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Microcredit for the Development of the Bottom of the Pyramid Segment: Impact of Access to Financial Services on Microcredit Clients, Institutions and Urban Sustainability

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Microcredit for the Development of the Bottom of the Pyramid Segment: Impact of Access to Financial Services on Microcredit Clients, Institutions and Urban Sustainability

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ABSTRACT

The focus of microcredit for the bottom of the pyramid segment in urban areas is increasingly becoming an area of focus as development policy-makers work towards improving the lifestyles of urban poor. Previous research has had a keen focus on the impacts of financial services to business outcomes, leaving behind other equally vital aspects of development. In addition, very little of this research has focused on socio-economic and sustainability outcomes in urban areas. Using randomized controlled trials, this paper measures the impacts of microcredit to selected groups of people in Kibera slum in Nairobi city, using a combination of double difference and propensity score matching techniques to evaluate the impacts of these financial services on businesses, households, microfinance institutions and urban sustainability outcomes. While the paper finds little evidence on urban sustainability outcomes, there is a significant, although small, improvement on business and households outcomes.

Keywords: Kenya, microcredit, financial services, urban poor, entrepreneurship, urban sustainability

Introduction

It is clearly evident that the bottom of the pyramid (BOP) segment lack financial access which limits their abilities to invest and increase their income. Research done on access to financial services by the poor has shown that access to financial services by this segment can be an instrument towards poverty alleviation (Klein, 2008). This is because, access to financial services increases people's choices which play an important role in empowering the poor. Microfinance services allow poor people to move into a more proactive mode that enables them to get protection against risks ahead of time and opens up new opportunities (Cohen and Sebstad, 2003). The benefits of microfinance investments revolve around empowerment of the poor as it provides economic freedom and the ability to make choices.

This study was performed in Kibera slum in Nairobi and non-randomized controlled trials were implemented to investigate and evaluate the impacts of access to financial services on income and poverty levels by those people in the BOP segment. Although this study focuses on the impacts of financial access, it also investigates other aspects like prior business experience, gender and group investment impacts. Some experiments (Morduch, 1998; Hashemi, 1997)) have shown that access to microfinance does not really lead to an increase in per capita after deducting costs especially operational ones. Karlan and Valdivia (2010) point out that if these costs are adjusted for, many ventures will show economic losses. Mel et al (2008) find considerable heterogeneity, with many micro-entrepreneurs earning negative returns to capital.

This research compares per capita income, savings and other microfinance outcomes between participants and non-participants using data from both the treatment and control groups. However, the comparative analysis comes with the challenge of selection bias. As Armendariz and Morduch (2010) point out, it is easy to control selection biases at household level but very difficult to address biases stemming from nonrandom program placement. This problem can be solved through the use of a combination of the double difference and propensity score matching approaches discussed later in this paper.

The study was conducted in collaboration with Umande Sacco and Cooperative Bank; two institutions that provide microcredit services in Nairobi's Kibera slum. These institutions among other financial institutions cover people within the BOP segment to invest in small businesses or expand their enterprises. The selection of people to participate in microcredit schemes poses a great challenge in this research. The way participants were enrolled into the programs in Kibera slum is evidently a strong source of selection bias. Umande Sacco and Cooperative Bank assigned financial services to existing groups in the slums with treatment groups accessing financial services while control groups were not provided with financial services. This study selected individuals who have access to financial services for the purposes of this research. Baseline survey was done before the treatment and a follow-up study was done after 18 months.

Access to Financial Services and Expectations

Rapid urbanization has placed increasing pressure on existing services and this has led to a decline in basic services provision. This is due in part to the government's general inability to understand and effectively respond to citizen-articulated service needs. While finance schemes for the middle and high-income segments of society are readily available, there exists an institutional vacuum for low-income investment funds.

High interest rates and exclusive approaches and conditions effectively preclude the urban poor from accessing credit to improve on their housing, water, sanitation, infrastructure, waste management and livelihoods. Living in slums comes with a host of life challenges that threaten the existence of humanity through all aspects of development including social, economic and environmental. Umande Sacco and Cooperative Bank of Kenya have set out to support socio-economic activities through financially empowering the poor in an attempt to alleviate poverty and improve people's living standards. The objective of providing financial services to the poor is to empower the poor, support small businesses, improve microfinance institutional performance, and to support urban sustainability.

Methodology and Monitoring

This study evaluates the impacts of microcredit access to slum residents in Kibera using non-randomized controlled trials[3]. The villages in which the participants came from were grouped randomly into treatment and control groups. The two MFIs spread information about their financial services to the treatment village, leaving the control village. The information[4] was passed through local community groups, schools, churches, and health centers by word of mouth and posters. After passing information about the MF services to the two selected villages, the residents were then left to decide whether to enroll into the program or not. A total of 2000 questionnaires were administered to randomly selected households in the two villages, with 1000 questionnaires per village. After data cleaning, out of the 1000 questionnaires administered to the treatment village, 470 had received financial services and were assigned to treatment group. From the control village, 534 were selected and were assigned to control group which received no financial access. In total, 1004 households were selected from the baseline data survey and followed for 18 months[5].

In collaboration with Umande Trust, this study monitored the two groups and followed the kind of investment activities that the treatment group was doing. The treatment group invested their loans in small businesses and was monitored by the microfinance institutions to ensure that the group was making efforts for the businesses to be successful. The meeting sessions also included training about market forces and business possibilities by the center manager. Meeting discussions mainly centered on business expansion, savings and loan repayment.

The empirical analysis in this paper compares the impacts of financial access by the poor on household, business, microfinance institutions and urban sustainability outcomes. The analysis does not take into consideration the kind of businesses the

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[3] After comparing the characteristics of the formal tests of the differences in means using the t-statistic as shown in table 2, this study finds that there is no difference in the means of the observables (variables), and thus the whole approach fully fits into the non-randomization technique.
[4] Due to the way information was disseminated about the availability of services by the two MF institutions, there was a contamination effect of the treated. This is because; the treatment and control villages shared information due to population density (proximity to one another). This could have led to underestimation as the control group might have gotten the same information as the treatment group from the treated which implies that residents without treatment could have performed better due to this knowledge diffusion.
[5] Data and related tabulations are not included in this paper but are available upon request

treatment group invested in, the distance from residential places to the microfinance institutions, and follow-up repayment interventions by the institutions. If these aspects are incorporated in access to financial services, the impacts could as well be different (Karlan, 2010). The time-line for this study was between February 2010 and July 2011, a period of 18 months.

Empirical Analysis and Evaluation

This paper uses data from Umande Sacco and Cooperative Bank of Kenya. The two institutions provided financial data for this study. In addition, this survey administered questionnaire that included baseline survey before randomization and post-survey after 18 months. Umande Sacco and Cooperative Bank provided financial transaction data which included financial reports and client information. The data also included information on the loan cycles, loan payment, interest rates, savings, and contributions to cover default of other members. The database also included some socio-economic characteristics of the clients, such as age, education, and business main economic activity, registered when the client first joined Umande Sacco and Cooperative Bank of Kenya microcredit program.

As shown in the table 1, 49 percent of the surveyed population in Kibera lives above the poverty line as defined by the World Bank and 51 percent are below the poverty line. The poverty line is the minimum income deemed necessary to achieve an adequate standard of living in any given country. The World Bank defines poverty line as the minimum income of 1.25 US dollars per day at 2005 purchasing power parity. Comparing the two poverty levels, a higher number of people above the poverty line (58 percent) participated in microcredit while only 36 percent below the poverty line accessed financial services. More females participated than males in both above and below the poverty line categories and those with business skills and experiences were more in the above the poverty line category. In the part of urban challenges, only 21 percent in the above the poverty line category were satisfied with access to water, improved sanitation and solid waste management as compared to 36 percent in the

below the poverty line category. This confirms findings by other researchers (Sharath et al, 2009) that people living below the poverty line face far more challenges than other categories in the BOP segment.

Estimation of the impact of microcredit participation can be done by either comparing the treatment group to control group in the follow-up data (with and without controls for baseline values of the outcome and other covariates), or use difference-in-difference (DD) estimator if the measure is included in both the baseline and the follow-up survey or a combination of DD and propensity score matching (PSM) technique. All estimators provide an estimate of the impact of the intention to treat on a particular outcome variable. However, the preferred estimator is the difference estimator or a combination of DD and PSM, with controls for baseline value of the outcome variable.

The DD approach compares samples of participants and non-participants before and after the intervention (initial baseline survey of both non-participants and subsequent participants and follow up survey of both groups after the intervention). It calculates the difference between the "after" and "before" values of the mean outcomes for each of the treatment and comparison groups. The difference between these two mean differences is the impact estimate.

As Abadie et al (2001) discuss in their work, since the work by Ashenfelter and Card (1985), the use of DD method has become very widespread. The simplest set up is one where outcomes are observed for two groups for two time periods. One of the groups is exposed to a treatment in the second period but not in the first period. The second group is not exposed to the treatment during either period. In the case where the same units within a group are observed in each time period, the average gain in the second (control) group is subtracted from the average gain in the first (treatment) group. This removes biases in second period comparisons between the treatment and control group that could be the result from permanent differences between those groups, as well as biases from comparisons over time in the treatment group that could be the result of trends. In some cases a more convincing analysis of a policy change is available by further refining the definition of treatment and control groups.

For the missing data problem, the double difference estimator assumes that the selection bias $B^{TT}(X)$ is time invariant: outcome changes for non-participants reveal the counterfactual outcome changes:

$$E(Y_1^T - Y_0^T | T_1 = 1) = E(Y_1^C - Y_0^C | T_1 = 0) \qquad \text{(i)}$$

Where; given a two-period setting where $t = 0$ before the program and $t = 1$ after program implementation, Y_t^T and Y_t^C represents outcomes for a program beneficiary and non-treated units in time t, and T_1 denotes treatment or the presence of the program at $t = 1$, whereas $T_1 = 0$ denotes untreated units.

This is a weaker assumption that $B^{TT}(X) = 0$ than in the single difference estimation.

The DD estimator gives the mean treatment effects (ATE) on the treated for a given period. Econometrically, the single difference estimator comes from the following expression:

$$Y_{ij1} = \alpha + \beta_3 K_j^T + \beta_4 Y_{ij0} + \varepsilon_{ij1} \qquad (t = 0,1; ij = 1, \dots, n) \qquad \text{(ii)}$$

And the double difference estimator comes from:

$$Y_{ijt} = \alpha + \beta_1 T_t + \beta_2 K_j^T + \beta_3 T_t K + \varepsilon_{ijt} \qquad (t = 0,1; ij = 1, \dots, n) \qquad \text{(iii)}$$

Where; Y_{ijt} is the outcome variable for client i in bank j at time t, K_j^T is a dummy variable that takes the value one if the client belonged to a treatment group, T_t is a binary variable equal to one if the observation corresponds to the post-treatment time, and ε_{ijt} denotes the error term. β_3, in both specifications is the treatment estimate of the program's impact on the outcome. That is, β_3 measures the difference between the treatment and control groups overtime to outcome Y, and is an unbiased estimate of the average impact of being assigned to a treatment group on the outcome variable Y (Karlan and Valdivia, 2010).

The potential problem with DD analysis is that other factors unrelated to the depended variables may have an impact on the outcome. The upshot of these observations is that controlling for initial heterogeneity is crucial to the credibility of DD estimates (Karlan and Valdivia, 2010). The DD method can be refined in a number of ways. One is by using PSM approach with the baseline data to make certain the comparison group is similar to the treatment group and then applying double differences to the matched sample. This way, the observable heterogeneity in the initial conditions can be dealt

with. Using PSM for selecting the initial comparison group will almost certainly reduce the bias in DD estimates (Ravallion and Chen, 2005). It is important to note that PSM is criticized because it only matches variables based on observed variables leaving the unobserved variables unmatched. On a similar note, the DD method's weakness is the inability to control for unobserved variables. A combination of both DD method and PSM approach gives readily reliable results. This is because by using PSM with the baseline data to make certain the comparison group is similar to the treatment group and then applying double differences to the matched sample helps refine the DD method. This way, the observable heterogeneity in the initial conditions can be dealt with since the matching of participants to nonparticipants, ensures that the two groups are more similar and comparable at the beginning (Kandiker et al, 2010).

According to Abadie and Imbens (2009), just like the DD approach, PSM estimators (Rosenbaum and Rubin, 1983) are widely used to estimate treatment effects when all treatment is measured. Their key insight is that adjusting for the propensity score is enough to remove the bias created by all treatment confounders. Relative to matching directly on the covariates, PSM has the advantage of reducing the dimensionality of matching to a single dimension. This greatly facilitates the matching process, because units with dissimilar covariate values may nevertheless have similar values in their propensity scores.

Results

The main objective of providing services to the poor in this study can be divided into four: i) to empower the poor, ii) to support small businesses, iii) to improve microfinance institutional performance, and iv) to support sustainable development. The possibility to access financial services by poor entrepreneurs may motivate them to expand their businesses, or open new businesses to increase their per capita income, savings, and profits. If the borrowers honor their repayments, this could encourage microfinance institutions to provide more loans and also to expand their outreach.

Access to microfinance may lead the poor in expanding their businesses, educating their children, saving for future use, good nutrition and generally improved lifestyles. Most of the academic literature on this subject has focused on social impacts of microfinance with no clear separation of external influential factors (Neubert, 2000). In addition, many microfinance institutions are more focused on institutional gains and especially client retention (Copestake, 2002) and loan repayment. The net impacts of microfinance are critical for any microfinance institution, since maintaining a stable client base is important for institutional sustainability (Khandker, 2010). However, the net impacts of microfinance to economic and environmental development should also be identified.

Table 3 shows the propensity scores for access to MF with a Log likelihood of -493.5324. The likelihood ratio chi-square of 400.17 with a p-value of 0.0000 means that the probit model as a whole is statistically significant, that is, it fits significantly better than a model with no predictors. The output shows that gender, income level and and employment are statistically significant at 1 percent significance level and therefore have an effect on the selection of participants in microfinance.

The next step is to identify the region of common support - where distributions of the propensity score for treatment and comparison group overlap - as shown in Table 4. The area of common support is those propensity scores within the range of the lowest and highest estimated values for households in the treatment group. The following output shows that the identified region of common support is [0.0445, 0.9913] and the final number of blocks is 5. This number of blocks ensures that the mean propensity score is not different for treated and control observations in each block.

The number of treated observations is different from the number of control observations in each block as shown in Table 5. Becker and Ichino (2002), argue that the matching of observations does not necessarily have to be the same in each block after matching. This is because since matching is done with replacement[6], the same control unit may be used several times. Furthermore, several treated and control observations might

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[6] According to Becker and Ichino (2002), "with replacement" implies that a control unit can be a best match for more than one treated unit. Once each treated unit is matched with a control unit, the difference between the outcome of the treated units and the outcome of the matched control units is computed.

have identical estimated pscores, that is, there might be ties. Also in each block within the treated and control groups, there might be similar observations. These similar observations in the treated group for instance are matched to 1 or more similar observations in the control group and vice versa. This leads to unequal number of observations matched in all the blocks. In addition, the outcomes of participating and nonparticipating households with similar propensity scores are compared to obtain the program effect. Households for which no match is found are dropped because no basis exists for comparison (Hahn, Hirano, and Karlan, 2011). Heckman, Ichimura, and Todd (1997) encourage dropping treatment observations with weak common support.

Treatment units will therefore have to be similar to non-treatment units in terms of observed characteristics unaffected by treatment; thus, some non-treatment units may have to be dropped to ensure comparability (Ravallion 2008). This situation is more problematic because it creates a possible sampling bias in the treatment effect. Examining the characteristics of dropped units may be useful in interpreting potential bias in the estimated treatment effects. This can be corrected by analyzing the dropped observations or by using a combination of approaches; for instance PSM and DD.

The first stage probit regression gives results that show that gender, income level and employment (independent variables) are significant at 1 percent significance level and therefore have an effect on the selection of participants in microfinance. These results lead to the conclusion that the PSM scores yield satisfactory results under the balancing scenario since the balancing property is satisfied. The impact results presented in this paper are based on specifications that passed the balancing test.

After generating the propensity scores and satisfying the balancing property, the next step is to perform matching of observations by comparing treated and untreated units. This research uses the nearest neighbor matching with replacement to match each participant to one or more nonparticipants on propensity score. Matching with replacement means that untreated observation can be matched to multiple treated units (Caliendo & Kopeinig, 2008; Reynolds and Desjardins, 2009) and this makes it more superior than other matching techniques. This involves a trade-off between bias and variance and leads to improved quality of matching and a decline in bias. This is

important especially when the propensity score distribution is very different in the treatment and the control groups (Caliendo & Kopeinig, 2008). Once each treated unit is matched with a control unit, the difference between the outcome of the treated units and the outcome of the matched control units is computed (Becker and Ichino, 2002). In addition, bias-corrected bootstrap is applied to produce valid standard errors and confidence intervals because the estimators are asymptotically linear (Imbens, 2004).

With the propensity scores generated, the outcomes between the treatment group and the matched control group are now compared to see whether the microfinance programs affect the outcome of interest. The next step is to estimate the treatment effect of microfinance program participation. The treatment effect can be defined as either the average treatment effect (ATE) between participants and control units, or the treatment effect on the treated (TOT), a narrower measure that compares participant and control units, conditional on participants being in a treated area (Kandker et al, 2010; Todo, 2008). In this research, TOT is used to measure the impact of MF participation.

The results of access to financial services were divided into four aspects: a) impacts on social welfare, b) business outcomes, c) microfinance institutional outcomes, and d) urban sustainability impacts.

a) Impacts on social welfare

Table 6 shows the results of the impact of access to financial services on BOP social welfare. For the purpose of this study, household social welfare is discussed based on per capita income. The research found that there is a positive impact on household per capita income. The results show that microfinance program participation through access to financial services by BOPs increases per capita income by around Ksh. 851.79 as shown in the OLS difference-in-difference column (columns 8). When double difference and propensity score matching approach were combined, the impact on per capita income shows an increase of about Ksh. 836.38 (column 9). Both impacts are significant at less than 1 percent level. An increase in per capita income by participating

households decreases the incidence of poverty through self-employment, savings and building of assets.

b) Business outcomes

Table 7 presents business outcome results by examining improved business development in terms of business skills. This research found strong and significant impacts of access to financial services on entrepreneurial skills. The number of clients with entrepreneurial skills increases by a probability of 13 percent. When a consideration of the preferred specification in columns 9 is done, the impacts remain positive with a change to 19 percent and significant at 1 percent level. Entrepreneurial skills is measured by the number of people who invested their loans in small businesses out of the total number of participants as some beneficiaries spent their loans in paying school fees and other household expenditures.

The survey of 1004 in Kibera slum shows a strong interest in entrepreneurship. 33 percent of the respondents stated that they would like to change occupations. Of this number, most would like to start a business. Many of the respondents said that they cannot start a business because they lacked financial strength. Among the entrepreneurial households, 67 percent said that their businesses will make more profits if they expanded, and when asked why they do not undertake this profitable venture, 63 percent said that they do not have enough money. This indicates that just like with big businesses, entrepreneurs in the BOP segment face financial constraints. Results from the OLS approach show a similar trend.

c) Microfinance institutional impacts

Table 8 presents results on institutional outcomes with a focus on loan repayment and client retention. The results show that there is no impact on loan repayment and client retention.

The lack of impact of access to microfinance on repayment rate and client retention can be explained by the complexities of the urban BOP business environment and also the

length of period this research was conducted. The support from the microfinance institutions provided by credit officers on a bi-weekly basis in the form of business discussions therefore had no impact during the 18 months of field study.

Improved repayment rate and client retention is supposed to have an impact on microfinance institutional profitability. The lack of impact on client retention rate in this research could imply that the businesses did not generate increased revenues. Though the impact of client retention on business performance is easier to estimate for Umande Sacco and Cooperative Bank of Kenya, improved client repayment rate is not since financial institutions coerce their clients to repay loans.

d) Urban sustainability impacts

In table 9, the impacts of financial services on urban sustainability are presented. This is tested by examining urban sustainability through discussions based on access to clean water, access to sanitation, access to solid waste management and access to energy. The preferred specification in Column 9 show strong statistically significant effects in some outcomes as results of combined DD and PSM fixed effects indicate. For the OLS double difference, this research found a strong impact of access to financial services on access to clean water and access to energy. While this can be explained from the affordability perspective of these public services, it is also about maintaining a clean and friendly environment. Column 9 shows that there is a strong impact of access to financial services on access to water. Whereas this can be attributed to an increase in household per capita income, it can also be attributed to contribution through awareness creation by non-governmental organizations and community based groups on creating and maintaining an environmentally friendly society. In this case, due to increased income and environmental awareness, people are able tap on clean water services provided in slums at a fee. The improved access to clean water could further be explained by increased affordability.

For access to energy, the impact is positive and significant. This could be explained by empowerment of the poor that comes with creation of awareness on sustainability aspects and enlightens people to make the best choices. For instance, this research

finds that people with increased incomes would buy solar lanterns to light their houses as compared to the use of traditional lamps that use kerosene and produce a lot of carbon monoxide. The marginal benefit of using these solar lanterns is high since it is cheaper to use them for lighting in the long term. This positive impact on access to energy is also supported by the OLS approach.

Conclusion

The lead question raised in the beginning of this section was: what is the impact of access to financial services by BOP segment in urban Kenya; and are micro-entrepreneurs maximizing benefits from their micro investments, given the constraints their businesses face? This research found that access to financial services by the poor leads to higher per capita income as indicated by the double difference and PSM specifications. An increase in per capita income can be associated with households' ability to meet basic needs and as a measure of poverty alleviation.

Clients who participate in microfinance programs benefit from improved business skills. This research found that most borrowers have previous entrepreneurial/business skills from owning or running small businesses. Access to financial services increases the number of participants with business skills by a probability 13 percent. Business skills are very vital in understanding how markets work. Micro-entrepreneurs with strong business skills understand well how to approach the markets and how to run their businesses as they are well prepared for any eventualities. This can be connected with the good business performance by those participants with prior business skills. These findings are supported by Karlan and Valdivia (2010), who find that entrepreneurial skills are important for the success of micro-entrepreneurs as this enlightens them to separate money transactions between business and household, reinvest profits in the business, maintain records of sales and expenses, and think proactively about new markets and opportunities for business development. For microfinance institutional impacts, the lack of impact on loan repayment and client retention is an indication of lack of sustainability of microfinance institutions.

The impact of microfinance on urban sustainability is difficult to measure due to the many interconnected factors that are contained in sustainable development domains. This research estimated the impact of financial services on different aspects of urban sustainability. While there is a positive and significant impact, it is difficult to disentangle these impacts from the impacts of the support provided by government and non-governmental organizations. The results explain the affordability of public services and the ability and willingness of people to maintain a better urban environment. For instance, being able to pay for and use toilets in Kibera slum means that people will not dispose human wastes in water masses or in bushes. An increase in per capita income leads to affordability of clean water, good practices of solid waste disposal and the use of clean energy. It should be noted here that, though there is a positive impact on urban sustainability, especially on access to clean water and energy, further research is needed to include the participation of municipal government and other development players.

This research delivers implications for business and policy pertaining to sustainable urban development with a focus on stakeholders' participation to improve lives in slums. The future of slum upgrading and eventual urban sustainability will depend on political willingness to ensure that the poor are empowered so as to actively participate in the process of development. For implications for business, the urban BOP segment provides business opportunities to both individuals and institutions like MFIs. Microfinance businesses should be supported and operated formally so as to support national development through payment of taxes. This is because current microfinance businesses within the urban BOP settings are operated informally. To promote performance and sustainability of these businesses, customized financial training is necessary and should be encouraged. Also, business investment in slums should not only focus on micro small businesses but also small and medium enterprises to support industrialization, and the government should support the regulation of MF institutions to support BOP development.

For implications for public policy, the development of the urban BOP segment should be hinged on slum upgrading as opposed to resettlement and eviction. As a tool for urban

poverty alleviation, easy access to microfinance should be promoted in order to support BOP entrepreneurship. Moreover, stakeholder participation in urban development should be promoted to improve service delivery in slums. Policies should promote empowerment of the poor and promote collective investments within the BOP segment. As for policy implications, therefore, this research proposes that top down approaches to urban development should be complemented by bottom up approaches that involve all stakeholders in slums' development to ensure that the poor are empowered to actively participate in the process of development.

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Appendix

Table 1: Summary Statistics Based on Poverty Levels

Poverty Levels	No. of Clients	Mean Income Level (Ksh)	Access MF	Mean Loan size	Employed	Entrepreneurs	Males	Females	Education above highschool	Sanitation	Water	Waste
Above Poverty Line	490 (49%)	4,374	284 (58%)	12,551	375 (77%)	330 (67%)	131 (27%)	359 (73%)	445 (90.8%)	20 (21%)	20 (21%)	20 (21%)
Below Poverty Line	514 (51%)	1903	186 (36%)	7,190	374 (73%)	242 (47%)	187 (36%)	329 (67%)	335 (65%)	40 (39%)	40 (39%)	40 (39%)

Table 2: Differences in means by program group

Variable	Treatment		Control			Significance level
	Mean	SD	Mean	SD	*t*	
Household level						
Per capita income	9.70	0.194	9.31	0.534	-15.02	***
Child education	0.99	0.065	0.58	0.493	-18.02	***
Employment	0.81	0.389	0.68	0.465	- 4.84	***
Meeting basic needs	0.62	0.486	0	0	- 29.35	***
Business level						
Total sales	0.82	0.385	0.22	0.166	- 49.22	***
Business skills	0.73	0.445	0.43	0.495	- 9.99	***
Savings	0.73	0.445	0.30	0.192	- 37.80	***
Profits	0.69	0.464	0.17	0.200	- 34.28	***
Institutional level						
Loan size	0.94	0.589	0.89	0.172	- 3.90	***
Loan repayment	0.77	0.244	0.73	0.317	- 2.76	***
Client retention	0.77	0.423	0.07	0.260	- 31.79	***
Urban sustainability level						
Improved sanitation	0.60	0.458	0.33	0.463	0.15	
Access to clean water	0.62	0.458	0.29	0.463	0.15	
Improved solid waste management	0.36	0.458	0.17	0.463	0.15	
Access to energy	0.55	0.458	0.24	0.463	0.15	

Note: 470 participants received treatment (treatment group) while 534 participants did not receive treatment (control group). The treatment group was coded 1 and the control group was coded 0
Significance level: ***, **,* = 1 percent, 5 percent and 10 percent respectively

Table 3: Estimating the Propensity Score for access to MF

Access to MF	Coef.	Std. Err	Z	P>|Z|	[95% Coeff.	Interval]
Gender	1.2259	0.1088	11.27	0.0000	1.0127	1.4391
Income	1.9735	0.1728	11.42	0.000	1.6348	2.3122
Employment	0.4183	0.1074	3.89	0.000	0.2077	0.6289
Marital Status	-0.1138	0.1423	-0.80	0.424	-0.3927	0.1650
-Cons	-20.066	1.6709	-12.01	0.0000	-23.3406	-16.7908

Note: The treatment is access to MF. Number of observations = 1004; chi^2 = 400.17; Prob > chi^2 = 0.0000; Log likelihood = -493.5324; Pseudo R^2 = 0.2885

Table 4: Description of the Estimated Propensity Score in Region of Common Support

	Percentiles	Smallest
1%	0.0565	0.0445
5%	0.0903	0.0445
10%	0.1440	0.0452
25%	0.2952	0.0473
50%	0.6145	
		Largest
75%	0.7355	0.9719
90%	0.8180	0. 9798
95%	0.8435	0.9886
99%	0.9264	0.9913

Note: The final number of blocks is 5. Number of observations = 876; mean = 0.5301; standard deviation = 0.2502.

Table 5: Inferior Bound, the Number of Treated and the Number of Controls for Each Block

Inferior of block of pscore	Access to microfinance		Total
	0	1	
0.0445	124	10	134
0.2	102	51	153
0.4	60	78	138
0.6	101	248	349
0.8	21	81	102
Total	408	468	876

Note: The common support option has been selected

Table 6: Impact of Access to Financial Services on BOP Households

	Summary statistics: Mean, standard errors and differences							OLS	Propensity score matching and DD
		Baseline			Follow-up			Double difference	Combined
Dependent variable	No of clients	Treatment	Control	Diff	Treatment	Control	Diff		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Double difference estimates									
Per capita income	1004	16689	12507	4182.7 (296.61)	17643	12609	5034.48 (301.80)	851.79 (211.63)***	836.38 (153.18)***

Notes: Each coefficient reported in the table is from a separate regression. The regressions include OLS with MFI fixed effects and standard errors clustered by MFI.

[1]Dependent variables are defined as: household per capita income which is monthly income in Kenyan shillings as reported by the respondent.

[2]The covariates include age, gender, marital status, size of household, religion, hometown (whether born in Nairobi city or in the countryside), number of years the client has lived in Kibera slum

Table 7: Impacts of Access to Financial Services on Business Outcomes

Dependent variable	No of clients	Summary statistics: Mean, standard errors and differences						OLS	Propensity score matching and DD
		Baseline			Follow-up			Double difference	Combined
		Treatment	Control	Diff	Treatment	Control	Diff		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Double difference estimates									
Business skills	1004	0.7265	0.4291	0.2974 (0.0299)	0.9167	0.4907	0.4260 (0.0260)	0.1286 (0.0205)***	0.1895 (0.0292)***

Notes: Each coefficient reported in the table is from a separate regression. The regressions include OLS with MFI fixed effects and standard errors clustered by MFI.

[1]Dependent variables are defined as: Business skills: a binary variable equal to one if the client has had entrepreneurial experience (has ran a business entity);

[2]The covariates include age, gender, marital status, size of household, religion, hometown (whether born in Nairobi city or in the countryside), number of years the client has lived in Kibera

Table 8: Impacts of Access to Financial Services on Financial Institutions

Dependent variable	No of clients	Summary statistics: Mean, standard errors and differences						OLS	Propensity score matching and DD
		Baseline			Follow-up			Double difference	Combined
		Treatment	Control	Diff	Treatment	Control	Diff		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Double difference estimates									
Loan repayment	1004	0.9359	0.8862	0.0497	1.000	0.9366	0.0634	0.0137	0.0134
				(0.0181)			(0.0113)	(0.0100)	(0.0160)
Client retention	1004	0.7665	0.0728	0.6938	0.8638	0.4403	0.4229	-0.2709	-0.2556
				(0.0219)			(0.0273)	(0.0257)	(0.0281)

Notes: Each coefficient reported in the table is from a separate regression. The regressions include OLS with MFI fixed effects and standard errors clustered by MFI.

[1] Dependent variables are defined as: <u>Loan repayment:</u> a binary variable equal to one if the client was able to repay his/her loan on time since the beginning of the loan cycle; <u>client retention:</u> a binary variable equal to one if the client does not dropout (does not leave the bank he/she got the loan from).

[2] The covariates include age, gender, marital status, size of household, religion, hometown (whether born in Nairobi city or in the countryside), number of years the client has lived in Kibera

Table 9: Impacts of Access to Financial Services on Sustainability Development

Dependent variable	No of clients	Baseline Treatment	Control	Diff	Follow-up Treatment	Control	Diff	OLS Double difference	Propensity score matching and DD Combined
		Summary statistics: Mean, standard errors and differences							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Double difference estimates									
Access to improved sanitation	1004	0.3141	0.2910	0.0231 (0.0291)	0.6902	0.6101	0.0801 (0.0301)	0.0570 (0.403)	0.0740 (0.1178)
Access to clean water	1004	0.3141	0.2910	0.0231 (0.0291)	0.7094	0.5746	0.1347 (0.0301)	0.1117 (0.041)***	0.2287 (0.0444)**
Improved solid waste management	1004	0.3141	0.2910	0.0231 (0.0291)	0.2799	0.2015	0.0784 (0.0269)	0.0553 (0.0290)*	0.1263 (0.0871)
Access to energy	1004	0.3141	0.2910	0.0231 (0.0291)	0.5962	0.4310	0.1652 (0.0312)	0.1421 (0.040)***	0.2723 (0.1129)***

Notes: Each coefficient reported in the table is from a separate regression. The regressions include OLS with MFI fixed effects and standard errors clustered by MFI.

[1]Dependent variables are defined as: <u>access to improved sanitation</u>: a binary variable equal to one if the client uses improved sanitation for human waste disposal (focuses on the ability to use toilets and affordability of sanitation facilities); <u>access to clean water:</u> a binary variable equal to one if the client is able to access clean drinking water; <u>improved solid waste management:</u> a binary variable equal to one if the client practices proper solid waste disposal; <u>access to energy:</u> a binary variable equal to one if the client can afford renewable sources of energy for lighting (solar energy- panels and lanterns) as opposed to the use of kerosene.

[2]The covariates include age, gender, marital status, size of household, religion, hometown (whether born in Nairobi city or in the countryside), number of years the client has lived in Kibera

Table 10: Descriptions of outcome variables

Variable	Description
Household Outcomes	
Per capita income	Logarithm of monthly income as reported by the respondent
Education	Binary variable equal to one if the respondent's child improved their attendance in school and zero if the respondent's child did not improve in their school attendance
Employment	Binary variable equal to one if the client is employed (defined as self-employment or industry employment) and zero if unemployed
Savings	Binary variable equal to one if the client is able to save money from businesses he/she runs for household consumption
Meeting basic needs	Binary variable equal to one if selected household is able to meet the minimum requirements of basic needs
Business outcomes	
Total sales	Binary variable equal to zero if client's average monthly sales revenues declined
Business skills	Binary variable equal to one if the client has had entrepreneurial experience (has ran a business entity);
Savings	Binary variable equal to one if the client is able to save money from businesses he/she runs
Profits	Binary variable equal to one if the client's business is making profits
Institutional outcomes	
Loan size	Logarithm of the amount borrowed from Umande Sacco and Cooperative Bank of Kenya by the client at beginning of loan cycle in Kenya Shillings
Loan repayment	Binary variable equal to one if the client was able to repay his/her loan on time since the beginning of the loan cycle.
Client retention	Binary variable equal to one if the client does not dropout (does not leave the bank he/she got the loan from).
Savings for repayment	Binary variable equal to one if the client is able to save money from the business(es) he/she runs for loan repayment
Sustainability Impacts	
Per capita income	Logarithm of monthly income as reported by the respondent
Access to improved sanitation	Binary variable equal to one if the client uses improved sanitation for human waste disposal (focuses on the ability to use toilets and affordability of sanitation facilities)
Access to clean water	Binary variable equal to one if the client is able to access clean drinking water
Improved solid waste management	Binary variable equal to one if the client practices proper solid waste disposal
Access to energy	Binary variable equal to one if the client can afford renewable sources of energy for lighting (solar energy- panels and lanterns) as opposed to the use of kerosene.
Covariates	
Age	The logarithm of age of the respondent at the time of the study.
Gender	Binary variable equal to one if the client is a Female and zero if the client is a male

Marital status	Binary variable equal to one if the client is married and zero if the client is not married
Household size	The logarithm of the number of members in the respondent's household
Religion	Binary variable equal to one if the client is a Christian
Hometown	Binary variable equal to one if the client was born in the country side and zero if he/she was born in a city.
Number of years lived in Kibera	The logarithm of the number of years participant has lived in Kibera informal settlement

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