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# When pro-poor microcredit institutions favour richer borrowers: A moral hazard story

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**Abstract.** We suggest an explanation for the existence of “mission drift,” the tendency for Microfinance Institutions (MFIs) to lend money to wealthier borrowers rather than to the very poor. We focus on the relationship between MFIs and external funding institutions. We assume that both the MFIs and the funding institutions are pro-poor. However, asymmetric information on the effort chosen by the MFI to identify higher-quality projects may increase the share of loans attributed to wealthier borrowers. This occurs because funding institutions have to build incentives for MFIs, creating a trade-off between the quality of the funded projects and the attribution of loans to poorer borrowers.

**Résumé.** Quand les institutions de microcrédit en faveur de la lutte contre la pauvreté favorisent les emprunteurs plus riches - une histoire d'aléa de moralité. Nous proposons une explication à l'existence de la « dérive de la mission », la tendance des institutions de microfinance (IMF) à prêter de l'argent à des emprunteurs plus aisés plutôt qu'à des emprunteurs très pauvres. Nous nous concentrons sur la relation entre les IMF et les institutions de financement externe. Nous supposons que les IMF et les institutions de financement sont en faveur de la lutte contre la pauvreté. Toutefois, une information asymétrique sur l'effort choisi par l'IMF pour cerner les projets de meilleure qualité peut augmenter la part des prêts attribués aux emprunteurs plus aisés. Cela s'explique par le fait que les institutions de financement doivent mettre en place des mesures incitatives pour les IMF, créant ainsi un compromis entre la qualité des projets financés et l'attribution de prêts aux emprunteurs plus pauvres.

JEL classification: O12, O16, G21

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## 1. Introduction

OVER THE LAST 30 years, the microfinance industry has been responsible for a massive growth of pro-poor financial services. The growth of the sector and the increasing financial flows into microfinance institutions (MFIs) have stimulated a debate on the evolution of the industry. The main recent developments are the explosion of for-profit and profit-oriented MFIs, the increasing competition between these for-profit MFIs and *socially motivated* ones and the change in the nature of some funding institutions (private vs. public). These different issues have contributed to fuel the debate on the so-called “mission drift” in microfinance. Armendáriz and Szafarz (2011) state:

mission drift arises when an MFI increases its average loan size by reaching out to wealthier clients neither for progressive lending nor for cross-subsidization reasons. Mission drift in microfinance arises when an MFI finds it profitable to reach out to unbanked wealthier individuals while at the same time crowding out poor clients.

In this paper, we present a theoretical analysis aimed at increasing our understanding of the role of funding institutions in affecting mission drift tendencies in microfinance. From its origins, microfinance has been about a double bottom-line: a mix of commercial and social concerns. MFIs need to run their *businesses* in a way that allows for costs to be recovered while at the same time achieving social goals. But the success of a MFI has long been associated with financial performance, as measured by loan portfolio quality, operating efficiency and profitability. There is a widespread fear that microfinance might be drifting away from its original double bottom line. The fact that funding institutions may want to encourage financial sustainability is not necessarily a sign of abandoning the pro-poor orientation of microfinance. This clearly appears in Yunus (2007, ch. 11, p. 204), when he states in his well-known book *Banker to the Poor*:

If Grameen does not make a profit, if our employees are not motivated and do not work hard, we will be out of business....In any case, it cannot be organized and run purely on the basis of greed. In Grameen we always try to make a profit so we can cover all our costs, protect ourselves from future shocks, and continue to expand. Our concerns are focused on the welfare of our shareholders, not on the immediate cash return on their investment dollar.

Similarly, in the “Key Principles in Microfinance,” published in 2004 by the Consultative Group to Assist the Poor, financial sustainability is evoked as the fourth principle and defined as “necessary to reach significant numbers of poor people.”<sup>1</sup> In this spirit, observers and policy-makers have increasingly put the accent on the necessity for microfinance institutions to be profitable, or *financially* sustainable, raising interest rates and going through commercialization to be able to attract private investors (see Cull et al. 2009).

Nonetheless, a report commissioned by Deutsche Bank showed that, in 2007, 70% of MFIs were small *start-ups* MFIs, mostly unprofitable, while only the top 150 MFIs were fully sustainable mature enterprises (Dieckmann et al. 2007). More recently, focusing on MFIs’ costs on a sample of 1,355 MFIs between 2005 and 2009, Cull et al. (2018) find that, while most firms earn positive accounting profits, only a minority make an economic profit (which fully accounts for the opportunity costs of inputs): 67% of institutions were profitable on an accounting basis, but only 36% were economically profitable. They also show that implicit grants and subsidies are widespread and persist in older institutions.

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1 Available at [www.cgap.org/sites/default/files/CGAP-Consensus-Guidelines-Key-Principles-of-Microfinance-Jan-2004.pdf](http://www.cgap.org/sites/default/files/CGAP-Consensus-Guidelines-Key-Principles-of-Microfinance-Jan-2004.pdf)

At the same time, the positive view of commercialization and profitability has been challenged in recent years by critics, following the news that the largest microfinance bank in Latin America, the Mexican Compartamos, was offering returns on equity of 53% while charging interest rates exceeding 100% to the poor. In a famous column appearing in *The New York Times* on January 14, 2011, Yunus reacted to this debate denouncing a tendency towards “sacrificing microcredit for megaprofits.”<sup>2</sup> Moreover, because microfinance is a profitable and viable business in some places, there is an increasing competition between for-profit and *socially motivated* MFIs (McIntosh and Wydick 2005) and this may have adverse effects especially regarding the social mission. Hossain et al. (2020), using data from 59 countries over the period 2005–2014, document that competition has a negative effect on the economic sustainability of MFIs. They also find that the impact of competition on social performance is mixed: it reduces the breadth of outreach (i.e., the number of active borrowers), but it enhances the depth of outreach because competition encourages MFIs to serve unserved or under-served borrowers with a smaller loan size.

The main difficulty when trying to assess the extent of mission drift is that it is complicated to empirically establish whether a microfinance institution has indeed deviated from its social mission of serving the poor. One widely used proxy for poverty is the average loan size, but as Armendáriz and Szafarz (2011) point out, the relationship between mission drift and loan size is not easy to tackle, so socially responsible investors should be cautious when interpreting empirical evidence on loan size. For instance, MFI could be encouraged to serve customers with larger loans when their first investments succeed so that larger loans are not a sign of mission drift but of progressive lending. Moreover, increasing the average loan size could be a sign of cross-subsidization, aimed at reaching a larger number of poorer borrowers. In these cases, MFIs aim to obtain a greater social impact from targeting bigger businesses rather than the micro-scale businesses, which were the original focus.

Another possible sign of mission drift could be a tendency to charge higher interest rates. However, Roberts (2013) shows that, although profit-oriented MFIs do usually charge higher interest rates, they are not significantly more profitable because they tend to have higher costs. He concludes that his analysis finds “no obvious indication of a mission drift.” In practice, the interpretation of these results is not obvious because MFIs that serve better-off borrower might grant larger loans and bear smaller fixed costs so that higher interest rates as such are not necessary a sign of mission drift. We believe that additional theoretical work is needed to understand the phenomenon and to be able to better interpret the empirical findings.

We propose a model in which both the funding institution and the MFI are pro-poor, although they can put different weights on the aim of providing credit to the poorest borrowers. Incentives have to be provided to the MFI to exert costly effort to identify the more valuable projects and to choose the ideal share of poorer borrowers (the *target value* of poor outreach). We characterize the optimal contract, proposed to MFIs with the aim of balancing outreach, budget considerations and MFIs’ survival.

Our main finding is that asymmetric information on the effort exerted by the MFI may increase the share of richer borrowers financed by MFIs, thereby increasing the mission drift. This depends on the fact that, even if the MFI and the funding institution have the same *ideal* pro-poor orientation, they may differ in the weights they put on this social goal, and in the costs they face. Our model shows that moral hazard has a direct adverse effect on mission drift when the pro-poor orientation of the financing institution is relatively large and the social rentability of effort small. As a result, whenever the optimal contract requires

<sup>2</sup> Available at [www.nytimes.com/2011/01/15/opinion/15yunus.html](http://www.nytimes.com/2011/01/15/opinion/15yunus.html).

a strictly positive effort, the share of richer borrowers will be equal to the highest of the two pivotal levels of the donor and of the MFI. The share of richer borrowers is at least equal to the share the donor prefers. He accepts a higher share if it is necessary to provide incentives for the MFI to exert a costly effort.

The paper proceeds as follows. Section 2 describes the related literature. Section 3 presents the basic model. Section 4 analyzes it and section 5 concludes.

## 2. Related literature

Although the economic issue of the relationship between MFIs and external funding institutions has gained importance in recent years, as Ghosh and Van Tassel (2013) point out, the literature on microfinance has not paid much attention to this question.<sup>3</sup> An indirectly related body of literature has considered the broader question of the relationship between external funding institutions and other recipients (such as NGOs). For instance, Besley and Ghatak (2001) consider the issue of the optimal contract between a government and an NGO in order to carry out a development project, showing how hold-up problems shape the optimal way to delegate responsibility to NGOs for providing social welfare and development services. Aldashev and Verdier (2009, 2010) examine the effects of international competition between NGOs for raising funds. They show that if the level of outside options for NGO entrepreneurs is low enough, increased competition among NGOs can lead to higher fund diversion, despite the fact that they care about the impact of their projects.

Another strand of literature has concentrated on issues arising in contracting environments specifically related to microfinance. For instance, Aubert et al. (2009) focus on the internal organization of MFIs and highlight the importance of the incentives given to the credit agents. They analyze the optimal contract in the presence of moral hazard and investigate the issue of mission drift in this context. In their model, the credit agents are not pro-poor and can under-report repayments so that they have to be given the right incentives to investigate the ability and wealth of borrowers. The MFI can monitor agents. However, when monitoring is costly, a pro-poor MFI can be obliged to provide the agent with incentives based on repayments, thus generating mission drift. In another paper, Baland et al. (2013) concentrate on borrowers' incentives to repay their credits. They compare individual loans with joint liability contracts and show that wealthier borrower can pool risks more efficiently, have higher repayment rates and get higher benefits from group lending. While Aubert et al. (2009) concentrate on the incentives provided to agents and Baland et al. (2013) look at repayment incentives, we concentrate instead on the contractual relationship between MFIs and external funding institutions. To simplify the analysis, we do not consider joint liability issues (thus differently from Baland et al. 2013 and as in Aubert et al. 2009). In our context, we find it reasonable to assume that both the MFI and the funding institutions are pro-poor, even though the intensity of the pro-poor motive may differ. Although we do not allow the MFI to under-report repayments, incentives in our framework need to be provided in order for the MFI to exert costly effort to discover valuable investment projects<sup>4</sup> (while borrowers' wealth is easily observable by the MFIs, which have better knowledge of the local conditions than funding institutions).

3 Most papers are dedicated to the process of contracting between MFIs and their clients: see Ghatak and Guinnane (1999), Rai and Sjöström (2004), Jeon and Menicucci (2011) or Shapiro (2015).

4 This can also be interpreted as a cost of helping borrowers improve the quality of their projects.

The first to focus directly on the relationship between funding institutions and MFIs were Ghosh and Van Tassel (2011, 2013). They concentrate on adverse selection problems that may arise when MFIs' costs are heterogeneous. In their first paper, they present a model in which *socially responsible* MFIs (their main goal is to reduce poverty) must be funded by a profit-seeking investor. They find that competition among MFIs to obtain external funds has two opposite effects: on the one hand, having to pay a high rate of return to the external funder raises the interest rates charged to borrowers; on the other hand, it is also a way to make the funding more efficient by redirecting funding from inefficient MFIs to more efficient ones. If the average increase in the quality of MFIs more than compensates for the higher interest rates, then competition for external funds is pro-poor.

Ghosh and Van Tassel (2013) extend the previous analysis by introducing asymmetric information and socially motivated funding institutions. They compare two alternative types of contract: the first is a pure grant, the second requires paying an interest rate sufficiently high to dissuade high-cost MFIs from applying for funding. They show that imposing high repayments to MFIs can increase efficiency by squeezing out less-efficient types. Our approach is complementary to theirs because we concentrate exclusively on moral hazard aspects. In this context, incentives do not serve to squeeze-out the less efficient MFIs, but to promote the efficient level of project-screening effort.

Our paper shows that moral hazard can be a source of mission drift, even when both the funding institution and the MFIs are pro-poor. Mission drift can be worsened by the distortions necessary to provide the right incentives to MFIs when project-screening is costly and the population of borrowers heterogeneous.

### 3. The model

We consider the relationship between a funding institution (the principal, “he”) and an MFI (the agent, “she”). The MFI lends a mass 1 of money to a local population of borrowers. The population of borrowers contains an infinity of borrowers, who don't have access to bank lending. Borrowers are heterogeneous: some of them are richer (they are unbanked but less poor with a positive initial wealth level that is not pledgeable and does not allow them to access bank lending) and some of them are poorer (they have no wealth whatsoever). The MFI chooses the proportion  $\alpha$  of the money to be lent to richer borrowers in her loans portfolio.

In addition, the MFI has to exert effort to screen out valuable projects, when examining the project proposed by both richer and poorer borrowers. This effort level  $e$  can be interpreted as the share of loans for which the MFI makes costly effort in order to identify the quality of the project. Without any screening effort on the MFI side, the expected repayment of richer borrowers,  $R_R$ , is strictly higher than the expected repayment of poorer borrowers,  $R_P$ . Of course, one may argue that because richer borrowers have more assets to pledge, they are more likely to be able to borrow elsewhere in the future (compared with poorer borrowers) if they default. In other words, a richer borrower may have wider outside options compared with a poorer one so that, in reality, the relationship between wealth and the incentive to repay is not necessarily monotonic. However, our model does not aim to capture all aspects of borrower characteristics and risk profiles, but has to be interpreted as a reduced form. As such, the model leaves aside many underlying aspects influencing repayment rates, such as loan size, gender issues, and differences in the fixed costs of serving different types of borrowers. The specific impact of these aspects has been explored in the literature and is not central to our analysis. We simply assume that, at each period, the MFI has a portfolio of loans granted to different types of borrowers, and that the expected repayment rate (i.e., the financial performance) is larger for funds lent to better-off borrowers. This creates a trade-off between financial and social performance.

This assumption can be justified on different grounds. First, we can assume that richer borrowers have higher collateral. This collateral might not be easily pledgeable or may be insufficient to guarantee a standard banking loan, but MFIs can use it to put pressure on the borrowers. Alternatively, this can be interpreted as higher social collateral. Second, following the empirical findings of Sharma and Zeller (1997) in Bangladesh or Zeller (1998) in Madagascar, we can consider that repayment performance an increasing function of wealth because the poorest borrowers may invest more in low-return activities because they have a low ability to bear risk. Our assumption thus simply aims to capture the idea that financing richer borrowers might guarantee larger revenues to the MFI so that the latter might be tempted to abandon the mission of serving poorer borrowers to increase profitability. This might as well depend on the fact that less poor borrowers have access to better education, land and/or social capital (see also Aubert et al. 2009). One may still object that the social objective of serving poorer borrowers does not always need to entail financial trade-offs. But, if there were no financial trade-offs, there would be no need for social orientation in the first place. Investors would spontaneously target the poor, in the same way they are willing to finance profit-oriented firms (see also Morduch and Ogden 2020 for a more general discussion on socially oriented investment).

We also assume that the screening effort increases the loans' return by a parameter  $\Delta R$ , and for simplicity, we assume that this parameter is identical for richer and poorer borrowers. Besides, we add a noise component  $\varepsilon$  with zero mean, independent from the portfolio composition and the level of effort. The term  $\varepsilon$  captures the idea that repayments are subject to a part of unavoidable uncertainty, described as a random shock distributed according to  $F$ , a uniform distribution function on  $[-\bar{\varepsilon}, \bar{\varepsilon}]$ , with  $\bar{\varepsilon} < (R_R - R_P)/2$ . It seems reasonable to assume that  $\bar{\varepsilon} < (R_R - R_P)/2$  because  $\varepsilon$  covers only the random fraction of the repayment, not related to the choice of  $(\alpha, e)$ , that cannot be explained by any observable and contractible element. It thus seems natural to consider that this is never higher than half the difference between  $R_R$  and  $R_P$ , which is supposed to be the major element explaining the motivation of the actors for financing a larger share of richer borrowers.

The repayment for the projects financed by the MFI is, therefore, equal to

$$\theta(\alpha, e, \varepsilon) = R_P + \alpha(R_R - R_P) + \Delta R e + \varepsilon, \quad (1)$$

where  $e \in [0, 1]$  is the fraction of loans for which the MFI exerts an effort. We assume that the cost associated to the effort  $e$  is linear and does not depend on the type of borrowers so that we can denote it  $\mu e$  with  $\mu > 0$ . This effort translates into a monetary cost because the MFI has to pay credit officers who study the quality of the projects. The effort provided by the MFI can thus be simply interpreted as an effort necessary to examine projects and screen the good ones with higher repayment potentials. Alternatively, this can be interpreted as the effort and the cost necessary to provide additional services and support to the borrowers, thus increasing the potential of their investment projects.

The MFI has no direct access to the financial market to finance her loans, so that she has to contract with a funding institution (the principal). The funding institution proposes a contract to the MFI. The contract specifies the transfer,  $T$ , that the MFI is supposed to pay back to the funding institution and a recommended effort level,  $\hat{e}$ . Even though the effort level actually chosen by the MFI,  $e$ , is not observable or contractible, the contract specifies that the MFI must spend an amount  $\mu \hat{e}$  for improving the quality of the financed projects. The funding institution can verify the amount that has been spent but he cannot verify the use of the money.<sup>5</sup>

5 For example, the funding institution can observe that employees have been paid by the MFI, but he may not verify the actual activities of these employees.

Therefore, the situation is equivalent to the allocation of an amount  $\mu\hat{e}$  by the funding institution to the MFI to finance the effort of improving the quality of the investment projects, while the MFI can ultimately decide of the fraction of this amount that will be spent for this purpose and the amount that will be used for other purposes because actual effort is not observable. For the sake of simplicity, we assume that the marginal utility of these other activities for the manager of the MFI is 1.

The funding institution observes only the repayment level obtained by the MFI,  $\theta$ , and ignores the actual values of  $\varepsilon$ ,  $\alpha$  and  $e$ . Therefore,  $T$  can depend only on  $\theta$ . Eventually, the contract proposed by the funding institution can be denoted  $(T(\theta), \hat{e})$ .

We also assume that the value of  $\mu$  is common knowledge and that the MFI has no other external funds at the time she accepts the contract with the funding institution so that she faces a budget constraint:

$$\theta(\alpha, e, \varepsilon) - \mu\hat{e} \geq T(\theta). \quad (2)$$

If this constraint is not satisfied, she pays an amount equal to  $\theta(\alpha, e, \varepsilon) - \mu\hat{e}$  to the funding institution and goes bankrupt.

The timing of the game is the following:

**Step 0:** The funding institution proposes a contract,  $(T(\theta), \hat{e})$ , which can be interpreted as a refund required from the MFI depending on the observed  $\theta$  and an effort level financed by the funding institution.

**Step 1:** The MFI accepts the offer or refuses it. If she refuses it, the game is over without any lending or transfers and both the MFI and funding institution get a utility equal to 0. If she accepts it, the game continues.

**Step 2:** The MFI chooses  $(e; \alpha)$ . The value of  $\varepsilon$  is realized.

**Step 3:**  $\theta(e, \alpha, \varepsilon)$  is common knowledge and the MFI makes her payment to the funding institution in accordance with the initial contract and the actual value of  $\theta$ . If  $T(\theta) > \theta - \mu\hat{e}$ , the MFI goes bankrupt. If  $e < \hat{e}$ , the MFI keeps an amount  $\mu(\hat{e} - e)$ .

The funding institution's utility is an increasing function of the amount he receives from the MFI, but the funding institution is also concerned with the share of loans going to poorer borrowers and the final situation of the MFI. More precisely, we represent his preferences with the following utility function:

$$V = \min(T(\theta), \theta(e, \alpha, \varepsilon) - \mu\hat{e}) - 1 + \lambda(1 - \alpha^2) - \mathbb{1}_B B_F, \quad (3)$$

where  $\mathbb{1}_B$  is equal to 1 if the MFI goes bankrupt and to 0 otherwise, and  $B_F$  is the cost associated to the bankruptcy of the MFI for the funding institution.  $\lambda > 0$  is the weight that the funding institution puts on targeting poorer borrowers.

For the sake of simplicity, we assume that the ideal fraction of loans granted to richer borrower is zero. In general, there are natural reasons for which this ideal target could be strictly positive instead of null. As noted in Armendáriz and Szafarz (2011), the fact that many MFIs in these regions serve a higher share of less poor borrowers does not necessarily mean that they have all deviated from their mission.<sup>6</sup> However, taking into account the

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<sup>6</sup> Different values for the target share of richer borrowers could be derived from natural welfare functions in which the funding institution cares for the welfare of the poorest borrowers, while taking into account that richer unbanked borrowers generate higher expected income. For instance, even if the funding institution cares only about poorer households, he might take into account that lending to some richer individuals might generate a trickle-down effect, such as



possibility of a higher ideal level of richer borrower does not alter our main intuitions so that we fix this target level to zero to simplify the exposition.

The expression  $\lambda(1 - \alpha^2)$  represents the utility that the funding institution derives from lending money to a population of borrowers, including a fraction of richer ones. This element is always positive, conveying the idea that the funding institution derives positive utility from lending. The loss, in term of utility, of not targeting the poorer borrowers is given by the term  $\lambda\alpha^2$ . We also assume that  $\lambda \geq (R_R - R_P)/2$ . This condition simply ensures that the financing institution's preferred level of  $\alpha$  is not always equal to one; otherwise, the funding institution would have a strict preference for funding only richer borrowers.

The MFI also cares about the ratio of poorer and richer borrowers to whom she grants loans. For the sake of simplicity, we assume that the target fraction of richer borrowers for the MFI is the same as for the funding institution, 0.<sup>7</sup> However, the weight that the MFI gives to this dimension of his utility,  $\beta > 0$ , may differ from the weight put by the funding institution,  $\lambda$ . Eventually, as long as she can pay the required refund the funding institution, the MFI's utility function is defined as follows:

$$U = \theta(\alpha, e, \varepsilon) - T(\theta) - \mu e + \beta(1 - \alpha^2). \quad (4)$$

If the MFI goes bankrupt, her utility is equal to

$$U = -B_M + \mu(\hat{e} - e) + \beta(1 - \alpha^2), \quad (5)$$

with  $B_M > 2\beta$ . This conditions means that one of the dimensions of the bankruptcy costs is the future impossibility to address the needs of the local population and most specifically its poorer members. Moreover, we assume that  $\beta > ((R_R - R_P)\Delta R)/(2\mu)$ . This ensures that the MFI does not always prefer increasing the share of richer borrowers instead of providing effort to increase income. As for the funding institution, the interesting case is when the MFI is also pro-poor to some extent.

#### 4. The analysis

Let us first consider the MFI's decision. If she accepts the offer of the funding institution, her utility depends on the values of  $e$ ,  $\alpha$  and  $\varepsilon$ . Because the value of  $\varepsilon$  is independent from her choice  $(e, \alpha)$  and the MFI knows the distribution function of  $\varepsilon$  only at the time she chooses  $(e, \alpha)$ , this choice cannot be affected by the value of  $\varepsilon$  that is subsequently drawn. We thus define  $\bar{\theta}$ , the expected repayment obtained by the MFI from the borrowers, as

$$\bar{\theta}(\alpha, e) = R_P + \alpha(R_R - R_P) + \Delta R e. \quad (6)$$

We will also denote  $g(\theta_1)$  the set of pairs  $(\alpha, e)$  such that the expected repayment rate is  $\theta_1$  and no other pair  $(\alpha, e)$  allows to obtain the same expected repayment rate at a lower

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creating local jobs and increasing the living condition of the poorer borrowers. On the other hand, even if richer households produce higher expected revenue, the funding institution would want to finance an ideal ratio of poorer borrowers to achieve a better distribution of wealth. In addition, the unbanked wealthier are relatively more abundant than the unbanked poor in many middle-income regions.

<sup>7</sup> We could alternatively set different ideal levels of richer borrowers for the funding institution and the MFI. However, we choose to consider a unique ideal target of richer borrowers in order to show that our results are not driven by the different views about the target share of richer borrowers.

total cost (including both the cost of effort and the utility cost of targeting a lower share of poorer borrowers). Formally,  $g(\theta_1) = \{(\alpha, e) | \bar{\theta}(\alpha, e) = \theta_1, \forall(\tilde{\alpha}, \tilde{e}) \text{ such that } \bar{\theta}(\tilde{\alpha}, \tilde{e}) = \theta_1, -\mu\tilde{e} + \beta(1 - \tilde{\alpha}^2) \leq -\mu e + \beta(1 - \alpha^2)\}$ . If  $g(\theta_1)$  is a singleton, we will denote its unique element  $(\alpha(\theta_1), e(\theta_1))$ . We also define  $G$  as the set of all  $(\alpha, e)$  that belong to a  $g(\theta_1)$  for any value of  $\theta_1$ .

Now, we can identify the elements of  $G$  considering that, for the MFI, increasing the share of richer borrowers is a substitute for a higher effort in order to increase the level of the repayment rate.

Let us consider values of  $\bar{\theta}$  such that  $\bar{\theta} \geq R_P$  so that the marginal cost of increasing  $\bar{\theta}$  by raising the fraction of richer borrowers is  $(2\beta\alpha)/(R_R - R_P)$ , strictly increasing in  $\alpha$ . The MFI prefers increasing  $\bar{\theta}$  by raising  $\alpha$  up to the point when further increasing the share of richer borrowers becomes more costly than increasing effort. The marginal cost of increasing  $\bar{\theta}$  by a rise in the effort level is equal to  $\mu/(\Delta R)$  which is a constant. The two costs are equal for a unique value of  $\alpha \equiv \alpha_M$  defined as follows:

$$\alpha_M = \frac{(R_R - R_P)\mu}{2\beta\Delta R}. \quad (7)$$

Therefore, we can consider three cases:

- If  $\theta_1 < R_P + \alpha^M(R_R - R_P)$ , in order to obtain  $\theta_1$ , the MFI prefers an effort level  $e = 0$  and  $\alpha = \frac{\theta_1 - R_P}{R_R - R_P}$  so that  $\bar{\theta} = \theta_1$ .  $g(\theta_1) = \left(\frac{\theta_1 - R_P}{R_R - R_P}, 0\right)$ .
- If  $R_P + \alpha^M(R_R - R_P) \leq \theta_1 \leq R_P + \alpha^M(R_R - R_P) + \Delta R$ , the MFI prefers  $\alpha = \alpha_M$  and the effort level  $e \in (0, 1)$ , which allows to obtain  $\bar{\theta} = \theta_1$  so that  $g(\theta_1) = \left(\alpha_M, \frac{\theta_1 - R_P - \alpha_M(R_R - R_P)}{\Delta R}\right)$ .
- If  $\theta_1 > R_P + \alpha^M(R_R - R_P) + \Delta R$ , the MFI will choose  $e = 1$  and an  $\alpha = \frac{\theta_1 - R_P - \Delta R}{R_R - R_P}$  in order to obtain that  $\bar{\theta} = \theta_1$  so that  $g(\theta_1) = \left(\frac{\theta_1 - R_P - \Delta R}{R_R - R_P}, 1\right)$ .

Initially, in order to increase the value of  $\theta$ , the MFI prefers increasing  $\alpha$  because the marginal cost of financing a higher fraction of richer borrowers is low (because the utility loss related to financing richer borrowers follows a quadratic function). For higher values  $\theta$ , when  $\alpha$  reaches  $\alpha_M$  (the cost of financing a higher fraction of richer borrowers is higher than the cost of effort), the MFI increases the effort in order to increase  $\theta$ . Eventually, if  $e = 1$ , the only way to increase  $\theta$  is to raise  $\alpha$  again.

We observe that for any value of  $\bar{\theta}$ ,  $g(\bar{\theta})$  is a singleton so that, for any  $\bar{\theta}$ , the MFI has a unique preferred pair  $(e(\bar{\theta}), \alpha(\bar{\theta}))$ . We represent the elements of  $G$  in figure 1. When the graph goes northeast, this corresponds to a higher  $\bar{\theta}$  chosen by the MFI. The graph is uniquely characterized by the value of  $\alpha^M$ .

Now, let us consider the funding institution. What is his first best, the choice that he would impose on the MFI if he could choose the pair  $(\alpha, e)$  which maximizes his utility while satisfying the MFI budget constraint,  $T(\theta) \leq \theta(\alpha, e, \varepsilon) - \mu e$ ? Let us first note that, because the funding institution can impose the choice of  $(\alpha, e)$  and he observes  $\theta(\alpha, e, \varepsilon)$ , he can deduce the value of  $\varepsilon$  and the noise is no longer an issue. The budget constraint of the MFI will always be binding because the funding institution has no reason to leave money to the MFI and he prefers not to ask for a refund strictly higher than  $\theta(\alpha, e, \varepsilon) - \mu e$ ; otherwise, rather than obtaining  $\theta(\alpha, e, \varepsilon) - \mu e$ , he would obtain  $\theta(\alpha, e, \varepsilon) - \mu e - B_F$ , which is strictly lower. Therefore, in the first-best contract,  $T(\theta) = \theta(\alpha, e, \varepsilon) - \mu e$ <sup>8</sup> and the funding

8 In the first best case, because the funding institution can impose  $(\alpha, e)$  and deduce  $\varepsilon$ , the contract can depend on all these parameters.

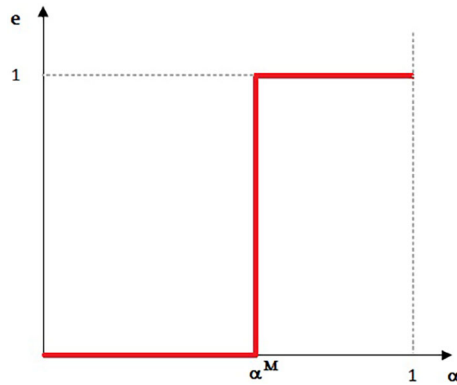


FIGURE 1 MFI's preferences

institution's utility is equal to

$$V = R_P + \alpha(R_R - R_P) + \varepsilon - 1 + \Delta R e - \mu e + \lambda(1 - \alpha^2). \tag{8}$$

This is equal to the expected utility of the MFI, except that the transfer for the MFI is replaced by 1 and the parameter  $\beta$  is replaced by  $\lambda$ .

Looking at the formula, we observe that, if  $\Delta R < \mu$ , the funding institution prefers  $e = 0$ ; if  $\Delta R > \mu$ , he prefers  $e = 1$ ; and, if  $\mu = \Delta R$ , he is indifferent among effort levels. As for the optimal level of  $\alpha$  from the point of view of the funding institution, we can find it by maximizing  $\alpha(R_R - R_P) + \lambda(1 - \alpha^2)$ . This gives

$$\alpha^F \equiv \frac{R_R - R_P}{2\lambda}. \tag{9}$$

Now, the funding institution cannot actually choose the pair  $(\alpha, e)$  because he does not observe the choice of the MFI. He observes only  $\theta$  so that the contract can depend only on this observation. We consider separately three cases.

If  $\Delta R \leq \mu$ , the cost of effort is higher than its social benefit, the funding institution would like to induce the choice  $(\alpha^F, 0)$ . He cannot infer the choice of the MFI by observing  $\theta$ , but he can propose the following simple contract:  $T(\theta) = \theta$  and  $\hat{e} = 0$ . With such a contract, the MFI would choose  $e = 0$ , which coincides with the objective of the funding institution. However, if  $T(\theta) = \theta$  and  $e = 0$ , the utility of the MFI becomes equal to  $\beta(1 - \alpha^2)$  so that she maximizes her utility choosing  $\alpha = 0 < \alpha^F$ , reducing the repayment level. In order to avoid this outcome, the funding institution must threaten the MFI and ask for a refund strictly higher than  $\theta$  when  $\theta$  is *too low*.

If  $\Delta R > \mu$  and  $\alpha^F \geq \alpha^M$ , the cost of effort is lower than the social benefit and the  $\alpha$  preferred by the funding institution is higher than the one preferred by the MFI. The funding institution would like to obtain that the MFI chooses  $(\alpha, e) = (\alpha^F, 1)$ . In order to do so, he can propose a contract  $(T(\theta), \hat{e}) = (\theta - \mu, 1)$  and again a form of *punishment* (some form of penalty in the contract) if  $\theta$  is *too low*.

The richest case is when  $\Delta R > \mu$  and  $\alpha^F < \alpha^M$ . Because  $\Delta R > \mu$ , the funding institution would prefer the MFI to make an effort equal to 1 (the social cost of the effort is lower than the social profit). The funding institution would also like the MFI to choose an  $\alpha$  strictly lower than  $\alpha^M$  because  $\alpha^F < \alpha^M$ . However,  $(\alpha^F, 1)$  is not an element of  $G$ . Whatever the shape of  $T(\theta)$ , the MFI will not choose  $(\alpha^F, 1)$ . If the funding institution designs a contract  $T(\theta)$  so as to obtain  $\theta(\alpha^F, 1)$ , the MFI can always reduce its effort (with

a marginal cost  $\mu/(\Delta R)$  for an increase in  $\theta$ ) and raise the ratio  $\alpha$  of richer borrowers (with a marginal disutility for an increase in  $\theta$  strictly lower than  $\mu/(\Delta R)$  when  $\alpha < \alpha^M$ ). Because  $g(\bar{\theta}(\alpha_F, 1)) = (\min(\alpha_M, \alpha_F + (\Delta R)/(R^R - R^P)), \max(0, 1 - (\alpha_M - \alpha_F)(R^R - R^P)/(\Delta R))) \neq (\alpha_F, 1)$ , the funding institution cannot obtain that the MFI chooses  $(\alpha_F, 1)$  if the only observable statistics is  $\theta$ . These results are formalized in the following proposition.

PROPOSITION 1. *At the equilibrium:*

1. If  $\Delta R \leq \mu$ , the MFI chooses  $(\alpha_F, 0)$ . This can be obtained with  $\hat{e} = 0$  and  $T$  such that  $T(\theta) = \theta$  when  $\theta \geq \theta(\alpha_F, 0, -\bar{e})$ , and  $T(\theta) = \theta(\alpha_F, 0, -\bar{e})$  otherwise.
2. If  $\Delta R > \mu$  and  $\lambda < \frac{\Delta R}{\mu}\beta$  (equivalent to  $\alpha^F > \alpha^M$ ), the MFI chooses  $(\alpha_F, 1)$ . This can be obtained with  $\hat{e} = 1$  and  $T$  such that  $T(\theta) = \theta - \mu$  when  $\theta \geq \theta(\alpha^F, 1, -\bar{e})$ , and  $T(\theta) = \theta(\alpha^F, 0, 0)$  otherwise.
3. If  $\mu < \Delta R < (\alpha^M - \alpha^F)(\lambda(\alpha^M + \alpha^F) - (R_R - R_P)) + \mu$  and  $\lambda \geq \frac{\Delta R}{\mu}\beta$  (equivalent to  $\alpha_M \geq \alpha_F$ ), the MFI chooses  $(\alpha_F, 0)$ . This can be obtained with  $\hat{e} = 0$  and  $T$  such that  $T(\theta) = \theta$  when  $\theta \geq \theta(\alpha^F, 0, -\bar{e})$ , and  $T(\theta) = \theta(\alpha^F, 0, 0)$  otherwise.
4. If  $\Delta R > (\alpha^M - \alpha^F)(\lambda(\alpha^M + \alpha^F) - (R_R - R_P)) + \mu$  and  $\lambda \geq \frac{\Delta R}{\mu}\beta$  (equivalent to  $\alpha_M \geq \alpha_F$ ), the MFI chooses  $(\alpha_M, 1)$ . This can be obtained with  $\hat{e} = 1$  and  $T$  such that  $T(\theta) = \theta - \mu$  when  $\theta \geq \theta(\alpha^M, 1, -\bar{e})$ , and  $T(\theta) = \theta(\alpha^M, 0, 0)$  otherwise.

Let us first discuss the case  $\mu \geq \Delta R$ , where the cost of effort is higher than its social benefit and none of the actors wants the effort to be made. The funding institution designs a contract so as to obtain  $\alpha = \alpha_F$ . Because  $\alpha_F$  is strictly higher than 0, this may be considered as mission drift. However, this difference is simply explained by the trade-off between lending money to poorer borrowers and obtaining a higher repayment rate through costly effort (both from richer and poorer borrowers).

Now, if the social cost of effort is lower than its social benefit,  $\mu < \Delta R$ , it is socially optimal to make an effort equal to 1. However, this effort will not always be implemented.

The simplest case is  $\alpha^F \geq \alpha^M$ . In this case, the funding institution can propose a contract targeting  $\bar{\theta}(\alpha_F, 1)$ . This is represented by point *B* in figure 2(a).

If instead  $\alpha_F$  is lower than  $\alpha_M$ , it is no longer the case that  $g(\bar{\theta}(\alpha_F, 1)) = (\alpha_F, 1)$ . A  $\theta = \bar{\theta}(\alpha_F, 1)$  can be obtained by a different pair  $(\alpha, e)$ , preferred by the MFI. The MFI will thus substitute effort for a higher proportion of richer borrowers (choosing  $E'$  rather than  $E$  in figure 2(b)). More generally, the funding institution cannot obtain that the MFI chooses a point in the northwest direction from the curve representing  $G$  because, by definition of  $G$ , there will always exist a point in  $G$  with an identical  $\bar{\theta}$  that will be preferred by the MFI.

Therefore, the funding institution cannot do better than choosing between two options. He can obtain that the MFI chooses either  $\alpha^F$  without any effort (corresponding to point *C* in figure 2(b)) or  $\alpha_M$  with effort 1 (corresponding to point *D* in figure 2(b)). In the first case, the effort level is suboptimal; in the second case the fraction of richer borrowers is too high, indicating a stronger mission drift. The funding institution will choose from among these two contracts the one that minimizes his utility loss.

The model thus shows how mission drift is affected by the objectives of the funding institution and the MFI. As expected, a high share of richer borrowers can be explained by the preferences of the funding institution. If the funding institution puts a low weight on the pro-poor mission, then he can decide to push the MFIs to realize his preferred share of richer borrowers by asking for a sufficiently high refund so that effort alone is not enough for the MFI to generate the required revenue and she is pushed to serve a higher share of richer borrowers. In addition, moral hazard can have an additional (adverse) impact on

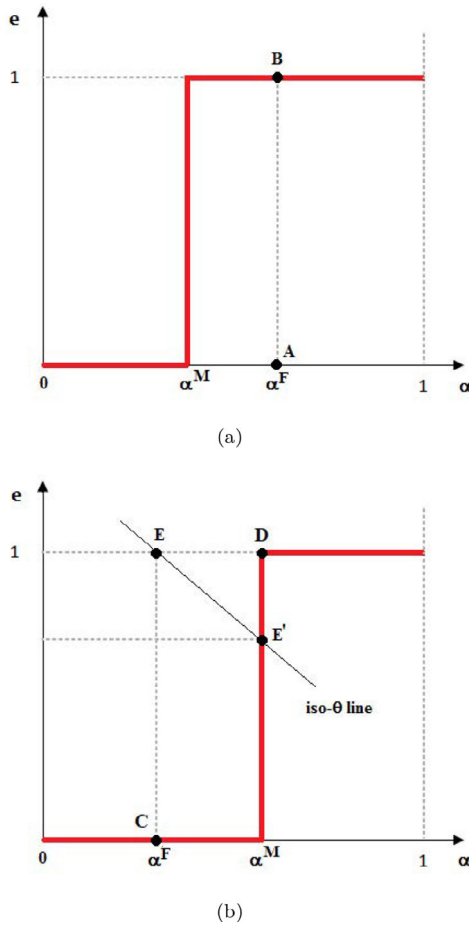


FIGURE 2 MFI's preferences and optimal contracts

the mission drift. This happens when the MFI puts a lower weight on the social mission than does the funding institution (as in the case illustrated in figure 2(b)). In this case, the funding institution cannot induce his preferred share of poorer borrowers and mission drift increases (as in point  $D$ ). Alternatively, the funding institution has to renounce inducing higher effort (as in point  $C$ ). This could also be interpreted as another source of mission drift in the sense that, for a given share of richer borrowers, the quality of the services provided by the MFI has to be degraded to satisfy the contract proposed by the funding institution.

The following corollary of proposition 1 provides a clearer representation of the effect of hidden action on mission drift, putting aside the negative effect on the provision of effort.

**COROLLARY.** *At the equilibrium, if the effort level is strictly positive, then  $\alpha = \max(\alpha_F, \alpha_M)$ .*

Because of the hidden action problem, whenever the effort is made by the MFI, the share of richer borrowers that is implemented is the highest between the two pivotal values  $\alpha_F$  and  $\alpha_M$ . When  $\alpha_F < \alpha_M$ , the funding institution is constrained to propose a contract which allows the MFI to choose its pivotal level of richer borrowers,  $\alpha_M$ . Otherwise, the MFI will

not provide the appropriate level of effort. When  $\alpha_M < \alpha_F$ , the funding institution designs a contract with a required refund such that the MFI chooses  $\alpha_F$ .

In order to obtain our results, we have assumed that  $\varepsilon$  is distributed uniformly with  $\bar{\varepsilon} < (R_R - R_P)/2$ . Actually, we need only to assume that  $\forall t \in [-\bar{\varepsilon}, \bar{\varepsilon}]$ ,  $F(t - \bar{\varepsilon})/(2\bar{\varepsilon}) \geq \alpha_F(t - \bar{\varepsilon})$ , which is a less-requiring assumption. In addition, even if this condition on  $\varepsilon$  and  $F$  were not satisfied, this would not affect the driving forces of proposition 1. The funding institution can always obtain that the MFI makes no effort and choose a specific  $\alpha$ , but he cannot force the MFI to choose a pair  $(\alpha, e)$  on the northwest of the curve  $G$  because the MFI can always profitably substitute an element of  $G$  to such a pair. Therefore, when  $\alpha_M > \alpha_F$ , the funding institution must accept the choice of a higher  $\alpha$  if he wants to obtain that the MFI chooses  $e = 1$ . More specific distributions of  $\varepsilon$  may be obtained at a higher cost for the funding institution and with a potential positive probability of MFI's bankruptcy, but the qualitative results would remain unchanged.

To derive some practical implications from the model, it is important to note that hidden action is related to the unobservability of effort. In practice, this problem is more relevant when the market is less transparent and the information on the functioning of MFIs is hard to gather. For instance, the report *Microfinance in Africa* (United Nations OSAA and NEPAD 2013) mentions that a widespread weakness of African microfinance is the prevalence of governance problems coupled with the diffusion of informal enterprises with scarce access to reliable information. In these countries, governments and development institutions should thus probably concentrate their efforts on increasing transparency and support MFIs to improve governance. In addition, we have shown that the distortions are driven from the weak pro-poor orientation of MFIs. In a context in which many MFIs are profit-oriented, as is the case in many Latin American countries, the presence of hidden action is more likely to worsen the mission drift. But things should be different in Asian countries such as India and Pakistan, which have a traditional focus on the social mission (see Bedson 2009). This is not to say that moral hazard cannot occur in pro-poor MFIs, but in our framework, we show that, in this case, it is easier for the funding institutions to obtain the desired levels of effort and redistribution through second-best contracting with the MFIs.

## 5. Conclusion

The present paper contributes to the debate on the recent evolution of the microfinance sector, fuelled by the explosion of for-profit and profit-oriented MFIs and by a change in the nature of some external funding institutions (private vs. public). The entry of new market players raises the fear for a deviation from the social mission, the so-called mission drift. We build a model in which we analyze the relationship between funding institutions and MFIs, assuming that both are pro-poor. Assuming that the effort to screen valuable investment projects is costly, incentives have to be provided to the MFI by the funding institution to exert the right effort level and to choose the desired share of poorer borrowers. We show that, in this context, asymmetric information can reduce the share of poorer borrowers reached by loans, thus increasing the mission drift.

In further research, it could be interesting to enrich the analysis to take into account the possible effects of competition among MFIs or among funding institutions. In asymmetric information contexts, competition is not necessary welfare enhancing and could either improve or exacerbate the distortions related to moral hazard. In addition, MFIs' heterogeneity could be added to the picture, analyzing how screening among different types of MFIs could impact the provision of screening effort and the social performance of the microcredit industry.

## Appendix: Proof of proposition 1

We first prove that, if the funding institution proposes the suggested contract, the MFI accepts it and chooses the pair  $(\alpha, e)$  mentioned in proposition 1. Then, we will show that the funding institution cannot obtain a preferred outcome to the one mentioned in proposition 1 with a different contract. We consider separately the four cases.

### Case 1. $\Delta R \leq \mu$

The proposed contract is  $(\hat{e}, T(\theta)) = (0, \theta)$  when  $\theta \geq \theta(\alpha_F, 0, -\bar{\varepsilon})$ , and  $(0, \theta(\alpha_F, 0, -\bar{\varepsilon}))$  otherwise.

Because  $\hat{e} = 0$ , the effort choice is constrained. Now, choosing  $(\alpha, 0)$  with  $\alpha > \alpha_F$  is not an interesting option because such a choice is strictly dominated by a choice  $(\alpha_F, 0)$ . Therefore, the only *deviation* that we need to consider is the choice of an  $\alpha < \alpha_F$ .

Suppose that the MFI chooses  $\alpha < \alpha_F$ . If  $\alpha < \alpha_F - (2\bar{\varepsilon})/(R_R - R_P)$ , with probability 1,  $\theta < \theta(\alpha_F, 0, -\bar{\varepsilon})$  and the MFI will obtain at most  $-B_M + \beta < 0$ . Therefore, the MFI will not make such a choice. Now, let us consider a choice of  $\alpha \in (\alpha_F - (2\bar{\varepsilon})/(R_R - R_P), \alpha_F)$ . The expected utility of the MFI with such a choice is

$$\beta(1 - \alpha^2) - B_M \frac{(\alpha_F - \alpha)(R_R - R_P)}{2\bar{\varepsilon}}, \quad (\text{A1})$$

while, if she chooses  $(\alpha_F, 0)$ , she obtains

$$\beta(1 - \alpha_F^2). \quad (\text{A2})$$

The difference between the two is

$$K_1 = \beta(\alpha_F^2 - \alpha^2) - B_M \frac{(\alpha_F - \alpha)(R_R - R_P)}{2\bar{\varepsilon}}, \quad (\text{A3})$$

which is equivalent to

$$(\alpha_F - \alpha) \left( \beta(\alpha_F + \alpha) - B_M \frac{(R_R - R_P)}{2\bar{\varepsilon}} \right) \quad (\text{A4})$$

because  $\alpha < \alpha_F$ ,  $K_1$  has the same sign as

$$\beta(\alpha_F + \alpha) - B_M \frac{(R_R - R_P)}{2\bar{\varepsilon}}. \quad (\text{A5})$$

Because  $(R_R - R_P)/(2\bar{\varepsilon}) \geq 1$  (see the assumption made before equation (1)),  $B_M \geq 2\beta$  (see the last paragraph of section 3),  $\alpha \leq 1$  and  $\alpha_F \leq 1$ ,  $K_1 \leq 0$ . Therefore, the *deviation* is not profitable.  $(\alpha_F, 0)$  is a best reply of the MFI to the contract proposed by the funding institution.

### Case 2. $\Delta R > \mu$ and $\lambda < \frac{\Delta R}{\mu} \beta$

The funding institution proposes a contract  $(\hat{e}, T(\theta)) = (1, \theta - \mu)$  when  $\theta \geq \theta(\alpha^F, 1, -\bar{\varepsilon})$ , and  $(1, \theta(\alpha^F, 1, -\bar{\varepsilon}))$  otherwise. Is  $(\alpha_F, 1)$  a best reply for the funding institution?

We can first rule out the choice of a pair  $(\alpha, e)$  such that  $\alpha(R_R - R_P) + R_P + \Delta R e + 2\bar{\varepsilon} \leq \alpha_F(R_R - R_P) + R_P + \Delta R$  because, with such a pair, the MFI will obtain at most  $-B_M + \beta < 0$  with probability 1. We can also rule out the choice of a pair  $(\alpha, e)$  such that  $\alpha(R_R - R_P) + R_P + \Delta R e > \alpha_F(R_R - R_P) + R_P + \Delta R - 2\bar{\varepsilon}$  because such a choice would be strictly dominated by a choice of  $(\alpha - \delta, e)$  with  $\delta$  arbitrarily small and strictly positive (if  $\alpha > 0$ ) or the choice of  $(\alpha, e - \delta)$  with  $\delta$  arbitrarily small and strictly positive (if  $e > 0$ ).

Now, the expected utility of the MFI with a pair  $(\alpha, e)$  such that  $\alpha(R_R - R_P) + R_P + \Delta R e + 2\bar{\varepsilon} > \alpha_F(R_R - R_P) + R_P + \Delta R \geq \alpha(R_R - R_P) + R_P + \Delta R e - 2\bar{\varepsilon}$  is

$$\beta(1 - \alpha^2) + \mu(1 - e) - B_M \frac{(\alpha_F - \alpha)(R_R - R_P) + \Delta R(1 - e)}{2\bar{\varepsilon}}, \quad (\text{A6})$$

while, if she chooses  $(\alpha_F, 1)$ , she obtains

$$\beta(1 - \alpha_F^2). \quad (\text{A7})$$

The difference between these two is

$$K_2 = \beta(\alpha_F^2 - \alpha^2) + \mu(1 - e) - B_M \frac{(\alpha_F - \alpha)(R_R - R_P) + \Delta R(1 - e)}{2\bar{\varepsilon}}. \quad (\text{A8})$$

Let us observe that

$$K_2 = K_1 + (1 - e) \left( \mu - B_M \frac{\Delta R}{2\bar{\varepsilon}} \right). \quad (\text{A9})$$

We know that  $(R_R - R_P)/2 > \bar{\varepsilon}$  and  $\beta > ((R_R - R_P)\Delta R)/(2\mu)$  (see the assumptions made before equation (1) and at the end of section 3) so that  $\beta > (\Delta R\bar{\varepsilon})/\mu$ . Besides, we are in the case  $\Delta R > \mu$ , this implies that  $\beta > \bar{\varepsilon}$ .

Now we also know that  $B_M > 2\beta$  (see the last paragraph of section 3). This implies  $B_M > 2\bar{\varepsilon}$  and  $B_M/(2\bar{\varepsilon}) > 1$ . We use again the fact that  $\Delta R > \mu$  to obtain  $(B_M\Delta R)/(2\bar{\varepsilon}) > \mu$  and  $\mu - (B_M\Delta R)/(2\bar{\varepsilon}) < 0$ . Therefore,  $K_2 < K_1 \leq 0$ , the *deviation* is not profitable and  $(\alpha_F, 1)$  is a best reply for the funding institution.

**Case 3.**  $\mu < \Delta R < (\alpha^M - \alpha^F)(\lambda(\alpha^M + \alpha^F) - (R_R - R_P)) + \mu$  and  $\lambda \geq \frac{\Delta R}{\mu}\beta$  so that  $\alpha_M \geq \alpha_F$

The funding institution proposes a contract  $(\hat{e}, T(\theta)) = (0, \theta)$  when  $\theta \geq \theta(\alpha^F, 0, -\bar{\varepsilon})$ , and  $(0, \theta(\alpha^F, 0, 0))$  otherwise. We can apply exactly the same reasoning as in the first case ( $\Delta R \leq \mu$ ) to prove that  $(\alpha_F, 0)$  is the best choice for the MFI with this contract.

**Case 4.**  $\Delta R > (\alpha^M - \alpha^F)(\lambda(\alpha^M + \alpha^F) - (R_R - R_P)) + \mu$  and  $\lambda \geq \frac{\Delta R}{\mu}\beta$  so that  $\alpha_M \geq \alpha_F$ .

The funding institution proposes a contract  $(\hat{e}, T(\theta)) = (1, \theta - \mu)$  when  $\theta \geq \theta(\alpha^M, 1, -\bar{\varepsilon})$ , and  $(1, \theta(\alpha^M, 0, 0))$  otherwise. Is  $(\alpha_M, 1)$  a best reply for the funding institution?

Following the same reasoning as in case 2), we need to consider only possible deviations with  $(\alpha, e)$  such that  $\alpha(R_R - R_P) + R_P + \Delta R e + 2\bar{\varepsilon} > \alpha_M(R_R - R_P) + R_P + \Delta R \geq \alpha(R_R - R_P) + R_P + \Delta R e - 2\bar{\varepsilon}$ . With such a deviation, the expected utility of the MFI is

$$\beta(1 - \alpha^2) + \mu(1 - e) - B_M \frac{(\alpha_M - \alpha)(R_R - R_P) + \Delta R(1 - e)}{2\bar{\varepsilon}}, \quad (\text{A10})$$

while, if she chooses  $(\alpha_M, 1)$ , she obtains

$$\beta(1 - \alpha_M^2). \quad (\text{A11})$$

The difference between these two is

$$K_3 = \beta(\alpha_M^2 - \alpha^2) + \mu(1 - e) - B_M \frac{(\alpha_M - \alpha)(R_R - R_P) + \Delta R(1 - e)}{2\bar{\varepsilon}}. \quad (\text{A12})$$

$K_3$  is equivalent to  $K_2$  except that  $\alpha_M$  replaces  $\alpha_F$ . Therefore, we can apply exactly the same reasoning (that did not rely on the specific value of  $\alpha_F$ ) to prove that  $K_3 < 0$  and the *deviation* is not profitable.  $(\alpha_M, 1)$  is a best reply for the funding institution.



Now, is it possible for the funding institution to design a different contract and obtain a more favourable outcome?

This is obviously not possible in the first two cases because the MFI's decision coincides with the optimal choice for the funding institution. Besides, the funding institution obtains this result with the lowest possible cost because it covers only the MFI's costs.

Let us consider the last two cases with  $\alpha_M > \alpha_F$  and  $\Delta R > \mu$ .

The preferred choice for the funding institution is  $(\alpha_F, 1)$ . However, it is not possible to obtain that the MFI chooses  $(\alpha_F, 1)$ .  $\alpha_M > \alpha_F$ , therefore,  $g(\bar{\theta}(\alpha_F, 1)) = (\alpha_M, 1 - ((\alpha_M - \alpha_F)(R_R - R_P))/\Delta R)$  if  $1 - ((\alpha_M - \alpha_F)(R_R - R_P))/\Delta R \geq 0$ , and  $g(\bar{\theta}(\alpha_F, 1)) = (\alpha_F + \Delta R/(R_R - R_P), 0)$  otherwise. If the funding institution designs a contract in order to obtain  $(\alpha_F, 1)$ , the MFI will always choose  $g(\bar{\theta}(\alpha_F, 1))$  rather than  $(\alpha_F, 1)$ . Because  $g(\bar{\theta}(\alpha_F, 1))$  gives the same  $\bar{\theta}$ , the funding institution cannot distinguish a choice of  $(\alpha_F, 1)$  from a choice of  $g(\bar{\theta}(\alpha_F, 1))$ . Besides,  $g(\bar{\theta}(\alpha_F, 1))$  is preferred and less costly for the MFI.

More generally, it is not possible to obtain that the MFI chooses a pair  $(\alpha, e)$  if  $\exists \alpha' < \alpha$  such that  $(\alpha', e) \in G$  because, in that case, the MFI can always find a pair  $(\tilde{\alpha}, \tilde{e}) \in G$  such that  $\bar{\theta}(\tilde{\alpha}, \tilde{e}) = \bar{\theta}(\alpha, e)$  and  $\tilde{e} < e$  so that the MFI will choose  $(\tilde{\alpha}, \tilde{e})$  rather than  $(\alpha, e)$  for any contract proposed by the funding institution. This means that the MFI can obtain only that the MFI chooses an element of  $G$  or a pair  $(\alpha, e)$  such that  $\exists \alpha' > \alpha$  with  $(\alpha', e) \in G$ . This is equivalent to all the points on the curve representing  $G$  and the points at the southeast of this curve.

Besides, for any  $(\alpha, e) \in G$ ,  $(\alpha, e)$  is preferred to  $(\alpha', e)$  with  $\alpha' < \alpha$  by the funding institution. Therefore, among all the choices that the funding institution can obtain from the MFI, she will always prefer an element of  $G$ .

Now, among the elements of  $G$ , the funding institution has the following preferences.  $\forall \alpha \neq \alpha_F$ ,  $(\alpha_F, 0)$  is preferred to  $(\alpha, 0)$ ;  $\forall \alpha > \alpha_M$ ,  $(\alpha_M, 1)$  is preferred to  $(\alpha, 1)$ ; and  $\forall e < 1$ ,  $(\alpha_M, 1)$  is preferred to  $(\alpha_M, e)$ . Therefore, among all the elements of  $G$ , only two can be preferred by the funding institution:  $(\alpha_F, 0)$  and  $(\alpha_M, 1)$ .  $(\alpha_F, 0)$  is preferred to  $(\alpha_M, 1)$  if and only if

$$\lambda(1 - \alpha_F^2) + \alpha_F(R_R - R_P) + R_P \geq \lambda(1 - \alpha_M^2) + \alpha_M(R_R - R_P) + R_P + \Delta R - \mu, \quad (\text{A13})$$

which is equivalent to

$$(\lambda(\alpha_M + \alpha_F) - (R_R - R_P))(\alpha_M + \alpha_F) + \mu \geq \Delta R. \quad (\text{A14})$$

This is precisely the case for which the funding institution obtains with the contract that the MFI chooses  $(\alpha_F, 0)$  at the lowest possible cost because she covers only the MFI's costs. Furthermore, in the others cases, when  $(\alpha_M, 1)$  is preferred, the funding institution obtains with the contract that the MFI chooses  $(\alpha_M, 1)$  at the lowest possible cost.

Now, is it possible for the funding institution to design a contract that would increase his utility by integrating a strictly positive probability of bankruptcy?

In the first two cases mentioned in proposition 1, the funding institution obtains his preferred choice at the lowest possible price. Therefore, we need to consider only this issue for the two last cases.

We showed in a previous paragraph that the funding institution cannot obtain that the MFI chooses a point that does not belong to the curve representing  $G$  and the points at the southeast of this curve. Even though we did not mention bankruptcy issues in this paragraph, all the arguments are still valid if we take into account a possible bankruptcy. Therefore, the funding institution cannot obtain that the MFI chooses a pair  $(\alpha, e)$  outside

of  $G$  and the southeast of  $G$ , even if the proposed contract and the best reply of the MFI induce a bankruptcy with a strictly positive probability.

Now, suppose that the funding institution designs a contract  $(T(\theta), \hat{e})$  and that the MFI best reply is to accept the offer and choose an  $(\tilde{\alpha}, \tilde{e})$  such that the probability of a bankruptcy is  $q > 0$ . The expected outcome of the funding institution is bounded as follows:

$$E(V(T(\theta), \hat{e}, \varepsilon) \leq E(\theta(\tilde{e}, \tilde{\alpha}, \varepsilon)) - \mu\hat{e} - 1 + \lambda(1 - \tilde{\alpha}^2) - qB_F. \quad (\text{A15})$$

We already showed that, if we restrict our attention to pairs  $(\tilde{\alpha}, \tilde{e})$  that belongs to  $G$  and the southeast of  $G$ , if  $\lambda\mu > \Delta R\beta$  and  $\Delta R > \mu$  (the conditions satisfied in cases 3 and 4 of proposition 1), the preferred pairs of the funding institution are  $(\alpha_F, 0)$  and  $(\alpha_M, 1)$ . Therefore, because the funding institution cannot obtain more from the MFI than all its monetary surplus, if  $\lambda\mu > \Delta R\beta$  and  $(\tilde{\alpha}, \tilde{e})$  belongs to  $G$  or the south-east of  $G$

$$\begin{aligned} E(\theta(\tilde{e}, \tilde{\alpha}, \varepsilon)) - \mu\hat{e} - 1 + \lambda(1 - \tilde{\alpha}^2) &\leq \max(E(\theta(0, \alpha_F, \varepsilon)) - 1 + \lambda(1 - \alpha_F^2), \\ E(\theta(1, \alpha_M, \varepsilon)) - \mu - 1 + \lambda(1 - \alpha_M^2)). \end{aligned} \quad (\text{A16})$$

The right term of this expression is precisely what the funding institution obtains with the contract introduced in proposition 1. Therefore, because  $qB_F > 0$ , equations (A15) and (A16) indicate that the funding institution would obtain a strictly lower utility with any contract that would induce a bankruptcy with a strictly positive probability (taking into account the best reply of the MFI) than what he obtains with the contract introduced in proposition 1.

Hence, the funding institution cannot improve his utility by proposing a contract such that the best reply of the MFI induces a bankruptcy with a strictly positive probability.  $\square$

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