity between the credit intervention and SBM-G policy.

Finally, we check the robustness of our findings to multiple hypothesis testing using the step-down procedure proposed by Romano and Wolf [2005]. The adjusted p-values are reported in each table testing hypotheses tested within that table and we also test jointly all outcomes considered in this paper in Table C.1 in Appendix C.

5 Results

In this section we report our main results. We start with discussing take-up of the newly introduced sanitation loan, followed by an analysis of investments made, leading to a discussion on sanitation loan to toilet conversion.

5.1 Sanitation Loan Uptake

We begin by studying the pattern of sanitation loan uptake in the study areas using the administrative data from our microfinance partner. The exhaustive information on any loan disbursements, sanitation or otherwise, that took place in the study branches since the start of this impact evaluation, provides us with an objective measure of sanitation credit uptake. The loan uptake evolution is displayed in Figure 2 which shows the cumulative number of sanitation loans per client disbursed (y-axis) since the introduction of sanitation loans in treatment areas in February 2015 (x-axis). The Figure shows a clear upward trend in sanitation loan disbursement.

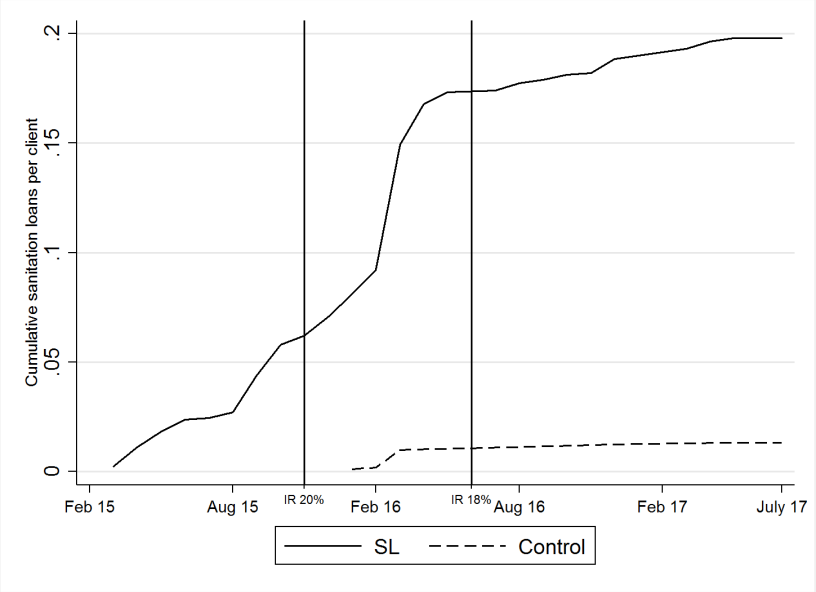
By the time of the endline survey, about 20 percent of client households in treatment areas had taken a loan for sanitation. A small number of loans - 21 in total - were also provided in the control areas, mainly as a result of clients asking for these loans; rather than them being (mistakenly) advertised in the control areas. These were given in two branches, primarily in February and March of 2016.[25] The slow-down observed in 2016 was reportedly driven by a drought that hit the study area as well as by prolonged cash shortages resulting from the GoI's sudden demonetization in November of 2016. [26]

[25]Through regular analysis of administrative loan data during the course of the experiment, this provision of sanitation loans could be quickly detected and reminders provided to the field staff on the experimental design.

[26]On 8 November 2016, the GoI announced the demonetization of all Rs 500 and Rs 1000 banknotes of the Mahatma Gandhi Series. This was done based on the assumption that the action could curtail the shadow economy and could crack down on the use of illicit and counterfeit cash to fund illegal activity and terrorism.

The vertical lines in the Figure indicate the points at which the interest rate on sanitation loans was reduced from 22 to 20 percent (left vertical line) and from 20 to 18 percent (right vertical line). Similar interest rate reductions were made on other loan products at the same time. The graph suggests that there was almost no demand response from clients to these interest rate reductions.

Figure 2: Sanitation loan uptake during the intervention



Notes: Source: Administrative data from our implementation partner. The vertical lines mark reduction in interest rates occurred in November 2015 and June 2016.

We consider impacts on loan demand more formally by estimating equation (1) with sanitation loan uptake as the dependent variable. Results are presented in Table 4. It indicates a positive and statistically significant impact (at the 1 percent level) on uptake of the sanitation loan. The coefficient shows that the intervention resulted in an increase in sanitation loan uptake of 18 percentage points. In other words, almost one in five clients took up the newly introduced loan product.

However, this is much lower than the proportion of clients who didn't have a toilet at baseline. The reasons for this are manifold. Below we will analyze whether the sanitation loans increase total household borrowing or whether households who take this loan need to forego other investments – a possible explanation for other clients not availing the credit. Moreover, the study area experienced two major macro-economic shocks over the study period, which might also have depressed sanitation loan take-up. Latur and Nanded experienced a severe drought in 2016, which was later followed by demonetization at the end of 2016. Both of these led to a reduction in loan disbursement by the MFI, which is apparent in a slowdown of loan take-up in 2016 and early 2017.[27] Finally, we note that this take-up rate is comparable with those found by other randomized controlled trials

[27]While not shown here, we find that take-up of all other loans provided by the MFI also slowed down over this period.

Table 4: Intervention impact on sanitation loan uptake

	Sanitation Loan
SL	0.180***
	(0.0356)
Cluster-robust p-value	[0.0000]
Strata FE	Yes
Interviewer FE	Yes
Household covariates	Yes
Ratio sample clients/GP size	Yes
Control Mean	0.0132
N	2841

Notes: SL equals sanitation loan arm. Standard errors clustered at the village level are shown in round parentheses. *, **, *** indicate significance at the 10, 5 and 1 percent level. Romano-Wolf p-value is not displayed as it corresponds to cluster robust p-value. 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. Data source: household survey. Dependent variable comes form administrative data.

on microfinance. Studies by Banerjee et al., 2015, Tarozzi et al (2015) and Angelucci et al., (2015), which sampled households most likely to be targeted by the relevant microfinance providers as potential clients, encountered loan take-up rates of 17-19 percent, indicating how challenging it is to predict loan take-up.

While this finding establishes positive and significant demand for the new loan product, it is only a necessary and not a sufficient condition for the intervention to be effective in improving sanitation. It is possible that households might simply substitute from different, potentially more expensive, loan sources while keeping overall borrowing and sanitation investments constant. A sufficient condition for the sanitation credit to be a viable strategy to address the sanitation challenge is that the new loan product results in an increase in sanitation investments. Our analysis thus considers the effects of the intervention on toilet uptake.

5.2 Sanitation investments

The sanitation loan could be used for two types of sanitation investments: (i) construction of a new toilet, or (ii) upgrade or repair of existing toilets. Table 5 tabulates responses by clients who took a sanitation loan (as reported in the MFI administrative data) on what they used this loan for.

The majority of clients (73 percent) report using the sanitation loan for the construction of a new toilet, with fewer than 5 percent reporting upgrade (3 percent) or repair (1 percent) of a toilet. A small number of clients report using the loan for sanitation and other purposes. If we assume that these intended to upgrade or repair an existing toilet, this would suggest that at most around 11

percent of clients who took a sanitation loan used it to upgrade or repair a toilet. Thus, the primary reported reason for taking a sanitation loan was to construct a new toilet.

Table 5: Reported loan use

	New toilet	Upgrade	Repair	Other only	Sanitation & other	Total
SL	146 (73%)	7 (4%)	2 (1%)	31 (16%)	14 (7%)	200 (100%)
Control	14 (70%)	0 (0%)	0 (0%)	5 (25%)	1 (5%)	20 (100%)
Total	160 (73%)	7 (3%)	2 (1%)	36 (16%)	15 (7%)	220 (100%)

Notes: Data source: Client survey and administrative data. Sanitation loan usage was reported for those clients who took a sanitation loan according to administrative data from the MFI and confirmed it during the interview. Hence, information is missing for clients who did not confirm to have taken a sanitation loan in the survey.

In the household survey we collected information on toilet ownership, whether it was not in use and the reasons for this, and a number of dimensions of toilet quality, which allow us to directly test whether households made the sanitation investments. We focus on three types of sanitation investments: (i) construction of new toilets; (ii) repair of existing toilets; and (iii) upgrade of toilets. We measure the construction of new toilets through (i) toilet ownership reported by household heads during the household survey, and (ii) toilet ownership confirmed by the survey enumerator. Households were asked to report on toilet ownership, regardless of whether or not it was functional.

In addition, we construct a measure for whether the toilet is functional, by combining responses and observations on toilet ownership with responses from the household head indicating whether the toilet was broken, or was under repair or upgrade or had a full pit. By estimating impacts on this indicator, we capture the impacts of the loan provision on the construction of new functional toilets, and on allowing toilets that existed at baseline from becoming dysfunctional. Comparing impacts on this variable, with those on toilet ownership, we obtain an indication of the intervention's impacts on sanitation repairs.

By estimating impacts on toilet ownership, we will capture the loan provision's impact on the construction of new toilets and avoiding existing toilets to become dysfunctional. We are primarily interested in two measures: i) toilet ownership reported by household heads during the household survey[28], and ii) toilet ownership as confirmed by survey enumerator observation[29].

Table 6 shows the effects of the sanitation loan intervention on toilet ownership status and on the ownership of a functioning toilet. Columns 1 and 2 of the table indicate that the intervention led to a 9 percentage point increase in toilet ownership among study households. Reassuringly, the coefficient estimate is similar across both measures of toilet ownership. We also find similar, though

[28]When asking the respondent whether his/her household has a toilet, it was emphasized that toilets that are not frequently used, or not functional, should also be reported.

[29]This includes toilets that were under construction at the time of observation.

slightly higher, impacts of the intervention on our measures of functioning toilet (Columns 3 and 4). A comparison of the coefficient estimates in Columns 3 and 4 with those in Columns 1 and 2 suggests that, in line with client responses on loan use, few of the sanitation loans were used to repair existing toilets. Reassuringly, all the estimates impacts are robust to adjustments for multiple hypothesis testing, as indicated by the step-down Romano-Wolf p-values, which are all below the 1 percent level of significance.[30]

It is of interest to note that this increase in toilet ownership is on top of a significant increase in the control areas since the start of the intervention. When the experiment started in February 2015, 25 percent of client households in control areas owned a toilet. By August 2017, this proportion had increased to 45 percent, as indicated by the last row of Table 6. This almost doubling in toilet coverage among MF client households in control GPs suggests that other factors, notably the Government of India's ambitious SBM(G) policy which started around the same time as the sanitation loan intervention studied here, might have successfully contributed to a boost in toilet construction.[31]

We next check whether sanitation loans improved the quality of toilets owned by households. This could be either because better toilets were constructed or because of upgrade or repair, which as shown earlier was reported by up to 11% of clients who took a sanitation loan.

We analyze toilet quality through surveyor-recorded observations of the toilets' characteristics along a number of dimensions, including the types of materials used to construct the underground chamber, ease of access, cross-ventilation, availability of a lockable door, availability of light among others. We combine the recorded observations into summary measures for underground and overground quality using polychoric principal components analysis. This procedure converts a set of observations of possibly correlated variables into a set of linearly uncorrelated variables in a manner such that the largest principal components explain the largest possible variance among the original variables. The analysis yields one component for underground quality and two for overground quality. A detailed description of the approach we used for the construction of these composite measures is provided in Appendix D.[32]

Table 7 displays the findings on these dimensions. The upper panel shows impacts on the overall sample and the lower panel shows impacts separately by whether or not the household had a toilet at baseline. The results based on cluster-robust standard errors suggest that the provision of sanitation loans led to an improvement in overground quality, potentially affecting different overground components for both new and existing toilets. However, these effects are not robust to

[30] All findings presented in this table are also robust to joint hypothesis testing with other outcomes studied in this paper. Table C.1 in Appendix C pools all regressions together and presents p-values adjusted for testing all 21 hypotheses jointly.

[31] And yet, this finding indicates that more than half of the MFI clients in control communities still had no toilet in August 2017. Hence, even though it seems likely that the launch of SBM(G) and/or other factors might have triggered a spurt in sanitation activity in the area, there is still scope for complementary interventions, such as the provision of sanitation loans, to make a difference. In Augsburg et al. [2018] we consider in more detail potential complementarities between the MFI intervention and the SBM subsidy scheme.

[32] See Attanasio et al (2018) for further details.

Table 6: Intervention impact on toilet uptake (self-reported and observed by interviewers)

	(1)	(2)	(3)	(4)
	Own toilet	Own toilet	Functioning toilet	Functioning toilet
	HH report	Interviewer observation	HH report	Interviewer Observed Toilet
SL	0.0869**	0.0911***	0.0919***	0.0958***
	(0.0262)	(0.0249)	(0.0236)	(0.0235)
Cluster-robust p-value	[0.0009]	[0.0003]	[0.0001]	[0.0000]
Romano-Wolf p-value	[0.0020]	[0.0000]	[0.0000]	[0.0000]
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
Control Mean	0.452	0.412	0.398	0.372
N	2841	2841	2841	2841

Notes: SL equals sanitation loan arm. Standard errors clustered at the village level are shown in round parentheses. *, **, *** indicate significance at the 10, 5 and 1 percent level, referring to Romano-Wolf p-values. These are obtained from a step-down procedure to adjust for multiple hypothesis testing performing 1000 bootstrap replications as proposed by Romano and Wolf (2005). 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. HH stands for household. Functioning toilet is defined as toilet that is either in use (household report), or is not in use because of household preferences or a lack of water. Dependent variable in Column 4 is defined on household reports related to functioning of toilets observed by interviewers. Data source: household survey.

adjustments for multiple hypothesis testing, as can be seen from the p-values calculated using the step-down procedure of Romano and Wolf [2005]. Combined with the findings above, this evidence indicates that few of the sanitation loans were used for upgrade or repair of toilets; which is also in line with households' own reports of how they spent the sanitation loan.

The findings presented so far, thus, show that the sanitation loan is demanded and used for sanitation investments, implying that the intervention providing credit for the purpose of investing in sanitation, at the given loan conditions, is effective in improving access to sanitation infrastructure. A question remains on how they were realized, which is what we turn to next.

6 Channels

Next, we consider the channels through which these impacts could have been realized. To do so, we first develop a simple theoretical framework of a household choosing whether or not to make a preventive health investment in the absence and presence of the sanitation loan program. The loan could have relaxed credit constraints. However, other attractive features of the credit – such as the lower interest rate, or the label – could also have made the loan attractive to households. The theory incorporates these three features, and considers how each of them affects household borrowing and sanitation uptake choices.

The theory suggests a test for the presence of credit constraints, which we implement in Section

Table 7: Intervention impact on toilet quality

	(1) Underground	(2) Overground 1	(3) Overground 2
Panel A: Overall			
SL	0.0140	0.0624	0.0537
	(0.0220)	(0.0339)	(0.0272)
Cluster-robust p-value	[0.5251]	[0.0660]	[0.0483]
Romano-Wolf p-value	[0.5215]	[0.1309]	[0.1249]
Strata FE	Yes	Yes	Yes
Interviewer FE	Yes	Yes	Yes
Household covariates	Yes	Yes	Yes
Ratio sample clients/GP size	Yes	Yes	Yes
Control Mean	1.379	2.429	0.370
N	1289	1289	1289
Panel B: By toilet ownership at baseline			
SL - toilet at BL	0.0022	0.0468	0.0523
	(0.0289)	(0.0459)	(0.0306)
Cluster-robust p-value	[0.838]	[0.341]	[0.078]
Romano-Wolf p-value	[0.838]	[0.663]	[0.296]
SL - no toilet at BL	0.0289	0.0820	0.0555
	(0.0292)	(0.0469)	(0.0350)
Cluster-robust p-value	[0.415]	[0.057]	[0.110]
Romano-Wolf p-value	[0.663]	[0.296]	[0.303]
HH owns a toilet at BL	0.00282	0.0664	0.0150
	(0.0273)	(0.0442)	(0.0273)
Strata FE	Yes	Yes	Yes
Interviewer FE	Yes	Yes	Yes
Household covariates	Yes	Yes	Yes
Ratio sample clients/GP size	Yes	Yes	Yes
F-test	0.487	0.581	0.930
Control Mean (no toilet BL)	1.361	2.424	0.406
Control Mean (toilet BL)	1.391	2.432	0.345
N	1289	1289	1289

Notes: Sample of households owning a toilet at endline observed by interviewers: 1,289 households. SL equals sanitation loan arm. Standard errors clustered at the village level are shown in round parentheses. *, **, *** indicate significance at the 10, 5 and 1 percent level, referring to Romano-Wolf p-values. These are obtained from a step-down procedure to adjust for multiple hypothesis testing performing 1000 bootstrap replications as proposed by Romano and Wolf (2005). Covariates: Toilet ownership at baseline, indicator for presence of a child aged 0 - 2 at baseline, ratio of number of clients to village size. Column 1 shows intervention impact on quality of the underground chamber, Column 2-3 refer to quality of the overground structure (component 1 and 2). Data source: household survey.

6.2, while Section 6.3 explores the relevance of loan attributes such as the interest rate and the loan label in explaining the findings.

We note that this section is very much still in progress and bound to change as the model and empirical analyses are further developed.

6.1 Model

To clarify the potential channels through which the observed impacts were realized, we develop a simple, two-period household model in which a household chooses whether or not to make a preventive health investment. Time is indexed by $t = \{1, 2\}$. In each period, the household earns labor income of y_t units. In period 1, the household can consume a non-durable good, c_1, or invest in the lumpy goods, e and s at a cost of p_e and p_d respectively. Each household can invest in at most 1 unit of each lumpy good. Good e is a productive business investment that generates a non-stochastic return $\theta > p_e$ in the period after the investment is made. Good s is a toilet (i.e. a lumpy preventive health investment) that yields benefits in the form of increased utility by γ units in the period after the investment is made. This utility gain captures both the monetary (e.g. reduced health expenditures) and non-monetary benefits (e.g. improved convenience, safety, etc) of having a toilet as compared to defecating in the open. Households make investment decisions in the first period, and any returns are realized in the second period.

Prior to the intervention, the household has access to a (labelled) business loan, b_1, in period 1. The loan is provided collateral-free, at an interest rate of r_1. The household can borrow at most b_1^{max}, and it cannot save. We also assume that $p_s + p_e > b_1^{max}$, so that the maximum amount of this business loan b_1 is insufficient to cover both investments.

The fact that the loan is earmarked for business investment through its label as a 'business' loan could influence household choices for a number of reasons. First, households may believe (correctly or incorrectly) that the lender will punish loan misuse by preventing access to future loans. Second, households may (potentially incorrectly) believe that loan use also plays a role in building their reputation with the lender, along the same lines as timely repayment does. Offering gradually larger loans at lower interest rates has been an important driver of the high repayment rates of microfinance institutions (Morduch, 1999). Households might therefore see proper loan use as a further means to signal to the lender that they are a good client, worthy of larger and cheaper loans in the future. Finally, labels attached to loans might matter if households are mental accounters, and assign sources of money to different expenditures and investments based on these labels (Thaler, 1999). A (labelled) business loan would thus be earmarked for the business investment, and would not be available to spend on other expenditures.

The label effect is modeled in the form of a disutility, experienced in the period when the loan is taken and used, that applies when the household does not use a Labelled loan for its intended purpose. This formulation is similar in spirit to Hastings and Shapiro [Forthcoming]. Specifically, a household that borrows b_1 and does not use it for business investment will experience a utility penalty of $\kappa_e b_1$, where $\kappa_e \geq 0$ is an exogenous parameter.

We assume that in the first period, the household gains utility from its non-durable consumption, net of disutilities from taking a business loan and using it for some other purpose. In the second period, it gains utility from its non-durable consumption and sanitation-related benefits, if a sanitation investment was made in the first period. Specifically, the household's first period utility is written

as $v(c_1) - \kappa_e b_1(1-e)$, and the second-period utility is $v(c_2) + \gamma s$; where $v(c)$ is a concave, twice differentiable function that is increasing in c. Notice that this formulation implicitly assumes that the productive investment, E, does not yield any non-monetary utility benefits to the household. The household's discount factor is β.

The household's inter-temporal optimization problem can be written as follows:

$$\underset{\{c_1,c_2,e,s,b_1\}}{max} v(c_1) - \kappa_e b_1(1-e) + \beta v(c_2) + \beta\gamma s \tag{1}$$

subject to

$$c_1 + p_e e + p_d s \leq y_1 + b_1 \tag{2}$$

$$c_2 + (1+r_1)b_1 \leq y_2 + \theta e \tag{3}$$

$$0 \leq b_1 \leq b_1^{max} \tag{4}$$

where $v(c)$ is a concave, twice differentiable function that is increasing in c, and $0 < \beta < 1$ is the household's discount factor.

Solving this optimization problem, we obtain a number of insights into households' borrowing and investment choices, which we present below:

1. Credit constraints hamper investments: Some households, for whom investing in both lumpy goods would be optimal in the absence of borrowing constraints, are unable to invest in one of them given the borrowing constraint.

2. Effects of the loan label:

   (a) The loan label affects the household's borrowing decisions. In particular, the disutility parameter, κ_e, discourages the household from taking a business loan if it is not going to make a business investment, even though taking a loan would be optimal in the absence of the label.

   (b) The loan label affects the household's investment decisions. In particular, some households, for whom it is optimal to invest in a toilet (relative to the business investment), will choose not to do so because of the disutility associated with diverting the business loan to another purpose. In addition, some households will be induced to make a business investment if they take a business loan, even if this is not otherwise profitable. Importantly, this effect can be generated even in the absence of borrowing constraints, if households can afford to only invest in one of the lumpy goods based on their intertemporal budget constraint.

Proofs for each of the predictions is provided in Appendix F.

Next, we analyze how household borrowing and investment decisions change with the introduction of the sanitation loan. We model the sanitation loan as an additional loan, denoted b_2 offered by lenders with an interest rate of $r_2 < r_1$. Households can borrow at most b_2^{max} of this loan. As with the business loan, households face a disutility of $\kappa_s b_2$ in the period where they take the loan, if they take the sanitation loan and divert it to some other purpose. The household's inter-temporal optimization problem is now as follows:

$$\underset{\{c_1,c_2,e,d,b_1,b_2\}}{max} v(c_1) - \kappa_e b_1(1-e) - \kappa_d b_2(1-d) + \beta v(c_2) + \beta sm \tag{5}$$

subject to

$$c_1 + p_e e + p_d s \leq y_1 + b_1 + b_2 \tag{6}$$

$$c_2 + (1+r_1)b_1 + (1+r_2)b_2 \leq y_2 + \theta e \tag{7}$$

$$0 \leq b_1 \leq b_1^{max} \tag{8}$$

$$0 \leq b_2 \leq b_2^{max} \tag{9}$$

We analyze how the newly introduced sanitation loan affects households' borrowing choices and sanitation investment choices. Specifically, we focus on analyzing the impact of the loan attributes – the 'sanitation' label, and the lower interest rate – on borrowing and sanitation investment choices. This analysis (proofs in Appendix F) yields the following insights:

1. Both the label, and the lower interest rate will induce the uptake of sanitation loans.
2. The lower interest rate will induce uptake of sanitation loans without changing households' investment or expenditure choices. Households will substitute from the more expensive business loan to the cheaper sanitation loan. However, this substitution effect is muted when the loan label matters.
3. The availability of the sanitation loan will motivate sanitation investments, through the label effect. Households that were previously constrained from investing in sanitation by the loan label will now be able to invest in a toilet.
4. The sanitation loan may induce sanitation investments by relaxing credit constraints. In this case, overall borrowing would increase.

6.2 Empirical Evidence: Household Borrowing

We start our empirical exploration of channels by considering impacts on household borrowing. An increase in overall household borrowing, combined with the findings from Section 5 would indicate that the impacts are realized through a relaxation of credit constraints. Our analysis of the intervention's impact on household borrowing draws on two sources of data - survey data reported by the household, and administrative data on microfinance borrowing obtained from credit bureau records. We use this information to assess the intervention's impacts on total household borrowing, and borrowing from specific sources.

As part of the household survey, respondents were asked to report on loans taken since the baseline survey was conducted. As is common in surveys of this type, we collected information on total household borrowing by asking households about the three largest loans (above Rs 500) taken since the start of the experiment.[33] In addition to information such as loan size and outstanding balance, respondents were asked to report on the lending source, which we use to classify loans into two categories - formal and informal.[34] We further split formal borrowing into loans from MFIs and those from other formal sources.

Table 8 displays estimated impacts of the intervention on total, formal (total formal, MFI, other formal) and informal household borrowing. We find that for all the outcomes considered, the coefficients on the treatment indicator are small in magnitude (compared to the mean in control areas), and are not statistically significantly different from zero.[35] These results thus indicate that the intervention had no significant impact on overall household borrowing. Moreover, we find no statistically significant evidence of switching between formal and informal sources of credit occurred after introducing sanitation loan. The finding that total household borrowing is not affected by the introduction and uptake of the sanitation loans, is despite the fact that the reported average amounts borrowed by households in control areas (reported at the bottom of the table, column (1)) suggest that RBI regulations are not binding for these households, as average borrowing over the whole 2.5 year period is far less than Rs 100,000 *annual* borrowing limit.[36]

[33]Furthermore, respondents are asked about the sum of all small loans taken in the month prior to the survey and the sources of this borrowing. We do not use this data in our analysis for the following reason: We only have this information for the month prior to the survey, rather than for the period since the start of the intervention, which is the relevant variable. It would not be possible to obtain an indicator for this without making extremely strong and implausible assumptions (e.g. that the borrowing in the past month is representative of the whole period). Moreover, it is very unlikely that households would be able to aggregate sufficient loans of this size ($<$ 500 Rs.) to invest in a toilet. It is thus reasonable for us to focus our analysis on large loans.

[34]We classify as formal sources banks, MFIs, NGOs, cooperatives/savings funds, and Self Help Groups (SHGs). Informal sources are moneylenders, relatives , friend/acquaintance/private financiers, work, pawnshop and other local shops.

[35]Of course, measurement error in borrowing would increase imprecision of the coefficient estimates if it is classical, making it more difficult to detect any impacts.

[36]We note that the average reported amount borrowed by a household in our study area (just over Rs 30,000 over the course of the experiment, hence about 12,000 per annum) is nevertheless substantial considering that median self-reported household annual income at baseline was just over Rs 40,000. A borrowing level of just over 30 percent leaves a household not too far off from being classified as over-indebted according to the World Bank definition which defines a household to be over-indebted if it overall borrowing is 40 percent or more of total HH income.

Table 8: Intervention impact on household borrowing - total, formal and informal sources

	(1) Total	(2) Formal	(3) MFIs	(4) Other formal	(5) Informal
SL	-252.1	76.75	521.3	-444.5	-328.8
	(1830.9)	(1872.7)	(1524.6)	(1577.4)	(403.3)
Cluster-robust p-value	[0.8905]	[0.9673]	[0.7324]	[0.7781]	[0.4149]
Romano-Wolf p-value	[0.9630]	[0.9670]	[0.9540]	[0.9630]	[0.8322]
Strata FE	Yes	Yes	Yes	Yes	Yes
Interviewer FE	Yes	Yes	Yes	Yes	Yes
Household covariates	Yes	Yes	Yes	Yes	Yes
Ratio sample clients/GP size	Yes	Yes	Yes	Yes	Yes
Control Mean	31738.0	29390.8	14938.2	14452.6	2347.2
N	2813	2813	2813	2813	2813

Notes: To remove the influence of outliers in the dependent variable, we drop households in the top 1 percent of the distribution of total borrowing. SL equals sanitation loan arm. Standard errors clustered at the village level are shown in round parentheses. *, **, *** indicate significance at the 10, 5 and 1 percent level, referring to Romano-Wolf p-values. These are obtained from a step-down procedure to adjust for multiple hypothesis testing performing 1000 bootstrap replications as proposed by Romano and Wolf (2005). 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. Amounts are in Indian Rupees (1 USD = Rs. 67.5). Data source: household survey.

Interestingly, the magnitudes and signs of coefficients on MFI, which accounts for around 50 percent of all formal borrowing, and other formal borrowing (Columns 3 and 4) suggests that there might be some degree of switching between different formal sources taking place; though neither of the coefficients is statistically significantly different from zero.

A concern might be that the survey data is subject to measurement error, making it difficult to identify significant impacts on borrowing. Moreover, some studies have raised the concern of misreporting of borrowing data in surveys (Karlan and Zinman, 2008), which could affect our ability to identify significant impacts if the misreporting is differential across treatment arms. To alleviate these concerns, and also to study switching behavior among different microfinance products and providers, we turn to analyze the administrative data on borrowing from the implementing MFI and from the credit bureau records. With this data, we are only able to analyze borrowing from microfinance providers, which accounts for around half of all reported formal borrowing. Indeed, as we show in Appendix E, there is evidence of significant under-reporting in the survey data, though this is not different by treatment arm.

We first confirm with administrative data from our implementing partner that amounts borrowed for sanitation increased significantly, in line with the impact on loan uptake. This is shown in column (1) of Table 9. The table also shows impact estimates on loan amounts taken for other loan products (columns (2) to (5)). All coefficients are considerably smaller, insignificant, and - except for education loans - positive. These results confirm that the average client did not shift away from other loan products offered by our implementing partner due to the sanitation loans. The finding is robust to multiple hypothesis testing as indicated by the Romano-Wolf p-values.

Using credit bureau data, which captures microfinance borrowing from all providers, we can look at whether clients shifted borrowing away from other microfinance providers to take the sanitation

Table 9: Intervention impact on uptake of loan products from the MFI (amount borrowed)

	(1) Sanitation	(2) Business	(3) Education	(4) Emergency	(5) Consumption
SL	2635.3***	985.4	-504.7	106.4	48.22
	(525.3)	(2252.3)	(876.1)	(143.2)	(99.38)
Cluster-robust p-value	[0.0000]	[0.6618]	[0.5646]	[0.4578]	[0.6276]
Romano-Wolf p-value	[0.0000]	[0.8801]	[0.8801]	[0.8711]	[0.8801]
Strata FE	Yes	Yes	Yes	Yes	Yes
Interviewer FE	Yes	Yes	Yes	Yes	Yes
Household covariates	Yes	Yes	Yes	Yes	Yes
Ratio sample clients/GP size	Yes	Yes	Yes	Yes	Yes
Control Mean	198.4	37868.4	8321.2	699.6	360.2
N	2841	2841	2841	2841	2841

Notes: SL equals sanitation loan arm. Standard errors clustered at the village level are shown in round parentheses. *, **, *** indicate significance at the 10, 5 and 1 percent level, referring to Romano-Wolf p-values. These are obtained from a step-down procedure to adjust for multiple hypothesis testing performing 1000 bootstrap replications as proposed by Romano and Wolf (2005). 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. Amounts are in Indian Rupees (1 USD = Rs. 67.5). Data source: household survey. Dependent variables come from administrative data.

loan. Table 10 considers impact estimates on total MFI borrowing (column (1)), borrowing from our implementing partner (column (2)) and borrowing from any other MFI (column (3)).[37] While coefficient estimates are much larger using this data source, estimated impacts are also insignificant. The coefficient on amounts borrowed from MFIs is Rs 5,156, primarily driven by additional borrowing from our implementing partner, as shown in column (2). Importantly, the coefficient on borrowing from other MFIs is positive (though insignificant), indicating that there is no evidence of switching away from other MFI lenders.

We conclude that the sanitation loan uptake is not accompanied by an increase in total household borrowing. Overall formal borrowing does not change, though there is suggestive evidence that borrowing from MFIs increased, while that from non-MFI sources likely decreased. However, coefficient estimates are very imprecise, making these conclusions somewhat speculative.

6.3 Empirical Evidence: Loan Attributes

The model reveals that both the label and loan conditions, particularly the lower interest rates, are important drivers of loan uptake and investment decisions. While we are currently not able to quantify the importance of each of these channels, we will provide evidence that each plays a role in our setting, concluding that loan labels impact borrowing and investment behavior, and can lead to credit constraints despite access to finance. Identifying the exact contributions of the two channels is left to future work.

According to the model, the intervention impacts on borrowing and sanitation investment could be driven by two channels: (i) label attached to the loan matters, or (ii) prior loan conditions made

[37] As discussed in Section 3.2.2, we do not have credit bureau data on all clients. Estimating the impacts of the intervention on this sub-sample yields similar estimates to those reported above. These are available on request.

Table 10: Intervention impact on household borrowing from MFIs (amount borrowed)

	(1) Any MFI	(2) Partner MFI	(3) Other MFIs
SL	5155.6	3192.9	1962.7
	(4152.3)	(3124.1)	(2423.9)
Cluster-robust p-value	[0.2145]	[0.3069]	[0.4182]
Romano-Wolf p-value	[0.4006]	[0.4775]	[0.4775]
Strata FE	Yes	Yes	Yes
Interviewer FE	Yes	Yes	Yes
Household covariates	Yes	Yes	Yes
Ratio sample clients/GP size	Yes	Yes	Yes
Control Mean	85314.0	50299.9	35014.1
N	2514	2514	2514

Notes: Credit bureau information available for 2,514 households. SL equals sanitation loan treatment arm. Standard errors clustered at the village level are shown in round parentheses. *, **, *** indicate significance at the 10, 5 and 1 percent level, referring to Romano-Wolf p-values. These are obtained from a step-down procedure to adjust for multiple hypothesis testing performing 1000 bootstrap replications as proposed by Romano and Wolf (2005). 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. Amounts are in Indian Rupees (1 USD = Rs. 67.5). Data source: household survey. Dependent variables come from credit bureau data.

sanitation investments unattractive.

We start by providing suggestive, descriptive evidence that the loan label could be driving our findings. The most compelling argument we can make is that a significant number of clients who were eligible to take a sanitation loan decided not to do so and take a business loan instead, despite less favorable loan conditions for the business loan. We find that 62 percent of clients eligible for sanitation loans take a higher-interest business loan instead. It is possible that clients take business loans because of larger borrowing limits. However, if the loan label doesn't matter, and since clients are not constrained to take only one loan at a time, it would be optimal (i.e. cost efficient) for the client to borrow the full sanitation loan and take the remaining loan amount as a business loan. We find that a significant proportion of clients fail to do so: 31 percent of all clients in the treatment area took a business loan of over Rs. 25,000 (the lowest amount that can be taken as separate sanitation and business loans) even when they are eligible for a sanitation loan. This suggests that the loan label likely matters for household borrowing decisions.

However, we also find evidence suggesting that the label effect is not sufficiently strong for all clients. This evidence comes from examining the loan-to-toilet conversion rate. We have seen in Section 5.1 that 20 percent of clients took a sanitation loan and in Section 5.2 that 9 percent owned a new toilet. This suggests a loan-to-toilet conversion rate of almost 50 percent. We can conduct a more formal analysis by looking at the impact of loan uptake on toilet construction and instrumenting sanitation loan uptake by the intervention. Doing so we make the implicit, and plausible, assumption that that the entire effect on toilet uptake is driven by the loan. The results are presented in Table 11. Columns (2) and (4) show the IV outputs for our two measures of toilet uptake, confirming a

Table 11: Loan-to-toilet conversion

	(1)	(2)	(3)	(4)
	HH report		Interviewer observation	
	OLS	IV	OLS	IV
Second stage				
Sanitation loan uptake	0.1640***	0.4815***	0.1380***	0.5049***
	(0.0377)	(0.1564)	(0.0349)	(0.1517)
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
r2	0.412	0.382	0.384	0.344
First stage				
SL - First stage		0.1805***		0.1805***
		(0.0354)		(0.0354)
F-stat		25.636		25.636
N	2841	2841	2841	2841

Notes: SL equals sanitation loan arm. Standard errors clustered at the village level are shown in parentheses. *, **, *** indicate significance at the 10, 5 and 1 percent level. 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. Strata and interviewer fixed effects included. Amounts are in Indian Rupees (1 USD = Rs. 67.5). Data source: household survey. Sanitation loan uptake comes from administrative data.

loan-to-toilet conversion rate of 48-50 percent.

Half of the loans are hence not used for toilet construction and, as we showed above, usage for repair and uptake cannot account for the remaining 50 percent, leaving a substantial percentage of loans that have not been used for sanitation investment. This is confirmed when looking back at Table 5, which displays self-reported sanitation loan use. We can see that almost one third of clients report themselves that they did not use any of the loan amount to invest into sanitation. We cannot exclude that these households had initially intended to use the loan for sanitation but some circumstance or another made them not do so. In either case, we can conclude that for at least one third of sanitation loan takers, the label effect was not strong enough to ensure its usage for sanitation. Further statistics we can bring forward to support the notion that the label did not imply a binding investment purpose include (i) 28 percent of clients that took a sanitation loan already a toilet when they did so, and (ii) 9 percent of clients that took a sanitation loan and said they used it for a new toilet, did not actually have one at the time of the endline survey. Unfortunately we are not able to detect in our data what households used the sanitation loan for if they did not invest it into sanitation infrastructure. This is on the one hand driven by the variety of possible alternative investments, but is also linked to the fact that the sanitation loans might have replaced other borrowing (as shown in Section 6.2) possibly for the same investment, so that no difference can be seen in comparison to control. More importantly though, we are not able to pin down what alternative investments households forgo in order to make the sanitation investment.

Overall, our descriptive evidence suggests, in line with the model, that both the loan label, and other loan attributes - primarily the interest rate - drive the findings of the impacts of the sanitation loan

program.

7 Conclusion

This paper provides first rigorous evidence on the effectiveness of micro-credit in improving the adoption of a lumpy human capital (health) investment - a household toilet. Drawing on a cluster randomized controlled trial in rural Maharashtra, India, and rich data from a primary household survey and two novel sources of administrative data on borrowing (loan-level data on lending by the partner MFI, and credit bureau reports) we show that providing joint-liability credit labelled for sanitation is an effective approach to motivate toilet construction.

Through a theoretical framework and supporting statistics, we show that it is not just the provision of credit that matters, but that credit attributes are important. A simple theoretical framework shows that loan labels can distort household borrowing and investment choices towards the Labelled investment. Moreover, in the absence of a product labeled for a specific investment, a household may be unable to borrow for that investment even if it has access to credit. The introduction of the sanitation loan would thus relax this constraint. However, the analysis also shows that other loan attributes – particularly the interest rate – will also influence household borrowing and investment responses. On the one hand, a lower interest rate would induce households to substitute away from more expensive credit sources, while keeping overall borrowing and investment choices constant. On the other hand, the lower interest rate might make the desired investment more affordable. Other loan attributes, such as the joint-liability contractual arrangement are also likely to play a role in the intervention's effectiveness, at least in terms of ensuring loan repayment. In further work, we aim to explore the role of group leaders in sanitation loan uptake and use.

Our empirical analysis show that microcredit based approaches can increase household toilet adoption, with toilet ownership increasing by 9 percentage points in our context. We find very little evidence of loan use for repairs or upgrades. This increase is measured around 2.5 years after the start of the intervention. This finding has important implications for policy and policy design. Much attention has been given to two widely used approaches to boost sanitation uptake - Community Led Total Sanitation and subsidies. However, recent literature has raised concerns about the ability of CLTS to boost the uptake of safe sanitation in a significant manner, particularly since it does not relax financial constraints (e.g.Abramovsky et al. 2018, Cameron et al. 2013). While its effectiveness has been shown when implemented with intense follow-up and in combination with subsidies [Pickering et al., 2015, Clasen et al., 2014, Patil et al., 2014], both approaches are very costly and can be difficult to target effectively [Lipscomb and Schechter, 2018]. Sanitation micro-loans offer another viable and effective alternative to these policies.

We analyze descriptively which of the loan label, and lower interest rate, can explain our results, and find evidence consistent with both mattering. On the one hand, we find that a significant proportion of households who have access to the cheaper sanitation loan choose to take a more

expensive business loan instead. Moreover, 31 percent of households, who could lower the overall cost of credit by taking a combination of the cheaper sanitation loan and a more expensive business loan choose not to take the sanitation loan. However, we also find evidence consistent with the interest rate mattering. In particular, we find that only around 50 percent of sanitation loans result in a new toilet, with few loans reported to be used for upgrade or repair. Being able to pin down a relatively accurate compliance rate is an important contribution to the literature. Very few studies have attempted to measure compliance with expected use of microfinance loans, particularly those that are not bundled with a specific product – as was the case here –, in an objective manner. Given the challenges to objectively verify actual loan use (e.g. business inventory might be sold off), researchers typically rely on survey questions asking a respondent how they spent a loan use to assess compliance. The latter method is not very accurate since respondents may over-report compliance in household surveys as shown by Karlan et al. [2014].

Studies of microcredit programs that are bundled with specific health investments do frequently report on the presence of the investment as measured by survey enumerators. See for example Benhassine et al. [2015], Tarozzi et al. [2014], Yishay et al. [2017]. Interestingly, Yishay et al. [2017], who measure the effects of microcredit availability on willingness to pay for sanitation in rural Cambodia, report than not more than 30 percent of households who took the loan construct a latrine 18-24 months after receiving loan offers; compared to 50 percent in our case. The low conversion rate they report is of particular interest when considering that households did not receive cash, as in our case, but were provided with toilet construction materials at their doorsteps. Two product design differences might play a role. For one, the credit they provide is given as an individual liability loan, whereas in our context loans are joint liability. Attanasio et al. [2015] show that group liability attracts different types of borrowers than individual liability contracts do. Second, the implementing partner introduced a rule that only clients who had been with them for at least one year could avail a sanitation loan, whereas in the context of Yishay et al. [2017] loans were given to those who wanted to purchase a specific toilet model, regardless of their borrowing history with the lender.

References

Johannes Abeler and Felix Marklein. Fungibility, labels, and consumption. *Journal of the European Economic Association*, 15(1):99–127, 2017.

Laura Abramovsky, Britta Augsburg, and Francisco Oteiza. Sustainable total sanitation - Nigeria endline report. Technical report, Institute for Fiscal Studies, 2018.

Orazio Attanasio, Britta Augsburg, Ralph De Haas, Emla Fitzsimons, and Heike Harmgart. The impacts of microfinance: Evidence from joint-liability lending in Mongolia. *American Economic Journal: Applied Economics*, 7(1):90–122, January 2015.

Britta Augsburg and Paul Andres Rodriguez-Lesmes. Sanitation and child health in India. *World Development*, 107:22–39, 2018. ISSN 0305-750X. doi: https://doi.org/10.1016/j.worlddev.2018.02.005. URL `http://www.sciencedirect.com/science/article/pii/S0305750X18300433`.

Britta Augsburg, Bet Caeyers, and Francisco Oteiza. The costs and benefits of investing in a toilet. Technical report, Institute for Fiscal Studies, 2015.

Britta Augsburg, Bet Caeyers, and Bansi Malde. Complementarities between micro-credit and government subsidies: Evidence from india's swacch bharat mission. mimeo, IFS, 2018.

Abhijit Banerjee, Esther Duflo, Rachel Glennerster, and Cynthia Kinnan. The miracle of microfinance? Evidence from a randomized evaluation. *American Economic Journal: Applied Economics*, 7(1):22–53, January 2015. doi: 10.1257/app.20130533. URL `http://www.aeaweb.org/articles?id=10.1257/app.20130533`.

Timothy K.M. Beatty, Laura Blow, Thomas F. Crossley, and Cormac O'Dea. Cash by any other name? Evidence on labelling from the uk Winter Fuel Payment. *Journal of Public Economics*, 118:86–96, 2014. ISSN 0047-2727. doi: https://doi.org/10.1016/j.jpubeco.2014.06.007. URL `http://www.sciencedirect.com/science/article/pii/S0047272714001479`.

Najy Benhassine, Florencia Devoto, Esther Duflo, Pascaline Dupas, and Victor Pouliquen. Turning a shove into a nudge? A "labeled cash transfer" for education. *American Economic Journal: Economic Policy*, 7(3):86–125, August 2015. doi: 10.1257/pol.20130225. URL `http://www.aeaweb.org/articles?id=10.1257/pol.20130225`.

Lisa Cameron, Manisha Shah, and Susan Olivia. Impact evaluation of a large-scale rural sanitation project in Indonesia. Technical report, World Bank Policy Research Working Paper, 2013.

Thomas Clasen, Sophie Boisson, Parimita Routray, Belen Torondel, Melissa Bell, Oliver Cumming, Jeroen Ensink, Matthew Freeman, Marion Jenkins, Mitsunori Odagiri, Subhajyoti Ray, Antara Sinha, Mrutyunjay Suar, and Wolf-Peter Schmidt. Effectiveness of a rural sanitation programme

on diarrhoea, soil-transmitted helminth infection and child malnutrition in Odisha, India: A cluster-randomised trial". *Lancet Global Health*, 2:645–53, 2014.

Florencia Devoto, Esther Duflo, Pascaline Dupas, William Pariente, and Vincent Pons. Happiness on Tap: Piped Water Adoption in Urban Morocco. *American Economic Journal: Economic Policy*, 4(4):68–99, November 2012. URL https://ideas.repec.org/a/aea/aejpol/v4y2012i4p68-99.html.

Katherine L. Dickinson, Sumeet R. Patil, Subhrendu K. Pattanayak, Christine Poulos, and Jui-Hen Yang. Nature's call: Impacts of sanitation choices in Orissa, India. *Economic Development and Cultural Change*, 64(1):1–29, 2015. doi: 10.1086/682958. URL https://doi.org/10.1086/682958.

Pascaline Dupas and Jonathan Robinson. Why don't the poor save more? Evidence from health savings experiments. *American Economic Review*, 103(4):1138–71, June 2013. doi: 10.1257/aer.103.4.1138. URL http://www.aeaweb.org/articles?id=10.1257/aer.103.4.1138.

Government of India GoI. Population by sex and residence, Census 2011. Provisional population totals paper 2 of 2011: India (vol ii)., 2011a. URL http://censusindia.gov.in.

Government of India GoI. District census handbook - latur, 2011b. URL http://censusindia.gov.in/2011census/dchb.

Government of India GoI. District census handbook - nanded, 2011c. URL http://www.censusindia.gov.in/2011census/dchb.

Government of Maharashtra GoM. Maharashtra Human Development Report 2012, 2012.

Government of Maharashtra GoM. Economic survey of maharashtra 2017-18, 2018. URL https://mahades.maharashtra.gov.in/files/publication.

Raymond Guiteras, James Levinsohn, and Ahmed Mushfiq Mobarak. Encouraging sanitation investment in the developing world: A cluster-randomized trial. *Science*, 348(6237):903–906, 2015. ISSN 0036-8075. doi: 10.1126/science.aaa0491. URL http://science.sciencemag.org/content/348/6237/903.

Raymond Guiteras, David Levine, Thomas Polley, and Brian Quistorff. Credit constraints, discounting and investment in health: Evidence from micropayments for clean water in dhaka. North Carolina State University, 2016.

Justine Hastings and Jesse Shapiro. How are snap benefits spent? evidence from a retail panel. *American Economic Review*, Forthcoming.

Dean Karlan and Jonathan Zinman. Lying about borrowing. *Journal of the European Economic Association*, 6(2-3):510–521, 2008. doi: 10.1162/JEEA.2008.6.2-3.510. URL https://onlinelibrary.wiley.com/doi/abs/10.1162/JEEA.2008.6.2-3.510.

Dean Karlan, Aishwarya Lakshmi Ratan, and Jonathan Zinman. Savings by and for the poor: A research review and agenda. *Review of Income and Wealth*, 60(1):36–78, 2014.

Santosh Kumar and Sebastian Vollmer. Does access to improved sanitation reduce childhood diarrhoea in rural India? *Health Economics*, 22(4):410–427, 2013. doi: 10.1002/hec.2809.

Molly Lipscomb and Laura Schechter. Subsidies versus mental accounting nudges: Harnessing mobile payment systems to improve sanitation. *Journal of Development Economics*, 135: 235–254, 2018. ISSN 0304-3878. doi: https://doi.org/10.1016/j.jdeveco.2018.07.007. URL http://www.sciencedirect.com/science/article/pii/S0304387818304814.

Lance Lochner and Alexander Monge-Naranjo. Credit constraints in education. *Annual Review of Economics*, 4(1):225–256, 2012. doi: 10.1146/annurev-economics-080511-110920. URL https://doi.org/10.1146/annurev-economics-080511-110920.

David McKenzie. Beyond baseline and follow-up: The case for more t in experiments. *Journal of Development Economics*, 99(2):210–221, 2012.

Sumeet R. Patil, Benjamin F. Arnold, Alicia L. Salvatore, Bertha Briceno, Sandipan Ganguly, John M. Colford, Jr, and Paul J. Gertler. The effect of india's total sanitation campaign on defecation behaviors and child health in rural Madhya Pradesh: A cluster randomized controlled trial. *PLOS Medicine*, 11(8):1–17, 08 2014. doi: 10.1371/journal.pmed.1001709. URL https://doi.org/10.1371/journal.pmed.1001709.

Amy Pickering, Habiba Djebbari, Carolina Lopez, Massa Coulibaly, and Maria Laura Alzua. Effect of a community-led sanitation intervention on child diarrhoea and child growth in rural Mali: A cluster-randomised controlled trial. *Lancet Global Health*, 3(11):701–711, 2015.

Joseph P. Romano and Michael Wolf. Stepwise multiple testing as formalized data snooping. *Econometrica*, 73(4):1237–1282, 2005. doi: 10.1111/j.1468-0262.2005.00615.x. URL https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1468-0262.2005.00615.x.

Ministry of Drinking Water SBM and Sanitation. Guidelines for Swachh Bharat Mission (Gramin), 2014.

Alex Solis. Credit access and college enrollment. *Journal of Political Economy*, 125(2):562–622, 2017. doi: 10.1086/690829. URL https://doi.org/10.1086/690829.

Dean Spears. Effects of rural sanitation on infant mortality and human capital: Evidence from India's Total Sanitation Campaign. *Princeton University Working Paper*, 2012.

Dean Spears and Sneha Lamba. Effects of early-life exposure to sanitation on childhood cognitive skills: Evidence from India's Total Sanitation Campaign. *Journal of Human Resources*, 2015. doi: 10.3368/jhr.51.2.0712-5051R1. URL http://jhr.uwpress.org/content/early/2015/11/20/jhr.51.2.0712-5051R1.abstract.

Alessandro Tarozzi, Aprajit Mahajan, Brian Blackburn, Dan Kopf, Lakshmi Krishnan, and Joanne Yoong. Micro-loans, insecticide-treated bednets, and malaria: Evidence from a randomized controlled trial in Orissa, India. *American Economic Review*, 104(7):1909–41, July 2014. doi: 10.1257/aer.104.7.1909. URL http://www.aeaweb.org/articles?id=10.1257/aer.104.7.1909.

Richard H. Thaler. Mental accounting matters. *Journal of Behavioral Decision Making*, 12(3):183–206, 1999. doi: 10.1002/(SICI)1099-0771(199909)12:3<183::AID-BDM318>3.0.CO;2-F. URL https://onlinelibrary.wiley.com/doi/abs/10.1002.

WHO/UNICEF. Progress on drinking water and sanitation: 2014 update. Technical report, WHO/UNICEF, 2014.

WHO/UNICEF. *Progress on Drinking Water, Sanitation and Hygiene: 2017 Update and SDG Baselines*. World Health Organization and UNICEF, 2017.

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.

Jonathan Zinman. Where is the missing credit card debt? Clues and implications. *Review of Income and Wealth*, 55(2):249–265, 2009. doi: 10.1111/j.1475-4991.2009.00321.x. URL https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1475-4991.2009.00321.x.

Appendix

A Appendix - Additional Tables

Table A.1 provides information on main loan products offered by the MFI.

Table A.1: Credit products offered by the MFI

Product	Loan Amout		Interest rate (%)	Tenure (weeks)	Frequency
	Min	*Max*			
Education	5000	15000	22 (later 18)	52	Weekly
Emergency	1000	1000	0	10/11	Weekly
Festival	2000	2000	22 (later 18)	24	Weekly
IGL Pragati Plus (Business)	15000	50000	25 (later 22)	104	Weekly
IGL Pragati (Business)	10000	20000	25 (later 22)	52	Weekly
Pragati Suppliment Loan	5000	10000	26 (later 22)	52	Weekly
Sanitation Loan	10000	15000	22 (later 18)	104	Weekly

Table A.2 displays intervention impact on main outcomes (sanitation loan uptake, total household borrowing and toilet uptake) for the sub-sample of households for whom credit bureau data are available. Results are similar to those obtained for the full sample.

Table A.2: Sanitation loan uptake, total borrowing, toilet uptake - credit bureau sample

	(1) Sanitation loan	(2) Total borrowing	(3) Toilet uptake
SL	0.190***	-122.8	0.0874***
	(0.0367)	(1870.9)	(0.0279)
Strata FE	Yes	Yes	Yes
Interviewer FE	Yes	Yes	Yes
Household covariates	Yes	Yes	Yes
Ratio sample clients/GP size	Yes	Yes	Yes
Control Mean	0.0141	32225.6	0.458
N	2514	2491	2514

Notes: Credit bureau information available for 2,514 households. SL equals sanitation loan arm. Standard errors clustered at the village level are shown in parentheses.*, **, *** indicate significance at the 10, 5 and 1 percent level. To remove the influence of outliers in the dependent variable, we drop households in the top 1 percent of the distribution of total borrowing (Column 2). 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. Data sources: household survey.

Table A.3 compares characteristics of households in credit bureau sample and not.

Table A.3: Comparison of household characteristics for households in credit bureau and not

	(1) CB	(2) no CB	(3) CB - no CB	(4) P-value	(5) N
HH head religion: Hinduism (%)	66.6	65.9	0.76 **	0.010	2841
	(0.88)	(2.64)	(2.51)		
HH head religion: Islam (%)	20.2	20.8	-6.61**	0.019	2841
	(0.75)	(2.87)	(2.04)		
HH head religion: Buddism (%)	12.4	12.6	-0.56	0.249	2841
	(0.62)	(1.71)	(1.64)		
Nr of HH members	5.04	5.09	4.90***	0.000	2841
	(0.037)	(0.060)	(0.13)		
HH head caste: Backward (%)	32.9	32.4	-0.22	0.133	2841
	(0.88)	(2.79)	(3.05)		
HH head caste: Scheduled (%)	40.9	41.4	1.91	0.163	2841
	(0.92)	(3.06)	(2.91)		
HH head caste: General (%)	25.5	25.6	-0.056	0.754	2841
	(0.82)	(2.98)	(2.70)		
Gender HH head ((%) male)	90.5	95.0	0.48***	0.000	2841
	(0.55)	(0.51)	(3.05)		
Age HH head in years	45.4	45.2	0.53***	0.005	2841
	(0.19)	(0.32)	(0.64)		
Years of education HH head	5.92	6.15	-4.62***	0.000	2841
	(0.088)	(0.14)	(0.25)		
HH head is married (%)	91.9	95.7	-0.47***	0.000	2841
	(0.51)	(0.48)	(3.07)		
Dwelling owned by HH member (%)	96.4	96.3	4.10	0.454	2841
	(0.35)	(0.69)	(0.85)		
Dwelling structure: Pucca House (%)	18.9	18.7	-0.097	0.644	2841
	(0.73)	(1.70)	(2.46)		
Dwelling structure: Semi-pucca house (%)	65.3	65.1	0.85	0.606	2841
	(0.89)	(2.16)	(2.99)		
HH owns BPL card (%)	58.6	58.3	-4.53	0.387	2841
	(0.92)	(1.69)	(2.57)		
HH owns APL card (%)	27.3	27.5	39.3	0.581	2841
	(0.84)	(1.50)	(2.76)		
Primary activity HH: agriculture (%)	53.5	52.3	0.22***	0.001	2841
	(0.94)	(2.80)	(3.11)		
Primary activity HH: Waged employment (%)	26.8	27.6	-1.87**	0.010	2841
	(0.83)	(1.74)	(2.71)		
HH owned a toilet at baseline (reconstructed) (%)	26.6	26.5	-0.24	0.705	2841
	(0.83)	(1.49)	(2.72)		

Notes: Sample size of endline survey: 2,841 households. CB stands for credit bureau data. Robust standard errors clustered at the village level are shown in parentheses. *, **, *** indicates significance at the 10, 5 and 1 percent level. HH stands for household. Column 2 and 3 report variables' mean and standard deviation (in parenthesis) for CB and no CB sample respectively. Column 4 reports differences in variables' mean between CB and no CB sample. Toilet ownership at baseline is reconstructed from toilet construction dates reported at endline. If a toilet was in the dwelling when household moved in we consider number of years HH head lived in the household as a proxy of construction date.

B Appendix - Sampling description

The sample was selected from 81 eligible study GPs. An eligible GP was defined as one where (i) the MFI had active lending groups (kendra) and (ii) where sanitation activities had not been undertaken in the past. Through interactions with MFI staff, we identified areas where no sanitation were ongoing but they were planned (and/or considered feasible) in the near future. Then we matched the list of kendra groups that were active in the selected area to the GPs they were located in. During the process, kendras located in urban areas were excluded. At the end of the listing process 81 GPs in five blocks (corresponding to MFI branches) within two districts were identified as our study area. As a second step we randomized the selected GPs to one of two evaluation arms: Control or SL. Randomization was stratified by branch and by size of the GP (size in terms of number of households). Within each GP the following sampling procedure was applied:

Step 1: in those GPs where only one kendra is present, we sampled all clients in that kendra

Step 2: in those GPs where more than one kendra is present, kendras with at least one client sampled at the baseline were sorted randomly within the GP, and all client households from the top kendra of each GP were picked.

Step 3: As more clients were needed to reach the desired sample size, a third step was conducted following this strategy: kendras not fully sampled (but with at least one client sampled at baseline) were randomly sorted, and the top 'x' kendras were picked until we reached the desired sample size. Note that at this stage, no sorting at the GP level was done.

C Appendix - Multiple Hypothesis Testing

Given that our analysis conducts several hypothesis tests, it is possible that we may falsely reject the null hypothesis when it is true for some hypothesis since the probability of conducting at least one Type I error increases with the number of hypotheses tested. We therefore verify whether our results hold once we account for the fact that we are testing several hypotheses. Table C.1 displays the impact estimates and standard errors for all outcomes in the two rows before reporting the original p-values (3rd row) and those adjusted for the fact that we are testing four hypotheses (4th row). We adjust the p-values using the procedure described in Romano and Wolf (2005), who develop a stepwise multiple-testing procedure that asymptotically controls the family-wise error rate. We can see that implementing this adjustment changes the significance of our results only marginally. We are hence confident that our conclusions on loan uptake, toilet construction and total household borrowing are not an artifact of multiple hypothesis testing.

Table C.1: Intervention impact on all outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Sanitation Loan	Own toilet		Toilet in use		Toilet quality	
		HH report	Interviewer observation	HH report	HH report on interviewer observation	Underground	Overground 1
SL	0.180***	0.0869**	0.0911***	0.0919***	0.0958***	0.0140	0.0624
	(0.0356)	(0.0262)	(0.0249)	(0.0236)	(0.0235)	(0.0220)	(0.0339)
Cluster-robust p-value	[0.0000]	[0.0009]	[0.00003]	[0.0001]	[0.0000]	[0.5251]	[0.0660]
Romano-Wolf p-value	[0.0000]	[0.0120]	[0.0040]	[0.0030]	[0.0020]	[0.9890]	[0.4875]
Strata FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Interviewer FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ratio sample clients/GP size	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control Mean	0.0132	0.452	0.412	0.398	0.372	1.379	2.429
N	2841	2841	2841	2841	2841	1289	1289

	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Toilet quality	Borrowing					
	Overground 2	Total	Formal	MFIs	Other formal	Informal	Sanitation
SL	0.0537	-252.1	76.75	521.3	-444.5	-328.8	2635.3***
	(0.0272)	(1830.9)	(1872.7)	(1524.6)	(1577.4)	(403.3)	(525.3)
Cluster-robust p-value	[0.0483]	[0.8905]	[0.9673]	[0.7324]	[0.7781]	[0.4149]	[0.0000]
Romano-Wolf p-value	[0.4166]	[0.9890]	[0.9890]	[0.9890]	[0.9890]	[0.9890]	[0.0000]
Strata FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Interviewer FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ratio sample clients/GP size	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control Mean	0.370	31738.0	29390.8	14938.2	14452.6	2347.2	198.4
N	1289	2813	2813	2813	2813	2813	2841

	(15)	(16)	(17)	(18)	(19)	(20)	(21)
	Borrowing						
	Business	Education	Emergency	Consumption	Amount from any MFI	Amount from partner MFI	Amount from other MFIs
SL	985.4	-504.7	106.4	48.22	5155.6	3192.9	1962.7
	(2252.3)	(876.1)	(143.2)	(99.38)	(4152.3)	(3124.1)	(2423.9)
Cluster-robust p-value	[0.6618]	[0.5646]	[0.4578]	[0.6276]	[0.2145]	[0.3069]	[0.4182]
Romano-Wolf p-value	[0.9890]	[0.9890]	[0.9890]	[0.9890]	[0.8641]	[0.9560]	[0.9890]
Strata FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Interviewer FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ratio sample clients/GP size	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control Mean	37868.4	8321.2	699.6	360.2	85314.0	50299.9	35014.1
N	2841	2841	2841	2841	2514	2514	2514

Notes: Columns 9 to 13 refer to borrowing activity reported in survey data. To remove the influence of outliers in the dependent variable, we drop households in the top 1 percent of the distribution of total borrowing. Columns 14 to 18 refer to borrowing activity from partner MFI reported in administrative data. Columns 19 to 21 refer to credit bureau information available for 2,514 households. SL equals sanitation loan arm. Standard errors clustered at the village level are shown in round parentheses. *, **, *** indicate significance at the 10, 5 and 1 percent level, referring to Romano-Wolf p-values. These are obtained from a step-down procedure to adjust for multiple hypothesis testing performing 1000 bootstrap replications as proposed by Romano and Wolf (2005). 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. Data sources: household survey, administrative and credit bureau data.

D Appendix - Variable definition

Toilet quality

To measure quality of a toilet's underground structure, we use information on materials used to construct the underground chamber (good quality materials such as cement rings and brick ensure that the underground chamber will not collapse), and also whether the interviewer observes flies or bad smells. Discussions with experts identified the latter two as indicators of poor quality construction of the underground chamber. We aggregate these variables into one measure using polychoric principal components analysis. Only one factor in the polychoric PCA has an eigenvalue

greater than 1 (see Table D.1).

To measure quality of the overground structure, we use an indicator based on observations of the toilet made by the survey interviewers at the time of the endline survey. Interviewers made notes on the quality of the super-structure (whether it is temporary, semi-permanent or permanent), ease of access, lighting in the toilet (at day and at night), availability of a lock and a lockable door, whether there is sufficient distance between the toilet pan and the wall, and whether the toilet has cross-ventilation. The polychoric PCA procedure combining these variables generated two components with eigenvalues greater than 1 (see Table D.4). Tables D.2 and D.5 show the impact of the intervention on the single dimensions considered to construct the quality indicators. Tables D.3 and D.6 report impacts separately by whether or not the household had a toilet at baseline.

Table D.1: Quality of underground chamber - Factor loading tables (polychoric PCA)

	(1) Component 1
Materials lining the walls of the underground storage chamber	0.0599
No bad smells	0.7065
No flies	0.7052

Table D.2: Intervention impact on quality of the underground chamber

	(1) PCA score	(2) Materials lining walls	(3) No bad smell	(4) No flies
SL	0.0140	0.0784*	0.0198	-0.00668
	(0.0220)	(0.0405)	(0.0184)	(0.0201)
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
Control Mean	1.379	1.896	0.909	0.884
N	1289	1289	1289	1289

Notes: Sample of households owning a toilet observed by interviewers at endline: 1,289 households. SL refers to 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. 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. Strata and interviewer fixed effects included.

Table D.3: Intervention impact on quality of the underground chamber by toilet ownership at baseline

	(1) PCA score	(2) Materials lining walls	(3) No bad smell	(4) No flies
SL - toilet at BL	0.00215	0.0286	0.0156	-0.0146
	(0.0289)	(0.0468)	(0.0208)	(0.0256)
SL - no toilet at BL	0.0289	0.115**	0.0251	0.00329
	(0.0292)	(0.0478)	(0.0277)	(0.0274)
HH owns a toilet at BL	0.00282	0.0950**	-0.00681	0.000654
	(0.0273)	(0.0407)	(0.0240)	(0.0226)
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
F-test	0.487	0.110	0.763	0.607
Control Mean (no toilet BL)	1.361	1.871	0.904	0.870
Control Mean (toilet BL)	1.391	1.945	0.912	0.894
N	1289	1432	1289	1289

Notes: Sample of households owning a toilet observed by interviewers at endline: 1,289 households. SL refers to 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. 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. Strata and interviewer fixed effects included.

Table D.4: Quality of overground structure - Factor loading tables (polychoric PCA)

	(1) Component 1	(2) Component 2
Toilet structure - observed by interviewers	0.1888	0.30756
Provision to lock	0.3779	-0.3521
Toilet easy to access	0.4068	-0.3698
Natural lighting during the day	0.3696	-0.2002
The toilet has a door that can be locked	0.4692	-0.1663
Light at night	0.3703	0.2366
Distance between pan and wall sufficient	0.3035	0.5048
Cross-ventilation	0.2647	0.5159

Table D.5: Intervention impact on quality of the overground structure

	(1) PCA score component 1	(2) PCA score component 2	(3) Structure	(4) Lock	(5) Easy access	(6) Light during day	(7) Door	(8) Light at night	(9) Dist. btw pan and wall	(10) Cross-ventilation
SL	0.0596*	0.0529*	0.0808*	0.0369	-0.00918	-0.00260	0.0104	0.0323	0.0490**	0.0127
	(0.0336)	(0.0272)	(0.0451)	(0.0253)	(0.0107)	(0.0202)	(0.0198)	(0.0345)	(0.0204)	(0.0180)
Strata FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Interviewer FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ratio sample clients/GP size	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control Mean	2.429	0.370	2.303	0.835	0.975	0.909	0.914	0.611	0.710	0.286
N	1289	1289	1289	1289	1289	1289	1289	1289	1289	1289

Notes: Sample of households owning a toilet observed by interviewers at endline: 1,289 households. SL refers to 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. 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. Strata and interviewer fixed effects included.

Table D.6: Intervention impact on quality of the overground structure by toilet ownership at baseline

	(1) PCA score component 1	(2) PCA score component 2	(3) Structure	(4) Lock	(5) Easy access	(6) Light during day	(7) Door	(8) Light at night	(9) Dist. btw pan and wall	(10) Cross-ventilation
SL - toilet at BL	0.0468	0.0523*	0.0650	0.0290	-0.0189	-0.00730	0.00885	0.0397	0.0380	0.0135
	(0.0459)	(0.0306)	(0.0506)	(0.0345)	(0.0142)	(0.0208)	(0.0290)	(0.0396)	(0.0275)	(0.0221)
SL - no toilet at BL	0.0820*	0.0555	0.0970*	0.0489	0.00349	0.00577	0.0147	0.0296	0.0637**	0.0167
	(0.0469)	(0.0350)	(0.0575)	(0.0318)	(0.0167)	(0.0270)	(0.0256)	(0.0457)	(0.0308)	(0.0296)
HH owns a toilet at BL	0.0664	0.0150	-0.0116	0.0252	0.0148	0.0255	0.0208	0.0471	0.0186	0.0407*
	(0.0442)	(0.0273)	(0.0414)	(0.0293)	(0.0168)	(0.0170)	(0.0271)	(0.0359)	(0.0320)	(0.0213)
Strata FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Interviewer FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ratio sample clients/GP size	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-test	0.581	0.930	0.587	0.643	0.315	0.598	0.876	0.838	0.536	0.931
Control Mean (no toilet BL)	2.424	0.406	2.330	0.816	0.966	0.889	0.912	0.617	0.736	0.284
Control Mean (toilet BL)	2.432	0.345	2.285	0.848	0.981	0.923	0.915	0.606	0.691	0.287
N	1289	1289	1289	1289	1289	1289	1289	1289	1289	1289

Notes: Sample of households owning a toilet observed by interviewers at endline: 1,289 households. SL refers to 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. 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. Strata and interviewer fixed effects included.

E Comparing credit data sources

Tables E.1 and E.2 reveal an interesting caveat of our data: comparison of the household survey data and the credit bureau data reveals some important discrepancies, which warrant further investigation. In particular, household survey data substantially underestimates total formal household borrowing. As shown in Table 8, while households report having borrowed, on average, just over Rs 31,000 since the start of the intervention, the credit bureau data indicates average borrowing of more than Rs 85,000.

Table E.1: Formal borrowing amounts (control means)

Total formal amount borrowed...	*Data source*	*Control*	*SL*
... during the intervention	CB	85,314	91,473
	Survey (all)	31,738	30268
	Survey (CB)	32,226	30,546
... during first-year intervention	CB	37,629	40,141
	Survey (all)	11,303	11,901
	Survey (CB)	11,461	12,000
... during second-year intervention	CB	29,059	30,614
	Survey (all)	12,418	11,253
	Survey (CB)	12,735	11,382
... during third-year intervention	CB	18,626	20,717
	Survey (all)	7,291	6,508
	Survey (CB)	7,317	6,575

Notes: SL refers to sanitation loan treatment arm. Average total borrowings from survey data are computed both on the 2,841 households included in the endline household survey and the 2,514 households included in the credit bureau data.

This is in line with other provided evidence of survey respondents' under-reporting when asked about credit and debit activity (Zinman [2009]; Karlan and Zinman [2008]i) and unlikely related to recall error or survey instrument design. Regarding recall error, we see that the percentage of borrowing not reported in the survey data is quite similar over the course of the intervention as shown in the same table. As for survey instrument design, it would be perceivable that the capped number of loans we ask the respondent about lead to an underestimation of total borrowing. However, as can be seen in Table E.2, only 23 percent of respondents, balanced by treatment and control, report on three loans, suggesting that at most a fifth of the sample would have a total borrowing amount that is censored at the top due to asking about a limited number of loans.

We believe it unlikely that this under-reporting is driven by the introduction of the sanitation loans, implying that our impact estimates should not be biased by it. We therefore feel confident in our finding that total household borrowing remains unaffected by the introduction and uptake of the newly introduced sanitation loan product.

Table E.2: Number of loans reported on

	Control		SL	
# loans	Freq.	%	Freq.	%
0	467	29.41	392	31.28
1	373	23.49	319	25.46
2	381	23.99	282	22.51
3	367	23.11	260	20.75

Notes: SL refers to sanitation loan treatment arm.

F Proofs

In this section, we provide the proofs underlying the model predictions. We start by analyzing household choices in the absence of the intervention. The household's optimization problem can be written as follows:

$$\underset{\{c_{n1},c_{n2},e_1,d_1,b_1\}}{max} v(c_{n1}) - \kappa_e b_1(1-e_1) + \beta v(c_{n2}) + \beta d_1 m \tag{10}$$

subject to

$$c_{n1} + c_e e_1 + c_d d_1 \leq y_1 + b_1 + se_1 \tag{11}$$

$$c_{n2} + (1+r_1)b_1 \leq y_2 + se_1 \tag{12}$$

$$0 \leq b_1 \leq b_1^{max} \tag{13}$$

At the optimum, the budget constraints will bind. Imposing this equality, and then substituting for c_{n1} and c_{n2} in the objective function 10, we obtain the following simplified problem:

$$\underset{e_1,d_1,b_1}{max} v(y_1 + b_1 - c_d d_1 - (c_e - s)e_1) - \kappa_e b_1(1-e_1) + \beta v(y_2 + se_1 - (1+r_1)b_1) + \beta d_1 m \tag{14}$$

subject to

$$0 \leq b_1 \leq b_1^{max} \tag{15}$$

Characterizing the Optimal Solution

To solve the problem, we set up the Lagrangian, and obtain the first order conditions:

$$L = v(y_1 + b_1 - c_d d_1 - (c_e - s)e_1) - \kappa_e b_1(1 - e_1) + \beta v(y_2 + se_1 - (1 + r_1)b_1) + \beta d_1 m$$
$$-\lambda_1(-b_1) - \lambda_2(b_1 - b_1^{max})$$

The first order conditions are as follows:

$b_1 :\ v'(c_{n1}) - \kappa_e(1 - e_1) - \beta(1 + r_1)v'(c_{n2}) + \lambda_1 - \lambda_2 = 0$

$e_1 :\ -(c_e - s)v'(c_{n1}) + \kappa_e b_1 + \beta s v'(c_{n2}) = 0$

$d_1 :\ -c_d v'(c_{n1}) + \beta m = 0$

Re-arranging these, we get the following conditions:

$$v'(c_{n1}) = \kappa_e(1 - e_1) + \beta(1 + r_1)v'(c_{n2}) - \lambda_1 + \lambda_2 \tag{16}$$

$$(c_e - s)v'(c_{n1}) = \kappa_e b_1 + \beta s v'(c_{n2}) \tag{17}$$

$$c_d v'(c_{n1}) = \beta m \tag{18}$$

When neither one of the borrowing constraints binds, the household chooses whether to borrow an additional dollar of loan b_1 by trading off the gain from the additional consumption it can enjoy in period 1 with the reduced consumption in period 2 (to repay the loan) and the utility penalty it experiences if it chooses to spend the dollar on something other than the durable E. Interestingly, the disutility associated with the label will influence borrowing decisions even when the maximum borrowing constraint binds.[38] Similarly, the label also enters the first order condition relating to the durable E: the household will trade-off the cost of the investment (net consumption given up in period 1) with the increased consumption in period 2, and a utility boost, $\kappa_e b_1$, if it had borrowed the amount b_1**.** By contrast, the labeling parameter doesn't enter the first order condition relating to the toilet investment decision. This condition trades off the lost non-durable consumption to invest in the toilet (LHS) with the discounted benefit of the toilet (RHS).

Totally differentiating 16, we get that

$$\frac{db_1}{d\kappa_e} = \frac{(1 - e_1)}{v''(c_{n1}) + \beta(1 + r_1)v''(c_{n2})}$$

By concavity of $v(.)$, $v''(c_{n1}) < 0$ and $v''(c_{n2}) < 0$. Thus $\frac{db_1}{d\kappa_e} < 0$ if $e_1 = 0$; and $\frac{db_1}{d\kappa_e} = 0$ if $e_1 = 1$.

[38] When the non-zero borrowing constraint binds, $b_1 = 0$, and the label related penalty will not apply.

Thus, as the disutility associated with diverting the loan to another purpose increases, households that want credit, but for whom a business investment is not optimal (given the label effect), will be discouraged from taking the business loan.

Next, we consider how the label affects households' investment decisions. Since $c_d + c_e > b_1^{max}$, the household will face a trade-off between the two investments unless y_1 is sufficiently high. In choosing which of the two investments to make, the household will compare the net present benefit associated with each investment, and choose the investment that generates the highest net present benefit. In other words, the household will choose to invest in a toilet over the business investment if:

$$\beta m - c_d v'(c_{n1}) > \kappa_e b_1 + \beta s v'(c_{n2}) - (c_e - s)v'(c_{n1}) \tag{19}$$

When the label attached to the loan matters, money will no longer be completely fungible; and households for whom the difference in net benefit from a toilet and that from the business investment is less than $\kappa_e b_1$ will choose to invest in the business investment rather than the toilet, which would have been optimal for the household had the loan b_1 been unlabelled.

Interestingly, a household might choose to make a business investment if it takes the loan, even though it might not otherwise be optimal. That is, some households for whom $\beta s v'(c_{n2}) - (c_e - s)v'(c_{n1}) < 0$ and $\kappa_e b_1 + \beta s v'(c_{n2}) - (c_e - s)v'(c_{n1}) > \beta m - c_d v'(c_{n1})$ would be induced to make the business investment if they take the business loan.

Finally, a household might choose not to make either investment if neither investment yields a positive net benefit.

Thus, the label attached to the loan might discourage households from investing in a toilet, even when it might be otherwise more optimal for the household to invest in a toilet, and it has access to credit.

The insights from this analysis can be summarized:

1. Loan labels distort household borrowing decisions. In particular, the disutility parameter, κ_e, discourages household borrowing if they are not going to make a business investment, even though this would be optimal in the absence of the label.

2. Loan labels distort household investment decisions. In particular, some households will choose not to invest in a toilet because of the disutility associated with diverting the loan to another purpose, even though this would otherwise be optimal in the absence of the label. In addition, some households will be induced to make a business investment if they take a business loan, even though this would be suboptimal in the absence of the label effect.

3. Putting (1) and (2) together, this means that a household could be unable to borrow to make a sanitation investment, even though it has access to credit, and a sanitation investment is otherwise optimal.

Analyzing the Effect of the Intervention

When the sanitation loan is made available, the household's inter-temporal optimization problem can be written as:

$$\underset{\{c_1,c_2,e_1,d_1,b_1,b_2\}}{max} v(c_1) - \kappa_e b_1(1-e_1) - \kappa_d b_2(1-d_1) + \beta v(c_2) + \beta d_1 m \tag{20}$$

subject to

$$c_1 + p_e e_1 + p_d d_1 \leq y_1 + b_1 + b_2 + s e_1 \tag{21}$$

$$c_2 + (1+r_1)b_1 + (1+r_2)b_2 \leq y_2 + s e_1 \tag{22}$$

$$0 \leq b_1 \leq b_1^{max} \tag{23}$$

$$0 \leq b_2 \leq b_2^{max} \tag{24}$$

At the optimum, the budget constraint will bind in each period. Using this, we can substitute for c_1 and c_2 in the objective function to obtain the following more simplified problem.

$$\underset{\{e_1,d_1,b_1,b_2\}}{max} v(y_1 + b_1 + b_2 - p_d d_1 - (p_e - s)e_1) - \kappa_e b_1(1-e_1) - \kappa_d b_2(1-d_1)$$
$$+\beta v(y_2 + s e_1 - (1+r_1)b_1 - (1+r_2)b_2) + \beta d_1 m$$

subject to

$$0 \leq b_1 \leq b_1^{max}$$

$$0 \leq b_2 \leq b_2^{max}$$

The associated Lagrangian is:

$$L = v(y_1 + b_1 + b_2 - p_d d_1 - (p_e - s)e_1) - \kappa_e b_1(1 - e_1) - \kappa_d b_2(1 - d_1)$$
$$+\beta v(y_2 + se_1 - (1 + r_1)b_1 - (1 + r_2)b_2) + \beta d_1 m - \lambda_1(-b_1) - \lambda_2(b_1 - b_1^{max})$$
$$-\lambda_3(-b_2) - \lambda_4(b_2 - b_2^{max})$$

The first order conditions are:

$b_1: \ v'(c_1) - \kappa_e(1 - e_1) - \beta(1 + r_1)v'(c_2) + \lambda_1 - \lambda_2 = 0$

$b_2: \ v'(c_1) - \kappa_d(1 - d_1) - \beta(1 + r_2)v'(c_2) + \lambda_3 - \lambda_4 = 0$

$e_1: \ -(c_e - s)v'(c_1) + \kappa_e b_1 + \beta s v'(c_2) = 0$

$d_1: \ -c_d v'(c_1) + \kappa_d b_2 + \beta m = 0$

Examining the first order condition for the sanitation loan, b_2, we can see that the label and interest rate both affect the loan take-up decision. As with the business loan, we can show that $\frac{db_2}{d\kappa_d} < 0$ if $d_1 = 0$, which implies that the label effect discourages households from taking a sanitation loan if they do not intend to use it for sanitation purposes. Moreover, the extent to which the household is discouraged depends on the value of κ_d, the strength of the label effect. The higher the value of κ_d, the lower the amount of b_2 taken if it is to be used for some other purpose than sanitation. Thus, the label discourages sanitation loan take-up by those who don't want to invest in sanitation.

In order to assess the effect of the interest rate, we need to consider both the direct effect of the interest rate on borrowing the sanitation loan; and indirect effects that operate through substitution effects with the other business loan.

The direct effect of the interest rate can be assessed by calculating $\frac{db_2}{dr_2} = \frac{\beta v'(c_2)}{v''(c_1) + \beta(1 + r)^2 v''(c_2)} < 0$

Thus, a household will borrow less as the interest rate rises. We next consider the indirect effect through substitution with other credit sources. First, consider how household choices are affected when the new loan is introduced, $r_2 < r_1$, and the label associated with the loan doesn't matter.

Combining the first order conditions related to b_1 and b_2 yields:

$$\beta(1 + r_1)v'(c_2) - \lambda_1 + \lambda_2 = \beta(1 + r_2)v'(c_2) - \lambda_3 + \lambda_4$$

Re-arranging, we get the following

$$\beta v'(c_2)[r_1 - r_2] = \lambda_4 - \lambda_3 + \lambda_1 - \lambda_2$$

Notice that only one of λ_1 or λ_2 can be positive at any one time; and similarly for λ_3 and λ_4. When $r_1 > r_2$, we can show that the optimal solution for the household would be to first borrow b_2 to the limit b_2^{max}, and then only borrow loan of type b_1.

The proof for this proceeds as follows. When $0 < b_2 < b_2^{max}$ and $b_1 = 0$, the equation F becomes $\beta v'(c_{n2})[r_1 - r_2] = \lambda_1$ Both sides of the equation are positive, and so there can be a value of b_2 in the permitted range such that this condition holds. Thus a positive value of b_2 before the borrowing limit hits and a non-zero value of b_1 is optimal.

Similarly, borrowing to the maximum limit for b_2 and borrowing none of b_1 will be optimal since the equation F will be $\beta v'(c_2)[r_1 - r_2] = \lambda_1 + \lambda_4$. Again both sides of the equation are positive, making this a feasible optimal solution.

Can a positive value for b_1 and a zero value for b_2 be optimal? No, since F will be $\beta v'(c_2)[r_1 - r_2] = -\lambda_3$. The left hand side will be positive, but the right hand side will be negative. Thus this is not a feasible solution. Finally, we can show that the maximum value of b_2 and a positive value of b_1 is a feasible optimal solution since F will be $\beta v'(c_{n2})[r_1 - r_2] = \lambda_4$, so both sides of the equation are positive.

The optimal borrowing solution when households can borrow different types of loans with different interest rates, and when the label attached to a loan doesn't matter will be such that a household first borrows from the cheapest source, and borrows from the next cheapest source once the first source is maxed out. Thus, keeping overall borrowing constant, the introduction of a cheaper source of credit should lead to households substituting away from more expensive sources of credit towards the new cheaper source.

However, this type of substitution is dampened when the label matters. Now, the intended investment choice will also influence which loans are taken. Combining the two first order conditions, we obtain

$$\beta v'(c_2)[r_1 - r_2] - \kappa_e(1 - e_1) - \kappa_d(1 - d_1) = \lambda_4 - \lambda_3 + \lambda_1 - \lambda_2$$

Consider a household that wants to take a (cheaper) sanitation loan for a business investment, or to consume it. In this case, $b_2 > 0$ and $b_1 = 0$. The condition above simplifies to

$$\beta v'(c_2)[r_1 - r_2] - \kappa_d = \lambda_1$$

which will not hold if $\kappa_d > \beta v'(c_2)[r_1 - r_2]$.

Thus, the analysis thus far yields the following predictions:

1. Both the label, and the lower interest rate will induce the uptake of sanitation loans.
2. The lower interest rate will not necessarily induce uptake of sanitation loans for sanitation investment only. When the label attached to the loan doesn't matter, it is optimal for the household to switch from the more expensive business loan to the sanitation loan without necessarily changing its investment/expenditure choices. However, this substitution effect is muted when the label matters, decreasing with the size of κ_d.

Next, we consider how the decision to invest in a toilet is affected by the introduction of the sanitation loan. Households that were going to invest in both goods in the absence of the intervention will continue to do so. We will thus focus on the households who couldn't borrow enough to fund both investments.

Recall that in the absence of a sanitation loan, a household would invest in sanitation rather than the business investment if $\beta m - c_d v'(c_{n1}) > \kappa_e b_1 + \beta s v'(c_{n2}) - (c_e - s)v'(c_{n1})$.

The sanitation loan allows households that could afford to borrow more (i.e. for whom the borrowing constraint was binding, or for whom the label effect was binding) and wanted to invest in sanitation (so for whom the net benefits from investing in sanitation were positive) to increase their borrowing and invest in a toilet. For these households, we would expect overall borrowing to increase, and the toilet to be constructed.

There will also be households whose inter-temporal budget constraint doesn't allow them to borrow enough to make both investments, even if the net benefit from each investment was positive. The presence of the sanitation loan alters the condition for building a toilet over the business investment to the following:

$$\beta m - c_d v'(c_{n1}) + \kappa_d b_2 > \kappa_e b_1 + \beta s v'(c_{n2}) - (c_e - s)v'(c_{n1})$$

The household will switch to a sanitation investment rather than a business investment if $\beta m - c_d v'(c_{n1}) - \beta s v'(c_{n2}) - (c_e - s)v'(c_{n1}) > \kappa_e b_1 - \kappa_d b_2$. Thus, take up of the sanitation loan (when available) allows households for whom the difference in net benefits from sanitation investments relative to business investments between $\kappa_e b_1$ and $\kappa_e b_1 - \kappa_d b_2$ to now invest in sanitation.

Finally, some households for whom $\beta m - c_d v'(c_{n1}) < 0$ and $\beta s v'(c_{n2}) - (c_e - s)v'(c_{n1}) < 0$; and $\beta m - c_d v'(c_{n1}) + \kappa_d b_2 > 0$ and/or $\kappa_e b_1 + \beta s v'(c_{n2}) - (c_e - s)v'(c_{n1}) > 0$ might be induced to make a sanitation and/or business investment if they want the loan for some other purpose by the label effect. Thus, the label effect could also lead to inefficient investment.