Non-grant Microfinance, Incentives and Efficiency

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Abstract

I show that charging interest on funds provided by donors or investors to microfinance institutions (MFIs) can increase efficiency, the total number of loans and borrower welfare, compared to grant or concessionary funding. In a setting in which MFIs supply costly non-contractible effort, putting a price or raising the price of loanable funds strengthens the MFIs' incentives to put effort in credit administration or monitoring, to extend more loans, and/or reduce overhead costs. This theoretical result is robust to several variations of the benchmark model allowing for an endogenous lending rate, motivated MFIs and endogenous overhead costs.

Keywords: non-grant microfinance, for-profits, incentives, overhead costs

JEL Classifications: O12, D21

1 Introduction

The 2000s saw major changes in the microfinance sector. While the early varieties of microcredit had relied almost exclusively on grants or concessionary public funds, recent years have brought the entry and expansion of non-grant and for-profit microfinance providers.[1] In addition, several high-profile microfinance institutions (MFIs) that had been initially funded through grants or near-grant 'soft' loans have gone public to tap into commercial sources of capital and grow faster. A leading example is Mexico's largest microlender *Banco Compartamos* which was founded in 1990 as an NGO, switched its operations to a for-profit company in 2000, and performed an IPO in 2007 (Rosenberg, 2007). Another example is *SKS Microfinance* in India which was listed on the Bombay Stock Exchange in 2010 and came under scrutiny in relation to a wave of suicides by heavily indebted borrowers in Andhra Pradesh.[2]

These developments have led to a backlash from some prominent public figures including the 'father of microfinance' Muhammad Yunus who exclaimed in a *New York Times* article titled "Sacrificing Microcredit for Megaprofits": "...I never imagined that one day microcredit would give rise to its own breed of loan sharks" (Yunus, 2011). Yunus went on to call for stricter regulation of the sector, to prevent lenders "...take advantage of the vulnerable".[3] Empirically, the notion that charging higher interest rates by for-profit microlenders is automatically bad for the poor does not find confirmation in the randomized study by Angelucci et al. (2013) who report overall positive effects and little harm to borrowers from an expansion of group lending at APRs as high as 110%.

This paper contributes to the ongoing debate on the role of non-grant funding and for-profits in microfinance by making a simple theoretical point to argue that some of the objections may be misguided. Specifically, I show that charging positive interest on donor-provided funds to microlenders (alternatively, investors requiring a positive return on funding) could have an incentivizing effect on MFIs and lead to increased efficiency and total lending and higher welfare for microfinance borrowers. This result obtains both in the case of an exogenous ('open economy') and endogenous (e.g., 'free entry') lending rate and is robust to variations of the baseline theoretical setting to allow for non-zero MFI profits, motivated MFIs or endogenous overhead lending costs.

The key assumption underlying this paper's main result is that microlenders supply a costly action (hereafter, 'effort') during their operations. For example, this action could be loan monitoring, assisting borrowers choose or implement their business projects, or other relevant administrative tasks. Supplying higher effort level increases the expected total repayment on the loans an MFI makes. The MFI effort is assumed unobservable / non-contractible to the donor or investor. In

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[1]For example, Reille et al. (2011) document an increase in institutional investors in microfinance, which include banks, private equity funds, pension funds, and insurance companies, from $0.5bln in 2005 to over $3.5bln (27% of the total surveyed by CGAP) in 2010.

[2]De Quidt et al. (2012) provide an excellent review of the circumstances surrounding these events and the current state of the Indian microfinance sector in general.

[3]For additional background on the evolution of microfinance from its roots as purely non-profit to its current state as well as discussion on whether the additional funding and entry by for-profits in the sector benefit or harm the poor, see Cull et al. (2009).

this setting, I show that an increase in the interest rate on funds provided to MFIs can increase the MFIs' incentives to supply effort or reduce overhead costs. The higher interest increases the donors' incentives to provide larger amount of funds to the MFIs. In turn, the need to repay the funds (plus interest) causes MFIs to issue a larger number of loans and motivates them to supply higher effort to increase the repayment probability of each loan (the borrower's project success), or increase expected total repayment, or to cut overhead costs. Combined, these effects (more loans and higher borrower repayment rate) lead to an increase in borrower welfare.

To motivate and support the main assumptions and results of the model, Table 1 presents a comparison between non-governmental (NGO) microlenders and bank microlenders performed by Cull et al. (2009).[4] The authors use a detailed dataset on 346 MFIs worldwide observed in 2002-2004 that serve 18 mln borrowers and have a combined total of $25 bln in assets. NGO microlenders are typical examples of non-profits and rely heavily on grant and subsidized funding. In contrast, bank MFIs are for-profits.[5] The values reported in Table 1 are medians for the listed variables unless stated otherwise.

Table 1 – Comparison of non-profit (NGO) and for-profit (bank) MFIs

	NGOs	banks
1. Active borrowers (thousands)	7.4	20.3
2. Average loan size (% of the 20th income percentile)	48	224
3. Operating cost as percent of loan value	26	12
4. Return on equity (%)	3.4	10
5. Return on assets (%)	0.7	1.4
6. Portfolio at risk, 30 days (%)	3.5	2.4
7. Subsidy per borrower (PPP$)	233	0
8. Percent non-commercial funding, median *(mean)*	74 *(55)*	11 *(3)*

Note: the reported values are the medians of the listed variables unless stated otherwise.

Source: Cull, Demirguc-Kunt and Morduch (2009)

Table 1 reveals three major empirical regularities consistent with the model assumptions and results. First, from lines 7 and 8 we see that NGO MFIs can be viewed as predominantly funded non-commercially (by grants and concessionary funds). In contrast, bank MFIs rarely rely on non-commercial funding (just 3% on average) and acquire funds at positive cost. In terms of the model, NGOs can thus be thought as funded by grants or under concessionary terms, while bank MFIs can be viewed as non-grant microlenders. Second, lines 1 and 2 in Table 1 show that banks have significantly more active borrowers (larger scale) and offer larger loans. This maps into the model prediction that for-profit funding can lead to an expansion of credit. Third, lines 3-6 in Table 1 relate to the efficiency of NGO vs. bank MFIs in supplying microcredit. The median bank MFI

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[4]See Tables 3 and 4 in Cull et al. (2009) for the complete data summary.

[5]NGO and bank MFIs account for 76% of the total number of borrowers in their sample. Cull et al. (2009) also report data for "non-bank financial institution" microlenders – a broad category that included both non-profits and for-profits.

has twice the ROA and three times the ROE of the median non-governmental MFI. The banks' operating costs per dollar lent (line 3) are more than twice lower than those of NGO microlenders. Banks also have significantly lower fraction of their portfolio at risk (line 6). The model results are consistent with these patterns in the data.

Similarly, Caudill et al. (2009) use data on Eastern European and Central Asian MFIs to estimate a statistical cost function for microlenders. Using mixture methods they isolate two distinct types of MFIs in the data – about half of MFIs become more cost effective over time, while the other half do not. Significantly, the MFIs that are found to become more efficient are those that rely less on subsidies (per loan and total). Rosenberg et al. (2009) analyze data from the Microfinance Information Exchange (MIX) database and find that MFI lending interest rates have been declining by 2.3 percentage points a year since 2003, much faster than bank rates, which has also been accompanied by declining administrative costs. They also do not find evidence for any widespread 'exploitatively' high interest rates. On the other hand, Roberts (2013) finds that for-profit status is associated with higher loan interest rates and higher operating and personnel expense ratios using 2009 MIX data. While he controls for various relevant factors including location fixed effects, quality of governance, competition, MFI size, age, mission, etc., other possible determinants of interest rates and costs such as the cost of funds, volunteer labor, or the ability to run a soft budget constraint are harder to account for. Roberts also finds that stronger profit orientation correlates with larger MFI size and, ceteris paribus, larger size corresponds to greater efficiency and lower effective interest rates.

The mapping between the data and the model should not be taken literally but only as supporting evidence for the proposed theoretical mechanism. A potentially important caveat is that banks and NGOs may have different objectives or serve different types of borrowers (for example, there could be assortative matching between donors and different MFIs), or there could be other possible differences that are not modeled or controlled for.[6] Additional supporting evidence, however, comes from the experience over time of Compartamos and SKS Microfinance which expanded their scale of operations significantly and improved their efficiency after switching to a for-profit business model. Indeed, the growth rate of Compartamos' number of borrowers doubled to 46% per year after 2000 when Compartamos became a for-profit lender (Rosenberg, 2007).[7] SKS switched to a for-profit status in 2005 and grew its number of borrowers from 0.5 mln to 5.8 mln between 2007 and 2010 while improving its portfolio yield and reducing its operating expense ratio (Chen et al., 2010).

MFI effort – interpretation and evidence

A key premise of the model is that MFIs undertake actions ('effort') that increase the repayment probability without imposing disutility for the borrowers.[8] Aside from standard lender practices

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[6]For example, Cull et al. (2007) find differences in institutional design and performance between MFIs lending to individuals vs. those lending to groups of borrowers and Hartarska (2005) finds that the board composition and managerial compensation affect MFI performance.

[7]Compartamos had 27,000 borrowers in 1996, 64,000 in 2000 and grew to 617,000 in 2005.

[8]In principle, it could be possible that higher costs of funding make MFIs "the new moneylenders" by jacking

like selection or monitoring, possible examples could be business development services or financial advice. Indeed, many MFIs promote comprehensive microcredit services by bundling credit and non-financial services. For example, the Grameen Bank Replication Guidelines require that before receiving a loan, eligible borrowers must undergo an intensive, one- to two-week training in the philosophy, rules and procedures of the Bank, including the merits/demerits of taking a loan, interest rates and loan repayment (Alam and Getubig, 2016).

There is also a lot of evidence on how non-financial services provided by MFIs can improve business or repayment outcomes. McKernan (2002) uses data on households in three major Bangladeshi microfinance programs promoting self-employment (Grameen Bank, BRAC and the Bangladesh Rural Development Board). The programs provide both credit and non-credit services (vocational training, provision of health and other information, information sharing and monitoring among members). For all three programs McKernan estimates a strong positive effect (125% increase in profits on average) of participation, after conditioning on loaned capital, which is attributed to the non-credit services.

Lammermann and Ribbink (2011) perform case studies on business development services (BDS), including market information, training, referrals, production techniques assistance and counseling provided to entrepreneurs by MFIs in Columbia (ADEMCOL), Bangladesh (BRAC), Tanzania (PRIDE), Peru (Banco del Credito) and Morocco (Al Amana). In all five cases the BDS impact is found to be positive, generating additional business revenue or increased investment. Another compilation of case studies is Flores and Serres (2009) who use evidence from CRECER in Bolivia, the Pro Mujer network in Latin America, FINCA-Peru and ASA in India and show that MFIs can be sustainable while combining financial and non-financial services in highly competitive environments. Specifically, MFIs offering non-financial services have better portfolio quality than their peers and, while non-financial services do lead to higher operating costs, the latter are compensated by higher portfolio yields.

Karlan and Valdivia (2011) note that a growing number of MFIs are putting effort in building the human capital of the entrepreneurs they finance to improve their livelihood and speed up poverty alleviation. The authors perform a randomized control trial to measure the impact of adding entrepreneurial skills training to a microcredit program by FINCA-Peru. While they find no statistically significant effect on business revenue and profits, the authors observe reduced fluctuation of sales, business knowledge improvements and increased client retention and repayments for the MFI.

Biosca et al. (2011) explore the impact of two non-financial services (preventive health training and business development) provided by MFIs in Chiapas, Mexico. Non-financial services are found to reduce the clients' likelihood of being under the asset poverty line.[9] Mintah et al. (2014) report that 95% of the respondents in a survey of microfinance borrowers in the Ashanti region

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up lending rates or intimidating borrowers to repay their loans, hence making borrowers worse off. Rosenberg et al. (2009) suggest that such concerns are not borne by the evidence, except in a few isolated cases.

[9]See also Smith (2002) on bundling microfinance with health education and services in Honduras and Ecuador.

of Ghana state that they have benefitted from MFI-provided loan management advice, while 78% have benefitted from financial and bookkeeping advice. Dikki et al. (2014) evaluate the impact of MFI non-financial services on women entrepreneurs in Kaduna, Nigeria and find that training and network meetings significantly improved their business performance. Barua and Sane (2014) study the impact of a mandatory financial education program on female customers of an urban MFI in Mumbai and find that financial literacy led to a decrease in the number of days taken to make loan repayments.

Further related literature

Much of the existing theoretical literature on microfinance has analyzed the relationship and outcomes between microlenders and their borrowers in the context of various relevant issues: limited enforcement, moral hazard, adverse selection, joint liability, sequential lending, etc. (Besley and Coate, 1995; Ghatak and Guinnane, 1999; Ghatak, 2000; Chowdhury, 2005 and 2007; Ahlin, 2014, among many others). In contrast, in this paper I keep the borrowers' role as stylized as possible and instead focus on the interaction between microcredit donors / investors and the MFIs.

In a related and complementary paper, Ghosh and Van Tassel (2013) derive conditions under which microfinance donors, by charging interest on the provided funds, alleviate an adverse selection problem by driving out of the market high-cost microlenders which would otherwise operate if grant funding were given. While I also study the effect of charging interest on microcredit funds as opposed to grant funding, in contrast to Ghosh and Van Tassel (2013), my argument is not about cost heterogeneity and adverse selection among MFIs but instead about the incentives of each individual MFI to supply costly effort, e.g., in monitoring, screening or reducing overhead costs when the loanable funds come at a price.

The paper also relates to other works on the role of donors or investors (as opposed to the microlenders themselves) in microfinance outcomes. For example, Roy and Chowdhury (2009) build a model in which a motivated NGO can help in channeling credit to the poor, both in borrower selection or in project implementation. The authors show that an efficiency distortion can arise due to the fact that the NGO puts higher weight on poorer, less efficient borrowers that can benefit from on-the-job training provided by the NGO. The inefficiency can be resolved by unbundling borrower selection from project assistance. Other papers, e.g., Guha and Chowdhury (2013) allow the MFIs themselves (as opposed to the donors) to be partially profit- and socially-oriented by considering a weighted objective function and show that double-dipping (borrowers taking multiple loans) could occur if MFIs are more profit-oriented.

The assumption that MFIs could vary their effort in performing their activities is consistent with the empirical evidence as reviewed in Cull et al. (2009) and relates to some of the theoretical literature on NGOs (for example, Aldashev and Verdier, 2010). Finally, the discussion and results obtained here also relate to the debate on grants vs. loans in foreign aid (for example, Djankov et al., 2004; Klein and Harford, 2005).

2 Model

2.1 Basic setting

A donor or investor (for example, an NGO, a government, an investment fund) funds small business projects operated by borrowers with zero wealth via a competitive microfinance sector composed of a large number of identical microlenders (MFIs). Each project requires a loan of size 1 and yields a gross return $\theta > 1$ if successful or zero otherwise. The project returns are i.i.d. across projects / borrowers. Each MFI finances a large number of projects. The donor/investor's opportunity cost of funds is normalized to one. MFIs charge gross interest rate R, where $\theta > R > 1$. One can think of R as the going market rate on microfinance loans or as exogenously given – this would not be essential for the main results. Holding R fixed can be also interpreted as shutting down the pass-through from cost of funds to MFIs to final borrower interest rates. The case of an endogenous MFI lending rate R, opening the pass-through between MFI cost of funds and borrower interest rates, is studied in Section 2.4.

The donor or investor charges a gross interest rate $r \in [0, R]$, on funds provided to MFIs. If $r = 0$, the funds can be thought of as 'pure grant' (no repayment is required). If $r = 1$, the donor wants the funds repaid but charges zero interest rate (a 'concessionary loan'). If $r > 1$, the lender requires to be repaid more than his opportunity cost of funds (a 'for-profit' investor). The funds interest rate r is initially taken as exogenously given, but I discuss its endogenous determination in Section 2.3.

The donor / investor decides on the amount of funding x (which equals the number of loans MFIs make) to maximize the following objective function

$$V(x) \equiv B(x) + rx - x \tag{1}$$

where $B(x)$ is strictly concave with $B'(0) > 1$ and $B'(\infty) < 1 - r$.

The interpretation of the function $B(x)$ is the *net benefit* to the donor/investor of providing funds x *in addition to* the interest income net of opportunity cost of funds, $rx - x$. For example, $B(x)$ could correspond to the net utility (possibly non-monetary, e.g., outreach) which the donor obtains from providing the funds.[10] The assumption $B'(0) > 1$ ensures that a strictly positive amount of funds x would be optimally provided even at $r = 0$ (pure grant). Assuming $B'(\infty) < 1 - r$ ensures the boundedness of $V(x)$ and a finite optimal $x > 0$.

MFIs perform a costly action, $z \in Z \equiv [\underline{z}, \bar{z}] \in \mathbb{R}_+$ which affects the probability, $p(z)$ with which an MFI loan is repaid, that is, the probability that a project financed by the loan is successful. One can think of z as 'effort' supplied by MFIs in borrower monitoring, loan administration, financial advice, etc. The MFI effort level z is not observed by the donor/investor or is non-contractible. If a loan is not repaid, which assuming limited liability by the borrower, happens when the project

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[10]This is similar to the assumption of McIntosh and Wydick (2005) who define the objective of non-profit MFIs to be maximizing outreach.

fails, then the MFI obtains zero return on that loan. The function $p(z)$ is strictly increasing and strictly concave and satisfies $p(z) \in [0, 1)$, $\forall z \in Z$ and $p'(\underline{z}) = +\infty$. Alternatively, one can think of $p(z)$ as the fraction of the x MFI loans which are repaid. Both interpretations imply that the expected total repayment received by the MFIs is $p(z)Rx$.[11]

Suppose that it costs the MFI $c(z, x) = zf(x)$ to supply effort level z when financing x projects. The linearity in effort z is without loss of generality. I could alternatively assume a convex cost of effort function $\phi(z)$ but, since only the ratio $\frac{p'(z)}{\phi'(z)}$ matters for the optimal effort decision, assuming constant marginal effort cost (for given x) is not restrictive. The function $f(x)$ is increasing and concave ($f' \geq 0$ and $f'' \leq 0$) with $f(0) > 0$. Alternatively, all results go through for f increasing and strictly concave with $f(0) \geq 0$. The role of $f(x)$ is to allow for scaling-up of the total costs of MFI effort (monitoring, loan administration, etc.), as the number of loans x increases. For example, monitoring borrowers in order to lower the average default rate costs more the higher is the number of borrowers. The assumed concavity of f implies that, for any given z, there are no diseconomies of scale to making more loans – that is, total costs increase in the number of loans x either linearly or at a decreasing rate. It is reasonable to think that monitoring, loan administration and similar actions have this feature, at least for the range of observed microlender sizes. Small fixed costs of effort, e.g., in monitoring (that is, $c(0, x) > 0$), can be incorporated too since they do not affect choices at the margin but only the break-even constraint – see Section 2.3 for details.[12] The results below would not hold if the action z were such that MFIs total costs were increasing in the number of loans x at an accelerating rate. Note also that the special case with effort costs constant in x (that is, $f(x) = k$ for any constant $k > 0$) is allowed.

Assuming that microfinance borrowers are risk-neutral and maximize expected net income implies that the borrowers' total expected payoff given total funding (number of loans), x and MFI action level, z equals:

$$W(x, z) = xp(z)(\theta - R) \quad \text{(BP)}$$

while the expected payoff (net income) per borrower is $w(z) = p(z)(\theta - R)$. Clearly, $W(x, z)$ is strictly increasing in x and z and $w(z)$ is strictly increasing in z. Beyond keeping track of these expected payoffs, the borrowers' side of the model is kept as simple as possible on purpose, to focus on the interaction between donors/investors and the MFI lenders.

2.2 MFI funding and effort

The donor/investor chooses the amount of funds, x to maximize his objective, (1) subject to two constraints. First, due to the effort non-contractibility, the MFIs' individual incentives to supply

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[11]Suppose there are N loans made to investment projects with i.i.d. outcomes. Each project repays R if it is successful and zero otherwise. For simplicity, call $p \equiv p(z)$ the probability of success and define Y to be the random variable "number of successes among N draws from the binomial distribution with parameter p". It is well known that $E(Y) = Np$. Since each success yields R, the expected total repayment then equals $E(Y)R = NpR$.

[12]In the presence of fixed costs per loan, allowing MFIs to make large loans (relaxing the unit loan size) could be an alternative mechanism for larger MFIs being more efficient.

costly effort must be taken into account. Given a required per-loan repayment (gross interest rate) r, an MFI would choose its effort level z to maximize its own expected payoff, which equals the expected revenue, $p(z)Rx$ minus total costs (repaying the donor plus effort costs), $rx + zf(x)$. Call this the 'incentive-compatibility constraint' (ICC),

$$z = \arg\max_{\tilde{z}} \ p(\tilde{z})Rx - rx - \tilde{z}f(x) \quad \text{(ICC)}$$

In Section 2.3 I also discuss the possibility of "motivated" MFIs as in Besley and Ghatak (2005), that is MFIs who also derive non-pecuniary utility from supplying the action z.

Second, MFIs must break even – call this the 'participation constraint' (PC),[13]

$$p(z)Rx - rx - zf(x) \geq 0 \quad \text{(PC)}$$

The optimal amount of funds (loans), x^* and MFI effort, z^* are chosen to maximize the objective, (1) subject to constraints (ICC) and (PC). Since $p(z)$ is strictly increasing and strictly concave with $p'(\underline{z}) = +\infty$, (ICC) implies that, for any given $r \in [0, R]$ and $x > 0$, the optimal effort level chosen by an MFI either satisfies the first-order condition,

$$p'(z)R\frac{x}{f(x)} = 1 \quad \text{(ICC')}$$

at an interior $z^* \in (\underline{z}, \bar{z})$ or, if $p'(\bar{z})R\frac{x}{f(x)} > 1$, then $z^* = \bar{z}$ (see Example 1 with functional forms below). Given the interest rate r, the problem of the donor/investor in the interior solution case is:

$$\max_{x,z} \ B(x) + rx - x \qquad \qquad \text{(DP)}$$
$$\text{subject to (ICC') and (PC)}$$

I next analyze the effect of a local increase in the MFI funds rate r (for instance, moving from pure grant funding, $r = 0$ to concessionary loan funding, $r > 0$) on the total amount of funds x provided (loans made) and MFI effort level z solving problem (DP). Suppose that,

Assumption A1:
$$r < p(\bar{z})R \qquad \qquad (2)$$

In words, Assumption A1 means that an MFI would not accept funding for which it has to pay back more per dollar than the maximum possible expected return it could receive from the borrowers. Together with the assumptions on $B(x)$ stated earlier, A1 guarantees the existence of a non-trivial solution to problem (DP).[14] Clearly, if the MFI funds rate r is too large relative to the

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[13]Alternatively, zero expected MFI profits could also arise as a result of competition (free entry) in the MFI sector among profit-maximizing microlenders. See Section 2.3 for more discussion.

[14]If $p(\bar{z})R = r$ and $\underline{z} = 0$ the problem has the trivial corner solution $z^* = x^* = 0$. Otherwise, if $p(\bar{z})R < r$, or if $p(\bar{z})R = r$ and $\underline{z} > 0$, it is clear from (PC) that no feasible x and z exist.

MFI lending rate R, there is no way to satisfy the MFI participation constraint even at maximum effort. Under Assumption A1 and the assumptions on $B(x)$ and $f(x)$ the solution (x^*, z^*) to (DP) satisfies $x^* > 0$.

Depending on parameter values, there are two possible scenarios that can occur when solving problem (DP), either

      case (i) constraint (PC) does not bind (MFIs break even or make profits) at the optimal (x^*, z^*) where x^* is determined from the lender's FOC, $B'(x) + r - 1 = 0$ and z^* solves (ICC) evaluated at x^*, or

      case (ii) MFIs make a loss at the unconstrained solution from case (i), which implies that constraint (PC) must bind at optimum and hence the optimal x and z are determined by solving (ICC') and (PC) taken at equality.

Proposition 1

Suppose Assumption A1 holds. Then, in both cases (i) and (ii),

(a) the MFI effort level, z^* and total number of loans made, x^* solving problem (DP) are both increasing (strictly at an interior solution) in the donor/investor funds rate, r.

(b) the borrowers' total expected payoff, $W(x^*, z^*)$ is strictly increasing in r and the borrowers' individual expected payoffs, $w(z^*)$ are increasing (strictly at an interior solution) in r.

Proof (see Appendix)

The intuition for Proposition 1 is as follows. In case (i), when the MFI participation constraint (PC) does not bind, the donor chooses his preferred funding amount x^* that solves $B'(x) = 1 - r$. A local increase in r makes providing funds more beneficial to the donor since he receives additional revenue. Consequently, the donor provides more funds – x^* increases. In addition, the MFI's marginal benefit of supplying effort (see condition ICC') is increasing in the funds received (loans made) and hence its effort choice z^* goes up as well (strictly for an interior z^*).

In case (ii), with a binding MFI participation constraint (PC), note that the higher is the funds rate r, the larger is the amount a microlender needs to pay back to the donor/investor in order to break even. But the more an MFI needs to repay, the higher the effort it needs to supply. Supplying more effort increases the expected marginal return on microcredit loans by raising the probability of success $p(z)$ for all financed projects, or equivalently, raising the fraction of financed projects that succeed, which in turn increases the MFI's incentive to supply effort. Hence, putting a price (if $r = 0$ initially) or raising the price on MFI funds can have an incentivizing effect and lead to more loans made and higher project success rate. Combined, these factors increase the expected total and individual payoffs of microcredit borrowers.

The classic 'debt-overhang' problem in credit markets, whereby a higher required repayment reduces a borrower's incentives to supply costly effort (e.g., see Ghosh at al., 2000) does not apply

here since this argument relies on limited liability – the borrower repays only if her project succeeds. This possibility does not arise between the donor/investor (the lender) and the MFI (the borrower) in the current setting because of the large number of MFI loans issued which finance projects with i.i.d. returns (MFI's income is non-stochastic).

Example 1

Let $0 \le r < 1$ and suppose $B(x) = \sqrt{x}$, $p(z) = \sqrt{z}$, $f(x) = \frac{\sqrt{x}}{2}$ and $Z = [0, \bar{z})$ with $\bar{z} < 1$. It is easy to check that all assumptions on $B(x)$, $p(z)$ and $f(x)$ are satisfied. Assumption A1 requires also $r < R\sqrt{\bar{z}}$.

Consider first case (i) in which (PC) does not bind at optimum (conditions are provided below). The donor's first-order condition implies $x^* = \frac{1}{4(1-r)^2}$ and so, using (ICC') assuming interior solution, $z^* = \frac{R^2}{4(1-r)^2}$ – hence both x^* and z^* are increasing in r. Also, $W(x^*, z^*) = \frac{R}{8(1-r)^3}(\theta - R)$ and $w(z^*) = \frac{R}{2(1-r)}(\theta - R)$, both of which strictly increase in r. For example, at $r = 0$, the solution is $x^* = \frac{1}{4}$, $z^* = \frac{R^2}{4}$ (assume $\frac{R^2}{4} < \bar{z}$), and MFI profits are $(p(z^*)R - r)x^* - z^*f(x^*) = \frac{R^2}{16} > 0$ – (PC) does not bind indeed. By a standard continuity argument, a local increase in the funds rate r starting at $r = 0$ (a switch from pure grant to concessionary funding) thus strictly increases the number of loans provided, x^* and MFI effort, z^* and results in higher borrower welfare.

Next, consider case (ii) in which (PC) binds at optimum and the MFI makes zero profits. That is, the MFI profits at the unconstrained solution from case (i), $x^* = \frac{1}{4(1-r)^2}$ and $z^* = \frac{R^2}{4(1-r)^2}$ are negative, $\frac{R^2}{16(1-r)^3} - \frac{r}{4(1-r)^2} < 0$, or $R < 2\sqrt{1-r}\sqrt{r}$. At an interior solution for effort, (ICC') implies $z = R^2x$. Substituting into (PC) yields $R\sqrt{x}Rx - rx - R^2x\frac{\sqrt{x}}{2} = 0$ and hence the optimum is $x^c = \frac{4r^2}{R^4}$ and $z^c = \frac{4r^2}{R^2}$, both of which increase in r. Also, $W(x^c, z^c) = \frac{8r^3}{R^5}(\theta - R)$ and $w(z^c) = \frac{2r}{R}(\theta - R)$ which are also strictly increasing in r. Interior effort obtains for $r < \frac{R\sqrt{\bar{z}}}{2}$ (see the proof of Proposition 1). If, instead, $r \in [\frac{R\sqrt{\bar{z}}}{2}, R\sqrt{\bar{z}})$ then the MFIs supply the maximum effort $\bar{z}$ and a local increase in r does not raise MFI effort and the individual payoff $w(\bar{z})$ but still increases the total number of loans x^c and the borrowers' total payoff, $W(x^c, \bar{z})$.

2.3 Discussion

Endogenous donor funds rate, r

The analysis above took the funding interest rate r as given and considered a local increase. If constraint (PC) does not bind at the initial r (for example, suppose MFIs make positive profit at the $r = 0$ optimum, x^* and z^*) then, by the Envelope theorem, the donor payoff $V(x^*)$ is strictly increasing in r since $\frac{\partial V(x^*)}{\partial r} = x^*$. In addition, by Proposition 1, total lending, the MFIs effort, and borrower welfare all locally increase in r.

As r increases further, however, the MFI participation constraint (PC) can eventually bind and then (see case (ii) above) the funding amount x^c and the MFI effort z^c which solve (DP) are found from (ICC) and setting (PC) at equality. In this case there are two countervailing effects on the donor's payoff $V(x)$ from increasing the funds rate r. On the one hand, the term rx goes up which raises $V(x)$. On the other hand, the funding x^c no longer satisfies the donor's FOC, which lowers

$V(x)$. Since in case (ii) MFIs make a loss at the x^* which solves the donor's FOC $B'(x) = 1 - r$, the latter effect means that the donor must increase the funding amount x^c above x^* to enable MFIs to break even (and microcredit to be provided), at the cost of reducing his own payoff. Therefore, in the case of binding MFI participation constraint (PC), an optimal funds rate r exists, balancing these two effects. The exact outcome can be worked out numerically and in general depends on the assumed functional forms and parameters.

For example, suppose $B(x) = 2x - x^2$, $p(z) = \sqrt{z}$, $f(x) = 1$ and $Z = [0, \bar{z})$ with $\bar{z} < 1$. Figure 1 illustrates the maximized donor payoff $V(x^*(r))$ plotted as function of r over the interval $[0, 1.5]$ at $R = 1.5$.[15] In this example the payoff-maximizing funds rate r is about 0.65.

Figure 1: Payoff maximizing funds rate, r
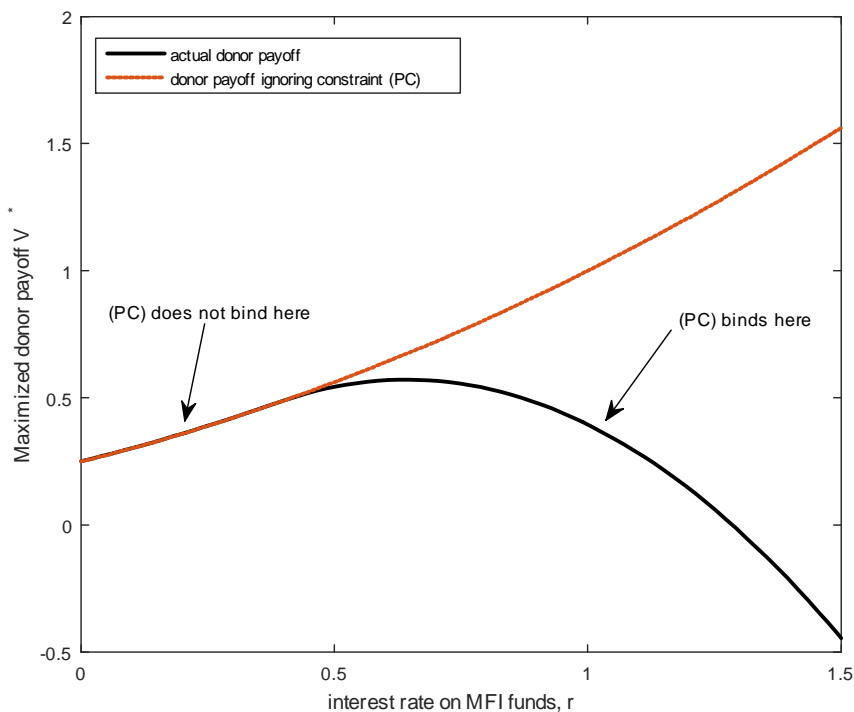
The interest rate r on funds provided to MFIs is bounded in the model by the largest value for which a solution to problem (DP) exists, which is $Rp(\bar{z})$; otherwise (PC) cannot be satisfied. In practice, the funds rate r could be also capped by competition among donors, donors' mission, or by the possibility of strategic default by MFIs. These issues remain beyond the scope of the paper. All that is needed for the result that an increase in the rate r can increase total funding, efficiency,

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[15]The maximized donor payoff is computed using either the solution at which (PC) does not bind ($x^* = \frac{1+r}{2}$ and $z^* = \frac{R^2(1+r)^2}{16}$) or the solution at which (PC) binds ($x^c = \frac{4r}{R^2}$ and $z^c = \frac{4r^2}{R^2}$), as appropriate for each r value (see cases i and ii in Section 2.2).

and borrower welfare is that the Proposition 1 result hold locally in a neighborhood to the right of $r = 0$ for grant donors or to the right of $r = 1$ for investors (see also Section 3).

Generalized participation constraint

Proposition 1 does not require that MFIs profits be bounded from below by zero. Suppose that, instead of (PC), MFIs must satisfy the alternative participation constraint,

$$p(z)Rx - rx - zf(x) \geq \pi \quad \text{(IPC)}$$

for some positive or negative value π. This could correspond to MFIs with market power ($\pi > 0$) or MFIs with a 'soft' budget constraint ($\pi < 0$). Retracing the steps in the proof of Proposition 1, it is easy to see that all results obtain as long as π is not too large in absolute value.

Fixed costs

Small fixed costs of effort can be incorporated too. Suppose $c(z, x) = k + zf(x)$ with $k > 0$. This does not affect the MFIs effort incentives (constraint ICC) and only changes the break-even condition (PC), exactly as in the case $\pi > 0$ in constraint (IPC) discussed above. An alternative cost specification could involve fixed costs per loan, $c(z, x) = (k + z)f(x)$ with $k > 0$. Going over the proof of Proposition 1, it is easy to verify that case (i) (non-binding participation constraint) is unaffected, while in case (ii) (binding participation constraint) it still follows that the optimal effort, $z^c(r)$ and loan amount, $x^c(r)$ are both strictly increasing in r.

Motivated MFIs

In modeling the MFI's effort choice, I align with the classical principal-agent literature by treating the 'agent' (the MFI) as an expected income maximizer. If, in contrast, e.g., as in Besley and Ghatak (2005), MFIs were "motivated", that is, derive additional non-pecuniary utility $\psi > 0$ per unit of supplied effort, then the incentive-constraint (ICC') becomes $p'(z)Rx + \psi = f(x)$ – the marginal cost of MFI effort is effectively decreased.[16] It is then easy to show, following the steps in the proof of Proposition 1, that, for ψ positive and sufficiently small, by continuity, the proposition results remain intact – the number of loans, MFI's effort level, and the borrowers' payoffs all increase in r.[17]

MFI effort and borrower welfare

The results on borrower welfare in Proposition 1 hinge on the implicit assumption that, as the MFI action level z goes up, its borrowers do not incur any additional costs that could reduce their welfare. For example, if MFIs put more effort to raise the repayment rate of their borrowers, this could come from more intensive monitoring and may cause the borrowers to exert additional costly

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[16]Guha and Roy Chowdhury (2013) model 'motivated' MFIs differently – they assume that their objective function is a weighted sum of the borrowers' total payoff and the MFI's own payoff.

[17]In the context of Example 1, in the case of binding (PC) and interior effort choice, we have $z = \frac{R^2 x^2}{4(1-\psi)^2}$ from the new (ICC) which, substituting into (PC) and solving for x yields, $x^{**} = \frac{4r(1-\psi)^2}{R^2(1-2\psi)}$ and thus $z^{**} = \frac{4r^2(1-\psi)^2}{R^2(1-2\psi)^2}$. Therefore, for $\psi \in (0, 1/2)$ both x^* and z^*, and hence $W(x^*, z^*)$ and $w(z^*)$, are still strictly increasing in r. In the case of non-binding (PC), it is imediate to see that x^* solving $B'(x) = 1 - r$ and z^* solving the new (ICC') $p'(z)Rx^* + \psi = f(x)$, both locally increase in r.

effort themselves. Not accounting for this possibility would overstate the gains to the borrowers from the increase in MFI's effort z caused by an increase in r. On the other hand, if the MFI effort z is in the form of the loan administration quality or financial advice to borrowers, then the borrowers are unlikely to incur extra costs as z goes up.

2.4 Endogenous MFI lending rate, R

Thus far and in Proposition 1 the MFI lending interest rate R was treated as exogenously given. As shown below, this assumption is not critical for the main results, with the possible exception of the effect on borrower welfare. Specifically, consider the following variant of the model in which, for example because of free entry in the MFI sector or because of the non-profit mandate of MFIs, the microcredit interest rate R adjusts endogenously, so that MFIs always make zero expected profits given the funding terms (r, x).

The donor/investor maximizes his payoff, $V(x) = B(x) + rx - x$ by choice of x and z subject to the MFIs' incentive constraint. The MFIs choose effort z taking the market lending rate R as given,

$$z = \arg\max_{\tilde{z}} \ p(\tilde{z})Rx - rx - \tilde{z}f(x) \ \ \text{(ICC)}$$

The equilibrium lending rate R must be such that,

$$p(z)Rx - rx - zf(x) = 0 \ \ \text{or,}$$
$$R = \frac{rx + zf(x)}{p(z)x} \ \ \text{(ER)}$$

Condition (ER) ensures zero expected profits for the MFIs in equilibrium. The equilibrium R^* will satisfy this condition evaluated at the optimal x and z. The donor/investor takes into account the effect of his choice of x and z (subject to ICC) on the equilibrium MFI lending rate R^*. Suppose also that the parameters are such that $R = \frac{rx + zf(x)}{p(z)x} < \theta$ at the optimal x and z, that is, the project return exceeds the required repayment. Otherwise no one would like to borrow from the MFIs (see Example 2 for functional forms and parameters that satisfy these assumptions).

The funding x is chosen by the donor/investor to maximize his objective $V(x)$ subject to the incentive constraint (ICC) and the equilibrium condition (ER). Consider first the case of interior effort level z satisfying the MFI's first-order condition (ICC'), $p'(z)R\frac{x}{f(x)} = 1$ derived as in Section 2.2. Substituting R from condition (ER) into (ICC') yields

$$\frac{p'(z)}{p(z)}\frac{rx}{f(x)} + \frac{p'(z)z}{p(z)} = 1 \ \ \text{(ICC'')}$$

The donor maximizes $V(x)$ subject to (ICC''). This implies that $x^*(r)$ solves

$$B'(x) = 1 - r \ \ \text{(FOC)}$$

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and so $x^*(r) = B'^{-1}(1-r)$ which is strictly increasing in r. The optimal MFI effort solves (ICC")
evaluated at $x^*(r)$,

$$\frac{p'(z)}{p(z)}\frac{rx^*(r)}{f(x^*(r))} + \frac{p'(z)z}{p(z)} = 1 \qquad (eq3)$$

Proposition 2 below shows that the solution to (eq3), $z^*(r)$ is strictly increasing in r. If, instead,
$\frac{p'(\bar{z})}{p(\bar{z})}\frac{rx^*(r)}{f(x^*(r))} + \frac{p'(\bar{z})\bar{z}}{p(\bar{z})} > 1$, then there is a corner solution, $z^* = \bar{z}$ which is non-decreasing in r.

Proposition 2 (endogenous MFI lending rate)

With endogenous MFI lending rate R,

*(a) the optimal MFI effort, z^* and total number of loans made, x^* are both increasing
(strictly at an interior solution) in the interest rate on donor/investor funds, r.*

*(b) the equilibrium MFI lending rate $R^* \equiv \frac{rx^* + z^* f(x^*)}{p(z^*)x^*}$ is decreasing in r, the borrowers'
total expected payoff, $W(x^*, z^*)$ is strictly increasing in r, and the borrowers' individual
expected payoff, $w(z^*)$ is increasing (strictly at an interior solution) in r, if the following
condition is satisfied:*

$$\frac{dR^*}{dr} \leq 0 \quad (I1)$$

at the optimal x^*, z^* solving (FOC) and (eq3).[18]

*(c) it is possible that the individual and total borrowers' expected payoffs, $W(x^*, z^*)$ and
$w(z^*)$ are increasing in r even when the sufficient condition (I1) is not satisfied (that
is, when $\frac{dR^*}{dr} > 0$).*

Proof (see Appendix)

The intuition for part (a) follows directly from the fact that MFI's optimal effort, z^* increases in
the total funds (number of loans) x as the marginal product of effort goes up while the total amount
of funds x^* increases in r because the donor's marginal benefit of lending increases. Regarding part
(b), note first that the effect of a higher r on the MFI lending rate R^* is ambiguous and in general
depends on the functional forms or parameter values. A higher interest rate r directly increases
R^* in order to satisfy the equilibrium condition (ER) but, on the other hand, the higher induced
effort level z^* works in the opposite direction – since projects succeed more often (or more projects
succeed on average) a lower lending rate is required to obtain the same expected revenue $p(z^*)R$ per
dollar lent. Consequently, there are also two countervailing effects from raising the donor interest
rate r on borrowers' payoffs: the increase in z^* triggered by the increase in r raises the borrowers'
expected payoff as it increases $p(z^*)$, whereas the possible increase in the interest rate R^* that
borrowers must pay can act in the opposite direction.

Proposition 2(b) shows that the equilibrium MFI lending rate R^* being weakly decreasing in r
is a sufficient condition for the borrowers' total and individual welfare to both increase in r, since z^*

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[18]See Example 2 for functional forms and parameters for which condition (I1) involving endogenous variables is
satisfied. Unfortunately, for general functional forms, $p(z)$, $B(x)$ and $f(x)$ it is impossible to supply a sufficient
condition involving only exogenous objects.

and x^* increase in r. Intuitively, the higher effort level z^* implies that borrowers' projects succeed more often, which together with the (weakly) lower interest R^* makes individual borrowers better off in expectation. The borrowers' total expected payoff, $W(x, z^*)$ goes up for three reasons: the larger number of loans made, the lower interest rate, and the higher fraction of loans succeeding.

For part (c), note that condition (I1) is just a sufficient condition – borrower welfare, $w(z^*)$ could still increase in r even if R^* is also increasing in r (condition I1 did not hold), provided that the effect of the increase in MFI effort z^* on $w(z^*) = p(z^*)(\theta - R^*)$ outweighs the effect of the higher interest rate R^*. Similarly, total borrower welfare $W(x^*, z^*)$ can locally increase in r even when $\frac{dR^*}{dr} > 0$ and $\frac{dw(z^*)}{dr} \leq 0$, as long as the effect of the increase in x^* dominates. The formal conditions under which these scenarios occur are described in the proof of Proposition 2. See also numerical Example 2 below for more details and for functional forms and parameters satisfying condition (I1) and all of the assumptions.

To conclude, Proposition 2 shows that assuming an exogenous MFI lending rate R, as in Proposition 1, is not crucial for the main results of the paper. Indeed, Proposition 2 demonstrates that a local increase in the donor/investor rate r could, under the appropriate conditions, lead to all of the following: (i) more loans given; (ii) higher MFI effort; (iii) higher borrower welfare (individual and/or total); and (iv) lower MFI lending rate R^*.

Example 2

This example illustrates Proposition 2 and shows that condition (I1) involving endogenous variables is easy to satisfy. Suppose $B(x) = \sqrt{x}$, $p(z) = \sqrt{z}$, $f(x) = 1$ and $Z = [0, \bar{z})$ with $\bar{z} < 1$. Let also $0 < r < 1$.

From (FOC), $x^* = \frac{1}{4(1-r)^2}$, which is strictly increasing in r. At interior effort (interiority requires[19] $rx^* < \bar{z}$), (eq3) implies $z^* = rx^*$ which is strictly increasing in r. The equilibrium MFI lending rate is $R^*(r) = \frac{rx^* + z^* f(x^*)}{p(z^*)x^*} = 2\sqrt{\frac{r}{x^*}} = 2(1-r)\sqrt{r}$ which is decreasing in r for $r \geq 1/3$. Condition (I1) is thus satisfied for any $r \geq 1/3$. Then, to ensure $R^* < \theta$ (so that people want to borrow) it is sufficient to assume $\theta > R^*(1/3) = 0.77$. Turning to borrower welfare, $w(z^*) = p(z^*)\theta - r = \frac{\theta\sqrt{r}}{2(1-r)} - r$ and so $\frac{dw(z^*)}{dr} > 0 \iff \theta > \frac{4\sqrt{r}(1-r)^2}{1+r}$. For θ large enough ($\theta > 1$ is sufficient) the latter inequality holds for any $r \in (0, 1)$ and so, for such θ both the individual and total borrower expected payoffs locally increase in r.

3   Endogenous overhead costs

This section considers a variation of the model explicitly modeling MFI effort as an action affecting their overhead costs per loan. Specifically, suppose it costs an MFI $d(z) > 1$ in gross to administer each loan it makes, where, as before, $z \in Z$ is the level of effort supplied. For example, $d(z) = 1.2$ would mean that, if a loan of size 1 is disbursed, 0.2 is spent on overhead costs administering it. The overhead costs are incurred *before* the loans are repaid. Suppose that the function $d(z)$ is

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[19]For example, if $\bar{z} = 1 - \varepsilon$ for a very small and positive ε, we need $\frac{r}{4(1-r)^2} < 1$ which is satisfied for $r < 0.61$.

strictly decreasing in z with $d(z) > 1$, $\forall z \in Z$. The interpretation is that an MFI spending more effort (e.g., on a more efficient management model, accounting practices, etc.) reduces the overhead costs per dollar lent.

As in the Section 2, assume there is a large number of MFIs charging gross interest R per loan of size 1. The repayment R is now obtained with certainty – there is no risk in the project outcome, which is always $\theta > 0$. Define the total borrowers' payoff as $W(x) = x(\theta - R)$ and individual payoff as $w = \theta - R$.

Suppose MFIs are provided $F > 0$ in funds (this amount could be determined by maximizing a donor objective function as in Section 2) and charged a gross interest rate $r \geq 0$ by the donor/investor. The MFIs choose the number of loans x to disburse and the effort level z. Two constraints must be satisfied. First, the available funds F must suffice to cover the disbursed loans x and the associated overhead costs,

$$xd(z) = F \quad (C1)$$

Constraint (C1) is an ex-ante feasibility or budget constraint, simply reflecting the assumption that the MFI's only source of funds is the donor/investor. Second, suppose that either because of free entry or their mandate, MFIs make zero profits – their gross revenue Rx is used to pay what is owed to the donor, rF plus the effort costs $zf(x)$,

$$Rx - rF - zf(x) = 0 \quad (C2)$$

where the function $f(x)$ has the same properties and interpretation as in Section 2.

Proposition 3 (endogenous overhead costs)

Suppose the inequality,

$$\frac{d'(z^*)}{d(z^*)^2}[z^* f'(x^*) - R] - \frac{f(x^*)}{F} > 0 \qquad (C3)$$

holds at z^* and x^* solving (C1) and (C2), at least locally to the right of r. Then, the MFIs' effort level, z^*, the total number of loans made, x^*, and the borrowers' total payoff $W(x^*)$ are all increasing in the funds interest rate r.

Proof (see Appendix)

Proposition 3 provides a condition under which a local increase in the interest rate on MFI funds, r results in increased effort by MFIs. Consequently, per loan overhead costs, $d(z^*) - 1$ are reduced and more loans are given (more projects are financed). This increases efficiency. The intuition is similar to that given after Proposition 1 – the increase in the funds rate r raises the amount MFIs need to pay back, which induces them to supply higher effort to reduce their overhead

costs and be able to break even. The higher effort level and lower overhead costs $d(z)$ in turn allow more loans to be given out of the same funding F, which increases the total payoff to borrowers.

Example 3

This example shows that it is easy to satisfy condition (C3) in Proposition 3. Suppose $RF = 50$, $f(x) = 1$ and $d(z) = 100 - 4z$ with $z \in (0, 99/4)$. Let initially $r = 0$ (pure grant). Then equation (7) in the proof of Proposition 3 implies $z^* \simeq 24.5$, taking the larger root of the quadratic equation. Therefore, $d(z^*) \simeq 2$ and, since $f(x) = 1$, condition (C3) becomes $-\frac{Rd'(z^*)}{d(z^*)^2} - \frac{1}{F} > 0$ which is equivalent to $\frac{200}{d(z^*)^2} > 1$ and is clearly satisfied at z^*. Hence, a local increase in the interest rate on MFI funds starting from $r = 0$ would strictly increase the MFIs' optimal effort z^*, the total number of loans x^*, and the borrowers' total payoff, $W(x^*)$ while reducing overhead costs per loan.

4   Conclusions

I describe an economic mechanism in which charging interest on funds provided to microlenders induces them to supply more effort, for instance in monitoring or assisting borrowers' business projects, thus increasing the expected repayment rate. Alternatively, charging interest makes MFIs reduce per-loan overhead costs. By offering a causal theoretical framework in the existing primarily empirical literature, this paper contributes to the debate on the role of for-profit funding and institutions in microfinance by showing that, under appropriate conditions, they can have positive impact on outreach, expected profitability, cost efficiency, and borrower welfare.

The policy and applied literature on the topic is largely in agreement that expanded for-profit funding and private investment are needed in order to scale up microfinance operations and outreach globally and ensure the sector's sustainability (Cull et al., 2009; Rosenberg et al., 2009; Roberts, 2013).[20] At the same time, reducing operational costs associated with making small loans remains a major challenge (Cull et al., 2009; Roberts, 2013). The mechanism identified in this paper provides a possible way to combine these two objectives, although other factors such as MFI age have also been found associated with cost reduction over time (Caudill et al., 2009; Rosenberg et al., 2009). There seems to be less agreement in terms of the effect of pro-profit MFIs on borrowing interest rates and welfare. Roberts (2013) finds higher interest and operating costs among for-profit microlenders while Rosenberg et al. (2009), focusing on sustainable MFIs only, report substantial interest rate reductions over time and only isolated instances of 'exploitative' lender practices. Cull et al. (2009) also find lower costs per dollar lent and larger scale for commercial microfinance banks relative to NGOs. In my model, Proposition 2 shows that higher cost of funding may or may not lead to higher interest rate for borrowers and, even when it does, borrower welfare may still go up due to the increased repayment probability. Of course, additional factors, that I do not model, such as technological advances (mobile money, smart cards, possibly blockchain technology) or expanding

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[20]Roberts (2013) further speculates that it may be concerns about attracting funds from lenders that drive increasing for-profit orientation in the microcredit industry, not the pursuit of profits per se.

financial services to deposits and insurance will likely play major role in the future development of the microfinance industry.

By emphasizing the role of MFI actions which raise the probability of repayment (the 'effort' z), the current paper also contributes to the debate on whether microfinance institutions should bundle provision of credit with non-financial aspects, such as business development services, financial and accounting advice or even health, education and literacy programs. The proponents of such integrated approach emphasize that many MFI clients such as poor women may lack not just credit but essential knowledge, skills or health to utilize the loan or start a business successfully (Smith, 2002; McKernan, 2002). In addition, Flores and Serres (2009) point out that non-financial services improve living conditions, hence capacity to repay and can lead to increased loyalty and diminished risk of loan diversion. Credit availability may also serve as an incentive to participate in other programs with benefits of which MFI clients may be unaware. On the other hand, while there may be complementarity in beneficial outcomes, it is not clear that there is always synergy in the provision of credit and non-credit services. Various problems could arise from lack of specialization or in eliciting proper incentives in multi-goal organizations (Gine et al., 2017). The empirical evidence discussed in the introduction suggests that, on average, non-credit services have been successful, however, caution should be exercised since many cases in which program participation is voluntary could be subject to selection bias and hence overstate the positive effects, necessitating the use of randomized control trials (Karlan and Valdivia, 2011).

Going back to the theoretical setting, I have not modeled the use of the proceeds from charging interest on MFI funds but presumably these proceeds could be used to make further loans or in other productive ways. It was also assumed, as a simplification, that all investment projects (loan sizes) and all MFIs are identical and that the borrowers' composition does not change when the interest rates charged to (or by) MFIs are varied. Extending the analysis to incorporate (possibly unobservable) borrower or MFI heterogeneity in productivity or costs should bring additional realism and insights. Finally, MFIs were assumed unable to default and always fully repay the donor/investor. Relaxing this assumption, e.g., as in a limited commitment setting, could weaken the incentivizing effect of the price of funds.

References

[1] Ahlin, C. (2014), "The Role of Group Size in Group Lending", working paper, Michigan State University

[2] Alam, N. and M. Getubig (2016), *Guidelines for Establishing and Operating Grameen-Style Microcredit Programs*, Grameen Foundation and Grameen Trust

[3] Aldashev, G. and T. Verdier (2010), "Goodwill Bazaar: NGO Competition and Giving to Development", *Journal of Development Economics* 91, p.48–63

[4] Angelucci, M., D. Karlan and J. Zinman (2013), "Win Some Lose Some? Evidence from a Randomized Microcredit Program Placement Experiment by Compartamos Banco", *NBER Working Paper* 19119

[5] Barua, R. and R. Sane (2014), "Repayment in microfinance: The role of financial literacy and caste", Discussion Paper 14-06, Indian Statistical Institute

[6] Besley, T. and S. Coate (1995), "Group Lending, Repayment Incentives and Social Collateral", *Journal of Development Economics* 46, p.1-18

[7] Besley, T. and M. Ghatak (2005), "Competition and Incentives with Motivated Agents", *American Economic Review* 95(3), p.616-36

[8] Biosca, O., P. Lenton and P. Mosley (2011), "Microfinance Non-Financial Services: A Key for Poverty Alleviation? Lessons from Mexico", working paper

[9] Caudill, S., D. Gropper and V. Hartarska (2009), "Which Microfinance Institutions Are Becoming More Cost Effective with Time? Evidence from a Mixture Model, *Journal or Money, Credit and Banking* 41(4), p.651-72

[10] Chen, G., S. Rasmussen, X. Reille and D. Rozas (2010), "Indian Microfinance Goes Public: The SKS Initial Public Offering", *CGAP Focus Note*, No. 65

[11] Chowdhury, P.R. (2005), "Group-lending: sequential financing, lender monitoring and joint liability", *Journal of Development Economics* 77(2), p.415-39

[12] Chowdhury, P.R. (2007), "Group-lending with sequential financing, contingent renewal and social capital", *Journal of Development Economics* 84(1), p.487-506

[13] Cull, R., A. Demirguc-Kunt and J. Morduch (2007), "Financial Performance and Outreach: A Global Analysis of Leading Microbanks," *Economic Journal* 117, p.F107–33

[14] Cull, R., A. Demirguc-Kunt and J. Morduch (2009), "Microfinance Meets the Market", *Journal of Economic Perspectives* 23, p.167-92

[15] De Quidt, J., T. Fetzer and M. Ghatak (2012), "Microfinance, Market Structure, and Borrower Welfare: Regulatory Lessons from the Indian Crisis", working paper

[16] Dikki, A., B. Muhammad, A. Dogarawa and I. Chechet (2014), "Impact of Non-Financial Services of Microfinance Banks (MFBs) on the Performance of Women Entrepreneurs in Nigeria", *European Journal of Business and Management* 6(34), p.158-163

[17] Djankov, S., J. Montalvo and M. Reynal-Querol (2004), "Helping the Poor with Foreign Aid: The Grants vs. Loans Debate", World Bank, Washington, DC

[18] Flores, I. and P. Serres (2009), "Microfinance and Non-financial Services: An Impossible Marriage?", *Private Sector and Development* 3

[19] Ghatak, M. (2000), "Screening by the Company You Keep: Joint Liability Lending and the Peer Selection Effect", *Economic Journal* 110, p.601-31

[20] Ghatak, M. and T. Guinnane (1999), "The Economics of Lending with Joint Liability: Theory and Practice", *Journal of Development Economics* 60(1), p.195-228

[21] Ghosh, P., D. Mookherjee and D. Ray (2000), "Credit Rationing in Developing Countries: An Overview of the Theory", ch. 11 in *Readings in the Theory of Economic Development*

[22] Ghosh, S. and E. Van Tassel (2013), "Funding Microfinance under Asymmetric Information", *Journal of Development Economics* 101, p.8-15

[23] Gine, X., G. Mansuri and S. Shrestha (2017), "Profits and Mission: Performance Incentives in a Multi-goal Development Organization", working paper, The World Bank

[24] Guha, B. and P. R. Chowdhury (2013), "Microfinance Competition: Motivated Micro-lenders, Double-Dipping and Default", *Journal of Development Economics* 105, p.86-102

[25] Hartarska, V. (2005), "Governance and Performance of Microfinance Organizations in Central and Eastern Europe and the Newly Independent States", *World Development* 33, 1627-43

[26] Karlan, D. and M. Valdivia (2011), "Teaching Entrepreneurship: The Impact of Business Training on Microfinance Clients and Institutions", *Review of Economics and Statistics* 93(2), p.510-27

[27] Klein, M. and T. Harford (2005), *Grants or Loans? Development Finance and Incentive Effects*, World Bank Group

[28] Lammermann, S. and G. Ribbink (2011), *Microfinance and Business Development Services in Europe. What Can We Learn from the South?*, European Microfinance Network, Paris and Brussels

[29] McIntosh, C. and B. Wydick (2005), "Competition and Microfinance", *Journal of Development Economics* 78, p.271-98

[30] McKernan, S-M., (2002), "The Impact of Microcredit Programs on Self-Employment Profits: Do Non-Credit Program Aspects Matter?", *Review of Economics and Statistics* 84(1), p.93-115

[31] Mintah, E., K. Attefah and F. Amoako-Agyeman (2014), "The effect of microfinance institutions on the growth of small businesses in Kumasi, Ashanti region of Ghana", MPRA Paper No. 57481

[32] Reille, X., S. Forster and D. Rozas (2011), "Foreign Capital Investment in Microfinance: Re-assessing Financial and Social Returns", *CGAP Focus Note,* No.72

[33] Roberts, P. (2013), "The Profit Orientation of Microfinance Institutions and Effective Interest Rates", *World Development* 41, p.120-31

[34] Rosenberg, R. (2007), "CGAP Reflections on the Compartamos Initial Public Offering: A Case Study on Microfinance Interest Rates and Profits", *CGAP Focus Note,* No.42

[35] Rosenberg, R., A. Gonzales and S. Narain (2009), "The New Moneylenders: Are the Poor Being Exploited by High Microcredit Interest Rates?", *CGAP Occasional Paper* No.15

[36] Roy J. and P.R. Chowdhury (2009), "Public-Private Partnerships in Microfinance: Should NGO Involvement be Restricted?", *Journal of Development Economics* 90, p.200-08

[37] Smith, S. (2002), "Village Banking and Maternal and Child Health: Evidence from Ecuador and Honduras", *World Development* 30(4), p.707-23

[38] Yunus, M. (2011), "Sacrificing Microfinance for Megaprofits", *The New York Times*, Jan. 14, 2011

5   Appendix

Proof of Proposition 1

(a) As explained in the main text, there are two cases: either (i) constraint (PC) does not bind at the optimal (x^*, z^*) where x^* is determined from the FOC of the lender's objective function and z^* solves (ICC) evaluated at x^* or (ii) the MFI makes negative profits at the solution from (i) and so (PC) must bind and the optimal (x^*, z^*) are determined from (ICC') and (PC) taken at equality.

(i) Non-binding participation constraint (PC) at r

The optimal number of loans, $x^* > 0$ solves

$$B'(x) = 1 - r, \tag{3}$$

which, calling $\phi(.) = B'^{-1}(.)$, yields $x^*(r) = \phi(1 - r)$. Consider first the case of interior effort level at which (ICC') holds and call

$$\gamma(x) \equiv \frac{x}{f(x)}.$$

From the assumed properties of $f(x)$, it is easy to show that the function $\gamma(x)$ is *strictly increasing* for $x > 0$.[21]

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[21]The concavity of $f(x)$ implies that, for any $x > 0$, we have $f(x) - f(0) \geq f'(x)x$. That is $f(x) > f'(x)x$ since $f(0) > 0$. This implies that the derivative of $\frac{x}{f(x)}$ at $x > 0$ is strictly positive. If f is strictly concave only $f(0) \geq 0$ is needed.

MFI effort z then solves, using (ICC'),

$$p'(z)R\gamma(x^*) = 1$$

Since $B(x)$ is strictly concave, B'^{-1} is strictly decreasing, and so an increase in the funds rate r results in an increase in the funds amount x^* solving (3). From (ICC'), since $p(z)$ is strictly concave, z increases in $\gamma(x)$ and hence in x, and thus $\hat{z}(r)$ solving (ICC') increases in r too. Interior solution for effort occurs when $p'(\bar{z})R\gamma(\phi(1-r)) < 1$. The remaining possibility is a corner solution in effort, $z = \bar{z}$ which is non-decreasing in r. This implies, $z^*(r) = \min\{\hat{z}(r), \bar{z}\}$. For the participation constraint (PC) to be satisfied at r, x^* and z^* it must be that

$$\phi(1-r)[p(z^*(r))R - r] - z^*(r)f(\phi(1-r)) \geq 0$$

For example, at $r = 0$ satisfying (PC) requires $\phi(1)p(z^*(0))R - z^*(0)f(\phi(1)) \geq 0$ where $z^*(0)$ solves $p'(z) = \frac{1}{R\gamma(\phi(1))}$. See also numerical Example 1.

    (ii) Binding participation constraint at r

    Now suppose that at $x^* = \phi(1-r)$ from (3) and the corresponding $z^*(r)$ from case (i) above, the MFI cannot break even, that is

$$\phi(1-r)[p(z^*(r))R - r] - z^*(r)f(\phi(1-r)) < 0.$$

This implies that (PC) must bind at optimum. So, the solution, call it (x^c, z^c), to problem (DP) in this case is obtained from (ICC) and setting (PC) at equality. Assume interior effort level first (ICC' holds). Using that $x > 0$ at the optimum as argued earlier, re-write (PC) at equality as:

$$p(z)R - \frac{zf(x)}{x} = r$$

or, substituting for $\frac{f(x)}{x}$ from (ICC'),

$$p(z)R - zp'(z)R = r \tag{4}$$

which is solved by the optimal effort z^c. The l.h.s. of (4) is strictly increasing in z since its first derivative with respect to z is

$$p'(z)R - p'(z)R - zp''(z)R > 0$$

by the strict concavity of $p(z)$. This implies that the optimal effort $z^c(r)$ solving (4) is strictly increasing in r (the right-hand side). In turn, this implies that $x^c(r)$, which solves (ICC'), $p'(z^c(r))R\gamma(x) = 1$, is also strictly increasing in r by the concavity of $p(z)$ and since $\gamma(x)$ is strictly increasing. Going

back to (4), in order to have an interior effort level, the following inequality must hold

$$p(\bar{z})R - \bar{z}p'(\bar{z})R > r. \tag{5}$$

The remaining possibility is $z^c = \bar{z}$, which is non-decreasing in r. Then, using (PC) at equality, $\gamma(x^c(r)) = \frac{\bar{z}}{p(\bar{z})R-r}$ which, since $\gamma(x)$ is strictly increasing, again implies that $x^c(r)$ is strictly increasing. For this case to arise we need (using ICC): $p'(\bar{z})R\frac{\bar{z}}{p(\bar{z})R-r} \geq 1$ which, together with Assumption A1, implies the condition

$$p(\bar{z})R > r \geq p(\bar{z})R - \bar{z}p'(\bar{z})R.$$

Therefore, in both cases (i) and (ii), the optimal amount of funds is strictly increasing in r and the optimal MFI effort level is non-decreasing (increasing at an interior solution) in r.

(b) The results about the expected payoffs $W(x, z)$ and $w(z)$ follow directly from part (a) since both functions are strictly increasing in x and z.

Proof of Proposition 2

(a) I showed that $x^*(r)$ is increasing in the main text. It was also shown that, in the interior effort level case, $z^*(r)$ solves (eq3) which is equivalent to:

$$r\gamma(x^*(r)) = \frac{p(z)}{p'(z)} - z \tag{6}$$

where $\gamma(x) \equiv \frac{x}{f(x)}$ as defined in the proof of Proposition 1. The function $\frac{p(z)}{p'(z)} - z$ on the r.h.s. is *strictly increasing* by the strict concavity of $p(z)$.[22] This implies that an increase in the donor/investor interest rate r, which increases $r\gamma(x^*(r))$, also raises the optimal MFI effort $z^*(r)$.

(b) Condition (I1), $\frac{dR^*}{dr} \leq 0$ implies the equilibrium MFI lending rate is decreasing in r. The borrower's individual expected payoff is $w(z^*) = p(z^*)(\theta - R^*)$ which, if (I1) holds, increases in r since z^* increases in r (see part a) and R^* (weakly) decreases in r. A similar argument applies to $W(x^*, z^*)$ since x^* also increases in r.

(c) We have $w(z^*) = p(z^*)(\theta - R^*)$. Thus, $\frac{dw(z^*)}{dr} = p'(z^*)\frac{dz^*}{dr}(\theta - R^*) - p(z^*)\frac{dR^*}{dr}$ which is positive if and only if

$$\frac{p'(z^*)}{p(z^*)}\frac{dz^*}{dr}(\theta - R^*) > \frac{dR^*}{dr} \tag{I2}$$

Since we assume $R^* < \theta$ (otherwise no one would borrow), the l.h.s. is positive and so condition (I2) is implied by and easier to satisfy than condition (I1) in the Proposition 2 statement. Hence, we could have $\frac{dw(z^*)}{dr} > 0$ even when $\frac{dR^*}{dr} > 0$, as long as the welfare effect from the increase in z^* dominates. Similarly, $\frac{dW(x^*, z^*)}{dr} = \frac{dx^*}{dr}w(z^*) + x^*\frac{dw(z^*)}{dr}$ and hence total borrower welfare, $W(x^*, z^*)$ can locally increase in r even if $\frac{dR^*}{dr} > 0$ *and* $\frac{dw(z^*)}{dr} \leq 0$, as long as the positive effect from the

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[22]Its derivative is $\frac{(p'(z))^2 - p''(z)p(z)}{(p'(z))^2} - 1 = -\frac{p''(z)p(z)}{(p'(z))^2} > 0$.

increase in x^* and z^* in the first term outweighs the negative effect of the higher loan interest R^* in the second term.

Proof of Proposition 3

From (C1), $x = \frac{F}{d(z)}$. Substituting into (C2),

$$\frac{R}{d(z)} - \frac{zf(\frac{F}{d(z)})}{F} = r \tag{7}$$

which is solved by the MFI's optimal effort z^*. The expression in inequality (C3) in the proposition statement is the derivative of the l.h.s. of (7) with respect to z evaluated at z^* and $x^* = \frac{F}{d(z^*)}$. As long as this derivative is positive (condition C3 holds), the MFI effort z^* is increasing in r (the right hand side of (7)). Since $x^* = \frac{F}{d(z^*)}$ and $d(z)$ is strictly decreasing, this implies that the number of loans x^* is also increasing in the funds rate r.