Designing Credit Agent Incentives to Prevent Mission Drift in Pro-Poor Microfinance Institutions

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May 2008

Abstract

Credit agents in microfinance institutions (MFIs) must be given incentives to acquire information on potential borrowers and select them in accordance with the MFI's objectives. We show that while giving incentives has no cost in for-profit MFIs, it is costly for pro-poor MFIs. This is because when repayment and wealth are positively correlated, agents' incentives to learn about borrowers' repayment probability and wealth status are in conflict. Auditing the share of very poor borrowers selected by an agent becomes necessary to induce adequate borrower selection. When audit costs are large, pro-poor MFIs may have to forego selection on wealth and use other targeting devices such as working in impoverished geographical locations and offering financial products that induce self-selection by the poor. When richer borrowers can offer agents non-monetary favors, pro-poor objectives seem to be compromised. However, a pro-poor MFI can respond by reducing wages, thus freeing resources to lend more to the poor and turning collusion unambiguously to its advantage. Driven by donor concerns with "mission drift" away from the poor, audits on the wealth status of clients have been introduced at the level of MFIs. We show that introducing pro-poor incentives requires extending such audits to the level of credit agents.

JEL Codes: O16, D82, L31.

Keywords: Micro-Credit, Pro-Poor Objectives, Incentives, Collusion.

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1 Introduction

Designing optimal incentives for credit agents has become a central concern for microfinance institutions (MFIs). The existing literature on microfinance has focused almost exclusively on incentive issues between borrowers and lenders. Yet, as credit agents play a critical role in ensuring the success of the MFIs they are working for, they must also be provided with adequate incentives. Without those, they may exert insufficient effort to learn about potential borrowers' characteristics, they may steal from repayments, and they may mis-represent the information they have obtained on potential borrowers (because of favoritism or corruption or simply to mask their lack of effort in information gathering).

Many pro-poor MFIs derive from non-governmental organizations and have non-profit status. Their objective is to give access to credit to very poor individuals with viable projects. There has, however, been a widely noted "mission drift" among these MFIs in increasingly working with clients that are less poor, a drift that has accelerated with rising competition from for-profit MFIs (Weiss and Montgomery, 2005). This has been of concern for donors supporting these institutions, leading to the search for mechanisms to induce MFIs to resist mission drift. This paper explores how to design credit agent incentives to achieve this result.

If less-poor borrowers reimburse more on average than very poor borrowers, a pro-poor MFI must strike a balance between financial viability and the selection of very poor borrowers. It wants to lend to an optimal mix of very poor and less-poor borrowers selected among potential borrowers with high ability and most likely to repay. The higher expected repayment rate with less-poor borrowers is used to cross-subsidize loans to very poor individuals, while meeting the zero profit constraint. But incentives for credit agents to select high-ability individuals then tend to conflict with incentives to select very poor individuals, who repay less. For these MFIs, repayment is an imperfect measure of an agent's performance.

To induce search for information on simultaneously poverty levels and ability, one would need to use incentive schemes that are non-monotonous in repayment. But such schemes would give the agent incentives to hide, and possibly steal, repayment. Observing another variable correlated with wealth is thus necessary. This requires costly audits. To meet their objectives, pro-poor MFIs thus have to bear the additional cost of an audit generating signals on the true type of borrowers by contrast to for-profit MFIs that bear no cost in providing incentives to their credit agents. Audits are, however, not always feasible. In contexts where the cost of

finding information on wealth is high, a pro-poor MFI may prefer to offer incentives based only on repayment performance, as would a for-profit MFI. In this case, the pro-poor MFI can meet its objective by selecting to work in notably poor geographical areas or by offering financial products that induce self-selection by the poor.

There also exists the possibility that a credit agent receives favors or in-kind transfers from less-poor individuals in exchange for getting a loan. This creates direct incentives for the agent to select less-poor individuals, apparently compromising the MFI's pro-poor objective. Yet it turns out that such collusion is unambiguously beneficial not only to the pro-poor MFI but also to poorer borrowers. This is because non-monetary favors are transfers which have no value for the MFI but have one for the agent: the MFI can reduce the agent's wage by the monetary equivalent of these favors. More resources are then available for lending, while auditing is still used for controlling the proportion of very poor borrowers among those selected by the agent. As a result, the number of poor individuals receiving a loan increases and the pro-poor MFI is better off. Contrary to usual settings, the benefits of collusion do not come at the cost of departures from the MFI's objective.

An important assumption in our analysis is that wealth and repayment are positively correlated. If rich borrowers were not more profitable to the lender than the poor, there fundamentally would be no tension between the outreach objective of the MFI and the viability constraint. There would be no possibility for cross subsidization, and lending to the poor would have to be viable. This would lead to the particular case in which a pro-poor MFI would always lend only to poor borrowers, and only to poor borrowers of high ability if information on this ability is not too costly. Agents would still need to be given incentive to acquire information, rather than selecting borrowers randomly. Yet a positive correlation appears more relevant, at least in areas where mission drift is a concern. A positive correlation arises when richer borrowers have access to better education, better quality inputs and land, and better social capital that facilitate success in their activity. Armendariz and Morduch (2005) show that this correlation may be positive or negative depending on the context and the specific clientele of an MFI.[1]. Empirically, Sharma and Zeller (1997) in Bangladesh, SEF (2003) in South Africa, Zeller (1998) in Madagascar, and de Janvry et al. (2004) in Guatemala all find that repayment performance

[1] A negative correlation can arise when repayment is subject to moral hazard from borrowers, and when poorer borrowers are more willing to reimburse than less poor ones. Since we only consider issues of adverse selection with respect to borrowers in this paper (the probability of reimbursing is a given characteristic of borrowers), we can safely assume a positive correlation.

does increase with wealth – the very poor tend to invest in low-return activities and in poorly developed markets where environmental and economic shocks are frequent, while they have low ability to bear risk (Hulme, 2000). This positive correlation, and the conflict it creates between outreach and financial viability, is confirmed by a concern among practitioners that using repayment performance incentives for agents reinforces their drift towards less poor clients. Based on a global survey of microfinance institutions, McKim and Hugart (2005) report that 70% of the MFIs that implemented an incentive scheme acknowledged that it reduced focus on the target population.

Another assumption made is that the agent is risk neutral with unlimited liability. This (admittedly special) case is particularly useful as it offers a clear benchmark: a for-profit MFI would bear *no* incentive cost due to delegation in this setting. Any cost borne by a pro-poor MFI stems exclusively from the interaction of the particular objective of a non-profit organization with internal incentives. If the agent was protected by limited liability or was risk averse, additional incentive costs would obviously arise but our main insights would still hold.

The remainder of the paper is organized as follows. The next section sketches the practical aspects of staff incentives in for-profit and pro-poor MFIs, and then summarizes the related literature. The model is presented in Section 3. Section 4 shows that using an audit procedure is needed to check the poverty level of selected borrowers. Section 5 characterizes the optimal incentive scheme for a pro-poor MFI under asymmetric information and gives examples of current practices used to combat mission drift. Section 6 considers the possibility that less-poor potential borrowers offer favors or bribes to the agent in order to be selected. Section 7 offers comments on the implications of rising competition on the ability to select very poor borrowers and also concludes.

2 Incentives in microfinance in practice and in the literature

2.1 The incentive issue in practice

Most for-profit MFIs have by now introduced incentive wages for their credit agents, with bonuses rewarding high repayment rates. McKim and Hugart (2005) surveyed 147 MFIs and report that 72% have formal staff incentive schemes compared to 6% only in 1990 and about 30% in 1999. Among MFIs with such schemes, 83% give individual incentives, not simply branch incentives.

These individual incentives consist in bonuses according to the portfolio at risk, the number of clients, and the value of the outstanding portfolio. Non-governmental organizations more often use the number of clients, and less often the value of the outstanding portfolio, than banks and non-bank financial institutions, probably as a consequence of their different objectives.

Experts in microfinance have observed a systematic evolution among MFIs in moving away from the very poor in selecting their clients (Wright and Dondo, 2001; Sustainable Banking for the Poor, 2002). Bi-lateral donors like USAID have recently shown increasing concern with this 'mission-drift', which has led the U.S. Congress to pass in 2000 the Microenterprise Self-reliance Act that mandates that half of all USAID microenterprise funds should benefit the very poor.[2] One of the main reasons for this drift is that it is easier for credit agents to work with less-poor borrowers: as we argued above, very poor borrowers may not repay as often as poor ones; moreover, very poor borrowers are less educated and require more help from credit agents when preparing and signing loan contracts.[3] The positive correlation between wealth and repayment plays a central role in this paper.

Selecting the poorest individuals is made difficult by the fact that pro-poor MFIs have few tools to screen borrowers according to their wealth level. To directly screen poor borrowers, pro-poor MFIs mainly use three (imperfect) strategies. One consists in limiting the size of loans; however, non-poor borrowers will still be attracted by these loans when the opportunity cost is borrowing from moneylenders and when larger loans may be expected in the future as part of dynamic incentives to repay (de Wit, 1998). They can also take a multiplicity of small loans from different lenders (McIntosh and Wydick, 2005). Loan size is thus an inadequate instrument for poverty screening (Simanowitz, 2004). A second strategy consists in imposing transactions costs in accessing loans (e.g., frequent repayment installment, required assistance to training sessions) to induce self-selection by the very poor. However, these costs reduce the poverty reduction value of the loans, and impose additional costs on lenders. A third strategy is to locate branches in areas where most potential borrowers are very poor, or to work exclusively with social categories such as young rural women or indigenous groups where most

[2]New legislation in 2003 defines 'very poor' as people living on less than US$1 a day or being in the bottom 50% of population below the national poverty line. Accurate and practical poverty assessment indicators that can be used to measure the extent of pro-poor orientation of client MFIs are being actively developed to permit verification that this mandate is being met (IRIS Center, 2004; Cerise, 2008).

[3]Another important cause for the 'mission drift' in borrowers selection is that competition for clients with for-profit MFIs makes it increasingly difficult for non-profit MFIs to use lending to less-poor borrowers in order to cross-subsidize loans to very poor borrowers.

members are very poor, provided that their repayment rates are sufficient for financial viability. While geographical or demographic targeting serves this purpose, it has limited use for reaching poor borrowers who are not easily identifiable based on observable characteristics. Strategies available to MFIs to directly screen borrowers according to wealth status are thus quite often not effective, indicating the importance of providing agents with adequate incentives to search for that information.

2.2 Related literature

While the literature on micro-credit is extremely large (see, e.g., Morduch, 1999), most studies do not consider the internal agency problems of MFIs, although the issue is raised as an important one in Armendariz and Morduch (2005), and only a few studies consider the issue of screening on wealth. This is in strong contrast to the debate among practitioners who insist that giving incentives to agents is both crucial and difficult. The problem of borrower selection has been extensively addressed in the literature with reference to group lending (see in particular Armendariz and Gollier, 2000; Ghatak, 1999, 2000; Ghatak and Guinnane, 1999; Laffont, 2003). However, group lending does not solve issues related to selecting borrowers according to their wealth status, particularly if wealth and repayment are positively correlated.

By their focus on incentives for micro-credit agents, the closest papers to ours are Conning (1999), Bond and Rai (2002), and Jeon and Menicucci (2005). As they do not consider issues related to pro-poor objectives, we offer a complementary analysis. Conning (1999) highlights a specific cost of having credit agents select poor borrowers. He addresses the situation in which credit agents exert unobservable monitoring efforts to ensure that borrowers do not divert too much of their project resources. Richer borrowers own collateral (contrary to our setting), which is observable. They have less incentive to divert resources as they must pledge a larger amount of collateral than poorer individuals. Lending to the poor is thus more costly, due to the added monitoring effort required. Although we also obtain that lending to the poor increases internal costs for an MFI, the mechanism is totally different as we focus on a different type of effort (ex ante information acquisition effort on borrowers' wealth and ability, rather than monitoring). In addition, in Conning's setting, incentive costs come from limited liability, while in ours they arise due to the non-verifiability of wealth levels, and the inadequacy of repayment as a measure of the agent's performance.

Bond and Rai (2002) and Jeon and Menicucci (2005) consider the possibility that credit agents be corrupted. Bond and Rai (2002) analyze ex-post moral hazard on the side of borrowers, who may decide not to repay. Enforcing repayment is costly. They show how denying future credit and imposing social sanctions on defaulters help solve this issue. As social sanctions have to be imposed by a credit agent, collusion at the repayment stage may arise. Jeon and Menicucci (2005) assume that credit agents can steal repayment (a possibility we also consider). If loans require different repayment levels depending on borrower's profits, the credit agent misrepresents to the MFI the actual value of profits, and pockets the difference in repayment. Non flexible loan contracts then become preferable to state-contingent contracts, and it is optimal to use either incentive pay or an audit of the agent's behavior. Conversely, in our paper both instruments may be used simultaneously as one induces information acquisition on borrowers' ability, while the other plays a role for information on borrowers' wealth.

The literature on the selection of aid recipients also applies to some extent in our setting. Besley and Coate (1992) have shown how self-selection can be obtained by imposing costs on recipients. This type of incentives is actually used by microcredit institutions, that require borrowers to repay their loans in small and frequent installments and attend training sessions. There is general agreement that these costs are sufficient to deter richer borrowers, but not those who are close to the poverty threshold desired by the MFI. Regarding selection by an intermediary, Banerjee (1997) has shown how corruption may be useful, not simply tolerated[4], when recipients for scarce goods must be selected by intermediaries, and valuation for the good may be higher than ability to pay. A corrupt bureaucrat will use red tape – useless procedures that are costly for recipients – to induce bribes from richer individuals who want to avoid these procedures. We also obtain that bribery can be useful to the principal but our analysis differs: the agent may benefit from non-monetary favors that have no value for the MFI.[5]

The paper also relates to the literature on not-for-profit firms. A large part of this literature (Besley and Ghatak, 2005; Francois, 2003; Rowat and Seabright, 2006) assumes that the employees of such firms will be 'motivated'; they require lower wages in equilibrium. We focus

[4]Kofman and Lawarrée (1996) have shown how a principal may prefer to tolerate some collusion if the intermediary is sufficiently likely to be non-corruptible. But collusion remains harmful in that paper and the literature deriving from it.

[5]Bac and Kanti Bag (2006) also find that collusion may be beneficial to a principal when non-monetary bribes are feasible, in a very different context. They consider an additional agent serving as 'corruption controller'. As in our analysis, non-monetary transfers cannot be directly obtained by the principal; hence a potential superiority of collusion.

by contrast on how to design incentive schemes to align the interests of selfish – or insufficiently motivated[6]– workers with the non-profit objective of their employer. In stark contrast to these papers, we obtain that incentive costs are higher in a non-profit MFI than in a for-profit as it is more difficult to observe a variable correlated to the non-verifiable non-profit objective.

3 The model and some benchmarks

An MFI lends to individuals who have independent projects. It uses agents as intermediaries to screen borrowers. The potential borrowers considered throughout the paper are all poor, in the sense that they have no collateral they could use in gaining access to (lower-rates) formal banking. In order to avoid confusion, we use the term 'poor' to refer to very-poor borrowers, and 'rich' to refer to less-poor borrowers, even though they also are poor.

3.1 The economic players

The borrowers Each individual borrows the same amount (that we need not specify here), to finance a project yielding verifiable benefits. Borrowers are protected by limited liability, and thus only reimburse in case of success. They are differentiated according to their 'ability' and their 'wealth'.

Ability: Borrowers differ in their ability to generate revenues (i.e., their probability of success). The expected gain of 'able' (A) borrowers is higher than that of 'unable' (U) ones, that is normalized to 0; we assume that individuals prefer to borrow despite this normalization[7]. Success yields a monetary amount, together with a non-monetary benefit V for the borrower: A borrower who obtains a loan and is successful in repaying builds a reputation and will obtain loans from other sources in the future; he also obtains some social capital, possibly trust from his customers and suppliers, and some expertise and skills thanks to his activity so that his

[6]If credit agents were to some extent 'motivated', incentive constraints would change but our main insights would still carry on as long as information acquisition costs are high compared to the motivation benefit obtained by selecting poor borrowers.

[7]Our assumptions can be interpreted as follows: Ability is needed to select a profitable project and manage it; Wealth is correlated with assets (such as education, social capital, etc.) that improve the returns from a suitably selected and managed activity. We could have assumed that rich borrowers gain more, even when they are not able. This would have had little impact on our results: As long as rich unable borrowers reimburse less than able rich borrowers, it remains optimal to lend in priority to able borrowers, for cross-subsidization.

future prospects are improved[8]. The non-monetary and/or future value V obtained by the successful borrower models such effects. The immediate monetary return is specified below. The proportion of able borrowers is denoted by μ^A.

Wealth: Borrowers can also be distinguished according to their wealth level. Borrowers can be either 'rich' (r) or 'poor' (p). 'Rich' borrowers have a positive initial wealth level that is not pledgable (e.g., illiquid or non monetary assets, such as buildings or land[9] with no title or common property rights, or social capital). 'Poor' borrowers have no wealth. The proportion of poor borrowers is denoted by μ^p. Moreover, the pool of poor borrowers of each ability level is assumed to be large compared to the amount of loanable funds (the current coverage of MFIs is indeed quite limited).

The proportion of able individuals, μ^A, is taken to be the same among rich and poor.[10] But rich able borrowers have higher expected revenues: the expected gain from the borrower's project, net of the subsistence amount that he must be left with, is normalized to one for a rich able borrower; it is lower, and worth only α on average, with $\alpha \in]0,1[$, for a poor able borrower.

Table 1 summarizes the characteristics of potential borrowers. It is assumed that most of

Table 1: Potential borrower types

Ability	Wealth	Proportion	Expected gain
Able	Rich	$\mu^A(1-\mu^p)$	1
	Poor	$\mu^A\mu^p$	α
Unable	Rich	$(1-\mu^A)(1-\mu^p)$	0
	Poor	$(1-\mu^A)\mu^p$	0

the benefits of a success are long-run: $V \geq \alpha$.

Last, there is no possibility of self-selection: Borrowers' wealth is not verifiable, so that a contract can only bear on repayment. Hence, any contract that is attractive to an able borrower is also attractive to an unable one, as the latter never repays. The non-monetary costs that the MFI can impose on borrowers (like attending regular meetings, filing forms, etc.) are assumed not to be sufficient to deter less-poor individuals from asking for a loan[11].

[8] See e.g., Kaboski and Townsend (2005) for empirical estimates of the benefits of microfinance at the village level in Thailand – these benefits include improved job mobility and income smoothing in case of bad shocks.

[9] See van Tassel (2004) on the potential benefits of allowing the use of land as collateral in formal banking.

[10] Extending the framework to the case where rich borrowers are also more likely to be able (different proportions $\mu_r^A \neq \mu_p^A$) can be done, but does not add to the main result.

[11] If non-monetary costs were high enough, it would be possible to use a screening mechanism, as in, e.g., Besley

The micro-finance institutions We compare two types of micro-finance institutions, for-profit and 'pro-poor'. Both are subject to a viability constraint, that states that they must earn a minimal return of $\underline{\Pi}$ per loan[12]. The larger the profitability target, the less freedom the credit institution will have in choosing borrowers. We do not consider these other activities here as they are otherwise not related to our concern. We take the total amount of loanable funds as given, and focus on the proportion of poor, able, borrowers who receive a loan.

To consider the most interesting case, we will assume that the expected repayment for poor able borrowers is below the minimum level needed by an MFI: $\alpha < \underline{\Pi} < 1$. Under this assumption, an MFI that lends to poor borrowers will need to cross-subsidize them by richer borrowers; it will never be able to lend only to poor borrowers.

For-profit MFIs design incentive schemes for their agents so as to maximize the expected value of repayment minus the costs of investing and rewarding the agent. We assume that the objective function of a pro-poor MFI is to maximize the welfare of the poorer individuals. Appendix 1 shows that provided $V \geq \alpha$ (as assumed), the program reduces to maximizing the share of poor borrowers with high ability in the pool of potential borrowers, subject to the viability constraint, while setting repayment at its maximal level.

This qualifying condition on V can be interpreted as follows: lending to able individuals provides permanent or long-term gains V larger than the one-time improvements in the welfare of the poor α that would come from giving away the loan.

Both types of MFIs find it optimal to ask for maximum repayment. In what follows, we will therefore make no distinction between the expected gain from the project and the expected repayment. The average repayment rate will be denoted ρ.

The credit agent Since self-selection is not possible, the MFI uses a credit agent to obtain information on borrowers' wealth and ability. This information is 'soft', i.e., not verifiable by the MFI. We denote by y_i^k the proportion of borrowers of wealth k, $k = r, p$, and ability i, $i = A, U$, required by the MFI, and by x_i^k the proportions actually selected by the agent.

The agent has no pro-poor preferences himself. He is risk neutral and not protected by

and Coate (1992): Rich able borrowers, who have the highest expected revenues from getting a loan, are more willing to bear high costs. But it would not possible to select given proportions of able borrowers according to their wealth level. It is for instance impossible to select poor able borrowers, and not rich able ones.

[12]Note that the net profit made by an MFI may be negative if the MFI has access to subsidized funding or resources from other for-profit activities. For instance, BRAC, in Bangladesh, uses for-profit activities to help cross-subsidize unprofitable loans.

limited liability. His utility is $w - C$ when he incurs a cost of information acquisition C and is paid w. The strong assumption of risk neutrality without limited liability means that we will derive lower bounds on the cost of incentives, as this is the case for which it is the *easiest* to induce a given behavior. Yet, we will show that the non-monetary objective of pro-poor MFIs makes it difficult to give incentives, even in this most favorable setting.

The agent obtains information for sure (without loss of generality under risk neutrality) if he incurs costs C^a for information on ability, C^w for information on wealth, and $C^{a,w}$ for information on both ability and wealth, with $\min\{C^a, C^w\} < C^{a,w} \leq C^a + C^w$ to reflect possible economies of scope. Because this information is non-verifiable, the agent can pretend that he is informed even though he is not; and he can also pretend that the information is favorable to selecting the borrower even though it is not.

In addition, the agent can steal part of the repayment: he can choose to report a repayment $\tilde{\rho}$ lower than the actual repayment ρ, and cash the difference. The value of this difference should be discounted to account for the need of hiding the amount stolen and for reputation and other costs if borrowers complain. Theft therefore earns a gain of $\lambda(\rho - \tilde{\rho})$, where $\lambda \in]0, 1]$ (as is routinely assumed in the literature on corruption).

The MFI can base the wage on the level of repayment brought by the agent. It can also use an audit procedure in order to obtain a signal on the wealth of the borrowers that have been selected by the agent: If it wishes so, the MFI can obtain at some cost C^s a contractible signal σ on the proportion of poor individuals, $x_A^p + x_U^p$, actually selected by the agent.

3.2 The full information benchmark

It is useful to compute the benchmark case of an MFI with perfect information on the ability and wealth of all potential clients. The expected profit of an MFI that pays an agent a wage w to select proportions y_A^p and $y_A^r = 1 - y_A^p$ of able borrowers is $[1 - y_A^p(1 - \alpha)] - w$.

Under full information, since rich borrowers have a higher expected gain, a profit maximizing MFI will only lend to rich able borrowers: $y_A^r = 1$.

If the expected repayment for poor able borrowers was above the minimum level needed by an MFI ($\alpha \geq \underline{\Pi}$), a pro-poor MFI would select only poor able borrowers, and make a positive profit on the operation. But with $\alpha < \underline{\Pi} < 1$, a pro-poor MFI will lend to rich able borrowers in order to obtain profits in excess of its profitability target and use these profits to finance poor

able borrowers. With this cross-subsidization, the viability constraint is binding[13] and the MFI lends to a proportion $y_A^p = \frac{1-\Pi}{1-\alpha} < 1$ of poor able borrowers.

4 The limitations of repayment incentives

From now on, we assume that the MFI must give incentives to the credit agent to search for information on borrowers' characteristics. For a profit-maximizing MFI, giving adequate incentives to its agents is easy: A wage related to borrowers' repayment enables to implement the first best as repayment is perfectly correlated with the profit objective. The problem is more difficult for a pro-poor MFI. To better understand the need for a pro-poor MFI to audit borrowers' wealth, let us assume for the moment that such an audit is not available.

4.1 Incentives in the absence of audit

When no audit is undertaken, the only verifiable variable available to the MFI is repayment. As the agent can report a lower repayment than the actual one, incentive constraints incorporate the need for the agent to gain more by reporting truthfully than by under-reporting and stealing from the repayment.

Assume that the MFI wishes the agent to become informed on both wealth and ability, and to select a proportion y_A^p of poor able borrowers, and $1 - y_A^p$ of rich able borrowers (the logic of the argument would be similar if the MFI wanted the agent to learn only wealth, and select a proportion y^p of poor borrowers). The expected wage paid to the agent is $w(\tilde{\rho})$. It cannot be increasing for all values, as the agent would have incentives to either learn wealth and ability and select only rich able borrowers, or to learn only ability and select able borrowers independently of their wealth. Nor can the wage be decreasing as the agent would have incentives to select borrowers randomly, or to learn about ability and select unable borrowers. The optimal wage must thus be non-monotonic or non continuous.

The MFI program writes as follows:

[13] See also Simanowitz, Nkuma, and Kasim (2000) on cross-subsidization by MFIs under budget constraints. Amin, Rai, and Topa (2003) test empirically whether micro-credit organizations lend more to more vulnerable groups. They conclude that these organizations could improve their targeting. Yet imperfect targeting might be necessary for the financial viability of the MFI, as in this paper.

$$\max_{\{y_A^p, w(.)\}} y_A^p$$

subject to

$$\begin{aligned}
w(1-(1-\alpha)y_A^p) - C^{a,w} \geq \quad & 0 \quad (PC) \\
w(1-(1-\alpha)y_A^p) - C^{a,w} \geq \quad & \max_{\tilde{\rho}, x_A^p, x_A^r} w(\tilde{\rho}) + \lambda[(x_A^p\alpha + x_A^r) - \tilde{\rho}] \\
& s.t.\ \tilde{\rho} \leq (x_A^p\alpha + x_A^r) \quad (IC)^{\emptyset} \\
w(1-(1-\alpha)y_A^p) - C^{a,w} \geq \quad & \max_{\tilde{\rho}, x_A} w(\tilde{\rho}) + \lambda[(1-(1-\alpha)\mu^p x_A) - \tilde{\rho}] - C^a \\
& s.t.\ \tilde{\rho} \leq (1-(1-\alpha)\mu^p x_A) \qquad (IC)^w \\
w(1-(1-\alpha)y_A^p) - C^{a,w} \geq \quad & \max_{\tilde{\rho}, x^p} w(\tilde{\rho}) + \lambda[(1-(1-\alpha)\mu^A x^p) - \tilde{\rho}] - C^w \\
& s.t.\ \tilde{\rho} \leq (1-(1-\alpha)\mu^A x^p) \quad (IC)^a \\
w(1-(1-\alpha)y_A^p) - C^{a,w} \geq \quad & \max_{\tilde{\rho}} w(\tilde{\rho}) + \lambda[\mu^A(1-(1-\alpha)\mu^p) - \tilde{\rho}] \\
& s.t.\ \tilde{\rho} \leq (\mu^A(1-(1-\alpha)\mu^p)) \quad (IC)^{a,w}.
\end{aligned}$$

(PC) denotes the participation constraint. $(IC)^a$ ensures that the agent prefers to learn about ability rather than just wealth, $(IC)^w$ that he learns about wealth rather than just ability, and $(IC)^{a,w}$ that he learns about both rather than nothing. $(IC)^{\emptyset}$ is the incentive constraint ensuring that the agent selects adequate proportions when he is fully informed.

In these equations, the left-hand side expression is the wage received by the agent who learns about wealth and ability and selects y_A^p as requested by the MFI. The right-hand side expressions are the wage received from the optimal selection of borrowers and reporting $\tilde{\rho}$ under alternative information choices. If the slope of $w(.)$ is lower than λ, the agent has incentives to steal repayment. This is not an issue for a for-profit MFI, which cares only about repayment: it can always offer a sufficiently steep incentive wage, while adjusting the fixed part of the wage to compensate for a higher variable part.

To the contrary, we show now that two incentive constraints faced by a pro-poor MFI cannot be satisfied. The best the MFI can do is to offer a wage such that $w(\tilde{\rho})$ is maximum for the average repayment with the desired proportions, at $y_A^p\alpha + (1-y_A^p) = [1-(1-\alpha)y_A^p]$. Denote $\overline{w} \equiv w(1-(1-\alpha)y_A^p)$. Then $w(\tilde{\rho}) \leq \overline{w}$ for all $\tilde{\rho}$. This means that if the agent is informed about wealth and ability, he has incentives to select only rich able borrowers, and steal repayment so that $\tilde{\rho} = [1-(1-\alpha)y_A^p]$, while actual repayment is 1.

This behavior[14] provides him with maximal payment plus the value stolen, $\lambda(1-\alpha)y_A^p$. Thus the MFI cannot satisfy the incentive constraint $(IC)^{\emptyset}$ that ensures that the agent, when informed, selects adequate proportions whenever $\lambda > 0$.

A similar reasoning applies to the incentive constraint ensuring that the agent learns about wealth.

Proposition 1 *Contrary to a for-profit MFI, a pro-poor MFI cannot obtain an adequate selection of poor able borrowers, and no theft, with incentives based solely on repayment.*

To summarize, due to the risk of theft[15], a pro-poor MFI needs to use additional tools, such as costly audits, in order to induce adequate selection of poor borrowers, and information acquisition on wealth. The need to obtain a verifiable variable related to wealth implies an intrinsically higher agency cost than in for-profit MFIs.

4.2 Using signals on wealth

In the remainder of the paper, we thus consider audits on borrowers' wealth, as instruments to be added to repayment incentives: the MFI can observe at cost C^s a contractible signal σ on the proportion of poor individuals actually selected by the agent.[16] We will assume that the cost of the audit is not so large that it forces the MFI to lend to fewer poor able borrowers than when it uses only repayment incentives and suffer from theft by the agent.

The signal may for instance arise from a survey on a random sample of the clients selected by the agent, with the objective of assessing the poverty status of these clients. The observed proportion of poor borrowers in the sample would then be an unbiased estimation of the true proportion x^p of poor able borrowers: $\sigma = x^p + \epsilon$, with $\mathbf{E}(\epsilon) = 0$. Under risk neutrality, the

[14] It might be that stealing more provides the agent with even more gain than the one considered here here. This would only reinforce our result.

[15] From a positive perspective, there are other reasons why non-monotonic schemes may not be implementable. This is true in particular if agents needs to exert effort to monitor borrowers; then the incentive scheme cannot reconcile the need for a bonus in case of high repayment to induce monitoring effort, and a bonus in case of low repayment to induce selection of poor borrowers. This problem could be resolved by separating tasks and having different agents select borrowers, monitor them, and collect payments. Yet these tasks are likely to be complementary and involve economies of scope. And theft remains possible with task separation so that our impossibility result remains.

[16] The signal is an ex-post one. See Crémer and McLean, 1988, and Riordan and Sappington, 1988, for more on correlation and the costs of asymmetric information. Rai (2002) proposes a scheme in which auditing is costless. This, however, requires that borrowers can be sufficiently punished in case of theft or misreporting. In our setting, borrowers have no resources that can be seized.

agent only takes into account expected values, and precision ($var(\epsilon)$, related to the size of the sample) does not matter[17]. Here, choosing the lowest sample size, at the minimal cost C^s, is optimal.

With an audit on wealth, the MFI is able to offer strictly increasing repayment incentives, while still inducing borrower selection on wealth. Strictly increasing repayment incentives will prevent theft provided that the derivative of the wage with respect to repayment is higher than λ, $\lambda \leq 1$. This constraint applies to all subsequent programs of the MFI; we will omit it in these programs to simplify the exposition.

5 The optimal incentive scheme for a pro-poor MFI

This section characterizes the best outcome a pro-poor MFI can obtain under asymmetric information on both wealth and ability. The MFI can use two instruments in order to induce two related tasks: Wages increasing with repayment allow to induce information acquisition on ability; and wages conditional on a signal on poverty status can induce an adequate selection on wealth. The institution must choose whether it will use both instruments, one only, or none. This choice is determined by comparing the number of poor able borrowers obtaining a loan in equilibrium in each case.

5.1 The best incentive compatible outcome for each degree of information

For each degree of information acquisition, the MFI must bear real information costs: the costs incurred by the agent, that are reimbursed through his wage (e.g., C^a for information on ability only, etc.), and the audit cost C^s when the MFI requires information on wealth. The best possible outcome for the MFI is to have all incentive and participation constraints satisfied at no additional costs than these real costs. We show that it can be attained with simple wages, that are linear in repayment and in the signal on wealth[18]. To prove that such wages exist, it

[17] If the agent was risk averse, he would require a risk premium linked to the precision of the signal. Choosing a more precise (and more costly) signal might be optimal to reduce the risk borne by the agent. The so-called Sufficient Statistics (Holmström, 1979) would apply. Risk aversion would impose additional incentive costs, as is usual in moral hazard settings. Note also that one could allow for a possible bias ($\mathbf{E}|\epsilon| \neq 0$), provided that the MFI corrects for it (in the following, one would have to substract the expected value of the bias to the signal, when comparing it to the target proportion of poor).

[18] As is usual when the agent is risk neutral and has unlimited liability, there are many possible wage schemes that also implement this outcome. Simple wages are here without loss of generality. If the agent was risk averse, linear schemes would generally not be sufficient. And the MFI would have to provide the agent with a risk

is enough to exhibit one of them, which is what we do below. Appendix 2 details the general program of a pro-poor MFI that induces information acquisition on both wealth and ability.

To simplify future expressions, let us denote by $\rho^A = (\mu^r + \alpha\mu^p) = (1-\mu^p(1-\alpha))$ the average repayment rate among able individuals, i.e., with poor and non-poor in proportions equal to what they are in the population.

A few features of the different options are worth noting. First, with linear wages, the fixed part W is always adjusted to have the participation constraint binding: the agent gets no information rent. Incentive costs are thus exactly equal to information acquisition costs for the MFI. Second, when the MFI has information on wealth, it will choose the highest proportion of poor borrowers compatible with the viability constraint. As poor borrowers reimburse less on average, this highest proportion is obtained when the viability constraint is exactly binding.

Option $[\emptyset]$ - No incentive When the MFI gives no incentives, the agent's wage is set at its reservation level, zero. The agent selects borrowers randomly. The proportion of poor able borrowers is then what it happens to be in the population, $\mu^A\mu^p$. This option can only be viable if the expected return for the MFI, $[1-\mu^p(1-\alpha)]\mu^A = \mu^A\rho^A$, is larger than $\underline{\Pi}$. This condition will only hold when poor able individuals are sufficiently profitable (α high) or when the proportion of rich able individuals is high in the population ($\mu^A(1-\mu^p)$ high) – which is unlikely in areas in which microfinance institutions operate. This option is thus likely to be chosen only for specific geographic areas.

Option $[a]$ - Incentives to learn about ability In order to induce information acquisition on ability, the MFI must use a wage increasing with repayment, for instance a linear wage, $w = \omega\rho + W$. The variable part ω must be large enough to induce information acquisition on ability, but not too large as the agent would otherwise also learn about wealth, in order to select only rich able borrowers.[19] The fixed fee W adjusts to have the agent's participation constraint binding: $W = C^a - [1-\mu^p(1-\alpha)]\omega$. The expected return of the MFI is then

premium to compensate for the risk associated to repayment incentives and audit uncertainty – hence additional costs. As this is standard in moral hazard contexts, we do not detail it further here.

[19] Two incentive compatibility constraints model these requirements: $\omega[1-\mu^p(1-\alpha)] - C^a = \omega\rho^A - C^A \geq \omega\mu^A\rho^A$, which translates into $\omega \geq \underline{\omega} \equiv \frac{C^a}{(1-\mu^A)\rho^A}$; And $\rho^A\omega - C^a \geq \omega - C^{a,w}$, i.e., $\omega \leq \overline{\omega} \equiv \frac{C^{a,w}-C^a}{\mu^p(1-\alpha)}$. Depending on the value of the parameters, the two inequalities may not be compatible (if $\underline{\omega} > \overline{\omega}$). Non linear wage schemes would then be required to satisfy both incentive constraints. To allow for easy comparison with other options, we assume that parameters are such that some value ω exists that satisfies both inequalities, while also being larger than λ to deter theft.

$[1-\mu^p(1-\alpha)]-C^a=\rho^A-C^A$. Assuming it to be higher than the minimum level $\underline{\Pi}$, the MFI lends only to able borrowers, and y_A^p is the proportion of poor individuals among able ones: $y_A^p=\mu^p$.

Option $[w]$ - Incentives to learn about wealth In order to induce information acquisition on wealth only, the MFI should use an audit procedure as discussed, and condition the agent's wage on the signal obtained, σ.

Given incentive constraints, a wage scheme implementing the optimal outcome consists of three terms: a fixed term W; a repayment bonus $\omega\rho$ (with $\omega\geq\lambda$) to avoid theft; and a penalty proportional to the difference between the signal and the required proportion of poor borrowers, y^p. The expected wage is thus $w(\sigma,\rho)=W+\omega\rho-s\mathbf{E}|y^p-(\sigma+\epsilon)|$. Expected repayment will be $\mu^A(1-y^p(1-\alpha))$.

The MFI wants to lend to a sufficient proportion of richer borrowers to satisfy its viability constraint; It therefore does not offer a bonus strictly increasing in the proportion of poor borrowers selected, but one increasing up to the preferred proportion, and decreasing above it. This explains the shape of the wage we consider: the agent is penalized when selecting less or more poor borrowers than y^p.

As the agent is risk neutral and not protected by limited liability, a large enough penalty always ensures adequate effort to obtain information on wealth status, and adequate selection – somewhat in line with the maximum fine result by Becker (1968). Repayment incentives must be large enough to avoid theft, but not so large that the agent has incentives to learn about ability and select high-repayment borrowers. Appendix 2 details possible solutions[20].

The MFI obtains an expected return of $[1-y^p(1-\alpha)]\mu^A-C^w-C^s$. To maximize the proportion of poor able borrowers who get a loan, the MFI will have the viability constraint binding. Equating expected return to $\underline{\Pi}$, one obtains[21]: $y_A^p=\mu^A y^p=\frac{\mu^A-(\underline{\Pi}+C^w+C^s)}{(1-\alpha)}$.

Option $[a,w]$ - Incentives to learn about both wealth and ability Assume now that the MFI wants to induce information acquisition on both characteristics, and a selection of y_A^p able poor borrowers. It should offer a wage scheme depending on both the signal obtained

[20] Assume $\lambda\leq\frac{C^{a,w}-C^w}{(1-\mu^A)(1-y^p(1-\alpha))}$; one of the many solutions is $\omega=\lambda$, $W=C^w-s\mathbf{E}|\epsilon|-\lambda\mu^A(1-y^p(1-\alpha))$ and $s\geq\max\{\frac{C^w-C^a+\lambda[1-\mu^A+(1-\alpha)(y^p\mu^A-\mu^p)]}{\mathbf{E}|y^p-(\mu^p+\epsilon)|-\mathbf{E}|\epsilon|},\frac{C^w+\lambda\mu^A(1-\alpha)(y^p-\mu^p)}{\mathbf{E}|y^p-(\mu^p+\epsilon)|-\mathbf{E}|\epsilon|}\}$.

[21] If this expression is negative (for α or μ^A very small), this option is not available.

by auditing borrowers and the repayment rate, $w(\sigma, \rho)$ – where the expected repayment rate is $\rho = \alpha x_A^p + x_A^r$, and the signal observed is a function of the proportion of poor individuals selected, $x_A^p + x_U^p$.

The agent will always choose the proportions of borrowers in order to maximize his utility, given the information available to him. This is reflected in the incentive constraints. When the agent acts as requested by the MFI, the expected repayment rate is $\alpha y_A^p + (1 - y_A^p) = 1 - (1 - \alpha) y_A^p$. If the agent is informed (and provided $\frac{\partial w}{\partial \rho} \geq \lambda$ to avoid theft), he has no incentives not to select borrowers as requested – contrary to the case of collusion we consider in the next section. The program of a pro-poor MFI thus writes as:

$$\max_{\{y_A^p, w(.)\}} y_A^p$$

$$\begin{aligned}
w(\sigma(y_A^p), 1 - (1-\alpha)y_A^p) - C^{a,w} \geq \quad & 0 \quad (PC) \\
w(\sigma(y_A^p), 1 - (1-\alpha)y_A^p) - C^{a,w} \geq \quad & \max_{x_A} \{w(\sigma(\mu^p x_A), 1 - (1-\alpha)\mu^p x^A)\} - C^a \quad (IC)^w \\
w(\sigma(y_A^p), 1 - (1-\alpha)y_A^p) - C^{a,w} \geq \quad & \max_{x^p} \{w(\sigma(x^p), 1 - (1-\alpha)\mu^A x^p)\} - C^w \quad (IC)^a \\
w(\sigma(y_A^p), 1 - (1-\alpha)y_A^p) - C^{a,w} \geq \quad & w(\sigma(\mu^p)), \mu^A(1 - (1-\alpha)\mu^p) \quad (IC)^{a,w} \\
w(\sigma(y_A^p), 1 - (1-\alpha)y_A^p) - C^{a,w} \geq \quad & \max_{x_A^p, x_A^r} \{w(\sigma(x_A^p), \alpha x_A^p + x_A^r)\} - C^{a,w} \quad (IC)^{\emptyset}
\end{aligned}$$

As shown in Appendix 2, a simple wage scheme linear in repayment and in the difference between the signal and the recommended proportion of poor borrowers, $w = \omega(\rho) - s|y_A^p - \sigma| + W$, will be sufficient to achieve the best outcome. As for the other options, the participation constraint binds and $W = C^{a,w} - \omega[1 - y_A^p(1-\alpha)] - s\mathbf{E}|\epsilon|$. With such a wage scheme, a high enough penalty s ($s \geq \omega(1-\alpha)\mu^A$) ensures that if the agent deviates and does not search for information on ability, he selects the number of poor required by the MFI. For $s \geq \omega(1-\alpha)\mu^A$, one can rewrite the incentive compatibility constraints as follows:

$$\begin{aligned}
\omega(\mu^p - y_A^p)(1-\alpha) + s[\mathbf{E}|y_A^p - (\mu^p + \epsilon)| - \mathbf{E}|\epsilon|] \geq \quad & C^{a,w} - C^a \qquad (IC)^w \\
\omega(1-\mu^A)[1 - y_A^p(1-\alpha)] \geq \quad & C^{a,w} - C^w \qquad (IC)^a \\
\omega[1 - \mu^A - (1-\alpha)(y_A^p + \mu^A(1-\mu^p))] + s[\mathbf{E}|y_A^p - (\mu^p + \epsilon)| - \mathbf{E}|\epsilon|] \geq \quad & C^{a,w} \qquad (IC)^{a,w}.
\end{aligned}$$

It is immediate that one can always increase the share of repayment ω to satisfy all constraints.

The agent earns no rent. Hence, whatever the value of the parameters, the MFI can always design a wage such that total internal costs be no more than $C^{a,w} + C^s$.

The expected return of the MFI is thus $[1 - y_A^p(1-\alpha)] - C^{a,w} - C^s$. From the viability constraint, the number of poor borrowers receiving a loan is $y_A^p = \frac{1-(\underline{\Pi}+C^{a,w}+C^s)}{(1-\alpha)}$.

5.2 How much information acquisition is it optimal to induce?

Table 2 summarizes the four options that can be available to the MFI, as described in the previous section. In options $\emptyset$ and a, the proportions of poor lent to will be the ones in the population (restricted to able borrowers for option a). The optimal choice is the scheme leading

Table 2: Outreach to able poor and profits for each option

Option: Information acquisition	Outreach: Proportion y_A^p	Net profit
No incentive $[\emptyset]$	$\mu^p \mu^A$	$\mu^A \rho^A - \underline{\Pi}$
Ability $[a]$	μ^p	$\rho^A - \underline{\Pi} - C^a$
Wealth $[w]$	$\frac{\mu^A-(\underline{\Pi}+C^w+C^s)}{(1-\alpha)}$	0
Wealth and ability $[a,w]$	$\frac{1-(\underline{\Pi}+C^{a,w}+C^s)}{(1-\alpha)}$	0

to the maximum number of loans to poor able borrowers, given the value of the parameters. Comparing the numbers of poor in Table 2 leads to conditions delimiting the choice of incentive schemes, that can all be simply written in terms of the share of able borrowers μ^A in the population, the repayment rate ρ^A, and the different costs of acquisition of information. These conditions are established in Appendix 3, by comparing the different incentive schemes two by two. Figure 1 summarizes the results when the cost of acquisition of information on poverty status $C^w + C^s$ is lower than the cost of acquisition of information on ability C^a.

On the horizontal axis, is the average repayment rate ρ^A that would be obtained if there was selection on ability only (with poor and non-poor in the proportion encountered in the population). For a very low ρ^A, the MFI could not cover any cost of acquisition of information and satisfy the minimum profitability $\underline{\Pi}$. As ρ^A rises, the MFI could cover the cost of acquisition of information on wealth $C^w + C^s$, or the cost of acquisition on ability C^a, or the cost of both $C^{a,w} + C^s$, if it so desires. On the vertical axis we report the share of able borrowers in the population, $\mu^A \in]0,1[$. The two lower down-sloping curves are isoquants along which the repayment rate in absence of selection on ability, $\mu^a C^a$, would exactly equal respectively the

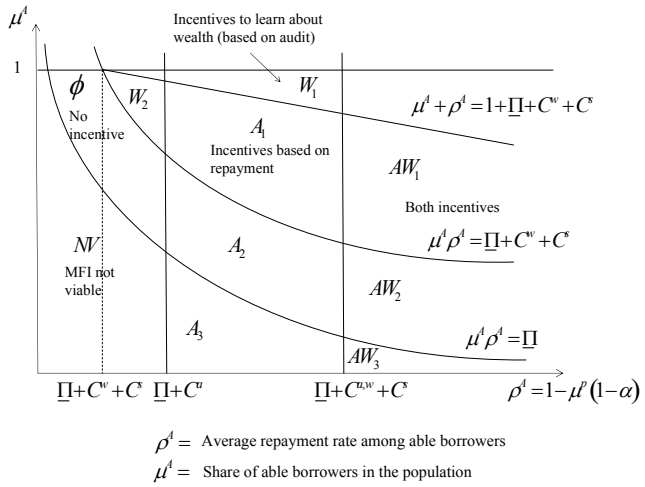

Figure 1: Map of optimal incentive scheme when $C^w + C^s < C^a$

minimum profitability, $\underline{\Pi}$, and this minimum plus the cost of selection on wealth, $\underline{\Pi} + C^w + C^s$.

Area NV is one in which the MFI is non-viable. The MFI optimally chooses to do no selection in area $\emptyset$; to induce selection on ability in areas marked A; to induce selection on wealth in areas W_1 and W_2; and to induce selection of clients on both wealth and ability in areas AW. A similar figure can be drawn for the reverse case when the cost of acquisition of information on poverty status $C^w + C^s$ is higher than the cost of acquisition of information on ability C^a.

We summarize our results in the following proposition:

Proposition 2 *No combination of incentives and audit can be ruled out for a pro-poor MFI. Incentives based on repayment are chosen unless there is little gain to be had from selecting out worse performers. Adding an audit appears particularly useful when the proportion of poor borrowers is not too large (μ^p sufficiently small), while the MFI prefer to forego selection according to wealth if audit costs are high and/or the very poor are prevalent in the population,as in particular geographic areas.*

A related result of Proposition 2 implies that incentive schemes may not allow to distinguish between for-profit and pro-poor MFIs. The internal functioning of the MFI will not always provide reliable information as a pro-poor MFI can find it optimal to have either no incentives at all, repayment incentives (as a for-profit institution), random audit, or both repayment incentives and random audit. Moreover, the use of an audit procedure is often informal in practice, and not written in labor contracts.

Corollary 1 *In some contexts, for-profit and pro-poor MFIs use the same type of incentive schemes – based on repayment only; They may not be distinguishable according to their internal incentives.*

5.3 Evidence on the use of poverty audits

There is evidence that social performance indicators are starting to be used by pro-poor MFIs in rewarding their credit agents, in addition to widespread use of incentives based on indicators of repayment performance (see Grammling and Holtman, 2006, 2008, and the discussion on microLinks, 2008). There is agreement that staff incentive systems (SIS) focused only on financial goals – with indicators such as loan portfolio quality, portfolio size, and client loyalty – can undermine meeting social objectives as they push agents to work with larger and less risky borrowers (as analyzed in Section 4 of this paper).

MFIs concerned with social performance have focused first on instruments other than SIS: They have targeted geographical areas with high poverty rates, and they have used product design, such as small loan size and frequent repayments, that induce self-selection by the poor. Examples are Equity Bank in Kenya and BancoSol in Bolivia (Grammling and Holtman, 2008). As this has proved insufficient in avoiding mission drift on a broader scale, staff incentive schemes are the object of increasing attention. Interesting initiatives are emerging that show signs of evolving toward a credit agent-level audit system as proposed in this paper. AMK in Cambodia uses twice-yearly staff performance assessments based on both financial and social performance indicators. Outcomes of these assessments affect rewards given to agents. PRIZMA in Bosnia and Herzegovina is the only MFI with a reported poverty goal explicitly built in its SIS. At the branch level, client "poverty scorecards" (i.e., client wealth audits) are used to assess the percentage of poor among new customers, determining branch-level awards. Monthly bonuses are also determined at the individual agent level that are strictly based on financial productivity

but that avoid introducing social biases toward larger clients. Indicators include number of disbursed loans and number of clients, but do not reward portfolio size. In our judgment, branch-level audits of social objectives combined with individual incentives to meet financial objectives may lead to free riding of agents on branch performance. Introducing individual agent audits of the same type as done at the branch level would seem to be a better option, as recommended in this paper.

Progress has been made in specifying indicators that can be used to rate MFIs – or their branches – on their social performance. Cerise (2008) is an alliance of four research institutes and NGOs that has proposed a set of indicators to rate the social performance of a microfinance institution. This methodology is used by MFIs in Morocco, Mexico, Cambodia, Albania, Philippines, Ethiopia, Guinea, Mali, Bolivia, and Madagascar (Cruz, 2007). It is also used by NGOs such as Trias in Belgium and the PROSPERA (Promotion of Social Performance) MFI network. Indicators developed to measure an MFI's or a branch's degree of inclusion of poor clients can readily be used to rate the performance of individual credit agents in the random audits suggested here. Now that such ratings systems have been developed, one may expect them to be increasingly used, including at the credit agents level.

6 Non-monetary favors at the selection stage

Local credit agents are often selected because of their links with potential borrowers: These links allow them to obtain information at lower costs. Yet these same links may also make local agents easier to bribe. Bribery will often take the form of social or other non-monetary favors, such as small gifts. Yet, as we analyze below, this may create interesting opportunities for an MFI.

6.1 The scope for non-monetary transfers

Loan agreements are such that borrowers reimburse on average what they earn from the project. But able borrowers will obtain a benefit in the future (V) from their initial success. They should consequently be willing to 'bribe' the agent in order to get a loan. In the absence of commitment, only rich borrowers can bribe the agent, since only them can use their illiquid assets – e.g., social connections, or small services and in-kind transfers – to offer an immediate bribe. We also assume

that influential individuals cannot coerce an agent into granting them a loan.[22]

For a for-profit MFI, since only rich able individuals are willing and able to pay a substantial bribe, bribery allows to sort them out without having to search for information. Bribery is thus beneficial as it suppresses information costs without creating internal conflicts.

To the contrary, incentives for the agent to select richer borrowers sharpen potential conflicts within a pro-poor MFI.

We denote $\overline{B}$ the average bribe the agent expects to receive per rich borrower he selects. This expected value is likely to depend on the social and cultural context. We suggest here a way to endogeneize it, but it should be clear that other elements than the ones we can model, may come into play.

Assume that offering a bribe B costs $b(B) > 0$, where $b(.)$ is some convex function, and is strictly positive. Then a richer individual will not offer bribes above $b^{-1}(V)$. As in an auction, competition between rich able individuals[23] enables the agent to obtain the highest possible bribe. The only Nash equilibrium of this theoretical game is that all able rich individuals offer a bribe $\overline{B} = b^{-1}(V)$, and the agent selects randomly a proportion of them.

In practice, the selection of borrowers is a sequential process; thus competition between rich able individuals may not be as strong as assumed just above. We therefore consider a conservative case: We assume that the expected bribe $\overline{B}$ may be any value above zero and below $b^{-1}(V)$; and that favors do not dispense the agent from exerting efforts to learn about wealth and ability.[24] As we will see, even in this worst-scenario case, the possibility that rich borrowers bribe the agent ultimately benefits the very poor.

6.2 The optimal response of a pro-poor MFI

Allowing non monetary transfers enables to reduce the wage paid to the agent since he anticipates receiving favors thanks to his position as a credit officer. In this particular setting, contrary to most three-tier hierarchy problems, the Collusion-Proofness Principle (Tirole, 1986) does not

[22] See Fuentes (1996) for an analysis of lending by agents who can be submitted to social pressures.

[23] The MFI controls the number of loans granted so that the agent will not in general be able to select all the rich borrowers who are willing to bribe him.

[24] If the bribery game was simultaneous, the agent would only have to search for information on ability – and this would allow to spot poor able individuals, as being the able individuals who have not offered a bribe. The cost of information acquisition would fall to C^a, and the benefits of tolerating collusion would be further increased. Yet, this would not hold in a sequential game. If the agent was not to learn wealth, after a certain number of rich individuals had been selected, others would prefer trying to make themselves pass as poor instead of offering a bribe.

apply. This is because the agent has better 'contracting abilities' than the MFI: he can derive utility from favors which would have had no value to the MFI.[25] The MFI takes these favors into account when designing an incentive scheme.

Let us first consider the behavior of the agent. He chooses by how many rich able individuals to be bribed, $x_A^r = y_A^r + z$. For the remaining borrowers, the agent can decide what information he wants to acquire. For instance, if he chooses to select the remaining borrowers $(1 - y_A^r - z)$ according to wealth only, then the proportion of poor able borrowers in his portfolio will be equal to $\mu^a(1 - y_A^r - z)$. A similar reasoning applies to the other cases[26].

Let us denote $\mathcal{U}$ the utility the agent gets when respecting the prescriptions of the contract (including favors for the recommended proportion of richer borrowers): $\mathcal{U} \equiv w(\sigma(y_A^p), 1 - (1 - \alpha)y_A^p) + (1 - y_A^p)\overline{B} - C^{a,w}$. The MFI maximizes the share of poor able borrowers selected, y_A^p, under the following constraints:

$$
\begin{aligned}
\mathcal{U} &\geq 0 \quad (PC) \\
\mathcal{U} &\geq \max_z \{w\Big(\sigma(y_A^p - z), 1 - (y_A^p - z)(1 - \alpha)\Big) + (1 - y_A^p + z)\overline{B}\} - C^{a,w} \quad (IC)^z \\
\mathcal{U} &\geq \max_{x_A, z} \{w\Big(\sigma(\mu^p(1 - z)), 1 + z - x_A(1 - \alpha\mu^p)\Big) + (1 - y_A^p + z)\overline{B}\} - C^a \quad (IC)^w \\
\mathcal{U} &\geq \max_{x^p, z} \{w\Big(\sigma(x^p - z), 1 + z - x^p(1 - \alpha\mu^A)\Big) + (1 - y_A^p + z)\overline{B}\} - C^w \quad (IC)^a \\
\mathcal{U} &\geq \max_z \{w\Big(\sigma(\mu^p(1 - z)), 1 - (y_A^p - z)(1 - \mu^A\mu^p(1 - \alpha))\Big) + (1 - y_A^p + z)\overline{B}\} \quad (IC)^{a,w}.
\end{aligned}
$$

Constraint $(IC)^z$ refers to the adequate selection of borrowers when the agent is informed.

The difference in wages must offset the benefits from deviating from the MFI's recommendations. A wage scheme linear in profits and in the difference between the signal and the required proportion of poor borrowers is sufficient to have all constraints satisfied and the participation constraint binding, as shown in Appendix 4. Hence, the following lemma:

Lemma 1 *Potential bribery does not increase internal incentive costs for pro-poor MFIs, when a signal correlated to the borrower's wealth status is available.*

[25] This is to some degree related to an argument frequently put forward to explain the prevalence of interlinkage in credit transactions in developing economies: Individuals may have some collateral, but of a type that has value only to some other individuals, not to formal lending institutions. For instance, a worker can pledge his labor as collateral to his employer, while it has no value to a bank.

[26] If the wage is increasing in repayment, the agent prefers to select only able borrowers when he is informed on ability. The proportion of poor among able borrowers is the same as among unable ones, so that selecting only able agents has no impact on the part of the wage that depends on the signal σ. Note also that the agent knows for sure that the individuals he is being bribed by are rich able borrowers (hence different repayment rates than in the absence of corruption).

Bribery directly increases the utility of the agent, but also indirectly via repayment incentives: rich able borrowers, who offer bribes, indeed repay more. The MFI must thus increase penalties after an unsatisfactory audit, to match increases in repayment incentives and avoid the selection of too many richer borrowers (cf. Appendix 4).

The participation constraint implies that the expected wage will be $w(\sigma(y_A^p), 1-(1-\alpha)y_A^p) = C^{a,w} - (1-y_A^p)\overline{B}$. Since the wage of the agent is decreased by the amount of the non-monetary bribes, this frees up resources for loans to poor borrowers. Using the fact that the viability constraint is binding, the proportion of poor borrowers that the MFI can lend to is now:

$$y_A^p(b) = \frac{1+\overline{B} - (\underline{\Pi} + C^{a,w} + C^s)}{(1-\alpha)+\overline{B}},$$

which is larger than

$$y_A^p = \frac{1 - (\underline{\Pi} + C^{a,w} + C^s)}{(1-\alpha)},$$

the proportion when non monetary favors are not possible. Tolerating that the agent receive favors from less-poor borrowers therefore enables to lend to a larger proportion of very poor, able, individuals.

To summarize, we obtain this apparently paradoxical result:

Proposition 3 *Assume that richer borrowers can offer favors and other in-kind transfers to the credit agent to get selected. Then a pro-poor MFI will pay the agent less, and will always induce the selection of a higher proportion of very poor individuals. Very poor individuals unambiguously benefit from these favors.*

Rather than trying to prevent the agent from receiving favors from richer able individuals, a pro-poor MFI can use them to its advantage, as it ultimately fosters its outreach objective. With social favors and in-kind payments, the MFI can indirectly extract more money (via the agent's wage) from less-poor borrowers, which favors cross-subsidization. Two aspects may however deserve further discussion.

First, one may argue that the MFI does not know the value of the bribe $\overline{B}$. Our results carry on if the agent does not know it either ex ante (and only learns it after having accepted the contract with the MFI). Participation is indeed determined by the expected value of the bribe, not its true, ex post, value. To the contrary, if the agent already knows the true value $\overline{B}$ before accepting the contract, while the MFI does not, there is adverse selection. The MFI

should then design an incentive contract to induce truthful revelation of this value. The agent will then obtain an information rent that will reduce the extent to which the MFI can lower his wage. Although the MFI will not be able to extract as much benefit from non-monetary favors, our results will still be qualitatively valid.

Second, the optimal contract is formally similar to tolerating some bribery while still punishing any corruption deemed excessive. This contrasts with most analyses of corruption, in which tolerating some corruption may be optimal but only in a second-best sense.[27] However, tolerating 'some' bribery may be difficult, as tolerance towards some corruption may weaken individuals' moral norms; Credit agents may then turn to more severe forms of corruption, including extortion and theft. It may thus be best to take advantage of non monetary favors in another way: The MFI can delegate some authority to the agent, who then becomes a 'branch'. Delegation of some authority makes it morally acceptable for the agent to receive payments (including in-kind payments and favors) from their clientele. Yet our results show that this delegation should be sufficiently limited for the agent to still have adequate incentives with respect to poverty screening. In particular, the clientele of this semi-independent agent or branch should be the object of random inspections (as done to some extent by PRIZMA, as discussed in 5.3.). A for-profit MFI may also delegate authority to independent agents or branches, as their incentives will be aligned with profit-maximization. Yet as it would not need to check the quality of borrowers selection, it would not need frequent inspections nor complex delegation contracts, contrary to a pro-poor MFI.

[27]For instance, Mookherjee (1997) in the context of tax collection has shown how tolerating corruption may be optimal when corruption provides intermediaries with incentives to exert monitoring effort; but corruption is strictly dominated by a bonus for the intermediary in case of good performance. It is only when such bonuses are excluded that some corruption becomes (second-best) optimal. Here, the pro-poor MFI is unambiguously better off with bribery than when it is not available. Our result is also related to that in Becker and Stigler (1974). In their paper, a government can reduce the wage of its public enforcers when the later are bribed by violators. Our result is however stronger. First, in Becker and Stigler, the objective of the government is to impose costs on violators, and bribes are in line with this objective (particularly so when enforcers have a strong bargaining power and obtain large bribes); In our context, bribes from richer borrowers would induce a behaviour from the agent that is not in line with the pro-poor objective, so that a carefully designed incentive scheme remains necessary. Secondly, the agent can benefit from 'objects' (in-kind payments and favors) that would have had no value to the MFI. So that bribery (or delegation) can be used to transform the objects borrowers have, into money for the MFI (and money is useful for cross-subsidization, due to the viability constraint).

7 Mission drift and viability of pro-poor MFIs

7.1 Cross-subsidization and competition between MFIs

There has been a rapid rise in competition among MFIs for good borrowers (McIntosh, de Janvry, and Sadoulet, 2005). Rising competition is particularly threatening to pro-poor MFIs. We have abstracted from this issue to this point by considering a single MFI. This section discusses the impact of competition on the possibility of using cross-subsidization and on incentives for agents (we do not discuss other aspects of rising competition such as multiple loan taking, see McIntosh and Wydick, 2005). Competition to recruit and keep their good borrowers implies that MFIs (either for-profit or pro-poor) must offer better terms to rich able borrowers. This substantially reduces the opportunity for cross-subsidization by pro-poor MFIs.

Consider a for-profit and a pro-poor MFI operating on the same market. If the pro-poor MFI wants to attract some of the richer borrowers, it has to offer loan contracts that are at least as profitable to borrowers as the ones offered by a for-profit MFI. But a for-profit MFI faces lower incentive costs, as it does not have to audit selected borrowers. A for-profit MFI thus benefits from a competitive advantage due to lower internal costs. The assumptions made as to the type of competition between MFIs matter: With the equivalent of Bertrand competition, a for-profit MFI lowers its per borrower profits until the pro-poor MFI is not able to follow suit. The pro-poor MFI can no longer use cross-subsidization as it is excluded from the market of rich able borrowers.

In practice, however, pro-poor MFIs often have access to subsidized funding, so that their viability constraint may be less severe than in for-profit institutions ($\underline{\Pi}$ is likely to be lower in a pro-poor institution), and they may be able to effectively compete with a for-profit MFI, and to compensate for their higher internal costs by their lower profitability target, maintaining financial viability and cross-subsidization. Our main results may thus be robust to competition, as long as pro-poor MFIs are sufficiently subsidized.[28]

Competition between pro-poor MFIs will tend to reduce their access to subsidized funds, obliging them to refinance a part of their loans at higher rates. This would be modeled in our setting by an increase in $\underline{\Pi}$.

[28] Competition therefore constitutes an additional justification for offering subsidies to pro-poor institutions —a potential problem being the fact that profit-maximizing MFIs may pretend that they have pro-poor objectives in order to benefit from such subsidies.

In addition, when several pro-poor MFIs lend to the same pool of borrowers, competition for the best clients imply a lower profitability for each institution. In our model, it then becomes more likely that audit costs are too large for the MFI to induce information acquisition on wealth.

Competition is also becoming fiercer for agents who have accumulated a high value asset in the form of private information on their clientele. Agents' turn-over seems to be important in all regions (see McIntosh and Wydick, 2005). Retaining agents with a good knowledge of the clientele requires offering them better wages, which reduces the number of loans that pro-poor MFIs can offer. In our model, this can be formalized as an increase in the minimum profit to be obtained, $\underline{\Pi}$. Indeed, we have normalized the outside option of the agent to zero. If competition leads to an increase in this outside option by some amount Δ (competition drives wages up), this translates, in our risk neutral setting, into an increase in the agent's wage by Δ (as the participation constraint of the agent is always binding). It is thus formally similar to an increase in the minimum profitability level, $\underline{\Pi}$, by Δ. Thus, more competition for agents has the same consequences, formally, as more competition for funds.

With rising competition, a pro-poor MFI that faces a stringent budget constraint will increasingly behave as a for-profit MFI since it then primarily lends to more profitable, richer, borrowers. Competition for agents, like direct competition between MFIs, makes it more likely that the poorest individuals will not obtain financing, contributing to the observed "mission drift".

7.2 Conclusion

We have shown how a positive correlation between wealth and repayment gives rise to problems in designing internal incentives for agents in pro-poor MFIs. In particular, random audits on the wealth of borrowers selected by agents, together with bonuses based on repayment, appear necessary to ensure that credit agents adequately select borrowers on the basis of both ability to repay and poverty levels. Auditing is particularly important for a pro-poor MFI when borrowers differ in terms of wealth – i.e., a sufficient proportion of them is not very poor – and when lending to able borrowers is sufficiently profitable to cover the added costs of the audit procedure. In practice, because wealth verification of individual borrowers through household interviews is expensive, random audits making use of easily verifiable and low-cost poverty indicators have

been introduced (see Gibbons, 1998, and Cerise, 2008). While these indicators are intended to be applied at the level of a pro-poor MFI or each of its branches, they can equally well be used to monitor the selection performance of individual credit agents.

Contrary to intuition, the possibility that a credit agent obtains non-monetary bribes from richer borrowers turns out to be beneficial to a pro-poor MFI. The MFI can use audits to ensure that an adequate proportion of very poor borrowers is still selected while increasing the size of its portfolio as it reduces wages. We argue that some controlled form of delegation (together with random inspections) can be optimal in this context.

When costs of acquisition of information on wealth and auditing are high and the share of very poor in the population of potential borrowers is large, an MFI will prefer to give incentives to agents to select on ability only. In this case, pro-poor targeting can be done by selecting impoverished geographical areas or by using financial products that induce self-selection by the poor, two widely used approaches. However, because this will leave large areas uncovered and has a cost on the poor, improving methods to gather information on wealth and carry low-cost audits of agents' clients is a priority to prevent mission drift among pro-poor MFIs.

Appendices

Appendix 1: The objective of a pro-poor MFI

We assume that a pro-poor MFI wants to maximize the welfare of poorer individuals. It faces a viability constraint, and constraints on repayment, as borrowers cannot reimburse more on average than their gain from the project they undertake. We do not rule out negative average repayments (direct aid to borrowers). For simplicity, we focus below on the situation in which the MFI is informed, at some cost C (possibly $C^{a,w} + C^s$).

Denoting by R_i^k the (possibly negative) repayment required from a borrower of ability i, $i = A, U$, and wealth k, $k = p, r$, the program of an informed pro-poor MFI is:

$$\begin{aligned} & \max_{\{y_i^k, R_i^k\}_{i=A,U,k=p,r}} \{y_A^p(\alpha + V - R_A^p) + y_U^p(0 - R_U^p)\} \\ s.t. \quad & R_A^p \leq \alpha, R_U^p \leq 0, R_A^r \leq 1, R_U^r \leq 0 \\ & \sum_{k,i} y_i^k = 1 \\ & y_A^p R_A^p + y_A^r R_A^r \geq \underline{\Pi} + w + C \end{aligned}$$

Let us note the following:

- As R_U^r must be at most zero and neither R_U^r nor y_U^r enter the objective of the MFI, it is clear that y_U^r must be set equal to zero (as it would otherwise reduce the proportions of borrowers from other types without providing financial resources).

- As the gross gain obtained from lending to able poor borrowers is larger than for unable ones ($\alpha + V > 0$) it is always improving to increase y_A^p by one unit while simultaneously reducing y_U^p to leave the total proportion of poor borrowers unchanged (it improves the objective while relaxing the viability constraint). We obtain a bang-bang solution with respect to these two proportions: $y_U^p = 0$, so as to allow more lending to able poor borrowers.

- R_A^r must be set to its maximal value, 1, so as to relax the viability constraint, without affecting the objective of the MFI.

The program thus rewrites as:

$$\begin{aligned} & \max_{y_A^p, R_A^p} \{y_A^p(\alpha + V - R_A^p)\} \\ s.t. \quad & R_A^p \leq \alpha \\ & y_A^p R_A^p + (1 - y_A^p) \geq \underline{\Pi} + w + C \end{aligned}$$

As $R_A^p \leq \alpha < \underline{\Pi} < 1$, the viability constraint must be binding. A non-binding constraint would allow an improvement in the objective thanks to an increase in y_A^p.

Suppose now that R_A^p is lower than its maximal level α, so that $\alpha - R_A^p = X$. By reducing X to zero, one can increase y_A^p by $\frac{y_A^p X}{\alpha}$ while still having the viability constraint binding. This generates a change in the objective of the MFI of $-y_A^p X + \frac{y_A^p X}{\alpha} V$. This change is always positive for $\alpha \leq V$.

For a large enough future gain of getting a loan for able borrowers ($V \geq \alpha$), it is optimal for the MFI to have $y_i^U = 0$, $i = p, r$, $R_A^r = 1$, $R_A^p = \alpha$, and y_A^p as high as is compatible with the viability constraint.

The problem of a pro-poor MFI is thus max y_A^p subject to a binding viability constraint.

When selection is done with no or only partial information, the viability constraint may no longer be binding as the MFI will not be able to have it so. The above reasoning however applies, so that the objective of the objective of the MFI remains maximizing y_A^p.

Appendix 2. Inducing information acquisition on ability and wealth

If the pro-poor MFI wants to induce information acquisition on both wealth and ability, the constraints are:

$$\begin{aligned}
\mathcal{U} \geq & \quad 0 \quad (PC) \\
\mathcal{U} \geq & \quad \max_{x^p \in [0,1]} \{w(\sigma(x^p), 1-(1-\alpha)\mu^A x^p)\} - C^w \quad (IC)^a \\
\mathcal{U} \geq & \quad \max_{x_A \in [0,1]} \{w(\sigma(\mu^p), 1-(1-\alpha)\mu^p x_A)\} - C^a \quad (IC)^w \\
\mathcal{U} \geq & \quad w(\sigma(\mu^p)), \mu^A(1-(1-\alpha)\mu^p) \quad (IC)^{a,w},
\end{aligned}$$

where $\mathcal{U} \equiv w(\sigma(y_A^p), 1-(1-\alpha)y_A^p) - C^{a,w}$ is the agent's utility when obeying the MFI (the constraint ensuring that the agent selects adequate proportions when he is informed will be satisfied in a linear scheme with $\omega \geq \lambda$).

We focus on linear wage schemes. Choosing unable borrowers only reduces the bonus based on repayment without modifying the penalty based on the selection on wealth, so the incentive constraint $(IC)^w$ simplifies, as the agent chooses only able borrowers. We get $\mathcal{U} = W + \omega[1 - y_A^p(1-\alpha)] - s\mathbf{E}|\epsilon| - C^{a,w}$ and:

$$\begin{aligned}
\mathcal{U} \geq & \quad 0 \quad (PC) \\
\mathcal{U} \geq & \quad \max_{x^p} \{\omega[1-x^p(1-\alpha)]\mu^A - s\mathbf{E}|y_A^p - (x^p+\epsilon)|\} + W - C^w \quad (IC)^a \\
\mathcal{U} \geq & \quad \omega[1-\mu^p x_A(1-\alpha)] - s\mathbf{E}|y_A^p - (\mu^p+\epsilon)| + W - C^a \quad (IC)^w \\
\mathcal{U} \geq & \quad \omega[1-\mu^p(1-\alpha)]\mu^A - s\mathbf{E}|y_A^p - (\mu^p+\epsilon)| + W \quad (IC)^{a,w}.
\end{aligned}$$

Let us construct a wage scheme that satisfies all constraints.

To simplify $(IC)^a$, we must compute the number of poor x^p chosen by the agent when informed on wealth only. As x^p enters the wage linearly, its value depends on the sign of its multiplier: $x^p = 0$ if $s < \omega(1-\alpha)\mu^A$, and $x^p = y_A^p$ otherwise. And $x_A = 1$ as wages increase in repayment. Last, (PC) binds in equilibrium. Assume $s \geq \omega(1-\alpha)\mu^A$; then the relevant constraints are

$$\begin{aligned}
C^{a,w} - \omega[1-y_A^p(1-\alpha)] - s\mathbf{E}|\epsilon| &= W \quad (PC) \\
\omega(1-\mu^A)[1-y_A^p(1-\alpha)] &\geq C^{a,w} - C^w \quad (IC)^a \\
\omega(\mu^p - y_A^p)(1-\alpha) + s\Big[\mathbf{E}|y_A^p - (\mu^p+\epsilon)| - \mathbf{E}|\epsilon|\Big] &\geq C^{a,w} - C^a \quad (IC)^w \\
\omega[1-\mu^A - (y_A^p + \mu^A(1-\mu^p))(1-\alpha)] + s\Big[\mathbf{E}|y_A^p - (\mu^p+\epsilon)| - \mathbf{E}|\epsilon|\Big] &\geq C^{a,w} \quad (IC)^{a,w}.
\end{aligned}$$

As ω and s always enter the constraints with the same sign, increasing one does not create conflicts. To characterize one of the many possible solutions in terms of ω, let us take $s =$

$\omega(1-\alpha)\mu^A$. Then $W = C^{a,w} - \omega[1 + (1-\alpha)(-y_A^p + \mu^A \mathbf{E}|\epsilon|)]$. The constraints become:

$$\begin{aligned}
\omega &\geq \omega^1 \equiv \frac{C^{a,w} - C^w}{(1-\mu^A)[1 - y_A^p(1-\alpha)]} \quad (IC)^a \\
\omega &\geq \omega^2 \equiv \frac{C^{a,w} - C^a}{(1-\alpha)[\mu^p - y_A^p + \mu^A(\mathbf{E}|y_A^p - (\mu^p + \epsilon)| - \mathbf{E}|\epsilon|)]} \quad (IC)^w \\
\omega &\geq \omega^3 \equiv \frac{C^{a,w}}{1 - \mu^A + (1-\alpha)[-y_A^p + \mu^A(-1 + \mu^p + \mathbf{E}|y_A^p - (\mu^p + \epsilon)| - \mathbf{E}|\epsilon|)]} \quad (IC)^{a,w}.
\end{aligned}$$

A solution is $s = \omega(1-\alpha)\mu^A$, $\omega = \max\{\lambda, \omega^1, \omega^2, \omega^3\}$ and W computed as noted above.

Information acquisition on wealth only, or ability only, can similarly be obtained.

We sketch here the case of information on wealth only:

To ensure that the agent acquires information on both wealth and ability (in which case he then chooses $x_A^p = y^p$ for s large), one must have $\omega\mu^A(1 - y^p(1-\alpha)) - C^w \geq \omega(1 - y^p(1-\alpha)) - C^{a,w}$, which is satisfied for $\omega \leq \hat{\omega} \equiv \frac{C^{a,w} - C^w}{(1-\mu^A)(1-y^p(1-\alpha))}$.

To ensure that he does not acquire information on ability rather than wealth, one must have $\omega\mu^A(1 - (1-\alpha)y^p) - s\mathbf{E}|\epsilon| - C^w \geq \omega(1 - (1-\alpha)\mu^p) - s\mathbf{E}|y^p - (\mu^p + \epsilon)| - C^a$. This is satisfied for $s \geq \frac{C^a - C^w + \omega[1 - \mu^A + (1-\alpha)(y^p\mu^A - \mu^p)]}{\mathbf{E}|y^p - (\mu^p + \epsilon)| - \mathbf{E}|\epsilon|}$.

Last, to ensure that the agent becomes informed on wealth rather than select randomly, one must have $\omega\mu^A(1 - (1-\alpha)y^p) - s\mathbf{E}|\epsilon| - C^w \geq \omega\mu^A(1 - (1-\alpha)\mu^p) - s\mathbf{E}|y_A^p - (\mu^p + \epsilon)|$. This is ensured if $s \geq \frac{C^w + \omega\mu^A(1-\alpha)(y^p - \mu^p)}{\mathbf{E}|y^p - (\mu^p + \epsilon)| - \mathbf{E}|\epsilon|}$.

A sufficiently large penalty s is thus sufficient, provided $\lambda \leq \omega \leq \hat{\omega}$; A possible solution is the one provided in footnote 20.

Appendix 3. How much information acquisition to induce?

The regions drawn on Figures 1 are characterized as follows.

1. Option $\emptyset$ (no incentives) is feasible (but not necessary optimal) if $\mu^A\rho^A - \underline{\Pi} \geq 0$. This corresponds to all areas above the $\mu^A\rho^A - \underline{\Pi} = 0$ curve, i.e., all areas except NV, A_3, and AW_3 in Figure 1.

2. If $\rho^A \geq \underline{\Pi} + C^a$ (areas A, W_1, and AW), the MFI can afford the cost of selection on ability and would reach more able poor if it does, as $\mu^p \geq \mu^p\mu^A$, with a positive net profit of $\rho^A - \underline{\Pi} - C^a$. Repayment incentives (option a) are thus better than no incentive, ($\emptyset$), in this area. Note that there may be cases (areas A_3 and AW_3) when an MFI would not be viable without incentives ($\mu^A\rho^A < \underline{\Pi}$), while it could make a profit with repayment incentives ($\rho^A \geq \underline{\Pi} + C^a$): this happens if μ^A is very low, so that selecting on ability makes a crucial difference in meeting the budget constraint.

3. Comparing options a and a, w in Table 2, one can show that incentives on both repayment and targeted share of poor will allow the MFI to include more able poor that under repayment incentives only if $\rho^A \geq \underline{\Pi} + C^{a,w} + C^s$ (areas AW). Hence, if profits could cover the corresponding information and auditing costs, the MFI could use selection on wealth to increase the proportion of poor.

4. Comparing now options $\emptyset$ and a, one can show that if $\mu^A \rho^A \geq \underline{\Pi} + C^w + C^s$ (i.e. the profits obtained when not giving incentives cover the costs of incentives for selection of the poor), as in areas A_1, W_1, W_2 and AW_1, the MFI could have its agents select a higher proportion of poor borrowers than their share in the population with an incentive scheme based on achieving the targeted proportion of poor.

5. Finally, there may be cases where $\mu^A \rho^A \geq \underline{\Pi} + C^w + C^s$ and $\rho^A \geq \underline{\Pi} + C^a$, but $\rho^A \leq \underline{\Pi} + C^{a,w} + C^s$ (area A_1 and W_1), meaning that the MFI can select on either wealth or ability, but not on both. Comparing the number of poor under options a and w, one can show that the MFI prefers to select on wealth alone rather than on ability alone if $\frac{\mu^A - (\underline{\Pi} + C^w + C^s)}{(1-\alpha)} > \mu^p$, which implies that $(\mu^A + \rho^A) > 1 + \underline{\Pi} + C^w + C^s$. This is represented in area W_1.

Appendix 4. Favors at the selection stage

Assume the pro-poor MFI wants to induce information acquisition on both wealth and ability. As before, the expected utility of the agent when he follows the instructions from the MFI is $\mathcal{U}$. Due to favors, we now have $\mathcal{U} \equiv w(\sigma(y_A^p), 1 - (1-\alpha)y_A^p) + (1 - y_A^p)\overline{B} - C^{a,w}$. When the agent can accept favors, denoting $x_A^r = y_A^r + z$, the MFI faces the following constraints:

$$
\begin{aligned}
\mathcal{U} &\geq 0 \quad (PC) \\
\mathcal{U} &\geq \max_z \{w(\sigma(y_A^p - z), 1 - (y_A^p - z)(1-\alpha)) + (1 - y_A^p + z)\overline{B}\} - C^{a,w} \quad (IC)^z \\
\mathcal{U} &\geq \max_{x_A, z} \{w(\sigma(\mu^p(1-z)), 1 + z - x_A(1 - \alpha\mu^p)) + (1 - y_A^p + z)\overline{B}\} - C^a \quad (IC)^w \\
\mathcal{U} &\geq \max_{x^p, z} \{w(\sigma(x^p - z), 1 + z - x^p(1 - \alpha\mu^A)) + (1 - y_A^p + z)\overline{B}\} - C^w \quad (IC)^a \\
\mathcal{U} &\geq \max_z \{w(\sigma(\mu^p(y_A^p - z)), 1 - (y_A^p - z)(1 - \mu^A\mu^p(1-\alpha))) + (1 - y_A^p + z)\overline{B}\} \quad (IC)^{a,w}.
\end{aligned}
$$

We show below that we can find values of W, ω and s such that all constraints are satisfied. This simple linear wage scheme is thus without loss of generality.

- One can rewrite $(IC)^z$ as

$$s[\mathbf{E}|z + \epsilon| - \mathbf{E}|\epsilon|] \geq \omega(1-\alpha)z + z\overline{B} \quad \forall z \in [0, y_A^p].$$

It is satisfied if $s \geq \hat{s}^1(\omega) \equiv \max_{z \in [0, y_A^p]} z \frac{\omega(1-\alpha) + \overline{B}}{\mathbf{E}|\epsilon + z| - \mathbf{E}|\epsilon|}$.

• Since the proportion of poor is independent from ability, and since wages increase with repayment, the agent is better off choosing only able borrowers among the $y_A^p - z$ who do not pay a bribe: $x_A = y_A^p - z$. $(IC)^w$ then simplifies into

$$\omega(1-\alpha)[y_A^p - \mu^p(y_A^p - z)] + s[\mathbf{E}|y_A^p - (y_A^p - z)\mu^p + \epsilon| - \mathbf{E}|\epsilon|] \geq z\overline{B} + C^{a,w} - C^a \quad \forall z \in [0, y_A^p].$$

Assume that s is such that the agent prefers not to accept additional bribes ($z = 0$). This holds for $s \geq \hat{s}^2(\omega) \equiv \max_{z\in[0,y_A^p]} z\frac{\omega\mu^p(1-\alpha)+\overline{B}}{\mathbf{E}|y_A^p-(y_A^p-z)\mu^p+\epsilon|}$. Then $(IC)^w$ can be written as

$$s[\mathbf{E}|y_A^p(1-\mu^p) + \epsilon| - \mathbf{E}|\epsilon|] \geq \omega(1-\alpha)y_A^p(1-\mu^p) + C^{a,w} - C^a,$$

which is satisfied for $s \geq \underline{s}^2(\omega) \equiv \frac{C^{a,w}-C^a+\omega(1-\alpha)y_A^p(1-\mu^p)}{\mathbf{E}|\epsilon+y_A^p(1-\mu^p)|-\mathbf{E}|\epsilon|}$.

• Consider $(IC)^a$. The agent will never select rich borrowers without having them pay a bribe, since this would decrease bribes without improving the audit. Hence, $x^p = y_A^p - z$. The difference in expected repayment when behaving well rather than not learning ability is $(1 - y_A^p(1-\alpha)) - (1 - (y_A^p - z)(1-\mu^A\alpha)) = y_A^p\alpha(1-\mu^A) - z(1-\mu^A\alpha)$. $(IC)^a$ can be written as

$$\omega[y_A^p\alpha(1-\mu^A) - z(1-\mu^A\alpha)] + s[\mathbf{E}|\epsilon + z| - \mathbf{E}|\epsilon|] \geq z\overline{B} + C^{a,w} - C^a \quad \forall z \in [0, y_A^p].$$

Assume that s is large enough for $z = 0$, i.e. $s \geq \hat{s}^3(\omega) \equiv \max_{z\in[0,y_A^p]} z\frac{\omega(1-\mu^A\alpha)+\overline{B}}{\mathbf{E}|\epsilon+z|}$.

Then $(IC)^a$ becomes

$$\omega y_A^p\alpha(1-\mu^A) \geq C^{a,w} - C^a,$$

which is satisfied for $\omega \geq \underline{\omega}^3 \equiv \frac{C^{a,w}-C^a}{y_A^p\alpha(1-\mu^A)}$.

• Last, $(IC)^{a,w}$ can be simplified by considering contracts that are such that the agent prefers to choose $z = 0$, i.e., contracts such that $s \geq \hat{s}^4(\omega) \equiv \max_{z\in[0,y_A^p]} z\frac{\omega(1-\mu^A(1-\mu^p(1-\alpha)))+\overline{B}}{\mathbf{E}|z\mu^p+y_A^p(1-\mu^p)+\epsilon|}$.

The constraint then becomes

$$\omega y_A^p[\alpha - \mu^A(1-\mu^p(1-\alpha))] + s(\mathbf{E}|y_A^p(1-\mu^p) + \epsilon| - \mathbf{E}|\epsilon|) \geq +C^{a,w},$$

which is satisfied for $s \geq \underline{s}^4(\omega) \equiv \frac{C^{a,w}-\omega y_A^p[\alpha-\mu^A(1-\mu^p(1-\alpha))]}{\mathbf{E}|y_A^p(1-\mu^p)+\epsilon|-\mathbf{E}|\epsilon|}$.

The conditions written on s and ω are compatible, so that there exist values that satisfy them all for any set of parameters. One can always increase ω and s in a way such that $s \geq \max\{\hat{s}^1(\omega), \hat{s}^2(\omega), \underline{s}^2(\omega), \hat{s}^3(\omega), \hat{s}^4(\omega), \underline{s}^4(\omega)\}$ and $\omega \geq \max\{\lambda, \underline{\omega}^3\}$. This is done at no expected cost, since W will be adjusted to keep the participation constraint exactly binding: $W = C^{a,w} - \omega(1 - y_A^p(1-\alpha)) + s\mathbf{E}[\epsilon] - (1-y_A^p)\overline{B}$. Hence Proposition 3.

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