Borrower targeting under microfinance: Competition with motivated microfinance institutions and strategic complementarity

Brishti Guha
Singapore Management University, bguha@smu.edu.sg

Prabal ROY CHOWDHURY
Indian Statistical Institute

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BORROWER TARGETING UNDER MICROFINANCE COMPETITION WITH MOTIVATED MICROFINANCE INSTITUTIONS AND STRATEGIC COMPLEMENTARITY

Brishti GUHA[1]* and Prabal Roy CHOWDHURY[2]

[1]*Singapore Management University, Singapore; and* [2]*Indian Statistical Institute, New Delhi, India*

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We examine how increased competition among motivated microfinance institutions (MFIs) impacts the poorest borrowers' access to microfinance. We find that competition depends on inequality, technology, and the possibility of double-dipping (borrowing from several sources). Without competition, even a motivated MFI may lend to the not-so-poor in preference to poor borrowers. If double-dipping is feasible, competition may encourage lending to the poor. The presence of double-dipping is critical for MFI competition to have a positive effect. When double-dipping is feasible, MFI coordination may worsen borrower targeting whenever inequality is intermediate. We discuss policy implications dealing with double-dipping, MFI coordination, and competition.

Keywords: Microfinance competition; Motivated MFIs; Inequality; Borrower targeting; Double-dipping; Coordination
JEL classification: D04, G21, L31, O16

I. INTRODUCTION

THE microfinance movement is growing at a dizzying pace. The number of the poorest microfinance clients worldwide increased from 7.6 million in 1997, to 66.6 million in 2004 (Daley-Harris 2005). In India, even in the aftermath of the global financial crisis, the number of outstanding accounts increased from 61.2 million in 2007–8 to 76.6 million in 2008–9 (Srinivasan 2009). In 2004–9, the average year-on-year increase in the portfolio of the Indian microfinance sector was 107% as compared with a mere 4% increase in commercial bank lending in 2008–9 (Parameshwar *et al*. 2009).

This rapid expansion has given rise to new issues and concerns. With increased microfinance penetration, many countries are witnessing an increase in *competition* among microfinance institutions (henceforth, MFIs), with many areas being

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* Corresponding author: Brishti Guha, Singapore Management University, 90 Stamford Road, Singapore 178903. Tel: (65)96357934; Email: brishtiguha@gmail.com

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served by multiple MFIs. In the context of Bangladesh, for example, the *Wall Street Journal* (November 27, 2001) reports that "Surveys have estimated that 23% to 43% of families borrowing from microlenders in Tangail borrow from more than one."[1] In India, the southern states are witnessing lots of competition among MFIs, with reports of increasing MFI competition in the North and the East as well (Srinivasan 2009).

This increase in competition can be problematic on several grounds. One of the central concerns, and the one we focus on in this paper, relates to the impact of increased competition on borrower targeting. For example, Olivares-Polanco (2005) finds that competition worsens poverty outreach in a cross-sectional study of 28 Latin American MFIs. Rhyne and Christen (1999) also report that increased MFI competition has worsened outreach. They mention that, typically, while the poorest clients would need loans of $300, Paraguayan microfinanciers were lending $1,200 and targeting the not-so-poor. Out of a sample of 17 Latin American MFIs, only two served very poor clients.[2] On the other hand, Nagarajan (2003) finds that the increase in competition between MFIs in Central Asian and Eastern European countries has actually improved targeting of the poor, particularly in Bosnia and Herzegovina. She mentions that the increase in competition in Bosnia spurred two major MFIs, Prizma and Mikra, to move "down market" and specialize in very poor rural clients. While the empirical evidence is mixed, it does suggest that competition may negatively impact borrower targeting in some cases.

Another area of concern is the presence of double-dipping, that is, borrowers taking loans from several MFIs. A survey by the Grameen Koota staff, covering 200 borrowers (including 105 defaulters), suggests that 25% of these borrowers had taken loans from six or more MFIs. In another extreme example, one woman was found to have borrowed Rs. 4 million from different MFIs (Srinivasan 2009). Other empirical studies (e.g., McIntosh, de Janvry, and Sadoulet 2005) confirm the importance of double-dipping. Multiple lending can weaken repayment discipline, with borrowers using loans from one MFI to repay another (see, e.g., Srinivasan 2009). Here we examine a somewhat less obvious implication of double-dipping, namely its effect on borrower targeting.[3]

[1] McIntosh and Wydick (2005) provide evidence of increased MFI competition from Uganda and Kenya in East Africa, and Guatemala, El Salvador, and Nicaragua in Central America.

[2] Kai (2009) conducts a panel study on 450 motivated MFIs in 71 countries, and finds that competition worsens outreach. However, he does not, of course, control for variables like inequality and technology.

[3] Traditionally an increase in MFI competition is presumed to increase overall borrower indebtedness, usually through double-dipping (as in McIntosh and Wydick [2005], where competition without information sharing raises indebtedness). In our model, however, competition does not increase the overall funds available to borrowers (it merely induces the donor to split his funds among a greater number of competing MFIs); therefore, though we consider double-dipping,

In this paper we examine the effects of increased competition among motivated MFIs, focusing on the implications for borrower targeting. We find that this depends in a subtle way on the interaction of several factors, that is, borrower inequality, the nature of the technology, and the possibility of double-dipping. We analyze this issue in a very simple framework that nevertheless has several practical aspects, including the MFIs being motivated as well as informed (regarding borrower characteristics), and the possibility of double-dipping.

We model MFIs as motivated agents[4] that maximize the aggregate utility of borrowers. That many NGOs (including MFIs) are motivated is well known in the literature. The United Nations Interagency Committee on Integrated Rural Development for Asia and the Pacific (United Nations 1992) (henceforth, UNICIRDAP), for example, defines NGOs as organizations with six key features: they are voluntary, nonprofit, service and development oriented, autonomous, highly motivated and committed, and operate under some form of formal registration.[5] Thus our approach is complementary to McIntosh and Wydick (2005) and Navajas, Conning, and Gonzalez-Vega (2003) where the MFIs are taken to be largely client-maximizing.

In our framework, the MFIs also have greater information regarding the borrowers, in particular their income levels. This is because of the closeness of MFIs to their clientele, something that donors, including the government, may not have. In fact, one of the central themes of the microfinance literature on peer monitoring, as well as assortative matching, is that MFIs have greater information as compared to formal sector lenders (see, e.g., Banerjee, Besley, and Guinnane 1994; Ghatak 1999, 2000; Ghatak and Guinnane 1999; Roy Chowdhury 2005, 2007; Tassel 1999).

We consider a framework with two kinds of borrowers, poor and not-so-poor, with the poor having no savings, and the not-so-poor (henceforth, rich for expositional reasons) having positive savings of w. All borrowers have access to a project requiring start-up capital of one unit to run it at an efficient level. Since none of the borrowers have that much capital, they have to borrow the shortfall from MFIs. The MFIs, in turn, access the money from donors, who decide how much to advance to each MFI, as well as the interest rate to be charged to

competition need not increase indebtedness. Interestingly enough, McIntosh, de Janvry, and Sadoulet (2005) find no effect of competition on average loan size, in spite of multiple loan taking. Similarly, Parameshwar *et al.* (2009) finds that incidents of over-indebtedness and default have affected less than 5% of the Indian microfinance sector's portfolio.

4 According to Besley and Ghatak (2005) motivated agents are those "who pursue goals because they perceive intrinsic benefits from doing so." They provide examples of such agents that include doctors, researchers, judges, and soldiers.

5 UNICIRDAP (1992) also says that "the rural poor are given higher priority by NGOs" (p. 20) as compared to governments.

borrowers. We consider two scenarios, one without competition, where there is a single MFI accessing one unit of capital from the donor. The other scenario involves competition among the MFIs, with competition being modeled as two MFIs receiving half units of capital each.[6]

One of our central results is that while, in the absence of competition, even a motivated MFI may prefer to lend to the "rich" in preference to poor borrowers, in the presence of double-dipping, competition may, in fact, improve targeting and encourage lending to the poor. Even more interestingly, the presence of double-dipping is critical for MFI competition to have such a positive effect.

The intuitions behind these results are as follows. In the absence of competition, a microfinance lender is more likely to lend to a rich borrower when inequality is small, that is, the rich are not very rich. There are mainly two effects at play here. On the one hand, since the rich borrowers have an outside option, this tends to make the *net* increase in utility higher in case the loan goes to a poor borrower. On the other hand, if the rich really only have a small amount of wealth, their outside option may simply be to let their wealth lie idle, making lending to a rich borrower more attractive. Further, a rich borrower has less to repay. The result follows since the last two effects dominate when inequality is small.

With MFI competition, lending to the poor may, however, happen in equilibrium even when inequality is small. This result is driven by two factors, the convexity of the production function and the fact that under competition the MFIs act independently. With a convex production function, efficiency demands that the projects are operated at the maximal scale. In the presence of double-dipping, this can be achieved if a poor borrower receives more than one loan, so that there is an equilibrium where more than one MFI lends to the same poor borrower knowing that in equilibrium this borrower is getting another loan from another MFI. In the absence of double-dipping, however, a borrower can receive at most half a unit of capital each, so that projects cannot be run at an efficient level by poor borrowers. Now convexity dictates that the loan goes to a rich borrower, since he or she already has some capital to begin with and the marginal welfare impact would be greater in that case.

We further show that with double-dipping, there may be other equilibria where the loans go to the rich. Interestingly, these equilibria are qualitatively different for different ranges of inequality. Whenever inequality is either small, or large but not too large, the MFIs themselves prefer that the rich double-dip and for these parameter ranges the equilibria necessarily involves double-dipping. For other ranges of inequality, however, the MFIs prefer that there be no double-dipping. In

[6] The idea is that MFIs are competing for limited donor funds. However, we perform a robustness check where aggregate funding from donors does increase, albeit not proportionately, with an increase in the number of competing MFIs.

this case the equilibria involve randomization across borrowers, and *ex post* the outcome may, or may not involve double-dipping.

We then discuss the implications of these results in somewhat greater detail. First, these show that one possible negative implication of MFI competition, both with and without double-dipping, is a negative impact on borrower targeting. This adds to the literature that identifies other negative implications of MFI competition, for example, a decrease in the ability to cross-subsidize the poor (McIntosh and Wydick 2005), mission drift (Aldashev and Verdier 2010), and lessening of information flows (Hoff and Stiglitz 1998).

This result is in line with evidence that MFIs often target those with a small, but positive level of wealth, rather than the poorest of the poor. Morduch (1999) and Rabbani, Prakash, and Sulaiman (2006), for example, emphasize the difficulty that the ultra-poor face in accessing microfinance. Rahman (2003) provides data that less than 49% of microfinance clients in Bangladesh are actually very poor.[7] According to Nagarajan (2003), out of over 100 NGO MFIs in the region of Central Asia, less than 12% actually targeted the poorest[8,9] (see Hermes and Lensink [2011] for a further discussion of the impact of microfinance on the poor).

Mallick and Nabin (2010) find that Bangladeshi MFIs, despite their interest in poverty alleviation, do not locate in the poorest areas because of considerations about physical infrastructure and operational costs. This is also compatible with our model, which is partly motivated by the fact that the poorest borrowers are, indeed, underserved by MFIs. As we show, this can happen either when rich borrowers are actually relatively poor, or when MFIs proliferate in number (and especially if the MFIs either share information, so as to coordinate strategies, or if double-dipping is discouraged). Among the factors discussed by Mallick and Nabin are the higher risk of lending to very poor borrowers, and the higher operational costs of doing so given that such borrowers usually take very small loans. We have focused on yet another channel—MFI's concern that their borrowers be able to reap economies of scale. While Mallick and Nabin's focus is on explaining MFI location, we take location as given and look at targeting decisions between poor and not-so-poor borrowers at a given location.

Further, in the present paper, the intuition behind such targeting relies on the interaction between several factors, that is, the MFIs being motivated, the presence

7 Defined as below the poverty line.

8 In fact, the Indian MFI Bandhan has a special program to target the ultra poor. Arguably the need for such programs suggests that the very poor do not generally get access to microfinance—an impression confirmed by Basu and Srivastava (2005) who find that outreach of Indian MFIs has remained modest in terms of the proportion of very poor households reached.

9 The report by Parameshwar *et al*. (2009) on Indian microfinance confirms that microfinance is still not serving most of those below the poverty line. Interestingly enough, the poorest states are also underserved by MFIs.

of double-dipping, and the nature of the technology. Thus our explanation is somewhat different from that in the literature, which relies on the very poor being more of a credit-risk, or on MFIs suffering from mission-drift. Aubert, de Janvry, and Sadoulet (2009), for example, discuss mission drift among "pro-poor" MFIs. However, in their model, unlike ours, this occurs due to the actions of "credit agents" who are not themselves motivated.

Second, MFI competition need not necessarily have a negative impact on borrower targeting. In fact, in the presence of double-dipping, and in the absence of MFI coordination, competition may have a positive impact on borrower targeting. Given that the literature generally views double-dipping as something of a problem (and seeks to improve MFI coordination as a response to this issue), this result identifies a potentially positive aspect of double-dipping, and a potentially negative effect of MFI coordination.

Third, as mentioned above, one of the responses to double-dipping has been to argue for greater coordination among the MFIs. In the Indian context, for example, Srinivasan (2009) argues in favor of such coordination.[10] We examine the implications of such coordination, in a scenario where information sharing does not occur, finding that the results are quite nuanced. Whenever borrower inequality is low, or at an intermediate level, we find that MFIs will coordinate on an equilibrium that involves targeting the rich. Thus competition with double-dipping and coordination definitely negatively impacts borrower targeting whenever the inequality is at an intermediate level. For other ranges of inequality though, there is coordination in relation to the poor borrower, so that the outcome is the same as that as in the absence of competition.

Another broad conclusion emerging out of the analysis is that the effect of competition on targeting seems to worsen with inequality, although for small levels of inequality, competition can actually improve targeting of the poor whenever double-dipping is possible. Thus one of the main contributions of this paper is to highlight the importance of inequality, as well as the nature of technology, for analyzing MFI competition.

In this context it is of interest to revisit the studies by Morduch (1999), Rabbani, Prakash, and Sulaiman (2006), Rahman (2003), and Nagarajan (2003), discussed earlier. Although none of these studies mention inequality (or technology) as possible explanatory variables, we observe that Bosnia and Herzegovina—for which Nagarajan (2003) found that competition improves targeting—has a low Gini coefficient of 26, while Latin American countries, for which others have found that competition has a negative impact on targeting, have very high Gini

[10] In Kolar district of Karnataka, India, for example, Srinivasan (2009) shows that such increased coordination has followed increased competition and default by borrowers.

coefficients (e.g., 58.4 for Paraguay and 60 for Bolivia).[11] It is clear that these facts are consistent with our results on how inequality enters into the relationship between competition and targeting, Although we do not claim that ours is the only explanation for these mixed empirical findings.

We then briefly relate our paper to the small but growing theoretical literature on MFI/NGO competition. Aldashev and Verdier (2010) examine a model of NGO competition, where the NGOs allocate their time between working on the project and fundraising. Interestingly, they find that if market size is fixed and there is free entry of NGOs, the equilibrium number of NGOs can be larger or smaller than that which is socially optimal. While such mission drift is of undoubted interest, for the sake of focus in our paper we abstract from the issue of endogenous allocation of funds, assuming instead that competition simply reduces the amounts available to all MFIs.

McIntosh and Wydick (2005), as well as Navajas, Conning, and Gonzalez-Vega (2003), have a model where a client-maximizing incumbent MFI competes with a profit-oriented entrant.[12] McIntosh and Wydick (2005) show that nonprofit MFIs cross-subsidize within their pool of borrowers. Thus when competition eliminates rents on profitable borrowers, it is likely to yield a new equilibrium in which poor borrowers are worse off. Our paper, however, differs from both these papers in several respects. Not only do we abstract from the issue of cross-subsidization,[13] we focus on a scenario where the MFIs are motivated. While the issue of client-maximizing MFIs is of undoubted interest, we believe that our focus in this paper is justified by the increase in number of socially motivated MFIs, for instance in countries like Bangladesh and India (Harper [2005] documents the fast growth of such "Grameen replicators" in India). We demonstrate that even if *both* competing MFIs are motivated, competition will still have significant effects.

Guha and Roy Chowdhury (2013) uses a Salop circular model to analyze competition between MFIs for clients, in particular evaluating the impact on default, interest rates, and borrower welfare, in a framework where MFIs care both about borrower welfare and profits. The present paper, in contrast, is focused specifically on the impact on borrower targeting, and models competition for donor funds, rather than competition for clients.

The rest of the paper is organized as follows. Section II sets up the economic framework, while Section III considers the case with a single MFI. Sections IV and

[11] Gini coefficient data are from the *Human Development Report 2007–2008* (UNDP 2007).

[12] In a related paper, Hoff and Stiglitz (1998) examine a model where there is competition between *informal moneylenders*, and examine the effect of credit subsidy on the outcome. They show that subsidy may trigger entry, which in turn may worsen repayment performance because of scale effects, lower information flows, etc.

[13] However, in our robustness section we briefly discuss changes in our results in case cross-subsidization was feasible.

V examine the effect of MFI competition in the presence of double-dipping, whereas Section VI looks at MFI competition in the absence of double-dipping. Section VII discusses the inefficiencies inherent in the system, while Section VIII pertains to robustness issues.

II. THE FRAMEWORK

The framework comprises three classes of agents: borrowers, one or more MFIs, and a donor. The borrowers are of two types: poor and rich. Poor borrowers have no wealth, whereas rich borrowers have a positive wealth level of w. While there are other, richer borrowers, neither the MFIs, nor the donor, all of whom are motivated, are interested in lending to them. Therefore, these borrowers are not part of our framework. We formalize the fact that the rich are really not-so-poor by assuming that w is small, to be precise $0 < w < 1/2$. Further, all borrowers are risk neutral.

All borrowers have access to one project each, where the project size is endogenous and depends on the scale of investment I, where I takes values in [0,1]. We will consider a project technology with both a linear and a convex component, so that an investment of I in the project yields a gross return of $f(I) = xI + yI^2$. The convexity of the technology captures the fact that with greater investment, more capital can be injected into the project so that complementarities among the various components leads to a more than proportionate increase in output.[14] Thus we interpret an increase in the convexity of the technology, modeled as an increase in y with an equal decrease in x, as a shift to more capital-intensive technologies. We shall maintain the following assumption throughout the analysis.

ASSUMPTION 1. (a) $x + y > 1$, (b) $0 < x < 1$, and (c) $y > 2(1 - x)$.

Assumption 1(a) guarantees that the efficient outcome (assuming an interest rate of zero for investment) involves implementing a project of size 1.[15] Assumptions 1(b) and 1(c) jointly guarantee that there is a threshold level of wealth w^*, $0 < w^* < 1/2$, such that in the absence of a loan, a rich borrower invests in the project provided $w > w^*$. Otherwise he simply lets his wealth w lie idle.

To see this, let w^* satisfy $f(w^*) = w^*$. Notice that $f(0) = 0$; given the convexity of $f(.)$, the existence of a nontrivial fixed point is guaranteed if $\lim_{w \to 0} f'(w) < 1$, which is equivalent to the requirement that the $f(.)$ function increase less steeply in w relative to the 45 degree line, for small enough w. Fortunately, this is already guaranteed by Assumption 1(b), since we have $\lim_{w \to 0} f'(w) = x < 1$ as $0 < x < 1$ by

[14] Sen (1962) also examines the issue of choice of techniques, although in a different context.

[15] This follows since the net project return, $yI^2 + xI - I$ is convex, decreasing at $I = 0$, and is increasing and positive at $I = 1$.

this part of the assumption. Solving the equation $f(w^*) = w^*$, we obtain $w^* = (1 - x)/y$. Note that assumption 1(b) guarantees $w^* > 0$, while assumption 1(c) guarantees $w^* < 1/2$.

The intuition for why the rich borrower's strategy changes at $w = w^*$ is the following. The production technology exhibits non-convexities, so that if only a very small amount can be invested, the returns are not enough to justify the investment. If the project is self-financed, therefore, and the rich borrower actually has very low wealth of his or her own, investment in the project is not worthwhile. This changes above the threshold w^* when the rich borrower can invest in a self-financed project.

Banerjee and Duflo (2005), in fact, show that in order to explain empirical findings on rates of returns and firm sizes in developing countries, it is necessary to assume that the production function has non-convexities and therefore displays increasing returns to scale over some range. (They show that otherwise, there would be a very large number of very small firms, and small firms would have implausibly high returns, which is not the case; moreover, a model with non-convexities is also better able to account for productivity differences between developing and developed country firms). Some possible reasons for non-convexities discussed by Banerjee and Duflo are as follows.

(1) At very small levels of investment, the entrepreneur is constrained to use inefficient techniques because he or she cannot afford good technologies. As investment in a project increases, the entrepreneurs become able to upgrade to better technologies, resulting in a jump in the rate of return.
(2) Suppose the investment involves human capital. Then, it is well established that net returns do not begin to set in until a certain threshold level of education has been reached.
(3) Machines and equipment require a fixed cost.[16]

Given the project technology, even rich borrowers cannot implement a project without borrowing, although they can undertake a less efficient project at scale w. The poor cannot implement any kind of project unless they get a loan, as they have no personal wealth. Thus borrowers must approach MFIs for a loan.

There are one or more MFIs, which are motivated nonprofit organizations. The fact that they are motivated is reflected in (i) they only care about the poor and the not-so-poor, and not about the richer borrowers, and (ii) their objective is to maximize the aggregate expected utility of the poor and the not-so-poor borrowers. Recall from the introduction, that in this respect the present paper differs from

[16] Since the assumption of a fixed cost is more common than the technology we have modeled, we have also worked out the implications of our model under a traditional fixed cost (and constant returns to investment beyond this fixed cost). This is discussed in the section on robustness.

McIntosh and Wydick (2005), as well as Navajas, Conning, and Gonzalez-Vega (2003), who assume client-maximizing MFIs.

The MFIs, however, have no funds of their own, and obtain funding from a donor. The donor maximizes a weighted sum of aggregate utility of the poor, and not-so-poor. We formalize this by assuming that the donor has a weight of 1 on the aggregate utility of the rich, and a weight of p on the aggregate utility of the poor. We assume that $p \geq 1$, so as to capture the fact that the donor may be more pro-poor compared to the MFI. This, for example, may make sense in the current Indian context whenever the donor is the government, given the government's emphasis on inclusive growth. This may also be true for foreign donors; according to Aubert, de Janvry, and Sadoulet (2009), bilateral donors like USAID have become increasingly concerned about MFIs' "mission drift," leading to the US Congress passing the *Microenterprises Self-Reliance Act* in 2000, which required half of all USAID microenterprise funds to benefit the very poor.

The donor selects the interest rate r, where r is the gross interest (inclusive of the principal). For instance, when the donor is the government, it may realistically set the interest rate. However, as we discuss in a later section, our results are robust to the case where MFIs have the freedom to influence the rate of interest. We assume that the donor faces an interest rate of zero, so that we must have $r \geq 1$. In order to focus on the interesting case where the efficient scale is potentially implementable, we also assume that $r \leq x + y$. The donor has funds of 1, which it gives to the MFI(s).

The MFI(s) then choose a borrower to lend the amount they have accessed from the donor. We assume that the MFIs observe borrower type and know who is poor, and who is not—a realistic assumption given that microfinance lenders operate at a grass-roots level and have extensive knowledge of their clients' living conditions. Moreover, the donor does not know the borrower type and hence cannot directly ensure whether the MFI lends to the poor, or not. Moreover, this information regarding the identity of the borrowers is soft, so that the donor cannot condition the contracts on the identity of the borrowers. Further, it is prohibitively costly for the donor to lend the money directly to the borrowers, so that it must rely on the MFIs as intermediaries in this process.

III. A SINGLE MFI

We begin by considering the baseline model where there is a single MFI. In this case the donor gives the whole of the one unit capital to this MFI, which then selects whether to lend this amount to a rich, or a poor borrower.

As the MFI is motivated, its objective is to maximize the aggregate utility of the borrowers through its loan. Which type of borrower will it target? It turns out that this is influenced by the level of inequality and also by the extent of convexity of the production technology.

Begin by considering a loan to a poor borrower. Note that a poor borrower's outside option without a loan is 0 as he or she has no wealth. Therefore the net (utility) surplus generated by lending 1 unit to a poor borrower is

$$S(P) = x + y - r > 0. \tag{1}$$

Next consider a loan to a rich borrower. Recall that a rich borrower's outside option is $f(w)$ if $w > w^*$, otherwise it is w. In either event, as the rich borrower already has a wealth of w, if the MFI lends to him or her it only needs to loan $1 - w$. If the MFI lent more than this, some of the rich borrower's wealth would be un-utilized, which would be inefficient. Thus the MFI lends $1 - w$: we assume that the unused part of the MFI's fund is remitted back to the donor. This is an innocuous assumption once we realize that in reality a MFI divides its funds among a huge number of borrowers instead of just having enough funds for one client. In that context, our assumption would be equivalent to ruling out complications caused by integer constraints.[17]

Thus the surplus generated by lending to a rich borrower is

$$\begin{aligned} S(R) &= x + y - yw^2 - xw - r(1-w), \forall w > w^*, \\ &= y + x - w - r(1-w), \forall w < w^*. \end{aligned} \tag{2}$$

Now if $w < w^*$, we have

$$S(R) = S(P) + w(r-1) \geq S(P), (\text{given } r \geq 1). \tag{3}$$

Thus, if w is low enough, that is, the "rich" borrowers are not too rich, then even a so-called motivated MFI may prefer to target the not-so-poor, rather than the poor.[18] The intuition is that if the rich borrower's own wealth is small enough, implementing a project in the absence of a loan may not be an option for him or her, as he or she loses economies of scale. Given that his or her outside option is not very large, the surplus the loan provided is significant, especially as the borrower only has to pay back interest on $1 - w$, instead of interest on the whole 1 unit in cases where the loan was made to a poor borrower.

What if $w > w^*$? This corresponds to a case where even the not-so-poor have a significant amount of wealth, so that intra-poor inequality is large. In this case, we have

[17] In the robustness section, we discuss what happens to our results if we explicitly allow the unused amount, w, to be lent out to a poor borrower instead of being remitted back to the donor.

[18] Of course, the MFI puts equal weight on the poor, and the not-so-poor. However, qualitatively similar results should go through whenever the weight put by the MFIs on the poor is greater than that on the not-so-poor.

$$S(R) = S(P) - w(yw + x - r). \tag{4}$$

Here, the optimal targeting policy depends on the level of r. If the interest rate is not too large, so that $r < yw + x$, the motivated MFI would lend to the poor borrower. The fact that the rich borrower can implement a project of size w even without a loan, while a poor borrower cannot, tends to increase the surplus from lending to a poor borrower, while the fact that the rich borrower only has to pay back interest on $1 - w$ instead of 1 tends to raise the surplus from lending to a rich borrower. The first factor dominates unless r is very large. However, if the interest rate is very high, so that $r > yw + x$, the motivated MFI would lend to the rich borrower instead.

We then examine if the nature of the technology, in particular the convexity of $f(I)$ affects the analysis. An increase in convexity is modeled as an increase in y, balanced by an equal decrease in x. It is straightforward to check that such a change increases w^*. Recalling that $w^* = (1 - x)/y$, and that $x + y > 1$, we have that

$$\frac{dw^*}{dy}_{[dy=-dx>0]} = \frac{1}{y} - \frac{1-x}{y^2} > 0.$$

Therefore, a more convex technology makes it more likely that $w < w^*$, that is, the MFI will lend to a rich rather than to a poor borrower. (We can also check that such a change reduces $x + yw$ so that it becomes less likely that $r < x + yw$, which would make it more likely that a rich borrower is targeted even when $w > w^*$.) We may summarize the discussion up to now in Proposition 1.

PROPOSITION 1. *Suppose that there is a single motivated MFI.*

1. *The MFI will target a rich borrower when inequality between the poor and not-so-poor is low, i.e., $w < w^*$.*
2. *When inequality among the poor is high, i.e., $w > w^*$, the MFI will target a poor borrower if and only if the rate of interest is low, i.e., $r < yw + x$.*
3. *When the production technology gets more convex, the MFI is more likely to target a rich, rather than a poor borrower.*

Interestingly, and as discussed in the Introduction, Proposition 1 is in line with evidence that MFIs often target those with a small but positive level of wealth, rather than the poorest of the poor. Moreover, Proposition 1 shows that this is likely to be the case whenever the level of intra-poor inequality is not too large (or when inequality is large but the rate of interest is high), and the technology is relatively capital intensive, that is, convex. Further, the result here is driven by the fact that the MFIs are motivated and that the technology is convex, rather than by the poorer borrowers being more of a credit-risk, or the MFIs suffering from mission-drift.

The Donor's Problem

Given that the donor cannot observe borrower types, the donor can only control the gross rate of interest r that the MFI must charge from the borrower. What is the optimal r for the donor? We find that optimally the donor sets $r = 1$, and the loan goes to the poor unless $w < w^*$.

Recall that the donor maximizes a weighted sum of the aggregate utility of the poor, and the not-so-poor. To begin with let us consider the case where the objectives of the MFIs and the donor are completely aligned, so that $p = 1$. Note that the aggregate utility is decreasing in r, so that optimally the donor sets $r = 1$. Next suppose that the donor objective is biased towards the extreme poor, that is, $p > 1$. Note that reducing r to the lowest possible value, that is, $r = 1$, not only increases the utility of the borrowers, but, from Proposition 1, also helps in targeting the poor. Thus, in the absence of competition, the donor always sets $r = 1$. This ensures that the loan goes to the poor unless $w < w^*$ (note that for $w > w^*$, $yw + x > 1$ so the loan always goes to the poor in this case).

IV. MFI COMPETITION IN THE PRESENCE OF DOUBLE-DIPPING

In this section we will look at the effects of introducing competition between MFIs, formalized as two identical MFIs competing for the donor's funds. We consider a scenario where the donor splits his funds equally among these two, giving each half. We consider the case where the MFIs cannot know (barring *voluntary* disclosure by borrowers) whether a borrower approaching it has already taken a loan from another MFI or not. Such a scenario is especially likely if the MFIs do not share the credit history of the borrowers among themselves. In that case double-dipping is a possibility that the MFIs and the donor must take into account. In fact, as our discussion in the Introduction shows, double-dipping is quite prevalent in many cases.

For simplicity, let there be two poor borrowers, *P1* and *P2*, and two rich borrowers, *R1* and *R2*.[19] Let us consider the possibilities with double-dipping. If a poor borrower double-dips, he or she can implement a project of size 1 by taking two loans of 1/2 from both MFIs. He or she would also have to pay interest on the total amount borrowed of 1.[20] If a rich borrower double-dips, then the scenario depends on whether he or she wants to hide the fact that he or she is double-dipping from the MFIs or not. Ideally, he or she would like to borrow 1/2 from one MFI and

[19] Thus, there are two MFIs serving four borrowers, so that we are essentially modeling a situation where the MFI competition is really dense.

[20] A poor borrower will never conceal double-dipping activity, because it turns out that MFIs always prefer him or her to double-dip in order to take advantage of economies of scale.

$1/2 - w$ from the second.[21] This would enable the borrower to reach the efficient project size of 1 and he or she would have to pay back interest on the total amount borrowed of $1 - w$. As in the case with one motivated MFI, the unused part of the second MFI's funds (amounting to w) would be remitted to the donor. If, however, the rich borrower wishes to conceal from the MFIs that he or she is double- dipping (as might happen if they would not lend to the borrower if they knew he or she was), he or she may have to borrow the same amounts from each MFI, half each, as he or she would if just borrowing from one of them. However, after implementing a project of size 1, the borrower could then return the unused portion of the loan (by which time it is too late for the MFI to prevent double-dipping).

We consider the following two-stage game:

Stage 1

The borrowers simultaneously decide which of the MFIs to apply to. Further, they are free to apply to both the MFIs, or neither of them. If they apply to both, they decide whether to voluntarily reveal that they are doing so.

Stage 2

The MFIs simultaneously decide which of these borrowers to lend to, and how much to lend to the selected borrower.

Further, we allow for conditional contracts in that an MFI can say that it is going to lend to a borrower if, and only if, this borrower also has a loan from another MFI. We shall show that under certain situations, such contracts may actually be used by the MFIs. As is usual, we use a backwards induction argument (subgame perfection) to solve for the equilibrium outcome. Therefore, our solution concept is subgame perfect Nash equilibrium (henceforth, SPNE).[22]

Proposition 2 below is the central result in this section, and shows that irrespective of the level of inequality, there exists an equilibrium where the loan goes to the poor.

PROPOSITION 2. *Let there be MFI competition with the possibility of double-dipping. Both the MFIs lending to the same poor borrower (allowing double-dipping) can be sustained as a subgame perfect Nash equilibrium.*

[21] In fact, all that matters is that he or she would like to borrow $1 - w$ in the aggregate.

[22] The equilibria of Propositions 2 and 3 are the SPNE of the game above, in the second stage of which both MFIs move simultaneously. In Section V.1, we consider the SPNE of a game in which the MFIs make their targeting decisions sequentially, with the second mover observing the first mover's decisions. In Section VIII.1, we look at the SPNE of a game with two borrowers (one rich, one poor) and two MFIs when the MFIs move (a) simultaneously, and (b) sequentially.

Here we briefly discuss the intuition.[23] As discussed in the Introduction, this depends on two factors, first, the convexity of the technology, and second, that the MFIs act independently. Consider a situation where one of the poor borrowers has already obtained a loan of 1/2. Given that the other poor borrower has no savings, and even the savings of the rich are less than 1/2, making a further loan to this poor borrower leads to a greater increase in net utility since, given convexity, this borrower starts with a higher baseline savings.

The MFIs' competition for donor funds generates a "strategic complementarity" between their actions. Cooper and John (1988) show that strategic complementarity—the property of one player's optimal strategy reinforcing that of the other player—underlies multiple equilibria in coordination games. In the context of our model, it is the competition between MFIs that generates this complementarity, given the overall scarcity of funds. Proposition 2 is an illustration of this. Because one MFI can only lend 1/2 a unit of capital, the presence of economies of scale in borrower technology implies that the other MFI's optimal strategy depends on which borrower the first MFI targets. Thus, if the first MFI targets a poor borrower, it is best for the second to target the same poor borrower. If competition for limited funds had not resulted in each MFI having scarce capital, however, our results could have been different despite the fact that complementarities would still have been present.[24]

Proposition 2, coupled with Proposition 1, has some interesting implications for targeting. From Proposition 1 we find that it is possible that, for $w < w^*$, while the loan goes to the rich in the absence of competition, under competition with the possibility of double-dipping, the loan may go to the poor. This is interesting given that the literature has generally argued that double-dipping has negative implications for repayment performance. Our analysis shows that these argument needs to be qualified by the possibly positive effect of double-dipping on competition.

We next examine the effects of an increase in the convexity of the project technology. Recall that if the project technology becomes more convex, then w^* rises. Thus a more convex technology increases the range for which competition may help the poor (provided double-dipping is feasible). The intuition is as follows. If there is just one MFI, we have seen that a more convex technology makes it more likely that a loan is given to a rich, rather than a poor borrower. If there is competition and double-dipping is feasible, however, there is always an equilibrium where the loan goes to the poor.

[23] Formal proofs of this and some other Propositions are in an online working paper version, available at http://econpapers.repec.org/paper/siuwpaper/05-2012.htm.

[24] For example, suppose an individual MFI had enough funds to ensure that its borrowers could run projects at their optimal scale, the other MFI would not find it optimal to lend to the same borrowers.

V. MFI COMPETITION: MULTIPLE EQUILIBRIA AND MFI COORDINATION

In this section we explore MFI competition further. We show that there could be multiple equilibria in the presence of double-dipping, with interesting implications for MFI coordination. We find that there always exist equilibria where the loan goes to the rich. Interestingly, however, depending on the level of inequality, the equilibria are qualitatively different.

We begin by introducing some notations that we require in the subsequent propositions. Let

$$\underline{w} = \frac{-(2y+x-r)+\sqrt{(2y+x-r)^2+2y^2}}{2y},$$

$$w' = \frac{-(2y+x-1-r)+\sqrt{(2y+2x-1-r)^2+4y^2}}{4y}, \text{ and}$$

$$w\sim = \frac{2y+r-x-\sqrt{(2y+r-x)^2-2y^2}}{2y}.$$

It is straightforward to show that $w' < w^* < \underline{w} < w\sim$.

Let us classify intra-poor inequality as small ($w < w'$), medium ($w' < w < w^*$), large ($w^* < w < \underline{w}$), and very large ($\underline{w} < w$). We find that whenever intra-poor inequality is either small or large, there exists an equilibrium that involves double-dipping by the rich, as well as the rich borrowers revealing to the MFIs that they are double-dipping.[25] Further, over this range, the MFIs prefer an outcome with double-dipping by the rich, to one where the loan goes to the poor, but there is no double-dipping. When the inequality is either medium, or very large, then there is an equilibrium where the loans go to the rich, but there may, or may not, be double-dipping. In this zone the MFIs would like to prevent double-dipping, but they have no mechanism for doing so, so that in equilibrium each rich borrower approaches both the MFIs, and the MFIs randomize between them.

PROPOSITION 3. *There are equilibria that involve lending to the rich.*

1. *Double-dipping by the rich borrowers can be sustained as an equilibrium whenever either* $0 < w < w'$, *or* $w^* < w < \underline{w}$.
2. *For* $w' < w < w^*$ *and* $w > \underline{w}$, *there is an equilibrium where both rich borrowers apply to both MFIs, and the outcome may, or may not involve double-dipping.*

[25] Aiyar (2009), in fact, suggests that it is unlikely that the MFIs are ignorant as to whether double-dipping is going on or not.

The intuition for multiple equilibria is as follows. Consider a situation where one of the rich borrowers, say *R1*, has already obtained a loan. Given the convexity of the technology, making a loan to the other rich borrower dominates making a loan to the poor borrowers. There are two ranges of w, $w < w^*$ and $w > w^*$. Within both these ranges, lending to *R1* (i.e., allowing double-dipping) is the preferred option whenever w is relatively small, that is, either $w < w'$ when $w < w^*$, and $w < \underline{w}$ if $w > w^*$. In this case lending to a rich borrower who already has another loan is more attractive, compared to another rich borrower whose wealth level is low.[26]

Otherwise, the MFIs would prefer to prevent double-dipping. The only factor that might discourage double-dipping, however, is that if rich borrowers do not double-dip they only have to pay interest on a loan amount of 1/2, while if they do double-dip they have to pay interest on a larger amount of $1 - w$.[27] As we show, however, this is not going to prevent rich borrowers from double-dipping. Thus the equilibria here involve both rich borrowers approaching both MFIs, and there being randomization by the MFIs in allotment of loans. In equilibrium there may be double-dipping even though the MFIs do not prefer it.

A. *MFI Coordination and Sequential Targeting*

Given that there are multiple equilibria, one natural question is whether coordination among the MFIs can improve matters. This is of interest given that in response to increased competition and double-dipping, there have been arguments in favor of increased coordination among the MFIs. We examine the following question: in case the MFIs can coordinate on which equilibrium to select, then what is the impact on borrower targeting?

Interestingly enough, the result turns out to be just the opposite. In the presence of coordination we find that for $0 < w < w^*$, the MFIs coordinate on the equilibria with lending to the rich. Even for $\underline{w} < w < w$~, the loans go to the rich in the presence of double-dipping and coordination. Comparing the results with that without competition (Proposition 1), we find that targeting is adversely affected by competition whenever the intra-poor inequality is at a relatively high level, that is, $\underline{w} < w < w$~ . Otherwise, competition has no effect on targeting.

PROPOSITION 4. *When double-dipping is feasible, if MFIs always coordinate on the equilibrium that maximizes aggregate borrower utility, they lend to the poor and permit double-dipping either if inequality is moderate ($w^* < w < \underline{w}$) or very*

[26] The MFI must compute whether one project of scale 1 is more or less efficient than two projects of scale $w + 1/2$, a calculation for which the outcome depends on the level of w.

[27] Recall that the MFIs cannot force a borrower who has originally borrowed 1 but not utilized the whole loan to pay interest on the unutilized portion (he may return it without paying interest).

high ($w > w$~), as long as $r < x + yw$. They lend to the rich for other ranges of w, and double-dipping may occur, whether or not this is desired by the MFIs.

We now pose the question of what would happen in a three-stage game where Stage 1 is the same as in our previous two-stage game (i.e, the borrowers choose which MFIs to approach); in Stage 2, one of the MFIs (call it MFI 1) makes its targeting decisions, while in Stage 3 the other MFI makes its decisions having observed the first MFI's decisions. What would be the SPNE of this game?

LEMMA 1. *Given the MFIs' objectives, the SPNE of a game in which the MFIs make their targeting decisions sequentially are identical with the equilibria of the game in which the MFIs move simultaneously, but coordinate, that is, with the equilibria described in Proposition 4.*

We now clarify the intuition behind Lemma 1. In general, it is not true that the SPNE of a sequential-move game must be identical with the outcomes that maximize surplus. However, in our case this result is obtained because of the MFIs' objectives; since they are motivated, their own payoffs are identical with borrowers' utility. Therefore, in a sequential targeting game, MFI 1 knows that MFI 2's best response to any strategies will be to seek to maximize the utility to borrowers, conditional on MFI 1's strategy. Knowing this, MFI 1 will choose the strategy that results in the highest possible borrower utility for the relevant parameter configuration (anticipating MFI 2's best response). But then, this yields the same outcome(s) as when MFIs consciously coordinate their (simultaneous) targeting decisions so as to maximize aggregate borrower utility (as in Proposition 4).

B. *The Donor's Problem*

The donor's problem is a complex one in case double-dipping is feasible and there is competition. In the absence of coordination, note that borrower targeting does not depend on *r*. Thus in this case the donor should optimally set $r = 1$.

Next suppose that MFI coordination is feasible (or alternatively, MFIs move sequentially).

PROPOSITION 5. *When double-dipping is feasible and there is borrower coordination, a donor who wants the poor to be targeted should discourage competition (give all his funds to one MFI) when inequality is moderately high ($\underline{w} < w < w$~). Competition policy will not matter for other ranges of inequality.*

PROOF. As $\underline{w} > \mathrm{w}^*$, we recall that in the single MFI case a poor borrower would have been targeted for the range $\underline{w} < w < w$~. However, with competition, when double-dipping is feasible the MFIs choose to lend to rich borrowers (who may double-dip) for this range of w. Thus competition is harmful in this range. For other ranges of w, targeting would be the same as in the single MFI case. QED

VI. MFI COMPETITION WITHOUT DOUBLE-DIPPING

In this section we examine MFI competition in the absence of double-dipping, showing that the implications for borrower targeting are markedly different in this case. We therefore focus on the case where each borrower can borrow from at most one MFI. Note that this involves two implicit assumptions, first, that the MFIs have information regarding whether the borrowers are double-dipping or not, and second, that they want to prevent double-dipping. Regarding the informational assumption, this is likely to be the scenario whenever the MFIs work so closely with the borrowers that they get to know not only the income level of the borrowers, but also their financial transactions. This would also occur where the MFIs share the credit history of the borrowers among one another, something that has often been recommended given the increase in MFI competition in recent years.[28,29] Regarding the second assumption, this framework makes sense in a scenario where, for example, because of the regulatory scenario, the MFIs avoid double-dipping. In the Indian state of Karnataka, for example, there are efforts to create a regulatory framework for MFIs with the explicit objective of preventing double-dipping (Srinivasan 2009).[30] As another example, the Microfinance Institutions Network, a regulatory organization formed by 35 leading Indian MFIs in 2009, binds its members not to lend to borrowers who have loans outstanding from three or more institutions (Parameshwar *et al*. 2009).

We consider a game form that is similar to that considered in the last two sections. In this case an individual borrower would be able to get a loan of only 1/2. Consequently, a rich borrower would be able to implement a project of scale w + 1/2, while a poor borrower would only be able to implement a project of scale 1/2. We now ask whether an individual motivated MFI has an incentive to lend to a rich, or a poor borrower.

We find that in this case the MFIs necessarily target a rich borrower. This is in sharp contrast to the case without competition, where, for $w > w^*$, the single motivated MFI would target a poor borrower unless r was very high. The intuition for this contrast is the following. With competition, a rich and a poor client alike

[28] For example, Rhyne and Christen (1999) suggest that information sharing among MFIs in the form of credit bureaus is becoming increasingly necessary as the market for microfinance matures.

[29] Of course, recent years have also witnessed the phenomenon of double-dipping, where a single borrower accesses loans from more than one MFI. We shall allow for this phenomenon in the next section.

[30] Alternatively, one can think that social norms, as well as the MFIs' reputational concerns imply that they try to distribute the loan among as many borrowers as possible.

would use up the whole loan of 1/2. This would enable a poor client to start a project of scale 1/2, but would enable a rich one to expand his or her project scale from w to $w + 1/2$, which, given convexity, represents a greater increase in productivity. Without competition, this effect was absent because while a poor client would get a loan of 1, a rich one would only need a loan of $1 - w$. Both types would end up with the same project size of 1.

Summarizing the preceding discussion we have Proposition 6.

PROPOSITION 6. *Let there be two MFIs, each obtaining* 1/2 *units of capital. In the absence of double-dipping, the MFIs lend to the not-so-poor borrowers.*

We then examine the effect of an increase in the convexity of the technology. With increasing convexity, as w^* increases and $yw + x$ falls, the range over which competition is harmful to the poor shrinks. This is in tune with, and essentially follows from part (3) of Proposition 1.

To summarize, from the preceding analysis we find that the nature of targeting depends on whether or not the laws and information environment are such as to make double-dipping feasible. If double-dipping is infeasible, rich borrowers are always targeted when two motivated MFIs are competing for a donor's funds. However, if double-dipping is feasible, this effect is at least partially mitigated as an equilibrium where the MFIs lending to poor borrowers always exists. Even with coordination, for certain levels of inequality, the MFIs will lend to poor borrowers unless r is very high.

The Donor's Problem

From Proposition 6, under competition without double-dipping the loan always goes to the rich borrower. Thus the donor cannot affect borrower targeting through manipulating r. Thus under competition, the donor should set $r = 1$, which maximizes borrower utility, as well as the donor's objective.

Next, turning to the question of whether the donor should encourage competition or not, in the absence of double-dipping it turns out that restricting competition is always optimal for the donor as long as intra-poor inequality is not too low. In that case the donor can always set $r = 1$ to ensure that the poor are targeted, further this maximizes the donor's objective. Otherwise, however, the loan necessarily goes to the rich. In this case, depending on the parameter values, the donor may, or may not encourage competition.

From the analysis in the previous two sections, we may infer that a donor who puts a very large weight on the very poor (with p tending to infinity) would like to discourage competition whenever inequality is not too low ($w > w^*$) for the reason that in this range, the loan would always go to the poor with one MFI, while with two, there is some chance that it might not. Of course, in reality, there may be multiple donors so actually being able to determine the extent of MFI competition may not be up to a single donor.

VII. SOME INHERENT INEFFICIENCIES

The setup we model highlights several sources of inefficiency, which play a part in our results. The first of these is the pro-poor donor's lack of information. The donor is pro-poor, but since he or she finds it prohibitively costly to directly monitor MFI's targeting practices, and also lacks information about which borrowers are rich and which are poor, the donor cannot prevent the less pro-poor MFIs from targeting the rich. This constitutes an inefficiency from the donor's point of view. If this inefficiency was removed, the whole problem would disappear as the donor, being pro-poor, would always ensure that very poor borrowers were given loans; it would also become irrelevant whether the donor gave all funds to one MFI or to several.

Secondly, as we saw in Section V, there is an inefficiency in that MFIs are not always able to prevent borrowers from double-dipping, even when they wish to do so. This reflects the fact that sharing of information between MFIs may not be perfect. Thus, even when the MFIs would like to target two separate rich borrowers, they are forced to lend to whichever rich borrower approaches them, without being sure whether this borrower is also borrowing from the second MFI. If this inefficiency were removed, double-dipping would not occur in these instances and the MFIs would target two separate rich borrowers in equilibrium.

Finally, the third major source of inefficiency is the overall scarcity of funds. Because the donor, and therefore the MFIs financed, have only a limited amount of funds, not all borrowers can be targeted. In particular, given that projects have economies of scale, it is more efficient to give relatively large loans to a few borrowers rather than very small loans to many borrowers. The lack of funds then means that many borrowers cannot access microfinance. If this inefficiency were removed, the problem would, again, become redundant as MFIs would be in a position to serve all borrowers who approached them, and would not need to make decisions about allocating scarce funds. This relates more broadly to the credit market being imperfect (i.e., even the donor cannot access as much as he or she wants). Competition between MFIs for limited donor funds accentuates the problem, because then each competing MFI has even less to loan out. The possibility of double-dipping interacts with this scarcity of loanable funds in interesting ways.

In the next section, we discuss several robustness issues in turn.

VIII. ROBUSTNESS

A. *SPNE with Two Borrowers and Two MFIs*

In this subsection, we consider a setup with two competing MFIs and two borrowers, one rich and one poor. Comparing this with the single-MFI, two-borrower case, we see that here competition entails not just a competition for donor funds, but also a rise in the ratio of MFIs to borrowers. While in earlier sections, the ratio of MFIs to borrowers remained fixed (with one MFI per two borrowers, or two MFIs for four), here the number of borrowers remains fixed while the number of MFIs expands. Arguably, this kind of competition is more appropriate for a market that is already relatively saturated, while the competition of the earlier sections is more appropriate for a market where many borrowers remain unserved.

We look for the SPNE in both in terms of a game where MFIs make their targeting decisions simultaneously, and one in which each MFI moves in sequence. As argued in Lemma 1, the SPNE of the sequential-move game are also the equilibria that survive coordination in the simultaneous move game.

REMARK 1. Consider the game where the rich and poor borrower decide which and how many MFIs to approach in Stage 1, while in Stage 2 MFIs make simultaneous targeting decisions. This game has a SPNE where both MFIs lend to the poor borrower, for all levels of w. When borrower inequality is not very high, such that $w < w^{**}$ where $w^{**} > w^{*}$,[31] there is also a SPNE where both MFIs lend to the rich borrower. In both SPNE, both the rich and the poor borrower approach both MFIs.

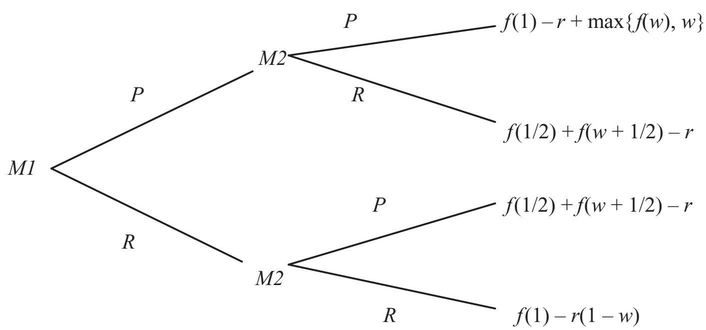
Remark 1 shows that competition can help in targeting the very poor, when borrower inequality is relatively low ($w < w^{*}$) as, in that case, the rich borrower would have been targeted with just one MFI, while in the two-MFI case, an equilibrium with lending to the poor borrower always exists. Nonetheless, there is also a danger that competition may worsen targeting for intermediate levels of inequality ($w^{*} < w < w^{**}$), since, for these ranges, the poor borrower is targeted when there is just one MFI, but with two, there exists an equilibrium with lending to the rich.

We now consider the SPNE of a game where the MFIs make targeting decisions sequentially. In Figure 1, the two MFIs are denoted by *M1* and *M2*, while the poor and rich borrowers are denoted by *P* and *R*. The payoffs at the four terminal nodes represent the total surplus generated from each outcome, which is what the MFIs are interested in. The borrowers' decision, that is, Stage 1, is not shown in the figure to save space (footnote 34 explains why both would want to double-dip in any equilibrium).

REMARK 2. In the game above, the SPNE involves both MFIs lending to the poor borrower (P,P) when $w > w^{*}$, and both lending to the rich borrower (R,R)

[31] More precisely, $w^{**} = \left[-(x+y-r)+\sqrt{(x+y-r)^2+2y^2}\,\right]\Big/2y.$

Fig. 1. Subgame Perfect Nash Equilibrium



when $w < w^*$, while in both these SPNEs, both the rich and the poor borrower approach both MFIs. The same outcomes obtain if MFIs coordinate (rather than moving independently as in Remark 1).

PROOF. Due to economies of scale, $f(1) - f(1/2) > f(w + 1/2) - f(w)$. Thus, when *M1* lends to *P*, it is clearly better for *M2* to also lend to *P*, both when $f(w) > w$ (i.e., when $w > w^*$), and when $w > f(w)$ (when $w < w^*$) as in the latter case we will have $f(1) + w > f(1) + f(w) > f(1/2) + f(w + 1/2)$. If *M1* lends to *R*, we can show that if $w < w^*$, *M2* will always lend to *R*, using $rw > w > f(w)$ for this range. For $w > w^*$, we find that if *M1* lends to *R*, *M2* prefers to also lend to *R* for $w < w^{**}$, and to *P* for $w > w^{**}$. However, it is easy to show that (R,P) is always dominated by (P,P). Moreover, (R,R) dominates (P,P) for $w < w^*$, whereas (P,P) dominates (R,R) for $w > w^*$ given $r < x + yw$. Putting these together, we find that the SPNE is (P,P) when $w > w^*$, and (R,R) when $w < w^*$.[32]

By Lemma 1, the SPNE of this sequential targeting game are also the equilibria that the MFIs would have coordinated if they moved simultaneously but if coordination were feasible. Remark 2 implies that in this case, competition would not have an impact on borrower targeting, as the outcomes are the same as in the single-MFI case.

Therefore, when competition entails not just the presence of more MFIs competing for scarce donor funds, but also a rise in the ratio of MFIs to borrowers, its

[32] The poor borrower always prefers to double-dip as $f(1) - r > f(1/2) - r/2$; while, if he or she double-dips, interest payments double, output more than doubles since $f(1) > 2f(1/2)$. The rich borrower also always prefers to double-dip. We can show that $f(1) - r(1 - w) > f(w + 1/2) - r/2$ via the following steps. The inequality simplifies to $f(1) - f(w + 1/2) > r(1/2 - w)$. Now, for any $w < 1/2$, it is easy to show, substituting in for $f(.)$, that $f(1) - f(w + 1/2) > f(1)\,(1/2 - w)$. But as $f(1) > r$, this also means that $f(1) - f(w + 1/2) > r(1/2 - w)$.

impact on targeting depends crucially on whether MFIs move independently and simultaneously, or whether they coordinate (or move sequentially). In the latter case, competition does not affect targeting, unlike in the former case. Comparing the coordination result with Proposition 5 (from the two MFI, four borrower case), we find that while in that case, a rise in MFI competition could actually harm targeting for some ranges of w, that does not happen in this case. Thus, our results suggest that, if MFIs coordinate, a rise in competition is potentially less harmful for targeting if the MFI market is already relatively saturated.

B. *Cross Subsidization*

In our main model, we ruled out the possibility of cross-subsidization. However, now suppose the donor sets two different interest rates meant for rich and poor borrowers, r_R and r_P, such that $r_R > 1 > r_P$. However, borrower identity is still soft information, so that the donor cannot force MFIs to cross-subsidize. Therefore, whether cross-subsidization is actually implemented is up to the MFIs. Given this, will MFIs do so?

REMARK 3. When there is only a single MFI, that MFI never cross-subsidizes. However, competition may occasionally encourage MFIs to cross-subsidize, but only if (i) MFIs act independently, (ii) double-dipping is permissible, and (iii) inequality is either moderate ($w^* < w < \underline{w}$) or very high ($w > w\sim$). Otherwise, there is no cross-subsidization even with competition.

The intuition underlying Remark 3 is as follows. One can show that if cross-subsidization were implemented, MFIs would lend out a part w_P of each loanable unit to a poor borrower and the rest to a rich borrower (where $w < w_P < 1$ for a single MFI, and $w < w_P < 1/2$ when there are two MFIs).[33] However, due to economies of scale, doing this is usually less efficient than using the option not to cross-subsidize, in which case larger loans can be targeted to fewer borrowers. (Note that, with cross-subsidization, it is not feasible for a MFI to lend solely to poor borrowers, since they would then not be breaking even—unlike in the case without cross-subsidization.) While a single MFI will never choose to cross-subsidize, cross-subsidization can occasionally happen with a rise in MFI competition. Intuitively, the reason is that with competition, MFIs give out smaller loans to individual borrowers even without cross-subsidization; specifically, when loans are given to rich borrowers, the extra surplus generated by these (small) loans is relatively modest, reducing the efficiency disadvantage of cross-subsidization. Thus, if MFIs act independently, an equilibrium involving lending to the rich can,

[33] The first order condition for w_P is $r_R - r_P = f'(1 - w_P + w) - f'(w_P)$ when there is one MFI. When there are two, the condition is $r_R - r_P = f'(1/2 - w_P + w) - f'(w_P)$.

for certain parameter ranges, be dominated by cross-subsidization. However, the equilibrium where both MFIs lend to the same poor borrower always dominates the cross-subsidization outcome.

C. *Alternative Assumptions on Technology*

As discussed in the framework, Banerjee and Duflo (2005) provide justification for examining non-convex technologies. In this subsection, we look at a relatively traditional way of modeling non-convexities: a fixed cost with constant returns to scale above and beyond this fixed investment. Specifically, the technology is $f(I) = \max[0, y(I - F)]$ where F represents fixed cost (production is zero for $I < F$) and $y > 1$ is a constant. The project requires a maximum of one unit of capital.

We find that with this change, most of our results go through qualitatively. (We now obtain $w^* = yF/(y–1)$.) There are only two changes in our results. First, in the two-MFI, four-borrower case, now if one MFI is lending to a rich borrower, then provided wealth inequality is not low (so that $w > w^*$), the other MFI always wants to prevent double-dipping and to lend to a different rich borrower. However, it is not always able to do so. Thus, with the change in technology MFIs are less keen to encourage double-dipping among rich borrowers for certain parameters. Second, suppose the fixed cost F is small, specifically, if $F < (y–1)/4y$, then there is also an equilibrium in which one MFI lends to a rich borrower while the other lends to a poor one, at $w > w^*$. However, if MFIs coordinate, this equilibrium disappears as it is dominated by the equilibrium where both MFIs lend to the same poor borrower.

D. *Allowing Unused Funds to Be Lent Out to Poor Borrowers*

In our main model, we had assumed that if a rich borrower does not use part of the amount lent to him or her (e.g., if the borrower gets a loan of 1, he or she does not use the amount w), the unused portion is remitted back to the donor. In this subsection, we discuss what happens if this unused portion is instead loaned out to a poor borrower, who gets a loan of w.

First, note that if $w < w^*$, nothing will change at all. This is because a poor borrower will then never accept a loan of w, knowing that he or she cannot earn enough to repay the loan (as $f(w) < w < rw$). Working out the changes to the results for $w > w^*$, we find that our qualitative results remain very similar. Specifically, the results with this change are as follows.

1. In the single-MFI case, the MFI targets the rich borrower when $w < w^*$. When $w > w^*$, and the surplus from lending to the rich and the poor borrower is exactly the same, we may use a tie-breaking rule, namely that the MFI then lends to the poor borrower, particularly since it knows the donor is pro-poor. Moreover, if the MFI itself has even a very small pro-poor bias, it will also prefer to target the poor borrower. If we do not use this tie breaking rule, and

assume that in this case the MFI randomizes between the rich and the poor borrower, results on the effects of greater number of MFIs on targeting remain qualitatively similar.

2. In particular, with two MFIs and four borrowers, the equilibrium where both lend to the same poor borrower still exists. Therefore it remains true that (provided double-dipping is allowed), an increase in the number of MFIs can improve borrower targeting. The improvement is even more marked if we do not use the tie-breaking rule mentioned in (1).
3. It also remains true that, if double-dipping is not allowed, it is always strictly better to lend to the rich; this is each MFI's dominant strategy, again worsening borrower targeting.
4. If double-dipping is allowed, and one MFI lends to the rich, we still find that in equilibrium, so will the other MFI. The only change is in one of the thresholds at which double-dipping rich borrowers voluntarily disclose that they are double-dipping (which changes from $\underline{w}$ to 1/4). In cases of such voluntary disclosure, the remaining w is lent to a poor borrower.
5. Moreover, with coordination, it remains true that an increase in the number of MFIs either does not improve, or, in some ranges, worsens borrower targeting.

E. *Other Issues*

1. *Mission drift and contagion*

The present paper analyses a scenario where competition does not lead to mission drift in the sense of the new MFIs being less motivated. Let us briefly consider a case where there are two MFIs, but the second MFI is less motivated in that it only cares about the aggregate utility of the not-so-poor borrowers. Suppose there is double-dipping. Clearly the second MFI will choose the not-so-poor borrower. Interestingly, this creates a contagion effect whereby the first MFI, which is motivated, prefers to lend to the not-so-poor borrower also. Thus competition with mission drift may worsen borrower targeting by motivated MFIs also.

2. *Client-maximizing MFIs*

While the case of client-maximizing MFIs is beyond the scope of the present paper, we briefly consider such MFIs in the presence of double-dipping. It is immediately clear that Proposition 3 is dramatically altered. In this case for all parameter values there are equilibria where the rich borrowers approach both the MFIs, and the MFIs randomize between these borrowers. Further, the equilibria with double-dipping to the rich borrowers with probability one, cannot be sustained. We further conjecture that, in this case, the equilibria with lending to the poor borrowers with double-dipping (as discussed in Proposition 2), cannot be sustained. This shows that our assumption, that the MFIs are welfare maximizing rather than client-maximizing, does make a difference to the results.

3. *MFIs manipulating interest rates*

What would happen if MFIs were free to change the interest rate set by the donor? It is easy to show that the motivated MFIs in our framework have no incentive to do this. The only difference between the motivations of donors and MFIs is that the donor might have a greater pro-poor bias relative to the MFI. However, if the donor does use interest rate policy to influence targeting[34] note that it does so by setting an r equal to one, which is the lowest possible rate of interest. Since this policy is pro-poor, and since both MFIs and donors are keen to keep interest rates low to benefit borrowers in general, the MFIs have no incentive to change this.[35]

4. *Competition with more elastic donor funds*

We have assumed that the donor's funds are completely inelastic so that it has to split its fixed funds in half between the two competing MFIs. What happens if, in case of competition, the donor can respond to the greater number of MFIs by increasing its aggregate funds, though perhaps less than proportionately? We investigate this issue by checking how our results are affected when the donor can give each of the two competing MFIs 0.75 instead of 0.5. While detailed calculations are available from the authors on request, our main findings remain largely similar. We still find that competition when double-dipping is feasible and can be beneficial for the poor when inequality is relatively low, as for this range of w. There is always a Nash equilibrium where both MFIs lend to the poor (while only the rich would get the loan in the single MFI case). Also, we still find that equilibria with lending to the rich exist, and that coordination among MFIs may encourage the MFIs to coordinate on the equilibrium with lending to the rich (unless w is very high). The main difference from before is the change in the MFIs' attitude towards double-dipping. We find that now they want to encourage the rich, and not just the poor, to double-dip, and the only constraint is whether the rich borrowers themselves wish to double-dip or not. The intuition is that as each MFI now has more funds, a rich borrower who double-dips needs to dip into only a very small portion of the second MFI's funds. The second MFI thus has enough funds left over to lend to another borrower, while the double-dipping rich borrower is able to implement an efficient project. Thus double-dipping is more efficient and occurs in equilibrium unless the borrowers themselves have enough wealth so that they do not need to double-dip.

[34] Note that the donor often cannot influence targeting at all via interest rates, for instance, in the case of competition without double-dipping, or when $w < w^*$.

[35] The MFI is always willing to lend to the borrower who generates the maximum surplus given a particular interest rate.

To summarize, this paper examines one of the emerging issues in microfinance, the effect of MFI competition. We seek to extend the literature by analyzing the case where the MFIs are motivated, as well as focusing on the issue of borrower targeting. The empirical evidence supports a finding that, depending on the extent of inequality, as well as the nature of the technology, the MFIs may, or may not give loans to the very poor, and furthermore, MFI competition may have an adverse impact in terms of borrower targeting. In the presence of double-dipping, however, MFI competition may have a positive impact on targeting. Moreover, our analysis identifies conditions under which MFI coordination may have a negative impact on borrower targeting. All these results add to the literature.

Finally, the main policy implications seem to be mainly cautionary in nature. First, MFI coordination need not always be an unmixed blessing, even with motivated MFIs. Second, double-dipping need not be always harmful, and may have a role in improving borrower targeting. Thus one needs to be careful while making blanket policy recommendations, either favoring MFI coordination, or preventing double-dipping by the borrowers. Our paper also provides some qualitative guidelines as to when such caution is most called for.

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