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Credit access and life satisfaction[†]

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Abstract

Microfinance institutions are used to claim that their impact goes beyond money since rescuing from exclusion uncollateralized poor borrowers significantly affects their dignity, self-esteem, social recognition, future economic perspectives and, through it, life satisfaction. Our paper aims to verify the validity of this claim by evaluating whether access to microfinance loans has significant direct impact on life satisfaction beyond its indirect impact via current income changes. Empirical findings on a sample of poor borrowers in the suburbs of Buenos Aires show that, after controlling for survivorship, selection and interview bias, microfinance membership has a significant and positive effect on life satisfaction.

Keywords: *microfinance, life satisfaction, impact analysis.*

JEL codes: G20, I31, I32, O16.

1. Introduction

Successful development projects which rescue beneficiaries from marginalization and provide access to opportunities go beyond the provision of monetary resources since they end up healing in beneficiaries wounded relationships with themselves (restoration of dignity and self-esteem) and with other members of the society (social recognition and reputation).

Along this line many MFIs argue that lending to the uncollateralized poor living close to the poverty line has an impact which goes beyond the mere money concession. This is well reflected in the main advertising statement of the *Worldrelief* organization claiming that:

“The world of microfinance opens the door of opportunity for the poor – providing the dignity and satisfaction that comes from working to support one’s family. Microfinance is about much more than just money. It helps create stability at home, teaches individuals how to thrive, and fosters self-respect and community well-being. Once empowered, men and women are able to support their families for a lifetime – not just a few days or weeks. It’s the difference between a hand up and a handout” (<http://worldrelief.org/microfinance>).¹

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Are these claims overstated? In order to give an answer it is necessary to broaden the scope of microfinance impact analysis by considering among performance variables not only standard economic (consumption, productivity, income per capita) but also non pecuniary wellbeing indicators.

This enhanced focus is important for at least four reasons.

First, the discussion on the relationship between income and happiness and, more generally, between subjective and objective wellbeing measures is always more at the center of the economic debate² and is relevant not only for highly industrialized countries but also for developing countries (see section 2). This growing attention may be explained by the increasing awareness that social sustainability, local empowerment and active participation to development projects are fundamental for their success. In this perspective measuring the effects of projects characteristics on broader concepts of wellbeing may help to evaluate the local support and the probability of success of future initiatives beyond their expected income and economic effects.

Second, findings from life satisfaction estimates can be a good complement of standard impact analyses since they are able to capture the effect of relevant (material and immaterial) omitted factors on individual wellbeing. This point is all the more important in microfinance where a loan to an uncollateralized borrower may save him from social exclusion. From this point of view we may conceive the capacity of an individual to contribute to social life and to create economic life as an “iceberg”. The smaller visible part (easier to investigate) is its productivity and its visible contribution to the creation of economic value in the society, while the larger hidden part, made of dignity, self-esteem and social recognition is actually the invisible pillar of the former.

This perspective may help us to solve some microfinance puzzles such as the surprisingly high repayment rates despite loans are generally uncollateralised. In order to explain the paradox the literature has emphasized so far the role of assortative matching (Murdoch 1999; Ghatak and Guinnane 1999), peer monitoring in presence of group lending with joint liability (Armendariz, 1999; Stiglitz 1990; Banerjee, Besley and Guinnane 1994) and dynamic incentives in presence of individual progressive loans (Wydick 1999; Karlan 2005a). Beyond these monetary incentive based rationales, the loss of the two “invisible pillars” (social recognition and self esteem) which may originate from non repayment may be enough to avoid moral hazard during the project and strategic default at the end of it, when the social sanctions and the loss of dignity effects more than compensate the sums diverted from the bank.

² Within this debate a line of thought argues that happiness indicators represent a unique, subjective and “non paternalistic” measure of wellbeing which cannot be suspected of imposition from external experts and should reflect the real desires (driven by individual tastes which may be self driven or affected by social norms) of those who are targets of a policy intervention (Sugden, 2008). The critique to this position is well expressed by the “happy slave paradox”: if individuals are so deprived of their rights, they may be in a condition of not even desire their emancipation and therefore remain satisfied of their condition of slavery (Sen, 2005). The ample empirical literature however shows that happy slave paradoxes are irrelevant when drawing inferences on large samples which always reveal a strong positive correlation between life satisfaction and capabilities (Frey and Stutzer, 2002b).

From this point of view our analysis on the effects of the microfinance loan concession on life satisfaction helps us to identify, net of the income effect, an extra non-pecuniary benefit which is an additional deterrent to opportunistic behavior.

Third, further motivation for our study may come from the fact that the life satisfaction literature has started investigating the role of financial capabilities also in high income countries. From this point of view Taylor et al. (2009) document in their empirical analysis on the British Household Panel Survey that financial capability has a significant and positive impact on life satisfaction and health reducing by 15 percent the possibility that an individual suffer from anxiety or depression. This implies that, if the same nexus holds also in poor countries, part of the microfinance effect on life satisfaction may be due to the enhanced financial capability (provided that the borrower successfully repays) even though this effect may be counterbalanced by the stress of meeting repayment deadlines.

The fourth reason which motivates our work is that another component (not fully captured by traditional quantitative indicators) in the overall effect of microfinance on life satisfaction may be its impact on trust and trustworthiness. First of all, the loan concession is an act of trust (after the verification of borrower qualities) on the borrower's capacity to repay which has horizontal externality effects since it reveals to individuals living in the same geographical area the creditworthiness of the new borrower. This signaling effect may improve relationships with neighbors (Becchetti and Conzo, 2010) and, through it, life satisfaction.³

Based on these considerations which help us to understand the multifaceted effects of microfinance (not all captured by traditional quantitative indicators) our paper aims to verify its impact on the synthetic indicator of borrower's life satisfaction. To do so we perform an impact study on poor individuals living in the suburbs of Buenos Aires. Half of them are clients of Protagonizar (a microfinance organization) and are heterogeneous in terms of length of the relationship (credit cycle).⁴ The other half of the sample is made of a control group of individuals living in the same area and being eligible according to the Protagonizar standards for creditworthiness.⁵

³ Consider however that part of this enhanced trustworthiness may also have sound economic effects since, in a framework of contract incompleteness, many aspects of business relationships may be modelled under the form of an investment game (Berg, Dickhaut and McCabe, 1995). More specifically, the relationships between business partners, between an entrepreneur and her partners generally assume a sequential structure. One of the two players takes the initiative first by sharing something (knowledge, physical or financial assets) and, after it, the counterpart may decide whether to do the same or to abuse of the trust of the first mover. As in the typical investment game the counterparts joint decision to share (the trustor) and not to abuse (the trustee) has superadditive effects and a higher outcome than the two suboptimal equilibria in which the first player shares and is abused or the first player decides not to share because she is afraid of the risk of being abused. As a consequence, enhanced reputation has monetary but also non monetary effects.

⁴ In the relationship with Protagonizar borrowers can have access to a new loan once they have paid the previous one. For credit cycle we therefore mean the number of subsequent loans that the borrower had with Protagonizar whatever the time interval occurred between two consecutive loans.

⁵ To account for survivorship we add to the original sample made by these two groups a third group of Protagonizar drop-outs in a number proportional to the historical dropout rate of the MF organization.

Our main finding is the identification of a significant correlation between the borrower-MFI relationship and life satisfaction, net of the effect on the latter of household income and after controlling for survivorship, interview and selection bias. More specifically on this point, our final result on the positive and significant relationship between credit cycle and life satisfaction in the subsample of MFI borrowers (excluding eligible non participants) overcomes the selection problem between MFI and non MFI borrowers and can hardly be explained by the desire of respondents to please the interviewer (which can exist for MFI borrowers only and can hardly be assumed to be proportional to credit cycles). In a final robustness check, following the approach of Ichino et al. (2006) we formulate plausible distributional hypotheses on an unobservable confounder which may be correlated with outcome and selection into treatment and document in a sensitivity analysis that our findings are robust to its introduction.

Our interpretation is that this finding captures all those positive MFI effects which do not materialize into current income (such as future economic perspectives arising from current investment, social recognition, self esteem, etc.).

The paper is divided into seven sections (introduction and conclusions included). In the second section we shortly summarize the literature on life satisfaction with specific reference to studies in developing countries. In the third section we briefly describe the characteristics of the MFI under scrutiny. In the fourth section we illustrate our survey design. In the fifth section we present descriptive statistics. In the sixth section we comment our econometric findings and robustness checks. The seventh section concludes.

2. Shall we rely life satisfaction results ?

Starting from the well known Easterlin (1974) paradox ⁶ which documented the decoupling between the dynamics of per capita income and happiness in the postwar US, the economic literature on the determinants of life satisfaction has flourished with an increasing number of published contributions. More in general, and beyond the provocation of the paradox, the interest in this strand of the literature arises from the desire to test empirically the undemonstrated assumptions about the shape of utility

⁶ Evidence supporting the paradox is also reported by Blanchflower and Oswald (2004) for the UK, Frey and Stutzer (2002b) on a large sample of countries using data from the World Database of Happiness and the U.S. Bureau of Census and Veenhoven (1993) for Japan over the period 1958-1987. In spite of it, the Easterlin paradox is not in itself a regularity always confirmed across countries and time. When Castriota (2006) repeats the Easterlin exercise on Eurobarometer data for some European countries in the last decade he actually finds that the paradox applies to Germany but not to Italy where a quite strong positive relationship between the happiness and per capita income is found.

functions which are at the basis of economic models once a wide array of large databases including information on self declared life satisfaction has become available.⁷

The life satisfaction empirical literature has examined the relationship between happiness and several determinants such as income (see, among others, Easterlin, 1995 and 2000; Frey and Stutzer, 2000; Di Tella et al. 2005 Winkelmann and Winkelmann, 1998; Ravallion and Lokshin, 2001; Ferrer-i-Carbonell and Frijters, 2004; Ferrer-i-Carbonell, 2005 and Clark et al., 2005), employment status (Winkelmann and Winkelmann, 1998), marital status (Argyle, 1999; Johnson-Wu, 2002; Blanchflower and Oswald, 2004; Frey and Stutzer, 2002a, 2002b and 2006), unemployment and inflation (Clark and Oswald, 1994; Gallie and Russell, 1998; Di Tella et al., 2001, 2003), relational goods (Becchetti et al., 2002), natural capital (Engelbrecht, 2011) and many other factors.

Life satisfaction studies are also of practical interest since they reveal themselves very useful for estimating with approaches such as the compensating surplus, the shadow value of several non marketable goods such as air quality and pollution (Welsch, 2002 and 2006), airport noise (Van Praag and Baarsma, 2005), terrorism (Frey et al., 2007), the fear of crime (Moore and Shepherd, 2006), marriage (Johnson and Wu, 2002; Blanchflower and Oswald, 2004; Frey and Stutzer, 2006) and unemployment (Clark and Oswald, 1994; Gallie and Russell, 1998; Di Tella et al., 2001 and 2003).

From a methodological point of view life satisfaction has been measured either as a short run reaction to daily events (momentary affect) with the diary method (Kahneman et al., 2006), or as a comprehensive long run evaluation of one's own satisfaction about life. The largest part of empirical contributions has followed this second direction considering that a clearer evaluation of one's own satisfaction requires the contribution of a (delayed in time) inner resounding of lived experiences.

The use of interview based information on respondents' evaluation about the overall quality of their life is not free of methodological problems well discussed in this literature – i.e. the signal on the inner state of the respondent mixed with the noise caused by the current affect (Schwarz and Strack, 1999), the intercomparability of ordinal scales across different cultures, etc.). In spite of these problems there is substantial evidence that life satisfaction passed a series of validation checks (for references see Frey and Stutzer, 2002b)⁸.

2.1 Life satisfaction studies in developing countries

Most empirical studies investigate determinants of life satisfaction in high income countries, while research on the effects of development projects in low income countries, not just on economic

⁷ Even though the question whether life satisfaction responses measure flow or lifetime utility is still open, life satisfaction measures nonetheless represent the closest empirical proxies to the standard utility concept in economic theories.

⁸ See also Penn (2009) on the importance of non-response in self-reported measures of satisfaction.

indicators but also on broader concepts of wellbeing and life satisfaction, is still lagging behind. In the last decade however several authors have tried to bridge this gap by emphasizing that the combination of quantitative and qualitative wellbeing indicators can yield important additional insights also in the case of development studies (Herrera et al., 2006; Ravallion and Loskin, 2002a and 2002b and Narayan et al., 2000a and 2000b). More specifically, since inclusion processes involve important non economic effects (on self-esteem, dignity, social recognition), while changes in economic conditions have indirect effects on population cultures and habits, the broader wellbeing effect of development policies does not coincide with the traditionally measured economic one. Furthermore, life satisfaction indicators may help to measure shadow values of non market goods for the affected populations and the real distribution of benefits of a given policy program among different stakeholders. In this respect Rojas (2008) analyses the intra-household distribution of health satisfaction and identifies in this way gender inequalities which can be due to cultural discrimination and bargaining in family arrangements.

A typical finding of life satisfaction studies in developing countries, when compared with those in high income countries, is the confirmation of the concave life satisfaction-income hypothesis and of the implied law of decreasing marginal utility,⁹ one of the basic tenets of the standard economic theory formulated well before the availability of data for empirical testing.

From this point of view Herrera et al. (2006) compare Madagascar and Peru, and document that the correlation between subjective wellbeing and income is stronger in poorer environments. A similar result is obtained by Becchetti et al. (2011) comparing the life satisfaction effect of affiliation Fair Trade in two areas with markedly different standard of living. In the same direction Becchetti and Castriota (2010) illustrate how exogenous shocks on income, such as the “negative lottery” of the tsunami, and the subsequent project to recapitalise microfinance institutions, determine changes in the life satisfaction of the borrowers hit by the catastrophe which appear stronger than those observed with parallel exogenous shocks in rich countries (Gardner and Oswald, 2004; Frijters et al., 2004).

A second peculiarity of determinants of life satisfaction in developing countries is that we generally observe (especially in societies with high perceived vertical mobility) a more positive reaction to income inequality than in high income countries (Herrera et al., 2006) since wellbeing improvements by peers are interpreted as increased opportunities for social mobility. This is consistent with what observed in transition countries, in which the Hirschman’s (1973) *tunnel effect* generally prevails over the negative impact of inequality (Senik, 2004).

Within this literature we aim to extend the use of life satisfaction measures of the impact of development projects to initiatives explicitly designed to promote inclusion and credit access such as microfinance.

⁹ For its earliest formulations see Gossen (1854), Jevons (1886) and Menger (1971).

3. Protagonizar

*The help we received from Protagonizar was enormous. I felt that not everything was lost. On some occasions we tried to get a bank loan but they asked for a credit card and wages receipt; impossible. Here instead, we go with our word, they believe and trust us. This is beautiful and I feel we are not alone.*¹⁰

Protagonizar is a microfinance organization with 8 years of life providing uncollateralized loans to small microentrepreneurs engaged in activities such as bakeries, textile enterprises, beehives or basketworks.

The organization operates in a well-circumscribed area (the three slums of *Santa Brígida*, *Villa de Mayo* and *Mitre* and in the suburbs of Buenos Aires). This choice determines low operative costs and makes it feasible an approach of personalized attention to the borrowers. A group of motivated volunteers working together with the paid professional staff members support the microfinance institution.

Protagonizar lending activity started with *staggered individual credits* and more recently evolved to a *group lending mechanism with full joint liability*. The *staggered individual credit mechanism* required the formation of a group of three entrepreneurs with independent projects (who, differently from the Grameen and many other examples, can also be connected by family ties). The MFI lent sequentially to each member of the group, conditional to the repayment of the member who borrows before.

The *group lending credit* is based on the creation of groups of 4-6 individuals which receive their loan simultaneously. There is full joint liability among members since, when one of them is unable to repay, the groupmates are called to cover in full that amount.

Under both (staggered individual and group) lending approaches, administrative costs charged by the Foundation are 5 percent monthly over the debt balance against an average lending rate charged by moneylenders in the three villages of around 50 percent monthly.¹¹

The following eligibility criteria are required to obtain the loan: i) a minimum of six month entrepreneurial experience; ii) absence of family ties between groupmates, iii) maximum living distance of three blocks among group components and iv) (in order to diversify risk within the group) diversification of business activities (only one street vendor per group). Note also that the money of the group is not given individually but to the coordinator of the group (one of the group members) who distributes it to the other and collect the installments to pay to the lender.

¹⁰ Extracted from the “*microentrepreneurs’ stories*” section of the *Protagonizar* handbook (2005).

¹¹ Real interest rates are not particularly high if we consider unofficial inflation rates. Consider in fact that several authors judge Argentinean poverty lines grossly undervalued due to a downward bias in computing domestic inflation. One of the main independent research centers, Ecolatina, estimates that prices rose 65 percent from Dec. 1, 2006, to July 31, 2009, compared with the 20 percent increase calculated by the statistical institute (to follow this debate see <http://www.bloomberg.com/apps/news?pid=newsarchive&sid=aKQUiLozzZko> and http://www.bloomberg.com/apps/news?pid=newsarchive&sid=a5joiySC_mXc).

Protagonizar's group lending system has a three-sided screening process on the prospective borrower. The organization evaluates both the payment capacity of the client and the consideration that other Protagonizar borrowers (which are not part of her/his lending group) have of her/him. The group lending mechanism is expected to induce assortative matching with the consequence that, for groupmate-neighbours, trust on the borrower is not just declared in words but must be demonstrated by accepting a joint liability.

4. The research design

To assess the impact of microfinance participation on a set of quantitative and qualitative indicators, we develop an empirical analysis based on survey data. From June to September 2009 a questionnaire has been delivered to 359 micro-entrepreneurs located in proximity of the three agencies of Protagonizar (Santa Brigida, Mitre and Villa de Mayo) by two teams composed by one researcher and one field assistant each¹².

Treatment and control groups are formed as follows. From a list of all the Protagonizar's clients we randomly select 150 borrowers (in equal proportion from *Mitre* and *Santa Brigida*)¹³ equally representing new and veteran clients¹⁴. We use the credit cycle information (while not the time distance from the first loan) for the definition of borrowers' seniority since the former is better suited to proxy for borrowers' *quality* in terms of solvency. As a control sample, from the three areas of interest we randomly choose 150 *eligible non participants* micro-entrepreneurs who were not borrowers (neither of Protagonizar nor of any other MFI) at the moment of the interview. In addition, we also create a sample of 59 Protagonizar's former borrowers who dropped out from the program.¹⁵

Following the standard notation in the impact analysis literature, the group composed by the 150 MFI borrowers will be referred to as the *treatment group*, whereas the one by 150 eligible non-participants as the *control group*. The selection of control group members according to the eligibility criteria allows us to reduce the potential heterogeneity between MFI and non-MFI individuals, thus moderating the impact of the *selection bias* in our quasi-experimental framework. Moreover, by also including drop-out

¹² The questionnaire is omitted for reasons of space but is available from the authors upon request.

¹³ We include a third village (Villa de Mayo) in which Protagonizar activity has just started and there are no treatment group observations (MFI borrowers). This is typically done in impact studies in order to reduce the noise generating potential spillover effects from treatment to control group in the two other villages. The econometric results of the paper are however robust in a check in which we exclude respondents of Villa de Mayo from the control sample. Results are omitted here for reasons of space and available upon request.

¹⁴ Borrowers' seniority is evaluated according to their credit-cycle. Since borrowers must first reimburse the previous loan in order to ask for a new one, a higher credit cycle is a proxy of a better borrower's repayment record. Given a median credit-cycle of 17, borrowers with a credit-cycle higher than (or equal to) 17 are categorized as "veteran", while borrowers with a credit-cycle below the median as "new".

¹⁵ We selected a number of dropouts from each area which is proportional to historical exit rates of borrowers from the organization.

borrowers in our study we reduce the effects on our estimates of the *survivorship bias* (Alexander and Karlan, 2009).

5. Descriptive findings

Descriptive statistics (Table 1) document that the average schooling level is quite low (around 8.5 years) and that of the respondent partner is even lower (around 5.6 years). Average monthly household income is 3,654 pesos while median income is 3,000 pesos. This implies that half of sample household lives with around 100 pesos (5 euros) per day. Since the number of members of the household is around 4, interviewed individuals live on with roughly 12.29 PPP US\$ per day.¹⁶

The average amount of last monthly repayment for the microfinance loan among MF borrowers is 122 pesos and around 7 percent of income is saved. Respondents have no temporary employees. Average total productivity (considering main and other jobs) is around 7.9 pesos per hour.

When we decompose the sample in three groups (clients, eligible non participants and dropouts) we find that eligible non participants and dropouts have on average 83 and 67 percent of the monthly average household income of MF borrowers (the difference in means is significant at 95 percent with dropouts and not so with eligible borrowers). Interestingly, MF borrowers and dropouts have a significantly higher number of children than eligible non participants.

The distribution of life satisfaction for the different groups shows that none of the respondents declares a level below 3 and that the frequency of MF borrowers giving answers from 7 to 10 is higher than that of the other groups (see Figure 1). The average level of self declared life satisfaction is significantly higher for MF borrowers than for eligible non participants (8.62 against 8.14). Life satisfaction of dropouts is in the middle and not significantly different from that of MF borrowers. The Wilcoxon non parametric test documents that clients and dropouts have on average a significantly higher level of life satisfaction than eligible non participants (Table 2).

6. Econometric specification

To analyse the effect of MFI participation on life satisfaction we estimate the following specification:

¹⁶ During the survey period (July-Sept. 2009), the average malnutrition and poverty thresholds are set by the INDEC (National Statistical Agency of Argentina) at 4.88 and 11.04 pesos/day respectively, which are in turn equivalent to 3.84 and 8.70 PPP –US\$ according the PPP country's factor evaluated by the World Bank in 2005. When considering the country's implied PPP factor in 2009 (US\$ 2.033, source: IMF), both the malnutrition and poverty lines fall to 2.40 and 5.43 PPP-US\$ per day respectively. Consider however that several authors consider Argentinean poverty lines grossly undervalued do a downward bias in computing domestic inflation (see footnote 8).

$$\begin{aligned} LifeSatisfaction_i = & \beta_0 + \beta_1 Age_i + \beta_2 Female_i + \beta_3 Married_i + \beta_4 Wealth_i + \beta_5 DistanceRoad_i + \\ & + \beta_6 SchoolingYearsR_i + \beta_7 Hmembers_i + \beta_8 Othersources_i + \beta_9 Hincome_i + \varepsilon_i \end{aligned} \quad (1)$$

The specification includes traditional regressors used in life satisfaction estimates (*age, gender, marital status, income, number of household members*) without any variable measuring the microfinance impact (*MFI*). More specifically, *Age* is respondent's age; *Female* is the gender dummy taking value of one if the respondent is female and zero otherwise; *Married* is a dummy equal to one if the respondent is married; *Schooling* is the Respondent's number of schooling years; *Hincome* is the total income of the household divided by 1000 (i.e. monthly respondent's and partner's income from I and II activities); *Hmembers* is the number of household components; *Wealth* is an asset index calculated as the principal component of the various asset variables collected with the survey;¹⁷ *DistanceRoad*, is the distance from the main road as a proxy of the potential demand for the respondent's economic activity; *Othersources* is the total amount of debt service from other financing sources.¹⁸

We estimate the model for the overall sample and for the sample of microfinance borrowers only (Table 3).

Life satisfaction is measured as a categorical ordered variable based on the response to the question "How satisfied are you with your life, all things considered?" The responses are rated from 0 (completely dissatisfied) to 10 (completely satisfied). ...¹⁹ Since the dependent variable is reported in an ordinal scale, life satisfaction regressions are generally estimated with an ordered probit or logit. Van Praag and Ferrer-i-Carbonell (2004 and 2006) however show that the simple linear models are as good as the Probit and Logit method²⁰, but computationally much easier. For this reason we will propose both OLS and ordered probit estimates in order to check the robustness to estimating techniques of each model specification.²¹

¹⁷ The variables considered in the principal component analysis are ownership of a clock, radio, CD, Fridge, TV set, DVD, VCR, bicycle, motorbike, sewing machine, tool kit, car, truck, personal computer, telephone line, cell phone, internet connection. The first component explains around 16 percent of the variability. It is positively correlated with all the variables mentioned above (the highest correlations are with personal computer, 36 percent, and internet connection, 34 percent).

¹⁸ We ask in the questionnaire about the presence of loans from the following additional sources different from Protagonizar: NGOs, trade credit, ROSCAs, private banks, trade credit, family or acquaintances. Note that only 5 percent of individuals (10 percent among non members and 2 percent among members and drop-outs) have access to these additional financing sources (mainly moneylenders for non members and NGOs or trade credit for dropouts).

¹⁹ The question is standard in survey run in both high and low income countries and the same as the one posed in one of the main databases used for life satisfaction studies such as the German Socioeconomic Panel.

²⁰ Van Praag (2007 p. 18) simply argues that "All these specifications amount to different specifications of the labeling system of the underlying indifference curves, but the indifference curves themselves are unchanged and are these indifference curves which are estimated, either by Ordered Probit, Logit or what else."

²¹ Methodological problems such as scale heterogeneity in interpersonal comparisons using self-reported measures at the individual level (Harsanyi, 1955) are widely debated in the life satisfaction literature. There is however widespread consensus that these potential problems do not make empirical evidence on life satisfaction meaningless so that the related empirical literature has evolved and conquered space in top economic journals. More specifically on the issues at stake Di Tella and McCulloch (2006) consider that, even though accepting the existence of heterogeneity in individual scales, we do not need to believe a priori that such heterogeneity is systematically affected by drivers of life satisfaction. More recently, Beegle et al., (2009) with their vignette approach, document that heterogeneity cannot be ruled out but: i) it is uncorrelated with

6.1 Empirical findings

Our findings on the overall sample show that the only significant variable (with positive effect) is *household income* (Table 3, columns 1 and 2).

In a second specification we exclude the drop-out sub-sample and introduce the MF customer status dummy (*client*) which is equal to one if the interviewee is a MF borrower. The variable is strongly significant with positive sign (Table 3, columns 3 and 4).

As it is well known, the calculation of the marginal effect of a change in a regressor on the probability of declaring oneself very happy in the ordered probit estimate is obtained with the following formula:

$$\Delta\text{Pr}(\textit{VerySatisfied}) = F(S + \Delta S - c) - F(S - c) \quad (2)$$

where F is the cumulative normal distribution, S the predicted average satisfaction level and c the highest cutpoint. By applying this formula we find that the MF borrower status is correlated with a 11 percent higher probability of declaring the highest life satisfaction score (Table 4).

Obviously, the specification estimated in columns 3 and 4 (Table 3) is fully subject to selection bias which is particularly severe in microfinance studies.²² Is the nexus between life satisfaction and the borrower status driven by participation to microfinance or is it pre-existent and due to heterogeneous characteristics between treatment and control sample? In this second case a reverse causality nexus applies: individuals endowed with specific personality traits (assertiveness, sociability, etc.) are both happier and more likely to be successful in their job. Such individuals are thus more prone to receive a micro-loan and, by considering them as the treatment group, the impact of MF participation might be overestimated. Note as well that the presence of a selection bias, by overestimating the effect of the treatment on the treated, leads to wrong policy conclusions on its effectiveness. In essence, the argument for the endogeneity between income and happiness applies also to the relationship between life satisfaction and MF borrower status.

As a partial solution to the heterogeneity problem between treatment and control sample consider however that control sample individuals are chosen among those eligible as Protagonizar customers. They therefore live in the same three villages, have income which falls in the category of potential MFI borrowers and have started an economic activity since at least 6 months. Finally, only one out of six of them is a street vendor (see eligibility criteria in section 3).

happiness regressors; ii) vignette rankings are not correlated with the residual of the standard life satisfaction regression; iii) life satisfaction regression results do not change when self declared life satisfaction is rescaled with vignette results.

²² Among the first microfinance papers dealing with these issues see Hulme and Mosley (1996), Pitt and Khandker (1998) and Coleman (1999).

A second problem which prevents us from interpreting our result in the second specification as a causality nexus is the survivorship bias. What we observe are only successful borrowers (those for which the loan, the ex-post economic performance and, presumably, life satisfaction are positively correlated). However the initial pool of borrowers included also those who failed at a given credit cycle and therefore terminated their relationship with the MFI. This second group of initial borrowers is more likely to register a non positive nexus between the microfinance loan, economic success and life satisfaction. In order to have an evaluation of the impact of microfinance which mitigates survivorship bias, we create a dummy taking value of one for both current microfinance borrowers and dropouts (*Clients&Drops*). Results from this third specification document that the MFI borrower status effect on life satisfaction does not disappear when we take into account survivorship bias (Table 3, columns 5 and 6). The magnitude of the effect is just slightly reduced since the MFI borrower or dropout status is correlated with a 10 percent higher probability of declaring the highest level of life satisfaction.

As a fourth specification, in order to reduce heterogeneity between treatment and control group we estimate the model on the treatment group only by using the number of credit cycles as proxy of the microfinance effect. Note that we can restrict our analysis on the treatment group (MFI-clients) only since we have a non dichotomous measure of the treatment, that is the number of cycles. Here again, we find a strong positive effect of the number of credit cycles with life satisfaction (Table 3, columns 7 and 8). With regard to economic significance we find that a unit increase in the credit cycle from its sample mean increases the probability of declaring oneself at the higher level of life satisfaction by 0.6 percent. We can therefore conclude that the length of the relationship with the lender makes borrowers happier beyond current income which is also included as regressor.

Among the possible interpretations (widely discussed in the previous section) for our findings we may consider the expected effect of the financed investment on future income, the nonmonetary benefit of the increased self-esteem and social reputation, the enjoyment of the higher social capital lived in terms of increased trust and trustworthiness in interpersonal relationships.

A typical objection which may be raised on a survey measuring the effects of MF on happiness is that microfinance borrowers may feel themselves obliged to declare higher happiness levels if they figure that the MF institution may in some way check their answers. We however find that our result is robust to the inclusion of dropouts which should not feel the same obligation..In addition to it, it is hard to believe that the number of credit cycles effect may be interpreted in the sense that the interview bias is growing proportionally with the number of successful loans. Furthermore, in order to reduce the impact of a potential interviewer bias, for the whole interview process we recruited and trained local staff not belonging to Protagonizar.

As far as the relevance of our controls we observe that income is not always significant in our estimates. This is a puzzle since the empirical life satisfaction literature has provided ample evidence on

the fact that such variable should be significant for happiness of the poor (see Di Tella and MacCulloch, 2008 among others). More specifically, household income is significant in the overall sample estimate, while not when we eliminate eligible non participants from the sample (Table 3, columns 3-8). Note that the use of a quadratic income specification, personal income of the interviewer, the use of a discrete qualitative income variable based on the distribution of income deciles or the introduction of the level of income deemed satisfactory by individuals does not change our findings (the credit cycle variable remains significant while income does not).

In order to avoid the risk that the income variable is mismeasured (or that household income is a poor proxy of permanent income and/or financial satisfaction which are expected to affect more directly life satisfaction) we add the total amount of debt service from other financing sources (NGOs, trade credit, ROSCAs, private banks, family or acquaintances) among regressors. Note that the mean of this variable is very low (12.75 as an overall sample average) and no more than 10 percent of individuals have access to these additional financing sources (*Othersources*). However the same variable is strongly significant (although very small in magnitude) in the model estimated for clients and drop-outs (while it is not so in the estimate with also eligible non members).

Our interpretation of the income puzzle is that among members income is just one of the factors affecting permanent income and financial satisfaction. Other factors include credit perspectives, wealth (the asset index is strongly positive), other credit sources and even the married status which may capture economic as well as an affective component since income of the stable partner may be underestimated or the family internalizes some costs and allows economies of scale.²³

A second side result which is apparently counterintuitive is the negative effect of education. A plausible interpretation is that, as it is well known, education raises expectations and this may have a counterbalancing (negative) effect on life satisfaction with respect the expected positive one.²⁴

6.2 Further discussion: the income puzzle, potential biases and sensitivity analysis

Note that our findings may be potentially subject to other types of selection bias. From descriptive statistics we observe that eligible non participants are on average richer and closer to the main road. In

²³ Note that if we regress life satisfaction for clients and drop-outs only on the income variable we get a positive income coefficient with a t-stat of 1.68 (2.16 if we do the same for the overall sample) which drops to 1.31 if we just introduce a second regressors such as the number of credit cycles (correlation between the two variables is positive and equal to .12). Hence credit cycles may proxy (together with non monetary factors) future expected revenues for members arising from the financed projects and therefore proxy permanent income better than current income.

²⁴ The point is well resumed by Frey and Stutzer (2002a, p. 59) claiming that “the level of education, as such, bears little relationship to happiness. Education is highly correlated with income [...]. Education may indirectly contribute to happiness by allowing a better adaptation to changing environments. But it also tends to raise aspiration levels. Further, it has been found that the highly educated are more distressed than the less educated when they are hit by unemployment (Clark and Oswald, 1994)”.

principle, if non members living closer to the main road run a better business this could make them happier and therefore create a downward bias in our results. However the reasoning can go the other way round since it might be postulated that individuals with activity closer to the main road can be more stressed by overwork. In such case we have an upward bias. The problem is only partially taken into account in our baseline estimate (Table 3, column 1) when we control for distance from the main road and we have a principal component asset index which captures much better the latent wealth factor.

Another potential downward bias on our results arises if drop-outs and eligible non participants overstate their happiness levels in order to give good signals about their quality as potential borrowers to the bank. Hence if the reasoning applies the significance of our results should be stronger. Obviously also this bias could work in the opposite direction (members may have the incentive to show themselves happy toward interviewers). Consider as well that clients only know at the moment of the interview that they participate to a University experiment with monetary gains and not that the accompanying people is from Protagonizar (as already discussed, *ad hoc* staff having no previous relationships with the MFI organization has been hired for that purpose). This reduces further this kind of bias.

Given these considerations the main threat which can create an upward bias with the risk of invalidating our findings is, in our opinion, a confounder which correlates positively with the treatment, the outcome and selection into the treatment. Such a confounder can be for instance the unobservable skills and enterprising capacity which lead both to higher success in business and higher capacity in finding access to financing sources such as Protagonizar or, alternatively, the observable distance from the main road which implies less stress from overwork and therefore correlates positively both with the outcome (happiness) and selection into the treatment (affiliation to Protagonizar).

In order to address this potential selection bias, we use the propensity score approach and evaluate the Average Treatment Effect on the Treated (ATT) of the MFI membership (considering as members both clients and dropouts to correct for survivorship bias) on the probability of declaring the highest level of life satisfaction (ten)²⁵. The estimated ATT is 0.175 and is significant (t=3.685) supporting the hypothesis of the positive effect of MFI affiliation on life satisfaction.

²⁵ Individuals who declared the highest level of satisfaction are about 28% of the sample. The propensity score is estimated using the following probit specification:

$$\Pr[Clients \& Drops] = \beta_0 + \beta_1 Age_i + \beta_2 Female_i + \sum_k \beta_{3k} Marstatus_{ik} + \beta_4 Wealth_i + \beta_5 DistanceRoad_i + \beta_6 SchoolingYears_i + \beta_7 Hmembers_i + \beta_8 Othersources_i + \beta_9 Income_i + \sum_m \beta_{10m} Villagedummies_{im} + \beta_{11} JobExp_i + \varepsilon_i$$

where *Marstatus* includes the marital status dummies *Married*, *Widowed*, *Divorced*, *Cohabitant*; *Village Dummies* control for the respondent's geographical location (*S. Brigida*, *Mitre*, *Villa de Mayo*); *JobExp* is the respondent's number of years of experience in his/her main activity. To calculate the ATT we then use the radius matching controlling for the same set of regressors as the ones used in the propensity score model.

The validity of the matching estimator heavily relies on the assumption of conditional independence of potential outcomes and treatment assignment given observables. In other terms, conditioning on observed covariates treatment assignment may be independent of potential outcomes (Conditional Independence Assumption, CIA). In order to assess whether and to what extent the estimated ATT is robust to possible deviations from the CIA we carry out the sensitivity analysis proposed by Ichino, Mealli and Nannincini (2006)²⁶. Based on our above mentioned considerations on potential biases, let us suppose the CIA is not satisfied in our study and tackle the problem by modelling an unobservable additional binary variable (confounder).

Following the standard approach we define the distribution of the confounder U on the basis of four choice-parameters:

$$p_{ij} = Pr(U = 1 | T = i, Y = j, W) = Pr(U = 1 | T = i, Y = j) \quad (3)$$

with $i, j = \{0, 1\}$, T and W being the treatment indicator and the observable set of covariates respectively. Equation (3) gives the probability that $U = 1$ in each of the four groups defined by the treatment status and the outcome value.

We conceive our potential confounder as an unmeasured unobservable trait (i.e. skill, entrepreneurial capacity) that makes individuals more likely to be MFI clients ($T=1$, where T is the variable *Clients&Drop*) and, at the same time, more satisfied about their own life ($Y=1$, where Y is the probability of declaring the highest level of life satisfaction). One reasonable way to model the distribution of this confounder is by setting: i) $p_{11} > p_{10}$, so that $Pr(Y = 1 | T = 1, U = 1) > Pr(Y = 1 | T = 1, U = 0)$ - that is, among MFI clients, those who are more enterprising tend to be more satisfied (*positive effect of the confounder on treated outcomes*); ii) $p_{01} > p_{00}$, so that $Pr(Y = 1 | T = 0, U = 1) > Pr(Y = 1 | T = 0, U = 0)$ - that is, among the eligible non-participants, those who are more enterprising are also more satisfied (*positive effect of the confounder on the untreated outcome*); and $p_{1.} > p_{0.}$ so that $Pr(T = 1 | U = 1) > Pr(T = 1 | U = 0)$, that is, individuals who are more enterprising are more likely to be MFI client (*the confounder has a positive effect on treatment assignment*).

Following Ichino et al. (2006), we define the differences $d_1 = p_{11} - p_{10}$, $d_0 = p_{01} - p_{00}$ and $s = p_{1.} - p_{0.}$ in order to characterize the sign of the bias when estimating the baseline ATT (i.e. the ATT computed when U is not included in the matching set).

Results from the sensitivity analysis are summarized in Table 5 and in Figures 2 and 3. In panel *a* we report the results when the above-mentioned hypothesis of positive effect of the confounder on the treatment assignment is considered. In that case, in order to have a bias that leads our baseline ATT

²⁶ See also Blatmann and Annan (2010), Rosenbaum & Rubin (1983) and Imbens (2003) for a similar approach.

close to zero, the odds of the selection and outcome effects should be implausibly large, that is at least about 10 and 17 respectively²⁷.

A plausible variant to our base assumptions is a change in the third hypothesis (effect of the confounder into selection assignment). We might argue that Protagonizar selects the least skilled since the high skilled are not cash constrained. Given the framework in which Protagonizar operates however this is to us a secondary hypothesis with respect to the benchmark illustrated above. However results from our sensitivity show that, even in this case the significance of the effect is quite robust (Table 5, Panel b). The sign of the bias is reverse meaning that without such a “killer” confounder we get an underestimated measure of the ATT. However, also under this distributional hypothesis, a large bias is associated with unrealistic odds of the selection and outcome effects (i.e. 12 and 22). Hence our baseline estimate remains robust to such a confounder.

7. Conclusions

The process of inclusion of marginalised producers generated by a microfinance loan implies more than a simple improvement in economic conditions induced by the opportunity of financing a productive investment.

Rescue from poverty involves relevant effects not captured by current income arising from a process of “dignification” which increases self-esteem and social recognition of the financed borrower. As a consequence, we expect that when measuring the impact of microfinance program on a broader concept of wellbeing such as life satisfaction, such impact has an independent effect not absorbed by the change in income generated by the loan.

Our results support this hypothesis of a significant microfinance effect independent of income showing its robustness to survivorship, selection and interview bias and its sensitivity to the number of credit cycles. Unfortunately, it is impossible with the available data to assess which non income factors explain our findings. We argue that potential candidates are self-esteem, social recognition, improved expectations on future economic perspectives and enhanced trust and trustworthiness but the incidence of other unmeasured factors cannot be excluded and is left to future research.

²⁷ To have a bias of 60%, U should increase the relative probability of having $Y = 1$ by a factor greater than 10 and the relative probability of having $T = 1$ by a factor greater than 17. Similarly, to have a bias of 120%, U should increase the relative probability of having $T = 1$ by a factor greater than 24. The presence among unobservable factors of a confounder with similar characteristics can be considered implausible in the present setting (where the set of matching variables W is quite rich).

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Table 1 -Summary statistics for eligible non-participants, clients and drop-outs

Variable	Description	Whole sample (n. 359)			Eligibles (n. 150)	Clients (n.150)	Drop-outs (n. 59)
		Min	Max	Mean	Mean	Mean	Mean
Age	Age of the respondent.	17	79	43.204	43.833	42.333	43.842
Household Income (Hincome)	Monthly respondent's and partner's income from I and II activities.	0	65000	3654.283	3476.867	4165.640	2775.491
Household Food expenditure	Daily expenditure in food for the family.	0	24000	1452.899	1529.000	1400.900	1389.474
Total Productivity	Monthly productivity measured by the ratio of respondent's + partner's income from I and II activities and the average number of hours worked.	0	313	7.905	8.474	8.130	5.814
Productivity from I activity (Respondent)		0	125	1.773	1.801	2.234	0.483
Productivity from II activity (Respondent)		0	38	3.641	3.356	3.906	3.694
Productivity from I activity (Partner)		0	7	0.027	0.000	0.065	0.000
Productivity from II activity (Partner)		0	313	13.346	13.631	14.336	9.991
Job Experience (years) - JobExp	Years of experience in the main respondent's activity.	0	50	8.081	7.487	9.163	6.800
N. of temporary employees	N. of employees hired by the Respondent	0	2	0.036	0.027	0.060	0.000
Savings/month	Respondent's monthly savings	0	24000	252.064	79.533	466.047	142.983
DistanceRoad	Distance from the closer main route of commerce (usually, the closer asphalted road) - in cuadras; 1 cuadra = 130 m. approximately.	0	25	1.291	0.803	1.770	1.316
Life-Satisfaction	Respondent's general life satisfaction captured by the question "how happy do you consider yourself with your life" [from 0 to 10].	3	10	8.392	8.144	8.617	8.447
N. of persons in the house	Total n. of components in the house.	0	15	4.218	3.993	4.380	4.386
N. of children	N. of children living in and outside the respondent's house.	0	13	3.011	2.607	3.187	3.614
Schooling years (Respondent)	Respondent's total n. of schooling years (included repetitions).	0	18	8.452	8.780	8.483	7.509
Schooling years (Partner)	Partner's total n. of schooling years (included repetitions).	0	18	5.594	5.900	5.247	5.702
Female	Dummy variable = 1 if the respondent is female and 0 otherwise.	0	1	0.692	0.660	0.733	0.667
Single	Dummy variable = 1 if the respondent is single.	0	1	0.168	0.153	0.153	0.246
Married	Dummy variable = 1 if the respondent is married.	0	1	0.426	0.453	0.407	0.404
Widow	Dummy variable = 1 if the respondent is widow.	0	1	0.059	0.080	0.053	0.018
Divorced	Dummy variable = 1 if the respondent is divorced.	0	1	0.020	0.020	0.020	0.018
Cohabitant	Dummy variable = 1 if the respondent is cohabitant.	0	1	0.255	0.240	0.280	0.228
Client	Dummy variable = 1 if the respondent is a borrower of Protagonizar.	0	1	0.418			
Clients&Drops	Dummy variable = 1 for present borrowers (Clients) and former borrowers (Dropouts) of Protagonizar	0	1	0.582			
Wealth	asset index calculated as the principal component of the various asset variables collected with the survey	-6	2	-0.004	-0.066	0.078	-0.059
Othersources	total amount of debt service from other financing sources	0	1300	12.751	14.407	9.360	17.316
Credit cycle	Cycle of current loan (interpretable as the n. of loan asked and repaid up to the survey date).					15.920	
Total amount of last microcredit received	Amount of the last loan asked and received.					1215.385	
Amount of last repayment	Amount of the last instalment.					121.758	
Duration of the microcredit (weeks)	Duration of last micro-loan received (in weeks)					10.838	

Figure 1 Distribution of life satisfaction (*full sample, MF borrower, dropouts, eligible non participants*)

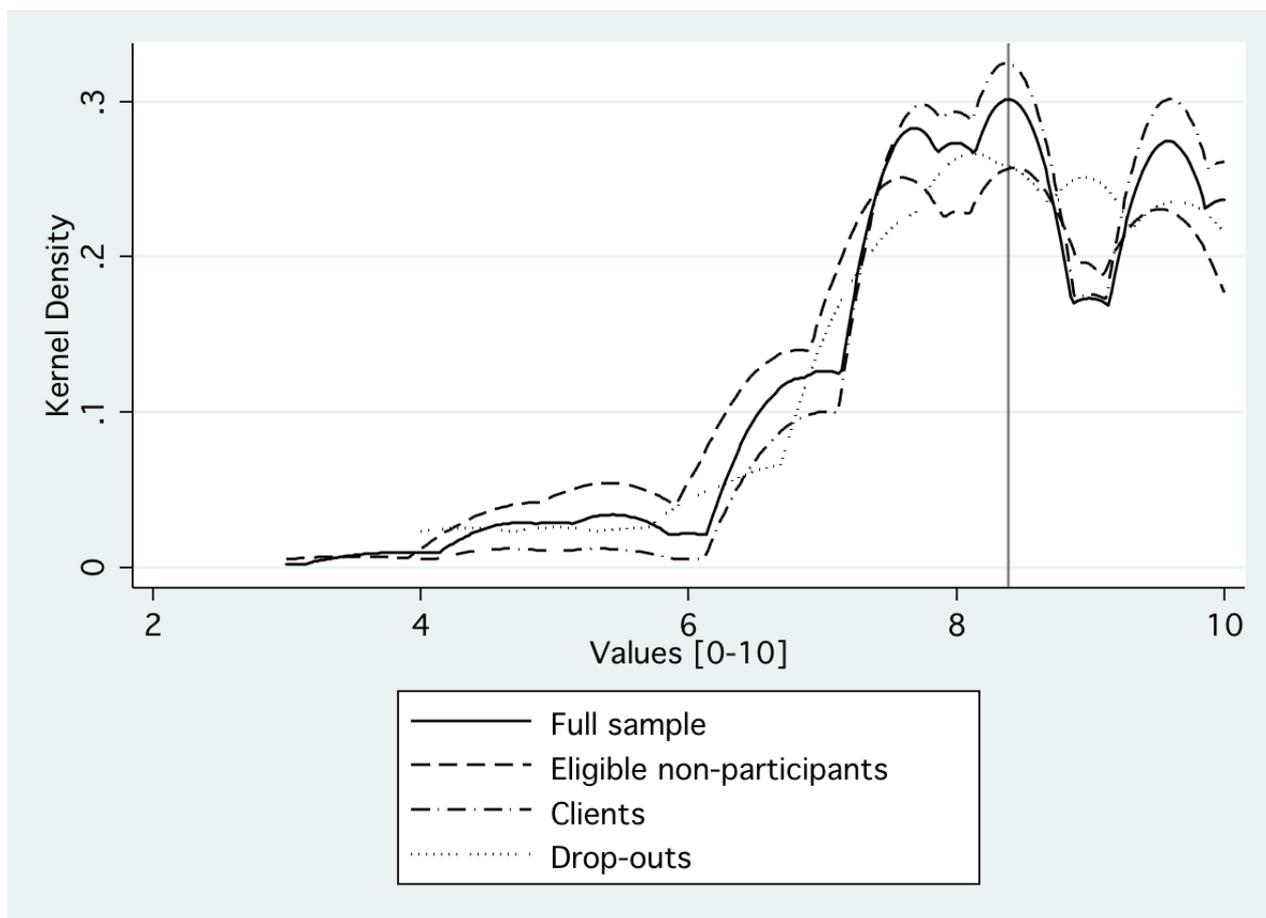


Table 2. Non parametric tests on differences in life satisfaction between groups

Test type	z- stat	p-value
<i>Wilcoxon rank-sum equality test on life satisfaction: clients and dropouts vs. eligible non participants.</i>	-2.663	(0.0077)
<i>Wilcoxon rank-sum equality test on household's income: clients and dropouts vs. eligible non participants.</i>	-3.974	(0.0001)

Table 3 The determinants of life satisfaction for MFI and non MFI borrowers

Dep. Var.: <i>LifeSatisfaction</i>	OLS	OPROBIT	OLS	OPROBIT	OLS	OPROBIT	OLS	OPROBIT
	<i>Overall sample</i>		<i>Clients & Eligibles (no Dropouts)</i>		<i>Overall sample</i>		<i>Clients only</i>	
	1	2	3	4	5	6	7	8
Married	0.196 (0.152)	0.169 (0.116)	0.212 (0.162)	0.205 (0.128)	0.237 (0.148)	0.205* (0.116)	0.432** (0.197)	0.447** (0.206)
Age	-0.005 (0.007)	-0.004 (0.005)	-0.012 (0.007)	-0.010* (0.006)	-0.005 (0.006)	-0.004 (0.005)	-0.026*** (0.008)	-0.028*** (0.009)
Female	0.130 (0.173)	0.074 (0.130)	0.123 (0.189)	0.080 (0.145)	0.108 (0.172)	0.061 (0.130)	0.130 (0.216)	0.151 (0.215)
SchoolingYearsR	-0.031 (0.028)	-0.030 (0.021)	-0.031 (0.030)	-0.028 (0.023)	-0.022 (0.028)	-0.023 (0.021)	-0.123*** (0.039)	-0.130*** (0.041)
DistanceRoad	-0.011 (0.025)	-0.007 (0.018)	-0.026 (0.025)	-0.019 (0.019)	-0.025 (0.025)	-0.018 (0.019)	-0.023 (0.028)	-0.022 (0.027)
Othersources	0.0001 (0.000)	0.0001 (0.000)	0.0001 (0.000)	0.0001 (0.000)	0.0001 (0.000)	0.0001 (0.000)	0.0001*** (0.000)	0.0001*** (0.000)
Hmembers	0.023 (0.043)	0.021 (0.033)	0.002 (0.045)	0.005 (0.036)	0.011 (0.042)	0.013 (0.032)	0.021 (0.054)	0.032 (0.052)
Hincome	0.022** (0.009)	0.023** (0.012)	0.012 (0.014)	0.012 (0.014)	0.018* (0.010)	0.019 (0.012)	0.005 (0.014)	0.009 (0.018)
Wealth	0.087 (0.091)	0.054 (0.066)	0.076 (0.100)	0.052 (0.074)	0.069 (0.092)	0.043 (0.068)	0.249* (0.129)	0.250** (0.113)
Clients			0.451*** (0.155)	0.351*** (0.122)				
Clients&Drops					0.412*** (0.152)	0.311*** (0.116)		
CreditCycle							0.032** (0.016)	0.030** (0.014)
Constant	8.516*** (0.514)		8.736*** (0.570)		8.268*** (0.516)		9.852*** (0.748)	
<i>Observations</i>	<i>359</i>	<i>359</i>	<i>300</i>	<i>300</i>	<i>359</i>	<i>359</i>	<i>150</i>	<i>150</i>
<i>R-squared</i>	<i>0.026</i>		<i>0.055</i>		<i>0.046</i>		<i>0.243</i>	

*Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

Table 4. Quantitative effects of microfinance participation on life satisfaction

Prob. <i>LifeSatisfaction</i> = 10	Marginal effects		
	<i>model 4</i>	<i>model 6</i>	<i>model 8</i>
Client	0.1135*** (0.03961)		
Clients&Drops		0.1005*** (0.0366)	
CreditCycle			0.06** (0.003)

Effect of a unit change in the regressors on the probability of declaring the highest level of life satisfaction

Robust standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 5. Sensitivity Analysis

Hypothesis	p ₁₁	p ₁₀	p ₀₁	p ₀₀	p _{1.}	p _{0.}	s	d ₀	d ₁	Bias (%)	ATE	Selection Effect	Outcome Effect	Bootstrapped SE
a) positive effect on treatment assignment	0.90	0.80	0.80	0.70	0.83	0.72	0.11	0.10	0.10	0.063	0.164	2.264	2.158	0.013
	0.90	0.70	0.70	0.50	0.76	0.54	0.22	0.20	0.20	0.178	0.144	2.927	3.210	0.018
	0.90	0.60	0.60	0.30	0.69	0.37	0.33	0.30	0.30	0.323	0.119	4.514	4.954	0.027
	0.90	0.50	0.50	0.10	0.62	0.19	0.43	0.40	0.40	0.592	0.072	9.915	17.103	0.025
	1.00	0.50	0.50	0.00	0.65	0.11	0.54	0.50	0.50	1.218	-0.038	24.510	.	0.035
b) negative effect on treatment assignment	0.80	0.70	0.90	0.80	0.73	0.82	-0.09	0.10	0.10	-0.006	0.176	0.596	3.174	0.007
	0.70	0.50	0.90	0.70	0.56	0.74	-0.18	0.20	0.20	-0.068	0.187	0.501	8.558	0.009
	0.60	0.30	0.90	0.60	0.39	0.67	-0.27	0.30	0.30	-0.130	0.198	0.350	11.890	0.012
	0.50	0.10	0.90	0.50	0.22	0.59	-0.37	0.40	0.40	-0.259	0.221	0.205	21.714	0.017
	0.50	0.00	1.00	0.50	0.15	0.61	-0.46	0.50	0.50	-0.402	0.246	0.117	.	0.008

Bias % = (ATE baseline-ATE)/ATE baseline - NB: Baseline ATE (no confounders) = 0.175. $d_1 = p_{11} - p_{10}$ (outcome effect of U for the treated); $d_0 = p_{01} - p_{00}$ (outcome effect of U for the controls); $s = p_1 - p_0$ (effect of U on the selection into treatment). Selection effect (odds) = $\frac{Pr(T=1|U=1,W)}{Pr(T=0|U=1,W)} / \frac{Pr(T=1|U=0,W)}{Pr(T=0|U=0,W)}$; Outcome Effect (odds) = $\frac{Pr(Y=1|T=0,U=1,W)}{Pr(Y=0|T=0,U=1,W)} / \frac{Pr(Y=1|T=0,U=0,W)}{Pr(Y=0|T=0,U=0,W)}$.

Figures 2 and 3. The impact of the "killer" confounder.

