Gendered Impact of Microcredit in Mali: An Evaluation by Propensity Score Matching

Koloma, Yaya and Alia, Hayyan

University of Montesquieu Bordeaux 4, ISTOM

2014

Gendered Impact of Microcredit in Mali: An Evaluation by Propensity Score Matching[1]

Yaya Koloma
ISTOM, School of International Agro-Development, Cergy Pontoise, France

Hayyan Alia
Burgundy School of Business, Dijon, France

Females benefit in the long term while males benefit in the short term.

Only males benefit significantly in the rural areas.

Our results indicate a negative, though non-significant, impact of microfinance on male beneficiaries in urban areas.

Microfinance in Mali has a positive impact on poverty alleviation in total and higher on female than on male beneficiaries.

During the last 30 years, the microfinance industry has developed and spread around the world. Along with its development, there has been an increased focus on analyzing its impact on the wellbeing of the beneficiaries. In Mali, microfinance started in the 1980s, and recent successive governments were particularly interested in it as a tool for fighting against poverty and gender inequality. Therefore, the implementation of microfinance programs in this country took into account the situations of gender inequality as an important consideration.

The gender position in the microfinance literature fundamentally postulates the particularity of women who are viewed (as clients) as being more able to achieve high-quality performance in terms of loan repayment compared with men (Yunus, 1997), and at the same time they use microfinance services more effectively for household-welfare-related purposes (Khandker, 1998, 2003). In this paper, we look at the gender question from the angle of impact on poverty. Our objective is to rigorously verify if the potential effects of microcredit on poverty reduction are of more significance for female than for male beneficiaries. The data set we are using comes from surveys conducted in 2007–2008 in Mali. This data set is of high importance because it includes gendered information on the use of microcredit, in addition to covering a large sample that compares 2400 microfinance client households among which around 70% are microcredit beneficiaries. Since the collected data is not randomized, in order to conduct a statistically valid comparison between microcredit beneficiaries and non-beneficiaries, we use the statistical method of propensity score matching (PSM), which we will discuss in detail.

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[1] JEL classification codes: C2, D63, G21, I32, J16.

Our paper tries to answer the following question: In what respect is the situation of male and female beneficiaries of microcredit programs different, on average, from what it would have been if these programs did not exist? In other words, we will treat two sub-questions: (1) How did the situation of the beneficiaries (including the two genders) change after the intervention of the microcredit program? (2) Was the impact of microcredit on the beneficiaries significantly different between the two genders? The paper will first conduct a brief literature review. Then, we explain the impact evaluation method of PSM. Finally, we present the results of some factors influencing the access to microcredit in Mali and the effect of access to microcredit on poverty reduction by gender.

Literature review

Research on poverty highlights the issue of gender discrimination and its effect on gendered poverty. It was found that in countries where the discrimination against women is higher, the poverty of women compared with men is also higher and so is the poverty rate in the country (Bashir *et al.*, 2012). Adopting the view that women are usually considered economically poorer than men, the sector of microfinance has focused on gender (Koloma, 2011). In fact, reports from the microcredit summit campaign show that 82.7% of the poorest clients reached worldwide during 2011 were women.[2]

The efficacy of exclusive micro lending to women, and encouraging them into self-employment, is not clear because of the scarcity of studies. There are no conclusive results yet on the values and benefits of focusing on women (Strier, 2010). Shetty (2010) highlights the complexity of measuring the impact of microcredit on women's empowerment. As the literature shows, many problems could be associated with female-focused lending: for example, violence and pressure on women increase when an increase in female labor (thanks to credit) takes place

without changes in social structure. Nevertheless, de Haan and Lakwo (2010) confirm that microfinance leads to women's empowerment, as well as social emancipation, even when its impact on poverty reduction and increase in wellbeing is considered marginal. A few studies on entrepreneurship have referred to gender differences and indicated that females have less confidence in their abilities when starting a new business compared with males (Manolova *et al.*, 2008).

Microfinance studies reason that the success of lending to women in reducing poverty is due to the commitment of women to their families when generating profits from their businesses in comparison with men. Serving women in microfinance is shown to have a better impact on households (Armendáriz and Morduch, 2010). However, impact evaluation studies view the impact of microfinance on gendered poverty with contrasting results. Pioneer studies such as those of Khandker (1998, 2003) and Pitt and Khandker (1998) focused on the impact of microcredit opposing non-beneficiaries to beneficiaries. These studies were conducted on three of the main microfinance programs in Bangladesh using the method of double difference and the indicator of per-capita expenditure by household. The results showed that the impact is significantly higher for women compared with men. Statistically, for every additional 100 taka lent to women, the annual consumption expenditure of households increased by 18 taka; while the increase was 11 taka for men after reimbursement. Their findings show that when women have access to credit, then due to their efficient use of resources, the observed impact of credit on their households is much greater compared with lending to men.

Lamberte and Manlagñit (2003) conducted a study in the Philippines to evaluate the incidence of poverty amongst microfinance beneficiaries according to the gender of household heads. The methodology is a descriptive analysis based on comparing the studied households through specific characteristics to specify the differential impact of access to the community-oriented financial institutions (COFI) system. A comparison was made

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[2] stateofthecampaign.org/2013/01/30/women-clients-reached/.

between two groups: male- and female-headed households. The authors found that households headed by women seem to be poorer than households headed by men. Concretely, the poverty incidence for female-headed households was 16.7% compared with only 8.8% among male-headed households. The results of Lamberte and Manlagñit (2003) may give two different interpretations. They may indicate that microfinance has a higher impact on poverty alleviation among male-headed compared with female-headed households. However, in terms of targeting, the result may indicate that the COFI system primarily targets poor people and women in particular, but the difference in microfinance impact on the wellbeing of the two genders could not be clearly appreciated as the study does not take into account long-term results. As such, the results can be interpreted as microfinance impact being of more importance for males in the short run. Evaluating this latter interpretation is not easy as long as this particular study does not examine the relation between the membership duration in the microfinance program and the household level of poverty.

Koloma (2011), in research on the poverty evaluation of microfinance clients in Mali, adopts the methodology of identifying the poor based on the micro-multidimensional measure developed by Chakravarty *et al.* (1998). The findings show, in total, a non-significant difference in the incidence of non-monetary poverty[3] by gender, although it is slightly higher among female than male recipients (44.4% among women and 43.7% among men). However, after considering the length of involvement period in microfinance programs, the results show that women have a poverty incidence significantly higher than men (22.9% for women and 15.7% for men) in both urban and rural areas for those members of long participation period (more than two years).

Methodology

Method of analysis

Many studies have been done on measuring impact. A recent review by Duvendack *et al.* (2011) covered 58 impact evaluation studies and concluded that there is no proof of positive impacts.[4] Impact evaluation studies use different methodologies including quantitative and qualitative research methods. While having the disadvantage of being expensive, the quantitative methods are generally given a higher value compared with qualitative methods because of the ability to overcome the counterfactual problem by conducting statistically valid comparisons between beneficiaries and non-beneficiaries. The randomization techniques allow for such strong validity.

In our study, because no randomization was considered when collecting the data, the main challenge we face is the selection bias. Such a bias might happen for different reasons: (1) self-selection of beneficiaries, when they choose for themselves whether to participate in microfinance programs or not; (2) the establishment of the program in a given area (Gubert and Roubaud, 2003; Guo *et al.*, 2006; Imai and Arun, 2008); and (3) the selection of participants by the MFI depending on some criteria (unless there are no restrictions).

Our main hypothesis is that access to microcredit has a differential impact on non-monetary poverty due to the gender of the beneficiaries. To solve the problem of selection bias, we have adopted the PSM method. Originally applied in health studies, the PSM was used in economics research for the first time by Heckman (1979) (Aroca and Hewings, 2009). In microfinance, a few studies used this approach for impact evaluation, including Gubert and Roubaud (2003) in a study in Madagascar, Imai and Arun (2008) in India, Setboonsarng and Parpiev (2010) in Pakistan, Aroca and Hewings (2009) in Latin America, and Islam (2011) in Bangladesh. In the following sections,

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[3] The level of poverty is measured by considering four dimensions: housing, durables, education, and social capital (Koloma, 2011).

[4] There is a lot of debate on this study, see Milana and Ashta (2012) for details.

we explain the concept of this approach and its application in our case.

Propensity score matching

As the experimentalists argue, in cases with a lack of randomization, it is not possible to determine whether the difference in the treatment results between the treated and control (untreated) groups is exclusively due to the treatment or differences in other characteristics between the subjects. When the condition of randomization is not respected in the studied data set, some statistical methods are required in order to overcome the sampling bias. The PSM method of Rosenbaum and Rubin (1983) is one of these methods. This method allows for improved comparability by allocating the subjects with similar characteristics to treatment and control groups. Thus, the PSM reduces the selection bias in non-randomized data sets. Two steps should be followed in PSM. (1) Conducting a probit regression model in which a set of control variables is considered to estimate a propensity score; choosing a matching algorithm in order to match the partners with similar propensity scores between the treated and the untreated (control) groups. (2) Afterwards the measurement of the treatment impact is done through calculating the average treatment effect on treated subjects (ATT) through another regression.

We explain here briefly the concept of ATT. For a given group of subjects and a treatment, we have only one outcome per subject (either an outcome under treatment for the treated subjects or the outcome under no treatment for the untreated subjects). The treatment outcome (Y_i) of any subject is:

$$Y_i = D_i Y_i(1) + (1 - D_i) Y_i(0)$$

where $D = (0, 1)$ is the binary variable which indicates whether a participant had access to microcredit (1) or not (0). The effect of the treatment on any of the subjects is:

$$Y_i(1) - Y_i(0)$$

and the average treatment effect for the treated subjects (ATT) is:

$$E[Y(1) - Y(0) | D = 1]$$

where E refers to the expectation.

The main difference between the observational studies (non-randomized experiments) and the randomized controlled trials is the use of randomization for allocating the subjects to treatment and control groups. Because there is no randomization in the observational study, the treatment effect on average (i.e., $Y(1)$) will not be equal to the average on all subjects because of the different characteristics they have. Therefore, $E[Y(1) | D = 1]$ is not equal to $E[Y(1)]$, and the same applies for $Y(0)$.

The method of propensity scoring is used to estimate the average effects of treatment. Rosenbaum and Rubin (1983) define the propensity score as the conditional probability of receiving treatment, such as having access to a loan, given pre-treatment characteristics (X) of the individual. Indeed, 'this method is to model the probability of being treated according to different variables and to consider that individuals who have the same probability of being treated are comparable (and therefore we have corrected the selection bias). Then, for every probability of being treated, we compare treated and untreated groups' (Lorenceau, 2009). In other words, the PSM method enables us to form similar propensity groups and compare similar subjects between the two groups in order to overcome any selection bias. When X is the multidimensional vector of pretreatment characteristics, the propensity score is represented as:

$$p(X) \equiv \Pr(D = 1 | X) = E(D | X)$$

Knowing the beneficiary population and the propensity score $p(X_i)$, the impact of a microfinance program can be evaluated by calculating the ATT as follows:

$$\begin{aligned}
\tau &\equiv E\{Y_{1i} - Y_{0i} | D_i = 1\} \\
&= E\big[E\{Y_{1i} - Y_{0i} | D_i = 1, p(X_i)\}\big] \\
&= E\big[E\{Y_{1i} | D_i = 1, p(X_i)\} \\
&\quad - E\{Y_{0i} | D_i = 0, p(X_i)\} | D_i = 1\big]
\end{aligned}$$

where i denotes the ith recipient, Y_{0i} and Y_{1i} are the potential outcomes (wellbeing) — for the two contrasting

situations (access and no access to microcredit). The first line of the equation indicates that the impact of microcredit is defined as the mean of the difference between the poverty index of the ith beneficiary of microcredit and the situation of the same beneficiary without access. The second line is the same as the first, except that the expected impact of microcredit is defined through the distribution of the propensity score. The last line refers to microcredit's effect as the expected difference of the score of the anticipated effect for the ith beneficiary, given the distribution of the probability to receive a credit, and for the same beneficiary without access to microcredit considering the same distribution.

Formally, to estimate the propensity score, the method must satisfy two hypotheses (Becker and Ichino, 2002; Smith and Todd, 2005; Imai and Arun, 2008).

H1: Balancing of pre-treatment characteristics given the propensity score (prior to the access to treatment, which is here the micro loan).

This implies that, in our sample, the households who use microcredit and those who do not should be identical (observationally) for a specific propensity score.

H2: Fulfilling the condition of unconfoundedness.

In the latter hypothesis, after calculating the propensity score, the assignment to treatment should also fulfill the unconfoundedness condition (Rosenbaum and Rubin, 1983). It is a conditional independence assumption (Lechner, 2002), which implies in our case that the poverty indicator is uncorrelated with access to microcredit.

In order to estimate the ATT, we should consider a selection measurement (a matching procedure) to enable the comparison (between treated and control groups) to be conducted between subjects that share the same propensity score (or very close scores). Many matching methods are used to achieve the right matching between the comparable groups of subjects. Among these matching techniques, we chose for our study 'kernel matching.'

This matching depends on a weighted average of all the controls with which all the treated subjects are matched with weights inversely proportional to the distance between the propensity scores and the controls.

Explicative variables

The two steps to implement the PSM method in our study will be as follows. (1) Specify the determinants of access to microcredit both overall and according to gender (here we identify variables that MFIs usually consider in choosing the clients in addition to other variables). This procedure is based on a probit regression model. Through this regression, we can identify what factors influence the probability of women or men having access to microcredit. Based on these results a propensity score is created to estimate a function matching the proximity of one household to another in terms of household characteristics. Finally, using the kernel matching technique enables grouping of households to minimize the distance between matched cases (Imai and Arun, 2008). (2) ATT is estimated through another regression (in our case it is an ordinary least squares 'OLS' regression) that considers the matched cases. The results of this regression provide the answer to our research question.

The model uses some independent variables that are the same for men and women. In the first regression, where the dependent variable is access to microcredit, the independent variables used are: age, sex, place of residence (rural in particular), status of head of household, literacy (yes or no), household size of the beneficiary, number of children under 18 in the household, number of educated children. In the second regression, where the dependent variable is the binary indicator of poverty, the independent variables are the same as listed before in addition to the variable 'access to microcredit.' We note that this model considers a limited number of independent variables, which is due to the sequential procedure. It considers only variables that provide conditional independence to the treatment. This means variables that 'explain' both the outcome and treatment assignment.

Source of data and descriptive statistics

The data used in this paper is sourced from a field survey realized by the Malian Observatory of Sustainable Human Development on microfinance beneficiaries and non-beneficiaries in Mali. The survey was run from December 2007 to January 2008 and is composed of 2400 microfinance client households (including beneficiaries and non-beneficiaries of microcredit) with the intention of assessing the impact of microfinance on poverty alleviation. The surveys were carried out to obtain data for all types of microfinance programs in Mali (e.g., CVECAs, mutual, solidarity lending institutions, financial companies), in addition to considering all economic activities.

Table 1 shows that the amounts borrowed and saved by male beneficiaries are significantly higher than those of female beneficiaries. In terms of total credit per person,

Table 1. Descriptive statistics for quantitative variables in Mali, 2007

Characteristics	Sex	N	Means	Standard deviation	Average standard error	t (t-test for equality of means)	Sig. (bilateral)
1 **Membership duration (in months)**	female	762	50.01	38.82	1.41	−2.30	0.02**
	male	1638	54.33	44.51	1.10		
2 **Deposit (current account) (in FCFA)**	female	762	56,196	191,527	10,156.99	−2.13	0.03**
	male	1638	134,862	690,201	19,709.64		
3 **Deposit by individual and group (in FCFA)**	female	762	34,087	96,809	3,885.62	−5.26	0.00***
	male	1638	113,580	371,247	9,945.72		
4 **Amount of initial deposit (in FCFA)**	female	762	22,949	97,519	4,643.77	−2.09	0.04**
	male	1638	55,838	326,778	8,509.56		
5 **Number of credits obtained**	female	762	2.48	3.23	0.12	0.44	0.66
	male	1638	2.42	3.29	0.09		
6 **Total credit by member (in FCFA)**	female	762	226,624	594,272	22,479.02	−3.22	0.00***
	male	1638	565,233	2,750,548	72,092.86		
7 **First credit obtained (in FCFA)**	female	762	123,211	252,292	13,776.41	−3.66	0.00***
	male	1638	238,698	559,829	17,657.88		
8 **Last credit obtained (in FCFA)**	female	762	180,227	553,678	30,284.59	−2.69	0.01***
	male	1638	317,222	874,367	27,539.17		
9 **Total amount used (in FCFA)**	female	762	143,966	361,878	15,915.30	−4.61	0.00***
	male	1638	309,637	775,223	24,474.92		
10 **Amount used for household expenses (in FCFA)**	female	555	66,065	96,205	13,065.88	−0.16	0.87
	male	1056	236,820	306,515	28,506.17		
11 **Amount used for productive activities (in FCFA)**	female	555	175,788	276,821	31,515.57	−4.01	0.00***
	male	1056	183,653	367,029	32,080.29		
12 **Length of production cycle (in months)**	female	555	3.93	5.08	0.22	−5.60	0.00***
	male	1056	5.43	5.05	0.16		
13 **Gross operating income/year (in FCFA)**	female	555	264,374	1,296,546	57,063.55	−1.57	0.12
	male	1056	912,163	9,338,456	312,594.86		
14 **Normal profit by production cycle (in FCFA)**	female	555	84,142	593,171	26,118.13	−3.60	0.00***
	male	1056	314,033	1,380,406	45,929.17		

Note: *** = significant at 1%; ** = significant at 5%.
Source: Based on survey data from the study 'Microfinance and poverty reduction in Mali' (ODHD, 2008).

the male beneficiaries get almost 2.5 times what the females get, as we can see in row 6. In rows 7 and 8, when comparing the first and last credits received by a beneficiary, we find differences as follows: the average amount of the first loan for male beneficiaries is almost 1.94 times the female average amount, and for the last loan the ratio is 1.67. These differences could be reasoned by, first, the confidence that microfinance organizations have in men who usually hold the major means of production. Second, it seems that men take more risks than women do. The women's behavior reflects also a gradual access to higher credit amounts after periods of experiencing the use of the loans.

In terms of the number of credits obtained, we notice in row 5 no significant difference between men and women. This indicates no differences in the renewal of loans. Row 9 shows that compared with women, men used a higher amount of credit. However, by comparing the means in rows 9 and 6, we find that 63.5% of the amount borrowed by women is used, while men use only 54.8% of the loan amount. The borrowed funds are used in two main categories: household-related expenditures and income-generating activities. Comparing row 10 with row 11 shows that, on average, female beneficiaries spend around 73% of the used amount of the loan for economic activities, while the remaining 27% was dedicated to household-related expenditures. For men, 56% is invested in the household and 44% in economic activities. These results might suggest, in relative terms, that women are more committed to using the loan for economic purposes.

For deposits, there is a marked and significant difference between men and women beneficiaries. In fact, men save 2.4 times the amount that women save on average — as we see in row 2. When we compare the savings relative to the loan amount (shown in row 6), we find that there is no significant difference because the ratio is 25% for women and 24% for men. Therefore, we can say that although women make bigger use of the loan compared with men, the relative saving is almost the same for both.

This can be interpreted as the use of the loan by women being, in the end, more efficient than it is by men, because in the women's case the loan is dedicated more to income-generating activities without affecting the level of savings.

The configuration of the economic activities developed by the male and female beneficiaries reveals two observations. On the one hand, the activities undertaken by women have a shorter average duration (in terms of cycles) and a larger size compared with men's activities. On the other hand, these activities generate slightly different revenues according to sex. The table shows no significant difference in terms of gross profit generated by economic activities of the two genders (row 13), however, the demonstrated figure (0.12) results from a t-test with hypothesis of equal variances. In row 13, the t-value concerning the gross operating income is non-significant (0.12). However, when we consider the non-equal variance hypothesis, t takes a value of 0.042 (as given in **Table 5** in the Appendix). This latter value indicates a significant difference between women and men whose generated incomes are far from the means of their groups. In other words, this statistical result indicates a difference only in exceptional cases for the two genders (and with superiority of men to women).

With these data, through nonlinear principal components analysis, we created a binary indicator (1 = poor, 0 = non-poor), that is two classes of living standards. This classification results from the inclusion of a non-monetary poverty line $Z = 50$th percentile of the distribution, according to multidimensional poverty indicators. This means that all beneficiaries with an index score above the threshold will be considered non-poor. Below this threshold, they are considered poor. **Table 2** shows the incidence of poverty according to the gender of beneficiaries. Based on this, among new clients (less than two years), the proportion of poor borrowers is 35.6% of women and 41.7% of men. Among longer-standing members (more than two years), the percentages of the poor are 57.1% and 53.9% for women and men respectively.

Empirical results

The main results presented below discuss the determinants of access to microcredit by gender and the average effects on poverty reduction between the two genders. In addition, because of their importance, other points will be highlighted in our analyses including differences between urban and rural areas, new and old clients, and younger versus older clients from the two genders.

Factors related to gender influencing access to microcredit

Derived from the first stage of analysis, the analytical results of the probit model are presented in **Table 3**. Overall, females have a higher chance of getting loans (row 3). However, being a woman and a head of household would not affect access to loans (row 4). For male beneficiaries, the status of being the head of the household increases the probability of having access to microcredit although with low significance.

The age of women significantly increases the likelihood of getting a loan, while for men the coefficient is

Table 2. The incidence of poverty of the beneficiaries

Characteristics	Sex	N	Percentage of poor borrowers
Poverty of new beneficiaries	female	89	35.6%
	male	225	41.7%
Poverty of long-standing beneficiaries	female	292	57.1%
	male	592	53.9%

Table 3. Results of probit model on determinants of access to microcredit by gender of beneficiaries

Parameters Variables	Total Mali			Sex of beneficiary					
				Male			Female		
	B	Z	Sig.	B	Z	Sig.	B	Z	Sig.
1 Age of beneficiary	0.040	3.16	***	0.010	0.63		0.095	4.13	***
2 Rural	0.581	9.67	***	0.625	8.71	***	0.499	4.50	***
3 Woman	0.475	5.97	***						
4 Head of household	0.103	1.26		0.232	2.21	**	−0.02	−0.19	
5 Household size of the beneficiary	0.014	1.83	*	0.018	1.83	*	0.007	0.53	
6 Number of children under 18 in the household	0.008	0.54		0.007	0.46		0.014	0.61	
7 Schooled children	0.086	1.55		0.040	0.61		0.213	2.09	**
8 Constant	−1.252	−4.45	***	−0.662	−1.93	*	−1.992	−3.89	***
9 Log-likelihood	−1471.748			−1031.936			−432.422		
10 Chi² (sig.)	LR χ²(8) = 200.88 (0.000)			LR χ²(7) = 126.89 (0.000)			LR χ²(7) = 49.80 (0.000)		
11 Pseudo R²	0.064			0.058			0.054		
12 Likelihood report	14.78 (0.000)								
13 N weighted	2400			1623			777		

Dependent variable: binary indicator of access (0–1) to microcredit.
Note:
*** = significant at 1%;
** = significant at 5%;
* = significant at 10%.
Source: Based on survey data from the study 'Microfinance and poverty reduction in Mali' (ODHD, 2008).

not significant (row 1). Moreover, living in rural areas (row 2) is a significant factor for access to microcredit, for both women and men. The household size has a positive impact on access to credit from microfinance organizations. This result is significant for men and insignificant for women beneficiaries. In addition, as we see in row 6, the number of children under 18 has no effect on the probability of receiving a loan. On the contrary, the number of schooled children in the household significantly increases the opportunities for women to get microcredit.

We can conclude from this table that microfinance programs in Mali focus on lending to women and targeting rural areas. The older age of female clients and having schooled children is positively and significantly considered by the MFIs, while such variables have no effect on men's access to microcredit. Finally, except for 'the number of schooled children,' the household-related factors are not significantly considered when lending to women, while some of these factors are significant when giving loans to men, namely the factors of 'being the head of the household' and 'the household size.'

The effects of microcredit on poverty reduction

Using the results of the probit model in the first stage, we derive propensity scores for each category of beneficiaries. **Figure 1** summarizes the results of the ATT[5] (which are calculated based on the propensity scores and kernel matching procedure concerning the effects of microcredit on poverty reduction in Mali). From this figure, three main observations can be made.

First, from panel A, we see that the overall results confirm the hypothesis of a reduction in poverty through access to microcredit. Indeed, the average effect of poverty is higher among members who have benefited from microcredit (0.096; $t = 4.655$) compared with non-beneficiary members with the same average propensity score.

At the individual group level, the gender analysis shows that women beneficiaries present an average effect of poverty reduction higher (0.123; $t = 3.783$) than men beneficiaries (0.071; $t = 3.120$).

Second, panel B shows the results according to areas of residence. It suggests that the effects of microcredit on poverty alleviation are overall significant in rural areas (0.090; $t = 2.344$), while we see a non-significant overall impact in urban areas (0.019; $t = 0.976$). In addition, for men in particular the impact has a negative value (but not significant), indicating poverty augmentation instead of alleviation in urban areas, while it is positive and significant in rural areas (0.104; $t = 2.347$). For women, we find a positive but not significant impact according to the area of residence.

Third, the results according to membership duration (as given in panel C of **Figure 1**) show that the poverty-reduction effects are significant and higher in the short term (0.107; $t = 2.892$) compared with the long term (0.081; $t = 3.073$). This is normal as the marginal impact declines but remains positive. However, the significance of the impact in the short term is driven primarily by the impact on men, while for women we find no significance. Microcredit has a greater impact on male adherents (0.112; $t = 2.605$), while the effects are insignificant for women. However, in the long term, women present positive and more significant effects on poverty reduction (0.102; $t = 2.317$) compared with men (0.050; $t = 1.889$).

To sum up, the overall results of our microfinance impact evaluation show a significant effect of microfinance on poverty alleviation for all beneficiaries, regardless of gender. Being a resident of rural or urban areas has no effect on the microfinance impact for women, while men show two contrasting results of negative and positive impact in rural and urban areas respectively. Finally, older female clients show significant impact while newcomers show no significance. On the contrary, male beneficiaries show an impact that is more positive on the newcomers than on older clients, with significance in both cases.

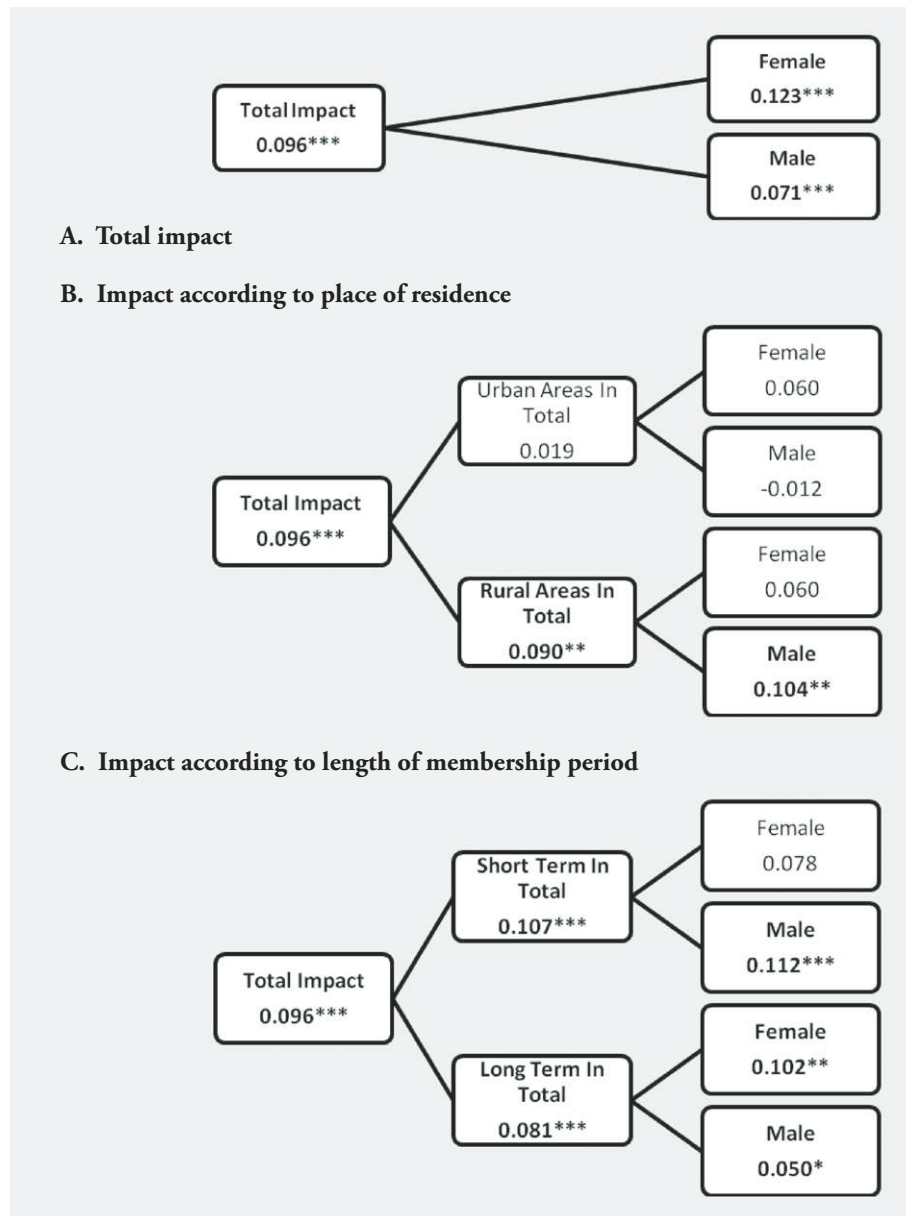[5] Detailed results are indicated in Table 4 in the Appendix.

Figure 1. Results of propensity score matching: Effects of MFIs in reducing poverty (ATT) in Mali (ODHD, 2008).

Conclusion

The use of the PSM approach enabled us to conduct a quantitative impact evaluation, although our data set is neither current nor randomized. However, the method suffers from some limitations, among which we can mention the following. It requires large samples in order to give more reliable results. It can only adjust for observed covariates and does not balance with non-observed ones as in the randomized control trials. It does not overcome all the selection bias (Li and Yue, 2008). However, this method is much cheaper compared with random controlled trials. Moreover, it makes use of already collected data, and contributes quantitatively to the measurement of impact.

This research confirms that microfinance in Mali has a positive impact on poverty alleviation in total, and higher

on female than on male beneficiaries. The findings present also the importance of the length of involvement period with the MFI for women. In addition, the place of residence is important for men. Men benefit more in the short term. It is also important to highlight one of the results that indicates a negative (though non-significant) impact of microfinance on male beneficiaries in urban areas.

Our sample shows that older women have more chance of getting loans than younger women. It was shown that in terms of amounts (borrowed and saved), men outweigh women. However, relative to loan amounts, women seem to use bigger proportions of the loan and they are more committed to using the money for income-generating purposes. At the same time, the level of savings relative to the loan amount is the same for the two genders. Based on the given information, we can interpret this as meaning that women show efficiency in using the loans for economic activity but rather in the longer term than in the short term in comparison with men.

In light of these results, microcredit in the Malian case seems to be efficient in alleviating poverty for both men and women. MFIs should target men in rural areas. Although this may lead to higher distribution costs in the short term, in the long term it may reduce the risks and lead to higher profits. Donors should provide support to women entrepreneurs so that their initial learning curve is enhanced and so they can benefit from microfinance loans even in the short term.

Appendix

Table 4. Results of propensity score matching: Effects of MFIs in reducing poverty

		Members with microcredit	Members without microcredit	Average poverty-reducing effect	*t*–Value*
Effects by gender of members					
1	All	1529	870	0.096	4.655***
1-A	Male	966	648	0.071	3.120***
1-B	Female	563	211	0.123	3.783***
2	**Effects by place of residence and gender of adherents**				
2.1	**Urban area**	834	666	0.019	0.976
2.1-A	Male	504	496	−0.012	−0.502
2.1-B	Female	330	159	0.060	1.305
2.2	**Rural area**	695	204	0.090	2.344**
2.2-A	Male	462	154	0.104	2.347**
2.2-B	Female	233	51	0.060	0.793
3	**Effects by status of membership and gender of adherents**				
3.1	**New beneficiary <2 years**	428	379	0.107	2.892***
3.1-A	Male	263	287	0.112	2.605***
3.1-B	Female	165	84	0.078	1.382
3.2	**Long-standing beneficiary >2 years**	1101	491	0.081	3.073***
3.2-A	Male	703	363	0.050	1.889*
3.2-B	Female	398	127	0.102	2.317**

Dependent variable: binary indicator of poverty of beneficiaries.
t-Values may be slightly different due to rounding.
Note:
*** = significant at 1%;
** = significant at 5%;
* = significant at 10%.
Source: Based on survey data from the study 'Microfinance and poverty reduction in Mali' (ODHD, 2008).

Table 5. *t*-Test for equality of means for quantitative variables

Characteristics (in FCFA)	Hypotheses	*t*-Test for equality of means					
		t	Sig. (bilateral)	Means difference	Standard deviation difference	Interval of confidence 95% of the difference	
						Inferior	Superior
Membership duration (month)	equal variances	−2.30	0.02	−4.32	1.88	−7.99	−0.64
	unequal variances	−2.42	0.02	−4.32	1.79	−7.82	−0.82
Deposit (current account)	equal variances	−2.13	0.03	−78,665.33	37,016.40	−151,271.77	−6,058.90
	unequal variances	−3.55	0.00	−78,665.33	22,172.83	−122,156.65	−35,174.02
Deposit by individual and group	equal variances	−5.26	0.00	−79,493.09	15,126.61	−109,158.55	−49,827.64
	unequal variances	−7.45	0.00	−79,493.09	10,677.80	−100,435.62	−58,550.56
Amount of initial deposit	equal variances	−2.09	0.04	−32,889.70	15,769.25	−63,816.42	−1,962.98
	unequal variances	−3.39	0.00	−32,889.70	9,694.19	−51,901.98	−13,877.41
Number of credits obtained	equal variances	0.44	0.66	0.07	0.15	−0.23	0.36
	unequal variances	0.45	0.67	0.07	0.15	−0.23	0.36
Total credit by member	equal variances	−3.22	0.00	−338,608.96	105,213.90	−544,940.43	−132,277.49
	unequal variances	−4.48	0.00	−338,608.96	75,516.13	−486,722.24	−190,495.67
First credit obtained	equal variances	−3.66	0.00	−115,486.50	31,594.16	−177,465.95	−53,507.05
	unequal variances	−5.16	0.00	−115,486.50	22,396.21	−159,425.50	−71,547.50
Last credit obtained	equal variances	−2.69	0.01	−136,995.01	50,912.21	−236,871.30	−37,118.72
	unequal variances	−3.35	0.00	−136,995.01	40,933.63	−217,330.65	−56,659.37
Total amount used	equal variances	−4.61	0.00	−165,671.37	35,961.52	−236,210.88	−95,131.86
	unequal variances	−5.68	0.00	−165,671.37	29,194.50	−222,937.55	−108,405.18
Amount used for household expenses	equal variances	−0.16	0.87	−7,864.42	48,300.82	−103,091.62	87,362.77
	unequal variances	−0.18	0.86	−7,864.42	44,970.84	−96,559.63	80,830.78
Amount used for productive activities	equal variances	−4.01	0.00	−17,0754.34	42,637.35	−254,928.96	−86,579.71
	unequal variances	−5.45	0.00	−17,0754.34	31,357.91	−232,703.87	−108,804.80
Length of production cycle	equal variances	−5.60	0.00	−1.50	0.27	−2.03	−0.98
	unequal variances	−5.59	0.00	−1.50	0.27	−2.03	−0.98
Gross operating income/year	equal variances	−1.57	0.12	−647,788.15	413,349.00	−1,458,634.97	163,058.67
	unequal variances	−2.04	0.042	−647,788.15	317,760.60	−1,271,381.94	−24,194.37
Normal Profit by production cycle	equal variances	−3.60	0.00	−229,890.85	63,912.21	−355,263.56	−162,452.03
	unequal variances	−4.35	0.00	−229,890.85	52,836.02	−333,541.50	−194,299.96

Source: Based on survey data from the study 'Microfinance and poverty reduction in Mali' (ODHD, 2008).

Acknowledgments

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BIOGRAPHICAL NOTES

Yaya Koloma is an associate professor at ISTOM, School of International Agro-Development, Cergy Pontoise, France.

Correspondence to:
Yaya Koloma
ISTOM, School of International Agro–Development
13 Boulevard de l'Hautil
95000 Cergy
France
e–mail: ykoloma@yahoo.fr

Hayyan Alia is a PhD student at CRESE, University of Franche-Comté, Besançon, France. He is also a teaching associate in the Finance, Law, and Control Department and a research associate in the Banque Populaire Chair in Microfinance, Burgundy School of Business, Dijon, France.