Access to Microfinance, Female Empowerment and Fertility in Urban India

PRELIMINARY AND INCOMPLETE VERSION - NOT FOR CIRCULATION*

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Abstract

Access to microfinance credit can reduce the female client's fertility by (1) increasing women's empowerment and decision-making power within the household, (2) increasing female labor force participation and (3) simply increasing household income. To date there has been little rigorous empirical investigation of the causal effect of access to credit on childbearing. Exploiting quasi-random variation in transaction costs of accessing credit, this study provides empirical evidence on the long-run effects of access to credit on fertility. The results provide rigorous evidence that access to microfinance increased rates of female labor force participation and women's share of household income, though it had negligible impact on total household income. This increased female labor force participation and female household earnings shares are associated with reductions in fertility. Given that access to microcredit in this setting did not significantly alter household income, we can infer that the fertility change operates through one of two distinct theories of change: Fertility reductions are either brought about by women's increased labor force participation, or fertility reductions are brought about by increases in women's bargaining power within the household.

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1 Introduction

The past two decades have witnessed a rapid increase in the availability of microfinance banking services to female entrepreneurs throughout the developing world. By increasing women's empowerment and decision-making power within the household, increasing female labor force participation, or simply increasing household income, access to credit provided through microfinance institutions (MFIs) has the potential to reduce fertility. Yet to date there has been little rigorous empirical investigation of the causal effect of credit access on childbearing. Although there is a burgeoning literature on the impact of microfinance on household poverty and entrepreneurial activity, none of these evaluations have focused on the impact of credit access on demographic outcomes, largely because fertility is challenging to investigate with experimental methods since it may take very long to respond to changes in credit access. Yet the impact of microfinance on fertility is a particularly relevant question in light of recent evidence from two separate studies that microfinance increases female decision-making power in the household, which has long been hypothesized to play an important role in reducing fertility (Ashraf et al. 2010 and Bali et al. 2012).

This study evaluates the long-run impact of access to credit provided by one of the first microfinance institutions in the world, the Self-Employed Women's Association (SEWA) Bank of India. We track a sample of 3,000 SEWA Bank borrowers over a decade (1999-2009), and make use of quasi-experimental variation in the transaction cost of taking out a loan to predict the total amount of borrowing each client undertook over this period. This setting presents a unique opportunity to learn about the influence of financial access on fertility and contraception for several reasons. First, Ahmedabad is one of the few settings in which it is possible to investigate the long-run influence of access to credit since SEWA Bank is one of the only banks that have been offering micro-loans for several decades. Second, the availability of administrative data on locations and lending histories of clients over more than a decade present a rare opportunity to apply a rigorous empirical method to evaluate the impact of access to credit on fertility.

The intuition behind the empirical strategy is straightforward. Lending technologies of microfinance institutions frequently rely on collection officers, who are required to collect loan repayment installments from clients' homes on a weekly basis and receive a commission per client loan, to screen and recruit clients for new loans (Ashraf et al., 2006). This gives rise to quasi-random variation in clients' access to credit based on small-scale variation across clients in their physical distance to loan officers, which varies over time and space. In our setting, we measure this distance precisely with detailed geographic data on the location of all clients and loan officers over the decade, which varied due to the entry and exit of loan officers and residential mobility of both clients and loan officers.

We will show that small-scale variation in a client's distance to a collection officer strongly influences

her likelihood of borrowing and similarly her total amount of borrowing over the decade. We also verify that, within an 800 square meters geographic unit, differences in distance to loan officers do not predict pre-existing differences across clients in demographic or socio-economic indicators, which indicates that variation in distance to loan officer within the unit is a valid instrument for access to banking services. Therefore, within the 800 square meters unit, we can use this variation in distance to evaluate the impact of a greater access to formal financial services on different socio-economic and demographich indicators.

The results provide rigorous evidence that access to microfinance increased rates of female labor force participation and women's share of household income, though it had negligible impact on total household income. Moreover, changes in female labor force participation and household earnings shares following microfinance access are also associated with reductions in fertility. Given that access to microcredit in this setting did not significantly alter household income, we can safely infer that fertility change operates through one of two distinct theories of change: Fertility reductions are either brought about by women's increased labor force participation, or fertility reductions are brought about by increases in women's bargaining power within the household.

The remaining of the paper is organized as follows: Section 2 will describe the background of our empirical research. In particular, it will describe the expansion strategy of SEWA Bank India that allows us to indetify the long term impact of access to microfinance on different socio-economic and demographic outcomes. Section 3 will review relevant previous literature to understand the relationship between access to microfinance and fertility. Section 4 will explain the source of data we used in this project. Section 5 will explain the empirical strategy that exploits small-sacale variation in distance among clients and loan collection officers. Section 6 will describe the results. Finally, Section 7 concludes.

2 Background

2.1 Setting

Our sampling area is limited to the city of Ahmedabad which is located in Western Indian state of Gujarat. Therefore, our population of interest will be always located in urban areas. Ahmedabad is India's fifth most populous city, with approximately 5.6 million inhabitants (Census of India, 2011). [1]. The incidence of poverty in Gujarat has generally been less than that of the country, both in rural and urban areas. An interesting fact is that the incidence of poverty has always been higer in urban than in rural areas (Bhatt, 2003). While the incidence of poverty was 15.6% in urban areas for the year 1999-2000, the incidence of

[1] The metropolitan Area of Ahmendabad, that includes adjacent cities, has a population of 6.3 millions and it is the seventh largest metropolitan area of india.

poverty in rural areas was 13.2%. (Ahmedabad Municipal Corporation, 2006).

The city population is 85% Hindu and 11% Muslim (Indian Census 2001), and religion remains an important determinant of economic activity, particularly among the poor employed in the informal sector. Although Gujarat is one of the most economically developed states in India, it has until very recently had one of the highest fertility levels of all states in India. According to the Census Commission of India, the total fertility rate (TFR) for women age 15-49 in urban Gujarat in 2000 was 2.3 , and it declined gradually to 2.0 by 2010. For rural Gujarat, the TFR goes from 3.2 to 2.7 in the same period. (SRS Report, 2012)[2]. In 2010, Gujarat was ranked 12th, out of 20 states in India, with respect to the smallest TFR.

2.2 Expansion of Microfinance in Ahmedabad

Our Microfinance Institution (MFI) partner, Shri Mahil Self Employed Women's Association Sahkari Bank (SEWA Bank), is arguably the oldest MFI in the world as it was established in 1974 in Ahmedabad[3]. While many commercial banks operate in Ahmedabad, SEWA Bank was the main source of formal sector finance for the urban poor at the onset of the expansion (Chen and Snodgrass, 2001). It exclusively serves poor women working in the informal sector, and remained relatively small until a rapid expansion beginning in the late 1990s. During this period SEWA Bank has sought aggressively to expand its client base and, in particular, to increase the ratio of borrowers to savers. A major aspect of SEWA Bank's expansion strategy is its emphasis on *doorstep banking* and its system of loan collection officers (called *loan officers* or *Saathis*). Loan officers are SEWA Bank clients who recruit new clients and collect door-to-door loan repayments and savings deposits on a weekly or daily basis.

The Bank has several loan and savings products: its most common loan products have an installment due every month while the most common saving products have no required installments. In 2000, SEWA Bank introduced *daily* loan and savings products - the installments for which are intended to be collected on a daily basis. Daily loans and the Saathi expansion were complementary in that many clients were unable to travel to a bank branch at such high frequency to deposit their payments, but Saathis could collect and deposit their payments.

In 2000, SEWA Bank formalized a system of loan officers by starting to pay these officers. The bank incentivizes loan officers to move their clients quickly into borrowing: they are paid entirely through commission on collections for loans and certain savings products. They receive the highest commission, 3%, for loan repayments, 1% for some illiquid savings products, and no commission for the most common savings accounts.

[2]For the state as a whole, the TFR goes from 2.9 in 2000 to 2.5 in 2010.

[3]Grameen Bank which is often referred to as the first MFI was started in the village of Jobra, Bangladesh, in 1976 (http://www.mixmarket.org/mfi/sewa-bank vs. http://www.mixmarket.org/mfi/grameen-bank)

By 2005, SEWA Bank had 291,535 open deposit accounts among exclusively female clients and the loans/deposits ratio was 0.23. The latter indicator has followed an increasing trend and by year 2009, SEWA Bank had 328,363 deposit accounts and the loans/deposits ratio increased up to 0.35. This change reflects the SEWA Bank policy expansion. On one hand, there are more clients and on the other hand, the number of loans increases more than the deposit accounts. According to SEWA Bank, by the year 2009, the bank had US $9.9 million in outstanding loans (SEWA Bank Report, 2012). SEWA's gross loan portfolio to total asset ratio of 32.7% placed it much lower than the the median Indian MFI (83%) and its portfolio at risk of 17.5% (defined as payments outstanding in excess of 30 days) far exceeds that of the median Indian MFI (0.53%) (MIX Market, 2013).

In Ahmedabad, the cumulative number of loan officers more than quadrupled from about 25 to over 110 between 1999 and 2007 (Figure 1). This expansion was on both the intensive margin - more loan officers for a given area - (Figure 2) and on the extensive margin, with loan officers beginning to work in areas that previously had none (Figure 3). The variation in the proximity of loan officers to clients comes primarily from the introduction of new loan officers, the exit of loan officers, client residential mobility, and the occasional relocation of a loan officer.

Loan officers - maximizing their own income - have an incentive to recruit clients close to their own residence in order to minimize transactions costs which could arise due to direct transportation costs, the travel time's opportunity cost or the relatively higher cost of client recruitment outside of the local social network. SEWA Bank's loans and savings/checking accounts are high-frequency products which should amplify the transactions and time costs. Thus, all else equal, one would expect proximity to a loan officer to increase the likelihood of borrowing and savings, particularly for high-frequency products because utility maximizing loan officers have incentives to operate locally. This hypothesis is supported by the fact that we observe that loan officers typically collect loan payments and saving deposits in the area they live in.

3 Microfinance and Fertility

There are alternative mechanisms through which access to credit and savings could impact fertility patterns among clients: First, by enabling investment in profitable enterprises, access to SEWA Bank loans may have increased household income, and thereby it may alter the household's demand for children. If children are considered normal goods, an *income effect* must increase the demand for children or child quality (Becker, 1974). If the preferences of the household prioritize the quantity of children, we must expect chilbearing to increase. Nonetheless, if household preferences prioritze the quality of children, we must not expect an increase in childbearing. Instead, we must expect a greater investment in education and health of the

children. As a consequence, the income effect on fertility must be greater or equal than zero.

Second, since SEWA Bank has almost exclusively targeted low-income women within Ahmedadad, we can expect an impact on *intra-household bargaining power.* Microloans and savings may have enable female entrepreneurs to start or expand microenterprises and thereby increase female labor force participation. In doing so, or simply by giving them greater control over household debt, they may have increased intra-household bargaining power, which could make women to attain greater control over fertility. The impact of a greater women empowerment on fertility depends on the female preferences. There is previous evidence that women value child quality higher than men[4]. Under this premise, women with greater decision-making power will choose to have less kids and they will invest more on those kids.

Finally, access to credit might increase female *labor force participation.*On one hand, access to credit allows to open a greater number of micro-enterprises and the existing ones could take advantage of profitable investments and they can grow. Therefroe, access to finance increases opportunites for female employment. On the other hand, an increase in women empowerement can reduce a common cultural friction that prevent women of participating in the labor market. Thereby, we must expect an increase in the proportion of salaried women. In either case, access to microfinance services could increase the value of woman's time. As a consequence, the opportunity cost of children will increase and the demand for children is likely to decrease. Pitt et al. (1999) develop a model to study the impact of access to credit on the demand for children. In a nutshell, the model concludes that the impact of microfinance on childbearing depends on the level of compatibility between self-employment (in more general terms, the type of job) and child rearing. When the self employment is not labor intensive (part-day job) or when the new job could be done from home, the income effect would be likely to dominate and the demad for children is likely to increase. Nonetheless, when the new employment and child rearing are incompatible, the substitution effect will be likely to dominate and the demand for children is likely to decrease.

Previous literature that evaluate the impact of microfinance on demographic outcomes is scarce. Pitt et al. (1999) estimates the impact of woman participation in group based credit programs on fertility in Bangladesh. Interestingly, the results indicate that a greater use of credit has a positive and significant impact on fertility[5]. Accordig to the authors, this result is explained by the fact that the self-employment activities forsterd by the credit programs do not necessarily raise the shadow cost of raising a child. Therefore, the income effect dominates and the demand of children increases[6]. Another relevant study is Basher (2007) who

[4]For instance, Thomas (1990) finds that income transfers that target mothers have a larger effect on famliy health in comparison to income transfers to fathers. In the context of microcredit, Pitt and Khandker (1998) find that women's credit have a large effect on the probability of children's school enrollment in comparison to men's credit.

[5]This is the case for 2 of the 3 microfinance programs analyzed by the authors.

[6]It is relevant to highlight that the authors also find a negative impact of man participation in credit programs over fertility in 2 out of the 3 analyzed microfinance programs. Nonetheless, the authors do not provide a satisfactory explanation for the latter result.

analyzes the impact of participation in the microfinance schemes of the Grameen Bank on fertility outcomes in Bangladesh. According to this research, participation in credit/saving schemes reduce the preference for male children which reduce general fertility rates. Finally, a recent paper which is a relevant antecedent of this project is Kuchler (2010). This project uses panel data to evaluates the impact of participation and access to microfinance on fertility outcomes in Bangladesh. In this paper, the author analyzes the impact of three different microfinance programs between the years 1991-1999 and he concludes the neither access or participation in microcredit programs has a significant impact on fertility. As we have seen, there is no conclusive evidence on the effect of access to financial services on fertility. The current study counts with high quality panel data that allows an empirically rigurous evaluation of the impact of microfinance on fertility. Even more, our rich data makes possible to evaluate competing underlying mechanisms.

4 Data

The main source of data is a client household survey we conducted in 2009/2010 (from here out referred to as the *household survey*). The SEWA Bank clients sample for this survey was selected on two criteria. First, in 1999 the client had a SEWA saving account but had never taken out a SEWA loan. By 2007, two thirds of these clients ended up taking out a SEWA loan. Among those who took out at least one SEWA loan, the average total loan amount was INR 34,000 and the average number of loans was 1.5 in between 1999 and 2007. Second, we also limited the sample to clients that lived in the five urban neighborhoods of Ahmedabad where SEWA Bank expanded the most between 1999 and 2007.

Following the above criteria we identified a sampling population of 3,692 respondents in 2009. 3.5% of the sampling population (128 clients) could not be surveyed due to death or physical incapability. We can confidently assume that these causes of nonresponse are not endogenous to the instrument. Another 12.6% non-response of the sampling population can be attributed to respondent refusal (67 clients) or physical non-traceability (399 respondents)[7]. Here differential or selective attrition could occur if the characteristics of the panel members who drop out of the panel because of attrition differ systematically from the characteristics of panel members who are retained in the panel. In order to establish that these non-responses are not selective, we test whether there is a systematic difference in the 1999 area of residence among the respondents and non-respondents in 1999[8]. As we can see in Table 1, 83.9% of the original sample was surveyed in 2009 and this proportion did not change in a statistical significant fashion for any of the five areas. The latter offers suggestive evidence that attrition is not selective, and therefore should not introduce bias in survey

[7] 99 of these respondents moved out from the metropolitan area of Ahmedabad between 1999 and 2009.

[8] The physical address of the non-traceable clients is based on the original address in 1999 that we got from SEWA Bank records.

estimates. Finally, out of the 3098 surveyed households, 93 (3%) were discarded in the cleaning data process. All in all, this paper will work with 81% of total relevant population (2,995 households).

The household survey provides information on household-level socioeconomic and business outcomes, and household composition. The survey also provides a retrospective history of household and client socio-economic characteristics and GPS data for all residences occupied by the clients over the decade. The surveyed households report an average per capita earning of less than a dollar a day (INR 39.2[9]) and they have in average 5.5 members. The majority of surveyed woman (SEWA's clients) are engaged in unskilled jobs (38%) while a big proportion of them do not participate in the labor force and do take care of the housework (28%).

A second round of the survey was collected in 2014. The main objetive of this survey was to collect detailed fertility history for each of the respondents in our sample. Additionally, we also collected information on respondents' education, history of contraceptive use and some proxys of current decision mking within their households. Out of 2,995 respondents in the relevant sample, we recontact 2,507 (84% of the sample of interest).

In addition to this primary data source, the study will use two complementary sources of information:

- Residence history and socio-economic information of all the individuals who have worked for SEWA bank as loan officers. This information was gathered in second survey conducted in 2009. The time-series of GPS data on client and loan officer locations of residence (1999-2007) allows us to costruct a continuous time-serie proxy of SEWA client's access to financial services. The lower distance between a client's residence and the loan officer's residence, the higher the access of this client to microfinance.

- Besides the survey information, we have secondary administrative data from SEWA, which includes savings and loan transaction records. Nonetheless, this data is clean from the year 2007 onwards. From the year 2007 onwards, we observe every transaction associated with any of the surveyed client's accounts. Along with the transactions record, the database also contains basic demographic information.

5 Empirical Strategy

Predicting borrowing with physical proximity to provider

The empirical strategy exploits the characteristics of the sudden and ambitious service expansion strategy executed by SEWA Bank from 1999 onwards. As we mentioned before, the main characteristics of this expansion was the multiplication of loan officers. Therefore, starting in 1999, the access to new financial

[9] In 2009, one dollar was equivalent to INR 47.

services (mainly credit) for current SEWA saving clients will differ based on small-scale variation across them in their physical distance to loan officers. In our setting, we measure this distance precisely with detailed GPS data on the location of all clients and loan officers over the decade, which varied over time and across the city due to the entry and exit of loan officers and residential mobility of both clients and loan officers. The idea is that SEWA clients that live close enough to a loan officer will have complete financial access, while the rest of the clients will have restricted access.

Since the location of the loan officer were not exogenously determined, we use spatial fixed effects. We divide the map of the city in homogeneus rasters within which we can argue that the access to microfinance - physical proximity among loan officers and SEWA clients - is exogenously assigend. In order to jointly determine the size of the rasters (RxR square meters) and the restricted access' threshold distance we perform an identification search process. We will consider that a SEWA bank client has complete access to credit services in some specific year if she lives in a distance of at most r meters from a loan officer for that year. We perform a seach excercise to find R and r. This exercise has two objectives: (1) To guarantee that the access to microfinance have a strong predicted power on having an active credit history (Strong first stage), and (2) to eliminate the endogeneity between the treatment (financial access in the period 1999-2007) and baseline controls characteristics. As it will be explained later, we perform an endogeneity test to show that the access to microfinance in the period 1999-2007 will be orthogonal to the characteristics of the households in 1999.

The identification search process is organized in two complimentary steps: A strong first stage and a succesful endogeneity test. The objective of this process is to set a theshold for the distance under which a SEWA client have complete access to microfinace (radius r) and a specific size for the square rasters (RxR). In order to find a strong first stage, we perform the following regression:

$$B_{jR} = X_{jR}\beta + \mu_R + Z_{jR}\pi + \varepsilon_{jR} \tag{1}$$

where B_{jR} is an indicator that client j in raster μ_R had active credit activity between 1999 and 2007, and Z_{jR} represents the number of years during the period 1999-2007 that a loan officer has lived within a radius r of the client's residence. Let be X_{jR} a vector of individual characteristics. In X_{jR}we control for the remaining individual-level pre-existing differences between treated and non-treated clients that have not been eliminated by the utilization of the spatial raster fixed effects. Along the paper, X_{jR} includes only one variable: client's religion measured as a dummy variable that takes value 1 in case the respondent is muslim. The fixed effects μ_R absorb any mean differences in unobervables within rasters. Thus we use only within area variation.

Our empirical specification considers several variables that reflect that a SEWA Bank client has an active credit history, including the total number of years with credit, the total amount of borrowing that took place over the decade, and whether or not a client ever took out a formal loan, all of which are strongly predicted by the geography-based instrumental variables. Just to recall, all the subjects in our sample are female SEWA Bank clients that had a deposit (saving) account in 1999 but who had not asked for a loan from this bank before 1999.

Complimentarily to the strong first stage, we perform an endogeneity test that guarantee that, within rasters μ_R, the variable Z_{jR} is orthogonal to the characteristics of the client in the pre-treatment period. The pre-treatment characteristics, from 1999, were recovered during the 2009 survey. Among those characteristics we include: labor partipacion in 1999, job characteristics in 1999, caste, ownership of assets and affilitiation to SEWA union.

The resulting specification in this project sets 800x800m. squares as rasters and consider that a client has complete access to microfinance whenever there is a loan officer living in a radius of at most a 350 m. We proxy access to microfinance over the period 1999-2007 as the number of years any Saathi has lived within a 350 meter radius of the client's residence. Hereafter, we will refer to the instrument simply as *Years Saathi (in 350m) radius.*

The identifying assumption is that, while the MFI may have targeted specific areas of Ahmedabad during its expansion, the location of a client's home relative to her collection officer's home within a geographic unit is uncorrelated with credit demand, credit-worthiness, or other factors that might be related to credit access. While SEWA can choose to have more loan officers in areas in which more subjects demand credit, we argue that within each 800x800m area the location of the loan officers is not correlated with credit related charactersitics of the client.

The impact of exogenous access to microfinance

Once we show that within rasters (μ_R), our measure of access to microfinance (Z_{jR}) is orthogonal to pre-existing characteristics, we can use the same equation to estimate the impact that a greater access to microfinance have on different socio-economic/demographic outcome variables (Y_{jR}). We do not employ a two-stage regression model here because we cannot fully isolate client borrowing from savings activities because we only have reliable data available on client borrowing and not on savings.

Let Y_{jR} represents a socio-economic/outcome variable of client j in area R, and let Z_{jR} be the number of years during the period 1999-2007 that a loan officer has lived within a radius r of the client's residence. Then, we can find the impact of access to microfinance (Z_{jR}) on Y_{jR} using the following specification:

$$Y_{jR} = X_{jR}\beta + \mu_R + Z_{jR}\pi + \varepsilon_{jR} \tag{2}$$

We compare the outcomes of those who have a loan officer in their radius to the ones that do not. If having a loan officer in one's radius is unrelated to outcomes except through the likelihood of getting a loan, this will rigorously estimate the impact of getting a formal loan on the outcomes of interest. The set of dependent variables includes fertiliy outcomes, labor force participation, household income and female share income within the household. This will be explained in greater detail in Section 6. It is important to notice that equation 2 should be implemented with cross-section data. In this specification, the dependent variable Y_{jR} corresponds to the outcome of interest in the year 2009 while Z_{jR} is the number of years during the period 1999-2007 that a loan officer has lived within a radius r from the client's residence.

As a complement to the cross-section regressions, and when the data allow us to do it, we estimate the following panel specification:

$$Y_{jRt} = X_{jR}\beta + \mu_x + D_{jRt}\pi + \varepsilon_{jRt} \tag{3}$$

where Y_{jRt} corresponds to the outcome of interest for client j in raste R at year t, and D_{jRt} is a dummy variable that takes value 1 when the client j at raster R lives in a distance of at most 350m from a loan collection officer. In this specification we will consider two different sets of fixed effects: Raster fixed effects (μ_R) and individual fixed effects (μ_j).

6 Results

6.1 Results from the identification search process: First Stage and Endogeneity Test

In the first stage regressions (Table 2), all outcome variables related to borrowing were collected during the 2009 household survey in an extensive loan history section. As mentioned above, while many commercial banks operate in Ahmedabad, SEWA Bank was the main source of formal sector finance for the urban poor at the onset of the panel. However, informal services - such as money lender loans - are available to the urban poor. In order to eliminate bias introduced by systematic substitution between SEWA loans and loans from other providers, all variables related to borrowing consolidate the information from SEWA Bank and non-SEWA Bank loans. For instance, the loan amount consider in Table 2 is the sum of all loan principals between 1999 and 2007 independent of the source of the loan. Within the 800x800 m^2 fixed effects raster,

the density of access to SEWA Bank and non-SEWA bank loans is most likely independent of each other, and therefore we can interpret the instrument's impact as SEWA's marginal impact availability of loans.

The preferred specification includes 800x800 m^2 rasters fixed effects and set the total number of years that a client has lived to a distance of at most 350m from a loan officer as the financial access treatment variable. As we can see in Table 2 - Section B, the treatment variable predicts a strong credit activity. In particular, if we increase the variable years saathi in 350m radius in one year, the total loan amount will increase in 24.4% over the period 1999-2007. Even more, for the clients that have never asked for a loan, an increase in one year in the treatment variable will increase the probability of getting a loan in 1.1%. Both results are statistically significant.

Additionally, taking advantage of the extensive loan and residence history, we have run a set of fixed effect panel regressions following the structure of equation 3. Every specification in the panel regresion includes indvidual fixed effects. The results of those regressions, presented in Table 2 - Section A confirm the predicted power of our measure of access to microfinance on an active credit history. According to these results, if we switch the dummy variable saathi in 350m radius from 0 to 1 along the period 1999-2007, the total loan amount will increase in 45.6% and the clients that have never asked for a loan will increase the probability of asking for a loan in 4.7%. Both results are statistically significant.

In Table 3 and 4 we show the endogeneity test results. While table 3 presents the results for the complete sample, table 4 considers just those respondents that were located during both rounds of data collection [10]. Those results verify that, within an 800 x 800 square meters geographic unit, differences in distance to loan officers do not predict pre-existing differences across clients in socio-economic indicators, which indicates that variation in distance to loan officer within each raster is a valid instrument for having an active loan history. Once we control for religion, a dummy variable that takes value 1 if respondent is muslim, access to micro-finance has not a significant effect over clients' pre-determined characteristics in 1999. Given these results, we can safely conclude that we pass the endogeneity test.

The successful endogeneity test and the robust first-stage results indicate that small-scale variation in a client's distance to a collection officer strongly influences their likelihood of borrowing and similarly their total amount of borrowing over the decade. Thus, we can use the variable years saathi in 350m as a instrument to evaluate the impact of a greater access to microfinance on household income, labor force participation and fertility outcomes.

[10] Table 4 includes some relevant variable scollected in 2014 such educational achievement measures and fertility outcomes in 1999.

6.2 The impact of financial access on fertilty

In order to identify the impact of microfinance access on fertility, we estimate both, the cross-section (equation 2) and its panel version (equation 3). While in the panel we use the number of children born and whether a new children was born at year $t+1$ during the period 1999-2007 as dependent variables, in the cross-section regression we use the number of children under born from 1999 onwards. The results of those regressions are presented in Table 5. Both sets of results, from the panel and cross-section analysis, show a negative impact of having a greater access to microfinance on fertility. Nonetheless, just the results from the panel regressions are significant. According to the panel regressions' results, if we switch the dummy variable saathi in 350m radius from 0 to 1 along the period 1999-2007, the probability of having a new children at any year between 1999-2007 is decreased by 2%. Since the probability of having a new children at any year between 1999-2007 in 4.2% in our sample, a greater access to microfinance reduces this probability in 50%.

6.3 Understanding the underlying mechanism

In this section, we explore alternative mechanisms through which a greater access to microfinance can reduce fertility. First, by increasing the household's income, a greater access to microfinance can affect the demand for new children. As we explained in Section 3, the impact of a greater income on fertility is not unambiguosly positive. On one hand, if the household income increase and the household preference prioritize children quantity over quality, we must expect a positive impact on childbearing. As we can observe in column 5 (Table 6), a greater access to microfinance does not have a significant impact on household income. Nonetheless, column 1 to 3 (Table 6) show that a greater access to microfinance increases SEWA Bank's clients income and her female household income. In the case of the respondent's income, an increase of one year in the years Saathi in 350m radius will increase the female income in 5.6%. Under the reasonable assumption that women have a greater preference for children quality than their husbands, as a consequence of a greater female income we must expect a decrease in fertility.

Second, an expansion in female access to financial services could increase women's empowerment and decision-making power within the household. On one hand, a woman with a access to financial services could manage individual resources and consequently, she could participate more actively in the intra-household expenditure's decision. This effect will be more robust in an environment in which the share of household income provided by the woman increases as a consequece of a greater access to credit. In fact, as we can see in column 2 (Table 6), the proportion of household income explained by the SEWA Bank female clients within their household will increase in 0.6% if we increase the dependent variable in one year. Therefore, if a woman had complete access to credit along the period 1999-2007, her share of household income increased

by 5.4%.

Finally, a greater access to microfinace can change childbearing choices through its effect on female labor force participation. As we can see in column 1 (Table 7), one more year of access to microfinance increases the labor force participation in 1.5% among the (female) clients of SEWA bank. We explore the change in labor force participation in greater detail in Table 7. In this table, we show that a greater access to credit reduces the probabilty that a woman just take care of the housework (-1.5%) and it increases the labor participation mainly in skilled jobs (+0.6%). Therefore, woman's value of time will increase and the demand for children could decrease (a substitution effect).

7 Conclusion

Along the past two decades there has been a rapid increase in the availability of financial services to low-income households in developing countries. This boom has been accompanied from a vast theoretical and empirical research on the consequence of a greater access to microfinance. Previous literature has shown that microfinance could favor entrepreneurship businesses, it could expand the labor market opportunities and in the case of women access to credit, it allows them to participate more actively in the management of household's resources. In fact, by increasing women decision making power, labor force paticipation or simply by increasing household income, access to credit provided through microfinance institutions can impact fertility in developing countries. Yet to date there has been little rogurous empirical investigaction of the causal effect of credit access on fertility.

In this study, we evaluate the long run impacts of credit access by one of the first micro-finance institutions in the world, the Self-Employed Women's Association (SEWA) Bank of India. We track a sample of 2995 SEWA Bank borrowers over a decade (1999-2007), and make use of quasi-experimental variation in the transaction cost of taking out a loan to construct a convenient measure of access to credit. We show that this measure, the number of years a client lives in a distance of at most 350m from a loan collection office, explained strongly the credit activity during the period 1999-2007 and it is not correlated with pre-determined socio-economic characteristics.

As a consequence of the successful endogeneity test and robust first stage, we can safely use our access to credit measure to estimate its causal long term impact on different socio-economic and demographic outcomes. If we give complete access to credit to a woman along the period 1999-2007, the probability of having a new children is decreased by 2%. Since the probability of having a new children at any year between 1999-2007 is 4.2% in our sample, a greater access to microfinance reduces this probability in 50%. Additionally, we have explored potential mechanisms that can explain the reduction in fertility. We have

found evidence of alternative mechanisms that can reduce fertility in this environment. On one hand, we have found that a greater credit access increases female labor force participation and therefore, it increases the opportunity cost of child bearing. On the other hand, we have also found that female household earnings share increases while the level of household income has not been impacted. As a consequence, it is expected that the women decision-making power within the household could increase. Under the reasonable assumption that women prioritize quality children instead of quantity of children, the latter could be the reason why fertility has decreased.

The results provide novel empirical evidence on the long-run effects of access to credit. Furthermore, by studying the role of female labor market participation and earnings power within the household on reproductive outcomes, we can gain insight as to whether social or labor market interventions – including but not limited to microfinance – enable individuals and households to achieve their desired reproductive and economic outcomes. By documenting changes in household decision-making that are likely to accompany changes in female earnings share, we will also be able to speak to behavioral impacts of microfinance through which reductions in fertility can be anticipated. Finally, the approach presents a novel means of gathering rigorous empirical evidence on the long-run effects of access to credit.

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9 Figures

Figure 1: Saathi Expansion over time – Number of Saathis on commission per year

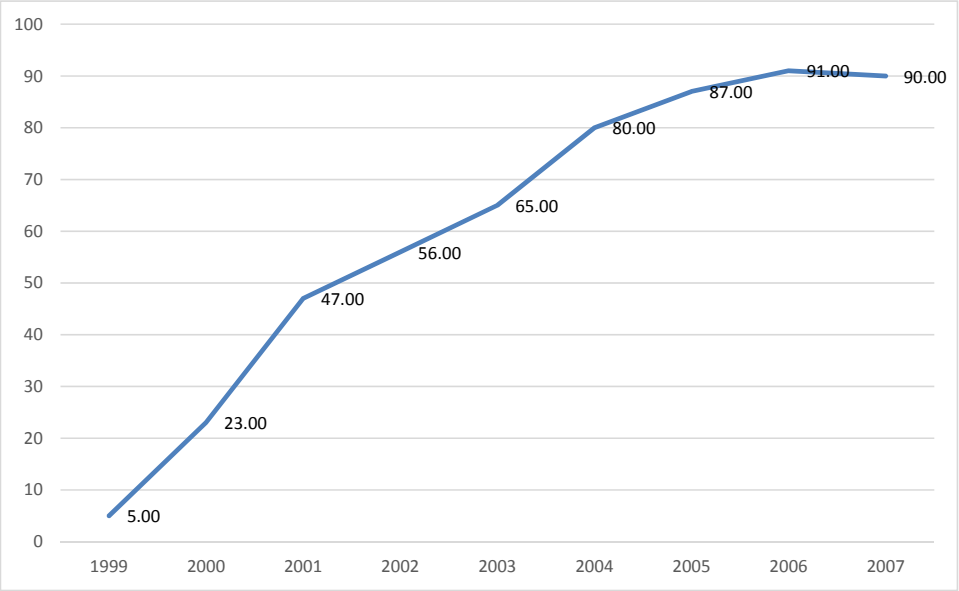


Figure 2: Probability of Saathi 350 meters around client residency over time

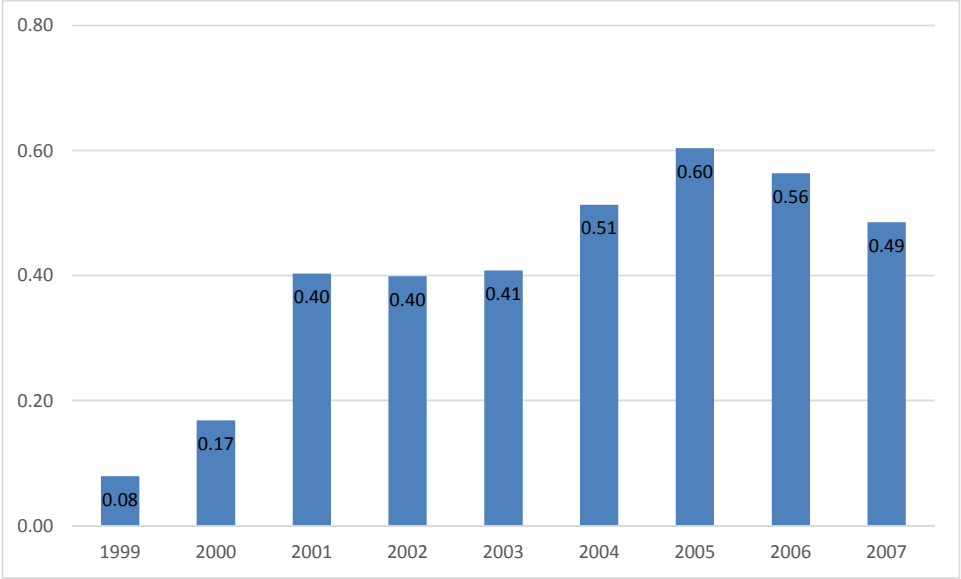


Figure 3: Density of Saathis 350 meters around client residency over time

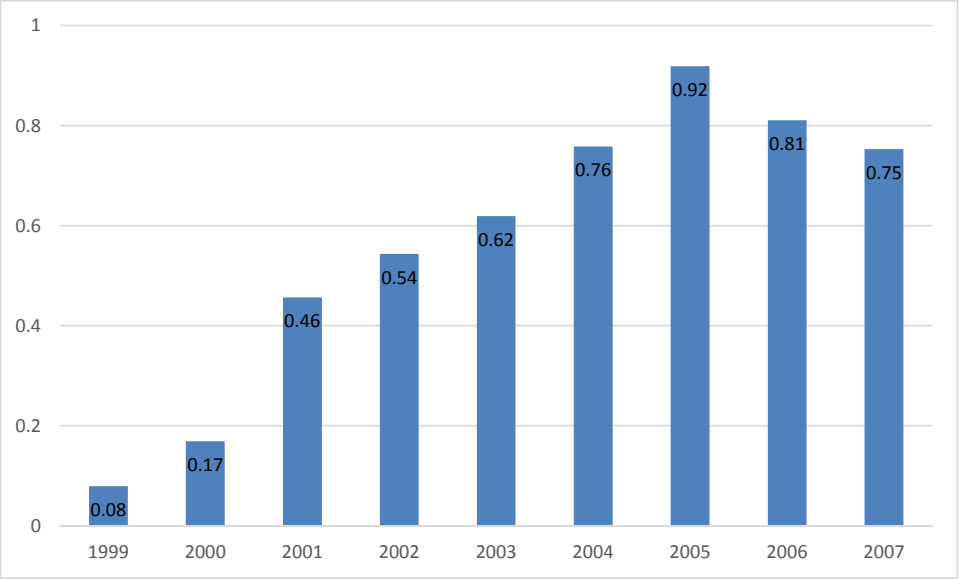


Figure 4: Original client sample in 1999 by Area

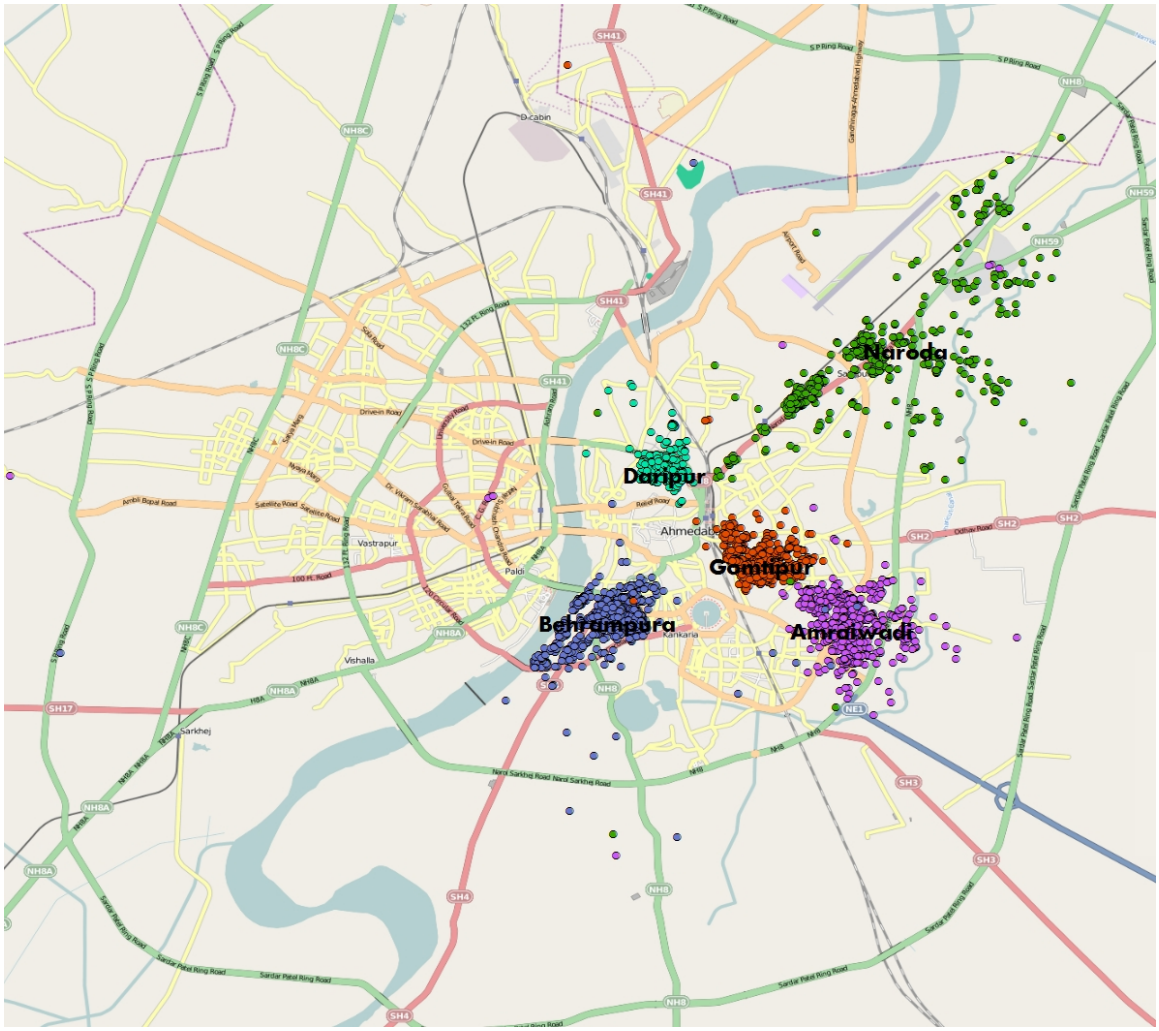
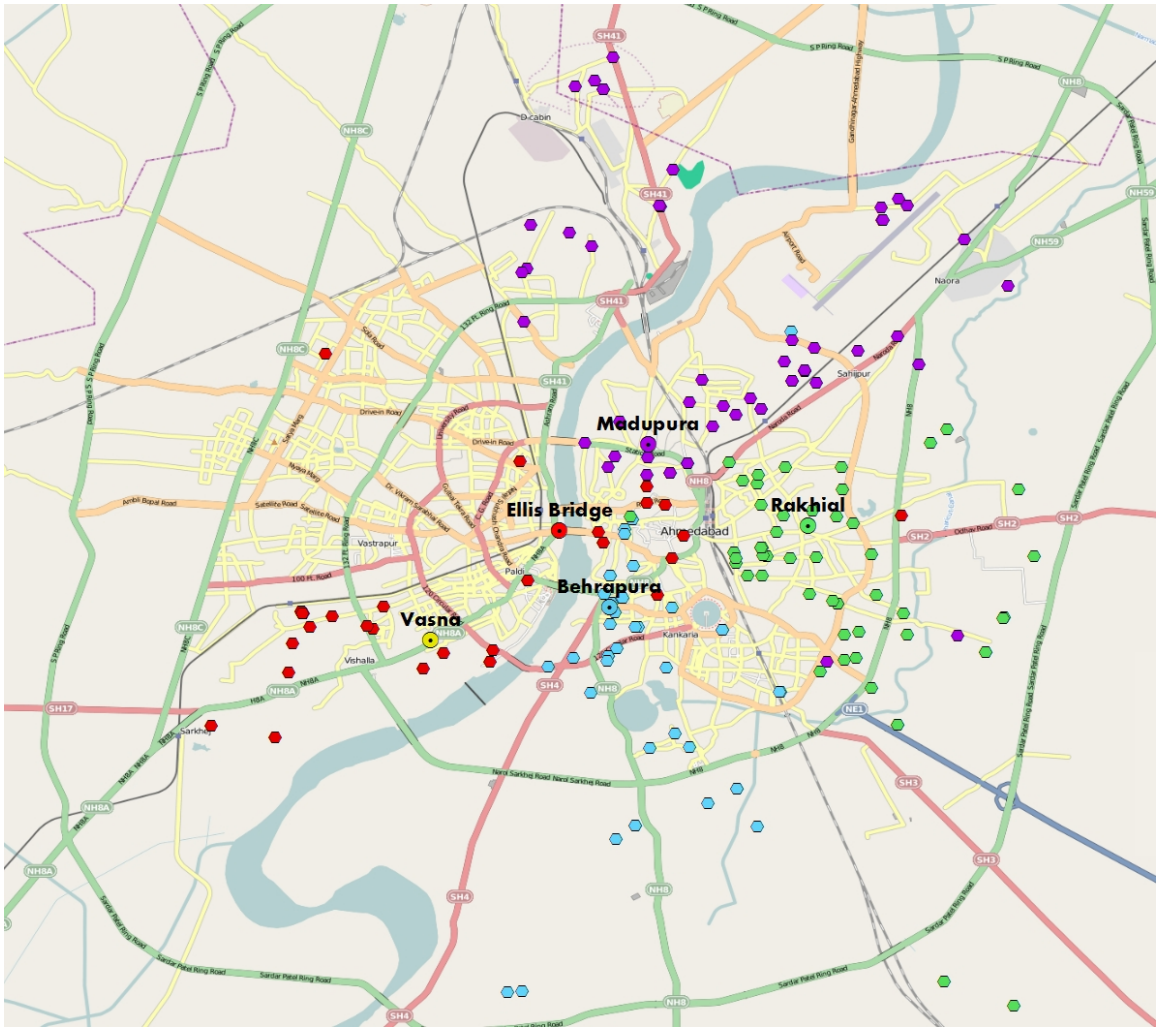


Figure 5: Cumulative Saathi positions in 2007



10 Tables

10.1 Attrition is not correlated with area of residence in 1999

Table 1: Attrition is not related to Area of Addresses in 1999

	D1: Participated in the Survey	D2: Used in the paper
	(1)	(2)
Area 2	-0.69	0.45
	(1.69)	(1.79)
Area 3	2.80	4.37*
	(2.22)	(2.35)
Area 4	2.85	3.19
	(1.92)	(2.03)
Area 5	2.76	2.45
	(2.10)	(2.22)
Constant	82.84***	79.89***
	(1.35)	(1.42)
Observations	3692	3692
Mean	83.88	81.39

Standard errors in parentheses with * indicating significance at 10%, ** at 5%, and *** at 1%. All reported standard error use the robust or sandwich estimator of variance.

10.2 First Stage in Panel and Cross-section

Table 2: First stage (1999-2007)

	Total loan amount (ln)	Loan dummy	Total loan count	Years with loan	Years since first loan
	(1)	(2)	(3)	(4)	(5)
	A: Panel				
Saathi in 350m radius	0.456***	0.047***	0.054***		
	(0.051)	(0.005)	(0.007)		
Observations	26955	26955	26955		
Mean	1.09	0.11	0.13		
Fixed Effects	individual	individual	individual		
Controls	yes	yes	yes		
	B: Cross-section				
Years Saathi in 350m radius	0.244**	0.011***	0.029**	0.026**	0.059**
	(0.106)	(0.004)	(0.013)	(0.011)	(0.024)
Observations	2995	2995	2995	2995	2995
Mean	12.13	0.61	1.47	1.27	2.58

Standard errors in parentheses with * indicating significance at 10%, ** at 5%, and *** at 1%. All reported standard error use the robust or sandwich estimator of variance. The inclusion of demographic controls and fixed effects (individual or 800x800m^2 spatial raster fixed effects) is indicated by in the table.

10.3 Endogeneity Test in cross-section

Table 3: Endogeneity Test - 1st Round Sample

	Years Saathi in 350m radius			
	(1)	(2)	Mean	N
	b/se	b/se	mean	N
Respondent age	0.093	0.069	42.27	2995
	(0.085)	(0.086)		
House owner upon joining SEWA	-0.001	-0.001	0.74	2995
	(0.003)	(0.003)		
Owned TV Color in 1999	0.004	0.001	0.24	2995
	(0.003)	(0.003)		
Owned Two Wheeler in 1999	-0.000	-0.001	0.06	2995
	(0.002)	(0.002)		
Government caste classification - SC and ST	0.015***	-0.004	0.52	2990
	(0.004)	(0.003)		
Government caste classification - OBC	-0.009***	-0.000	0.08	2990
	(0.002)	(0.002)		
Fixed Effects	Raster 800^2	Raster 800^2		
Controls	No	Religion		

Standard errors in parentheses with * indicating significance at 10%, ** at 5%, and *** at 1%. All reported standard error use the robust or sandwich estimator of variance.

Table 4: Endogeneity Test - 2nd Round Sample

	Years Saathi in 350m radius			
	(1)	(2)	Mean	N
	b/se	b/se	mean	N
Respondent age	-0.014	-0.025	42.03	2507
	(0.090)	(0.091)		
House owner upon joining SEWA	0.001	0.000	0.74	2507
	(0.004)	(0.004)		
Owned TV Color in 1999	0.002	-0.001	0.25	2507
	(0.004)	(0.004)		
Owned Two Wheeler in 1999	0.000	-0.000	0.06	2507
	(0.002)	(0.002)		
Government caste classification - SC and ST	0.015***	-0.002	0.53	2502
	(0.004)	(0.004)		
Government caste classification - OBC	-0.009***	-0.001	0.07	2502
	(0.002)	(0.002)		
Have at least one children 1999	0.004	0.004	0.87	2507
	(0.003)	(0.003)		
Number of children 1999	0.014	0.022	3.05	2507
	(0.018)	(0.018)		
Primary School Complete	-0.004	-0.007	0.49	2507
	(0.004)	(0.004)		
Middle School Complete	-0.004	-0.007	0.49	2507
	(0.004)	(0.004)		
Secondary School Complete	0.000	-0.002	0.17	2507
	(0.003)	(0.003)		
Fixed Effects	Raster 800^2	Raster 800^2		
Controls	No	Religion		

Standard errors in parentheses with * indicating significance at 10%, ** at 5%, and *** at 1%. All reported standard error use the robust or sandwich estimator of variance.

10.4 Cross-section and Panel results

Table 5: Fertility in cross-section and panel

	Cross-section		Panel	
	N. children under 10 (2009 data)	N. children under 15 (2014 data)	Children born in year t (2014 data)	Children born in year t+1 (2014 data)
	(1)	(2)	(3)	(4)
Years Saathi in 350m radius	-0.008	-0.004		
	(0.007)	(0.008)		
Saathi in 350m radius at year t			-0.020***	-0.020***
			(0.004)	(0.004)
Observations	2995	2507	22563	22563
Mean	0.44	0.47	0.049	0.042
Fixed Effects	raster	raster	individual	individual
Controls	yes	yes	no	no

Standard errors in parentheses with * indicating significance at 10%, ** at 5%, and *** at 1%. All reported standard error use the robust or sandwich estimator of variance. Demographic controls ("household is muslim") and 800x800m^2 spatial raster fixed effects are included in all specifications.

Table 6: Female and Household Income in cross-section

	Respondent		Female household members		Household
	Income (ln)	Respondent fraction of household income	Income (ln)	Female fraction of household income	Income (ln)
	(1)	(2)	(3)	(4)	(5)
Years Saathi in 350m radius	0.070**	0.006***	0.056*	0.006**	-0.005
	(0.028)	(0.002)	(0.029)	(0.002)	(0.009)
Observations	2995	2995	2995	2995	2995
Mean	3.833	0.194	4.476	0.241	8.435

Standard errors in parentheses with * indicating significance at 10%, ** at 5%, and *** at 1%. All reported standard error use the robust or sandwich estimator of variance. Demographic controls ("household is muslim") and 800x800m^2 spatial raster fixed effects are included in all specifications.

Table 7: Respondent Labor Force Participation

	Respondent – Job in 2009				
	In labor force	Household Business	Unskilled labor	Skilled Labor	Housework
	(1)	(2)	(3)	(4)	(5)
Years Saathi in 350m radius	0.015***	0.002	0.004	0.006*	-0.015***
	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)
Observations	2995	2995	2995	2995	2995
Mean	0.715	0.129	0.382	0.186	0.280

Standard errors in parentheses with * indicating significance at 10%, ** at 5%, and *** at 1%. All reported standard error use the robust or sandwich estimator of variance. Demographic controls (" and "household is muslim") and 800x800m^2 spatial raster fixed effects are included in all specifications.

Table 8: Respondent Labor Force Participation

	Household Composition in 2009			
	N. of members	N. children > 10	N. female children > 10	N. male children > 10
	(1)	(2)	(3)	(4)
Years Saathi in 350m radius	-0.016	0.019*	0.012*	0.007
	(0.019)	(0.011)	(0.007)	(0.008)
Observations	2995	2995	2995	2995
Mean	5.54	1.80	0.66	1.15

Standard errors in parentheses with * indicating significance at 10%, ** at 5%, and *** at 1%. All reported standard error use the robust or sandwich estimator of variance. Demographic controls (" and "household is muslim") and 800x800m^2 spatial raster fixed effects are included in all specifications.

Table 9: Mean Comparison between 1st and 2nd round sample

Dependent Variable	**Found in 2nd Round**	**Not found in 2nd Round**	**P-Value of Mean T-test**
Respondent is SEWA member	0.536	0.447	0.000***
Respondent Job 10 years ago: Skilled	0.146	0.127	0.252
Respondent Job 10 years ago: Unskilled	0.31	0.29	0.50
Respondent Job 10 years ago: Self-Employed	0.13	0.17	0.024**
Respondent Job 10 years ago: Housework	0.344	0.359	0.53
Respondent Job 10 years ago: Studying	0.133	0.135	0.929
Owned TV Color in 1999	0.25	0.208	0.039**
Owned Two Wheeler in 1999	0.057	0.049	0.443
Government caste classification - SC and ST	0.533	0.469	0.010**
Government caste classification - OBC	0.073	0.107	0.024**
N	**2515**	**490**	

11 Summary Stats

Table 10: SEWA Summary Statistics from SEWA Bank Annual Report 2012 and MixMarket.org

Fiscal year	Clients	Borrowers Female	No. Loans	No. Deposits Accounts	Loans/Deposits Ratio
2004			64,326	276,684	0.23
2005	309,212	1	76,857	291,535	0.26
2006	326,141	1	91,096	304,933	0.30
2007	329,384	1	91,096	307,558	0.30
2008	340,143	1	103,679	318,594	0.33
2009	349,356	1	115,944	328,363	0.35
2010	391,932	0.9949	126,510	361,639	0.35
2011	394,470	1		371,108	

Fiscal year	Gross loan portfolio to total assets	Portfolio at risk > 30 days
2005	.2978	.0066
2006	.3274	.0083
2007	.322	.0952
2008	.3477	.2212
2009	.3274	.1749
2010	.3197	.9871
2011	.3535	.1399