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Micro-finance Competition with Motivated MFIs

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Abstract: In this paper we examine the effect of increased MFI competition, focusing on its implications for borrower targeting, both in the presence and the absence of double-dipping. In the absence of competition we find that the loans are more likely to go to relatively richer borrowers whenever inequality is not too large, and the technology is sufficiently convex. In the presence of competition, the results depend on whether double-dipping is feasible or not. In case double-dipping is not feasible, we find that the MFIs necessarily target the richer borrowers. Interestingly, it turns out that double-dipping may encourage the MFIs to give loans to the poor, rather than the rich. Further, our analysis raises doubts regarding the benefits of encouraging coordination among the MFIs.

Keywords: Micro-finance competition, motivated MFIs, inequality, borrower targeting, technology.

JEL Classification Numbers: G21, L31, O16.

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1 Introduction

The micro-finance movement is growing at a dizzying pace. The number of the poorest micro-finance clients worldwide, for example, increased from 7.6 million in 1997, to 66.6 million in 2004 (Micro-credit Summit Report, 2005).\(^1\) In India, even in the aftermath of the global financial crisis, the number of outstanding accounts increased from 61.2 million in 2007-08, to 76.6 million in 2008-09 (Srinivasan, 2005).

This rapid expansion, however, has given rise to new issues and concerns. With increased micro-finance penetration, many countries are witnessing an increase in competition among micro-finance institutions (henceforth MFIs), with many areas being served by multiple MFIs. In the context of Bangladesh, for example, the Wall Street Journal (27.11.2001) reports that “Surveys have estimated that 23% to 43% of families borrowing from microlenders in Tangail borrow from more than one.”\(^2\) Even 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).\(^3\)

This increase in competition can be problematic on several grounds. One of the central concerns, and the one we focus on in this paper, has to do with 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 2 served very poor clients.\(^4\) On the other hand, Nagarajan (2001) finds that the spurt in competition between MFIs in the Central Asian and Eastern European countries has actually improved targeting of the poor, particularly in Bosnia and Herzegovina. She mentions that the increase in such competition in Bosnia spurred two

\(^1\) Even around 2000, there were around 8-10 million households under similar lending programs all across the world (Ghatak, 2005), including countries in Latin America, Africa, Asia and even the United States of America (see Morduch, 1999).
\(^2\) 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.
\(^3\) In the Indian state of Karnataka, for example, there were 7.31 million micro-finance accounts by the end of 2009 (SOS, 2009). Even assuming all the poor were covered, this comes to 2.63 accounts per household. The number would be higher if one takes into account that the loans generally go to women and the very poor are typically not covered (Srinivasan, 2009).
\(^4\) 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.
major MFIs, Prizma and Mikra, to move “downmarket” and make the decision to specialize in very poor rural clients. While the empirical evidence is mixed, it does suggest that competition may worsen borrower targeting in some cases.

Another area of concern is the presence of double-dipping, i.e. borrowers taking loans from several MFIs. A survey by the Grameen Koota staff covering 200 borrowers (including 105 defaulters), suggests that 25 per cent of these borrowers had taken loans from 6 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 (for example, McIntosh, de Janvry and Sadoulet, 2005) confirm the importance of double-dipping. It is of course clear that such multiple lending can weaken repayment discipline, with the 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 the effect on borrower targeting.

In this paper we examine the effects of increased MFI competition, focussing on its implications for borrower targeting, both in the presence and in the absence of double-dipping. We find that borrower targeting depends in a subtle way on the interaction of several factors, borrower inequality, the extent of competition, the nature of the technology and the possibility of double-dipping. While, in the absence of double-dipping, competition worsens borrower targeting, it turns out that double-dipping may encourage the MFIs to give loans to the poor, rather than the rich. Further, in the presence of double-dipping, MFI coordination may worsen borrower targeting. Also, in case increased MFI competition is accompanied by mission drift by newer entrants, then such competition may be accompanied by a contagion effect, whereby even motivated MFIs may switch to richer borrowers.

We analyze this issue in a very simple framework that nevertheless has several aspects that are in tune with reality, namely the MFIs being motivated as well as informed (regarding borrower characteristics), and the possibility of double-dipping (i.e. a single borrower accessing loans from multiple MFIs).

We model the MFIs as motivated agents\(^5\) that maximize the aggregate utility of the 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 (1992) (henceforth UNICIRDAP) for example, defines NGOs as organizations with six key features: they are voluntary, non-profit, service and development oriented, autonomous, highly motivated and committed, and operate under some form of formal

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\(^5\) 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.
registration.⁶ Thus our approach is complementary to McIntosh and Wydick (2005) and Navajas et al. (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 the donors, including the government, may not have. In fact, it is one of the central themes of the micro-finance literature on peer monitoring, as well as assortative matching that MFIs have greater information as compared to formal sector lenders (see, e.g. Bannerjee et al. (1994), Ghatak (2000), Roy Chowdhury (2005, 2007), etc).

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 a positive savings of w. All borrowers have access to a project each, which however requires a start up capital of one unit to run it at the efficient level. Since none of the borrowers have that much capital, they have to borrow the shortfall from some MFI. The MFIs in their turn access the money from some donor, who decides how much to advance to each MFI and the interest rate to be charged from the borrowers.

The benchmark model has a single MFI accessing one unit of capital from the donor. Interestingly, the analysis shows that even motivated MFIs need not select a poor borrower.⁷ There are several 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, rich borrowers have to pay back relatively less, since they have their own capital to partially fund the project. In addition, if the rich really only have a small amount of wealth, their outside option may simply be to let their wealth lie idle, instead of implementing an inefficiently small project. This in turn makes lending to the rich borrower more attractive, as his outside option is relatively small. We find that when inequality is small, that is, the rich are not very rich, then the last two effects dominate, so that the microfinance lender is more likely to lend to a rich borrower. For high levels of inequality, or when the technology is not too convex, however, the poorest borrowers are more likely to get loans unless the rate of interest is very high.

Interestingly, this 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 et al. (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

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⁶ UNICIRDAP (1992) also says that “the rural poor are given higher priority by NGOs” (page 20) as compared to governments.

⁷ Aubert, de Janvry and Sadoulet (2009) model a situation where a MFI may want to lend to poor borrowers but cannot due to agency problems involving non-motivated credit agents. Our results however obtain even without any such agency problems. This point is discussed in more detail in a later section.
Bangladesh are actually very poor. According to Nagarajan (2001), out of over 100 NGO MFIs in the region of Central Asia, less than 12% actually targeted the poorest.

We then turn to the effect of competition among the MFIs, with competition being modelled as two MFIs receiving half units of capital each. Interestingly, we find that the effects of competition depend on a subtle interaction of several factors, namely the level of inequality, the nature of technology, as well as whether double dipping is possible or not.

We first consider the case where the MFIs have information regarding the borrowing patterns of the borrowers, so that double-dipping can be prevented. In contrast to the case with a single MFI however, in this case the outcome necessarily involves lending to the rich borrowers. The intuition follows from the fact that both the poor and the rich will be using up the loan fully. Consequently, the rich stand to gain more given the convexity of the technology. In spite of effects that work in the opposite direction – such as the fact that rich borrowers have an outside option, unlike the poor - the first effect dominates, so that the MFIs prefer to lend to the rich, rather than the poor. This suggests that whenever inequality is relatively large (and the rate of interest is low), an increase in MFI competition can lead to the rich being targeted, thus hurting the poor borrowers.

This shows that one possible negative implication of MFI competition, at least in the absence of double-dipping possibilities, is worsening of borrower targeting. This adds to the literature which demonstrates other possible negative implications of MFI competition, e.g. a decrease in the ability to cross-subsidize the poor (McIntosh and Wydick, 2005), mission drift (Aldashev and Verdier, 2010), worsening of information flows (Hoff and Stiglitz, 1998), etc.

We then examine the case with double-dipping. Interestingly, it turns out that double-dipping may encourage the MFI to give loans to the poor, rather than the rich. The intuition is that in the presence of double dipping, once a poor borrower obtains a loan, giving a second loan to the same poor borrower increases his utility surplus by more compared to giving it to another poor borrower, or one of the rich borrowers. This follows from the convexity of the technology since once a poor borrower obtains a loan, he has access to more capital compared to the other borrowers. Given that the literature generally views double-dipping as something of a problem, this result identifies a potentially positive aspect of double-dipping.

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8 Defined as below the poverty line.
9 In fact, the Indian MFI Bandhan has a special programme to target the ultra poor. Arguably the need for such programmes 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.

10 We sometimes use the phrase “intra-poor inequality” interchangeably with “inequality”. This should be understood as inequality among the “poor” and “rich” borrowers in our model, since our “rich” borrowers actually have only a small level of wealth (neither MFIs nor donors have any interest in lending to those who are really rich, so really rich borrowers do not enter our model).
Further, in the presence of double-dipping we find that there may be multiple equilibria where the loan goes to the rich, rather than the poor. We find that as long as inequality is either small, or large but not too large, there is an equilibrium involving double-dipping by the rich borrowers. For intermediate and very high levels of inequality, however, there is an equilibrium where the loan goes to the rich, but the outcome may, or may not involve double-dipping.

We obtain some interesting results in case, with competition, the new MFIs suffer from mission drift, in that they maximize the utility of the not-so-poor borrowers. In this case not only does the newer entrant lend to the richer borrowers, but there is a contagion effect in that even the motivated MFIs will lend to the richer borrowers.

One interesting implication of this multiplicity involves the effects of coordination. Given the possibility of double-dipping, one of the responses has been to argue for greater coordination among the MFIs. In the Indian context, for example, Srinivasan (2009) argues in favour of such coordination. We find however that such coordination may, in fact, have adverse effects for targeting, and may lead to coordination on the equilibria where the loan goes to the rich, rather than the poor.

One broad conclusion emerging out of the analysis is that the effect of competition on targeting seems to worsen with inequality, though 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 re-visit the studies by Morduch (1999), Rabbani et al. (2006), Rahman (2003) and Nagarajan (2001), discussed earlier. Though none of these studies mention inequality (or technology) as possible explanatory variables, we observe that Bosnia and Herzegovina – for which Nagarajan (2001) found that competition improves targeting – has a low Gini coefficient of 26, while Latin American countries, for which others have found that competition worsens targeting, have very high Gini coefficients (for example, 58.4 for Paraguay, 60 for Bolivia). It is clear that these facts are consistent with our results on how inequality enters into the relationship between competition and targeting, though we do not claim that ours is the only explanation for these mixed empirical findings.

We then briefly relate our paper to the small, though 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 the market size is fixed and there is free entry of NGOs, then the

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11 In Kolar, Karnataka, India for example, Srinivasan (2009) shows that such increased coordination has followed increased competition and default by borrowers.
12 Gini coefficient data are from the Human Development Report 2007-08, UNDP.
equilibrium number of NGOs can be larger or smaller than the socially optimal one. 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. McIntosh and Wydick (2005) show that non-profits 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, our analysis adopts a motivated, rather than a client-maximizing MFI. This captures the increase in 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. For example, depending on whether double-dipping is feasible or not, competition may, or may not adversely affect borrower targeting.

Traditionally an increase in MFI competition is presumed to increase overall borrower indebtedness, usually through double dipping (as in McIntosh and Wydick 2002 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, 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.

The rest of the paper is organized as follows. Section 2 sets up the economic framework, while Section 3 considers the case with a single MFI. Sections 4 and 5 examine the effect of MFI competition, Section 4 in the absence of double-dipping, and Section 5 in the presence of double dipping. Section 6 has some concluding discussions, while some of the proofs are collected together in the Appendix.

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13 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.
2. The Framework

The framework comprises three classes of agents, the borrowers, one or more MFIs, and a donor. The borrowers are of two types – poor, and not-so-poor (denoted the rich). Poor borrowers have no wealth, whereas rich borrowers all have a positive wealth level of w. While there are other, richer borrowers, neither the MFIs, nor the donors, both of whom are motivated, are interested in lending to them. We formalise 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, so that that they maximize their expected income.

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 \( f(I) = yI^2 + xI \).

We interpret an increase in the convexity of the technology, formalised as an increase in y with an equal decrease in x, as a shift to more capital-intensive technologies. The idea is that with more capital-intensive technologies, complementarities among the various components become more critical, leading to an increase in convexity. Thus this framework allows us to examine the effects of an increase in capital intensity of the available technologies on MFI competition and borrower targeting.14

We shall maintain the following assumption throughout the analysis:

**Assumption 1.** (a) \( x + y > 1 \), (b) \( 0 < x < 1 \), and (c) \( y > 2(1-x) \).

Note that Assumption 1(a) guarantees that the efficient outcome 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 \( f(w^*)=w^* \). Solving, we obtain \( w^*=(1-x)/y \). Now assumption 1(b) guarantees \( w^*>0 \), while assumption 1(c) guarantees \( w^*<1/2 \).

Given the project technology, even rich borrowers cannot implement the project at its efficient scale, unless they borrow, although they can undertake a less efficient project at

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14 Sen (1962) also examines the issue of choice of techniques, though 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 \( I=1 \).
scale w. The poor cannot implement any kind of project unless they get a loan, as they have no personal wealth. Thus the borrowers must approach the MFIs in case they want a loan.

There are one or more MFIs, who are motivated non-profit organizations. The fact that they are motivated is reflected in the facts that (a) they only care about the poor, and the not-so-poor, and not about the richer borrowers, and (b) 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 McIntosh and Wydick (2005), as well as Navajas et al (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≥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 the USAID have become increasingly concerned about MFIs’ “mission drift”, leading to the U.S 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). We assume that the donor has an opportunity cost of zero for the capital, therefore we must have r≥1. In order to focus on the interesting case where the efficient scale is potentially implementable, we also assume that r≤x+y. The donor has funds of 1, which it gives to the MFI.

The MFI(s) then choose a borrower to lend the amount they have accessed from the donor. We assume that the MFI observes borrower type and knows who is poor, and who is not – a realistic assumption given that micro-finance 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 donors 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.
3. No Competition Among MFIs: 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, who 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 has no wealth. Therefore the net (utility) surplus generated by lending 1 unit to a poor borrower is

\[ S(P) = x + y - r > 0 \]  

(1)

Next consider a loan to a rich borrower. Recall that for a rich borrower his outside option is \( f(w) \) if \( w > w^* \), it is \( w \) otherwise. In either event, as the rich borrower already has a wealth of \( w \), the MFI, if it lends to him, only needs to loan him \( 1 - w \). If the MFI lent him more than this, he would leave some of his own wealth un-utilized, which would be inefficient. Thus the MFI lends him \( 1 - w \): we assume that the unused part of the MFI’s fund is remitted back to the donor.\(^{16}\) Thus the surplus generated by lending to a rich borrower is

\[ S(R) = x + y - yw - xw^2 - r(1 - w), \forall w > w^*, \]

\[ = y + x - w - r(1 - w), \quad \forall w < w^* \]  

(2)

Now if \( w < w^* \), we have

\[ S(R) = S(P) + w(r - 1) \geq S(P), \quad \text{(given } r \geq 1). \]

(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.\(^{17}\) The intuition is that if the rich borrower’s own wealth is small enough, implementing a project in the absence

\(^{16}\)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.

\(^{17}\)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.
of a loan may not be an option for him, as he loses economies of scale. Given that his outside option is not very large, the surplus from giving him a loan is significant, especially as he only has to pay back interest on 1-w, instead of interest on the whole 1 unit in case 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

\[
S(R) = S(P) - w(yw + x - r)
\]  

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 modelled 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.

*(a)* The MFI will target a rich borrower when inequality among the poor is low, i.e. \( w < w^* \).

*(b)* 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. \( r < yw + x \).
When the production technology gets more convex, the MFI becomes more likely to target a rich rather than a poor borrower.

Interestingly, 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. As discussed in the introduction, Morduch (1999), Rabbani et al. (2006), Rahman (2003) and Nagarajan (2001), all obtain results broadly supporting this claim. Aubert et al (2009) also 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. In our paper, in contrast, the MFIs may not target the poorest in spite of being motivated and in spite of being in a position to identify the poorest. 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, i.e. convex.

3.1 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, i.e. p>1. Note that reducing r to the lowest possible value, i.e. 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).

4. MFI Competition in the Absence of Double-dipping

Next, 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 ½. How will this affect targeting?
In this section we 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 in case 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.\footnote{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.} \footnote{Of course, recent years have also witnessed the phenomenon of double-dipping, where a single borrower accesses loan from more than one MFI. We shall allow for this phenomenon in the next section.} As regarding the second assumption, this is not innocuous. As we argue in the next section there may be scenarios where the MFIs may prefer to allow double-dipping. Thus the implicit assumption here is that because of the regulatory scenario, the MFIs avoid double-dipping. In the Indian state of Karnataka, for example, efforts are on to create a regulatory framework for MFIs with the explicit objective of preventing double-dipping (Srinivasan, 2009).\footnote{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.}

For concreteness, let there be two poor borrowers, P1 and P2, and two rich borrowers, R1 and R2.\footnote{Thus, there are two MFIs serving four borrowers, so that we are essentially modelling a situation where the MFI competition is really dense.} 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.

*Stage 2.* The MFIs simultaneously decide which of these borrowers to lend to, and how much to lend to the selected borrower.

As is usual, we use a backwards induction argument (subgame perfection) to solve for the equilibrium outcome. Turning to the solution, in this case an individual borrower would be able to get a loan of only \( \frac{1}{2} \). Consequently, a rich borrower would be able to implement a project of scale \( w + \frac{1}{2} \), while a poor borrower would only be able to implement a project of scale \( \frac{1}{2} \). We now ask whether an individual motivated MFI has an incentive to lend to a rich, or a poor borrower.
From an individual MFI’s perspective, the net utility surplus from lending \( \frac{1}{2} \) to a poor borrower is

\[
S(P, \frac{1}{2}) = f(\frac{1}{2} - \frac{r}{2}) = \frac{y}{2} + \frac{x - r}{4},
\]

(5)

as this poor borrower would also have to pay back interest on a loan size of only \( \frac{1}{2} \).

If the MFI lends to a rich borrower, this rich borrower can now implement a project of size \( w + \frac{1}{2} \). Without the loan he would have implemented a project of size \( w \) if \( w > w^* \), and would have let his wealth lie idle otherwise. Thus the net utility surplus generated by lending \( \frac{1}{2} \) to a rich borrower is

\[
S(R, \frac{1}{2}) = f(w + \frac{1}{2}) - f(w) - \frac{r}{2}, \quad \forall w > w^*
\]

\[
= f(w + \frac{1}{2}) - w - \frac{r}{2} = x(w + \frac{1}{2}) + y(\frac{1}{2})^2 - w - \frac{r}{2}, \quad \forall w < w^*.
\]

(6)

Note that

\[
S(R, \frac{1}{2}) > S(P, \frac{1}{2}), \quad w > w^*
\]

as \( f(w + \frac{1}{2}) > f(w) + f(\frac{1}{2}) \) for any convex \( f(\cdot) \). Thus when intra-poor inequality is large, i.e. \( w > w^* \), the MFI targets a rich borrower.

What about the case where \( w < w^* \), so that intra-poor inequality is low? In this case, from (5) and (6),

\[
S(R, \frac{1}{2}) - S(P, \frac{1}{2}) = yw(1 + w) + xw - w = w[y(1 + w) + x - 1] > 0
\]

given that \( x + y > 1 \). Therefore, even when \( w < w^* \), an individual motivated MFI targets a rich borrower in the presence of competition. 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 would use up the whole loan of \( \frac{1}{2} \). This would enable a poor client to start a project of scale \( \frac{1}{2} \), but would enable a rich one to expand his project scale from \( w \) to \( w + \frac{1}{2} \),
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 2.

**Proposition 2.** Let there be two MFIs, each obtaining ½ units of capital. In the absence of double-dipping, the MFIs lend to the not-so-poor borrowers.

Combining Propositions 1 and 2, we have our next corollary which is the central result of this section.

**Corollary 1.** In case double-dipping is not feasible, encouraging competition between MFIs hurts the poor when inequality is not too low \((w > w^*)\) and \(r\) is not too high \((r < yw + x)\). Otherwise, the loan goes to the not-so-poor irrespective of whether there is competition, or not.

**Proof.** From Proposition 1, we know that in the absence of MFI competition, the single MFI targets the poor borrower when \(w > w^*\) and \(r < yw + x\). However, when there are two motivated MFIs and double-dipping is ruled out, these MFIs always target rich borrowers—thus hurting the poor. For other values of \(w\) and \(r\), a rich borrower is targeted regardless of whether there is one motivated MFI or two, so competition neither helps nor hurts poor borrowers. QED.

**Remark 1** 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 (c) of Proposition 1.

### 4.1 The Donor’s Problem

From Proposition 2, under competition 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.

### 5. MFI Competition in the Presence of Double-dipping

In this section 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.

Let us consider the possibilities with double-dipping. If a poor borrower double dips, he can implement a project of size 1 by taking two loans of $\frac{1}{2}$ from both MFIs. He would also have to pay interest on the total amount borrowed of 1. If a rich borrower double dips, then the scenario depends on whether he wants to hide the fact that he is double-dipping from the MFIs or not. Ideally, he would like to borrow $\frac{1}{2}$ from one MFI and $\frac{1}{2} - w$ from the second. This would enable him to reach the efficient project size of 1 and he 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 is double dipping (as might happen if they would not lend to him if they knew he was), he may have to borrow the same amounts from each MFI – $\frac{1}{2}$ each – as he would if he were just borrowing from one of them. However, after implementing a project of size 1, he could then return the unused portion of the loan (by which time it is too late for the MFI to prevent him from double dipping).

We consider a game form that is similar to that considered in the last section. 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.

Proposition 3 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 3, 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

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22 In fact, all that matters is that he would like to borrow $1-w$ in the aggregate.
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.

**Proposition 3.** Let there be MFI competition with the possibility of double-dipping. Both the MFIs lending to the same poor borrower (allowing him to double dip) can be sustained as a Nash equilibrium.

While the formal proof can be found in the Appendix, here we briefly discuss the intuition. Consider a situation where one of the poor borrowers has already obtained a loan of $\frac{1}{2}$. Given that the other poor borrower has no savings, and even the savings of the rich are less than $\frac{1}{2}$, making a further loan to this poor borrower leads to a greater increase in the net utility since, given convexity, this borrower starts with a higher baseline savings.

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.

### 5.1 Multiple Equilibria and MFI Coordination

We must now examine whether any other Nash equilibria can exist. We find that there always exist equilibria where the loan go 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 Proposition 4 below. Let

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

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

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

It is straightforward to show that $w' < w^* < w < w^~$. 


Let us classify intra-poor inequality as small \((w<w')\), medium \((w'<w<w*)\), large \((w*<w<w)\) and very large \((w<w)\). We find that whenever intra-poor inequality is either small or large, the equilibrium involves double-dipping by the rich, as well as the rich borrowers revealing to the MFIs that they are double-dipping.\(^{23}\) 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 both the rich borrowers approach both the MFI, and the MFIs randomise between them.

**Proposition 4.** There are equilibria that involve lending to the rich.

(a) Double-dipping by the rich borrowers can be sustained as an equilibrium whenever either \(0<w<w'\), or \(w*<w<w\).  

(b) For \(w'<w<w*\) and \(w>w\), there is an equilibrium where both rich borrowers apply to both MFIs, and the outcome may, or may not involve double-dipping.

The detailed proof can be found in the appendix.

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, i.e. either \(w<w'\) when \(w<w*\), and \(w<w\) 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.\(^{24}\)

Otherwise, the MFIs would prefer to prevent double-dipping. The only factor which 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 \(\frac{1}{2}\), while if they do double dip they have to pay

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\(^{23}\) Swaminathan, 2009, in fact suggests that it is unlikely that the MFIs are ignorant as to whether double-dipping is going on or not.

\(^{24}\) Essentially the MFI computes whether one project of scale 1 is more or less efficient than 2 projects of scale \(w+1/2\) – a calculation whose outcome depends on the level of \(w\).
interest on a larger amount of 1-w. As we show however this is not going to prevent rich borrowers from double-dipping. Thus the equilibria here involves both rich borrowers approaching both MFIs, and there being randomisation by the MFIs in allotment of loans. In equilibrium there may be double-dipping even though the MFIs do not prefer it.

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 favour 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? While one aspect of such MFI coordination is information sharing on credit-history seems hard to implement in reality, perhaps for fear of client-poaching, ignoring such information sharing is perhaps not too unrealistic.

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 \(w < w < w^*\), the loans go 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, i.e. \(w < w < w^*\). Otherwise, competition has no effect on targeting.

**Proposition 5.** When double dipping is feasible, if MFIs always co-ordinate on the equilibrium that maximizes aggregate borrower utility, they lend to the poor and permit double dipping either if inequality is moderate \((w^* < w < w)\) or very 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 see that with competition between MFIs, targeting differs depending on whether or not the laws and information environment are such as to make double dipping feasible or infeasible. 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 mitigated as an equilibrium where the MFIs lend to poor borrowers always exists. Even with co-ordination, for certain levels of inequality (either moderate or very high levels), the MFIs will lend to poor borrowers unless \(r\) is very high. Intuitively, when the poor double dip, there can only be an efficiency gain as one project of scale 1 is always more efficient than 2 projects of

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25 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).
scale \( \frac{1}{2} \), due to the convexity of the technology. However, if the rich double dip, there need not be an efficiency gain, as 1 project of scale 1 is not necessarily more efficient than 2 projects of scale \( w+1/2 \). Therefore, the possibility of double dipping increases the relative attractiveness of lending to the poor, as opposed to lending to the rich. Interestingly, while double dipping has always been treated as a negative phenomenon in the literature, this unearths a positive effect of double dipping.

Propositions 1, 2, 3, 4 and 5 have been summarized in a diagrammatic form in Figures 1 and 2 for the sake of easy comparison.

### 5.2 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.

**Proposition 6.** 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 (\( w_* < w < w^- \)). Competition policy will not matter for other ranges of inequality.

**Proof.** As \( w > w^* \), we recall that in the single MFI case a poor borrower would have been targeted for the range \( w_* < w < w^- \). 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**

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.
Figure 1

No Competition (Prop 1)

\[ r = 1 \]

\[ 0 \quad W^* \quad \frac{1}{2} \]

\[ w \quad \rightarrow \]

Competition, no double dipping (Prop 2)

\[ R: \text{Lending to a rich borrower} \]

\[ P: \text{Lending to a poor borrower} \]
Competition, double dipping and multiple equilibria (Props 3,4)

Equilibria with double dipping and co-ordination (Prop 5)

Figure 2
6 Discussion and Conclusion

We begin by briefly discussing some robustness issues.

**Production function.** While for computational purposes we have adopted a specific production function, our analysis is robust to alternative specifications. As the intuitive discussions throughout the paper show, the qualitative results essentially depends on the fact that the production function is convex up to a point, after which the productivity falls off sharply. Our results should go through qualitatively for all production functions satisfying these properties.

**Mission drift and contagion.** The present paper analyses a scenario where competition does not lead to mission drift in the sense of the new MFI being less motivated. Let us briefly consider a case where there are two MFI, but the second MFI is less motivated in that it places no weight on the poor borrowers, and 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, who 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.

**Client-maximizing MFIs.** While the case of client-maximizing MFIs is beyond the scope of the present paper, given the literature, we briefly consider the case where the MFIs are client-maximizing. Clearly, the case of interest is when double-dipping is feasible. It is immediately clear that Proposition 4 is dramatically altered. In this case for all parameter values there are equilibria where the rich borrowers approach both the MFIs, and the MFIs randomise 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 3), 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.

To summarise, this paper examines one of the emerging issues in micro-finance, the effect of MFI competition. We seek to extend the literature by analysing the case where the MFIs are motivated, as well as focusing on the issue of borrower targeting. In consonance with the empirical evidence, we find 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. We show that MFI competition may have an adverse impact in terms of borrower targeting. In the presence
of double-dipping however, MFI competition may improve targeting, an effect so far not analysed in the literature. Moreover, our analysis identifies conditions under which MFI coordination may worsen borrower targeting.

7 Appendix

Proof of Proposition 3. First note that a poor borrower always has an incentive to double dip. If he borrows from only one MFI, his payoff is \( f(1/2) - r/2 \), while if he double dips his payoff is \( f(1) - r \). While he pays back twice the interest, the output he gets from his project rises faster as \( f(1) \) is greater than 2\( f(1/2) \), given the convexity of \( f(.) \).

Given that one MFI is lending 1/2 to a poor client, the second MFI has three choices: lending to the same poor client, allowing him to double dip (a strategy we label P1), lending to a different poor client (P2) and lending to a rich client (R1). Note that the second MFI will be able to distinguish between P1 and P2 as the double dipping poor client will always reveal that he has double dipped (he has no incentive to conceal it, because as we will show, MFIs are always willing to allow the poor to double dip). While choosing its optimal strategy, the second MFI will consider the total payoff of (rich and poor) borrowers generated by each of its strategies. First, we look at these payoffs when \( w > w^* \):

\[
P1: f(1) - r + f(w)
\]

\[
P2: 2f(\frac{1}{2}) - r + f(w)
\]

\[
R1: f(w + \frac{1}{2}) + f(\frac{1}{2}) - r
\]

Given the convexity of \( f(.) \), P2 is strictly dominated by P1. Substituting \( f(I) = xI + yI^2 \), we see that P1 dominates R1 iff

\[
y + x + yw^2 + xw > y(w + \frac{1}{2})^2 + x(w + \frac{1}{2}) + \frac{x}{2} + \frac{y}{2}
\]

or \( \frac{1}{2} > w \), which is always true. Thus, for \( w > w^* \), clearly (P1,P1) is a Nash equilibrium. For \( w < w^* \), the outside option of the rich borrower is to let his wealth lie idle, rather than implement a project of size \( w \), and we have

\[
P1: f(1) - r + w
\]

\[
P2: 2f(\frac{1}{2}) - r + w
\]

\[
R1: f(w + \frac{1}{2}) + f(\frac{1}{2}) - r
\]
Again, P1 dominates P2 given the convexity of \( f(.) \). P1 dominates R1 iff
\[
y + x + w > y\left(w + \frac{1}{2}\right)^2 + x\left(w + \frac{1}{2}\right) + \frac{x}{2} + \left(\frac{y}{2}\right)^2
\]
or
\[
w(1 - x) > y\left[w(1 + w) - \frac{1}{2}\right] \tag{7}
\]
Note that the derivative of the LHS of inequality (7) with respect to \( w \) is \( 1-x \) while the derivative of the RHS with respect to \( w \) is \( y(1+2w) > y > 1-x \) given our assumption that \( x+y > 1 \). Therefore, the RHS increases faster in \( w \) than the LHS. Hence, if inequality (7) holds at the highest possible value of \( w \), here \( w = w^* = (1-x)/y \), inequality (7) will also hold for all values of \( w \) between 0 and \( w^* \). At \( w^* \), the LHS has the value \( \left[(1-x)\sqrt{2}\right]/y \) while the RHS has the value \( 1-x + \left[(1-x)\sqrt{2}\right]/y - y/2 \). Simplifying, the LHS thus exceeds the RHS iff
\[
y/2 > 1-x
\]
or \( y > 2(1-x) \) which always holds by our assumption that \( w^* < 1/2 \). Thus, (7) holds for all values of \( w \) between 0 and \( w^* \); hence P1 dominates R1. Therefore, (P1,P1) is also a Nash equilibrium for all values of \( w < w^* \). Combining this with our earlier result, a Nash equilibrium where both MFIs lend to the same poor borrower, allowing him to double dip, exists for all values of \( w \). QED.

Proof of Proposition 4. First note that the second MFI will be able to distinguish between lending to the same rich borrower, allowing him to double dip (R1), and lending to a different rich borrower (R2), only if the double dipping rich borrower voluntarily reveals that he is double dipping. The borrower, in turn, will only do this if (a) he has an incentive to double dip, and (b) he knows that MFIs prefer (R1) to (R2), that is, they want to encourage double dipping by rich borrowers. Condition (a) translates into
\[
f(1) - r(1-w) > f\left(w + \frac{1}{2}\right) - \frac{r}{2}
\]
or
\[
r < \frac{f(1) - f\left(w + \frac{1}{2}\right)}{1/2 - w} \tag{8}
\]
We recall that \( r \) must always be less than \( f(1) \) for the project to be efficient. Now we can show that \( f(1) \) is always less than the RHS of inequality (8). The condition for \( f(1) \) to be less than this RHS boils down to
\[
\frac{f\left(w + \frac{1}{2}\right)}{w + \frac{1}{2}} < f(1)
\]
or
\[
x + y\left(w + \frac{1}{2}\right) < x + y
\]
which is always true given \( w+1/2 \) is less than 1. Therefore, as \( r \) is less than \( f(1) \), and \( f(1) \) is less than the RHS of (8), we infer that (8) must always hold. Rich borrowers always have an incentive to double dip.

To evaluate condition (b), note that MFI’s preferences between R1 and R2 are determined by looking at the total payoffs (of the two rich borrowers) from each strategy. First, consider \( w > w^* \):

\[
R1: f(1) + f(w) - r(1-w)
\]

\[
R2: 2f(w+1/2) - r
\]

Under R1, the double dipping rich borrower can implement the optimal project, and only has to pay interest on \( 1-w \), while the second rich borrower must use his own personal wealth to implement a smaller project. Under R2, two different rich borrowers would each borrow \( 1/2 \) and start projects of size \( w+1/2 \). We can show that there is a cutoff

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

such that R1 is preferred for \( w < w \), while R2 is preferred for \( w > w \).

If \( w < w^* \), the logic is similar except that \( f(w) \) in the expression for R1 is replaced by \( w \): if the first rich borrower double dips, the second must now let his wealth lie idle. Similar to the \( w > w^* \) case, we can find a different threshold, \( w' \), where

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

such that for \( w < w' \), R1 is preferred by the MFI to R2, while for \( w > w' \) R2 is preferred to R1.

From the above, we conclude that MFIs will be able to distinguish between R1 and R2 if \( w^* < w \) for either \( w < w \) or \( 0 < w < w' < w^* \) (in these ranges, rich borrowers intending to double dip will voluntarily reveal their borrowing patterns to MFIs, knowing that MFIs prefer them to double dip). First consider the case \( w^* < w \). If the first MFI lends to a rich borrower, the second now has to choose between R1, R2 and P1. Thus it compares

\[
R1: f(1) + f(w) - r(1-w)
\]

\[
R2: 2f(w+1/2) - r
\]

\[
P1: f(w+1/2) + f(1/2) + f(w) - r
\]

We see that P1 can never be a best response as it is dominated by R2, given \( f(w+1/2) > f(w) + f(1/2) \). We also already know that for this range of \( w \), R1 is preferred to R2. Therefore, for \( w^* < w \), a Nash equilibrium exists where both MFIs lend to the same rich
borrower, allowing him to double dip: \((R1,R1)\) is sustainable as a Nash equilibrium for \(w\) in this range.

For the case \(0<w<w'\), the second MFI’s choices between \(R1, R2\) and \(P1\) will yield

\[
R1: f(l) + w - r(1 - w) \\
R2: 2f(w + \frac{1}{2}) - r \\
P1: f\left(w + \frac{1}{2}\right) + f\left(\frac{1}{2}\right) + w - r
\]

We can check that the condition for \(R2\) to dominate \(P1\) boils down to

\[
y(1 + w) + x > 1
\]

which is always true given our assumption that \(x+y>1\). Hence \(P1\) can never be a best response when the first MFI is lending to a rich borrower. Moreover we already know that for this range, \(R1\) is preferred to \(R2\). Hence for \(0<w<w'\), there exists a Nash equilibrium where both MFIs lend to the same rich borrower, allowing double dipping \((R1,R1)\).

We now turn to the cases \(w'<w<w^*\) and \(w>w^*\), where the MFIs cannot distinguish between a double dipping rich borrower and a rich borrower who is not double dipping. In this case, the MFI’s choices are simply \(R\) (lending to a rich borrower) or \(P\) (lending to a poor borrower). Assume there are two rich borrowers and both approach both MFIs, and both MFIs randomize between the two rich borrowers with equal probability. First consider the range \(w'<w<w^*\). Given that the first MFI has picked a rich borrower, the second MFI estimates the expected total output (of two rich borrowers and one poor borrower) from lending to a rich borrower as

\[
R: \frac{1}{2}\left[f(l) + w - r(1 - w)\right] + \frac{1}{2}\left[2f\left(w + \frac{1}{2}\right) - r\right]
\]

which is an average of the output from lending to a double dipping rich client and the output from lending to two separate rich clients. In contrast, the output from lending to a poor borrower, given that the first MFI has lent to a rich one, is

\[
P: f\left(w + \frac{1}{2}\right) + f\left(\frac{1}{2}\right) + w - r
\]

Manipulations show us that \((R)\) exceeds \((P)\) as long as

\[
f(l) + rw > 2f\left(\frac{1}{2}\right) + w
\]

which is always true as due to convexity, \(f(1)>2f(1/2)\), and \(r\) is at least 1. Therefore, the second MFI’s best response is \(R\). As the analysis is exactly symmetrical for the other MFI, there exists a Nash equilibrium in the range \(w'<w<w^*\) where both MFIs lend to rich
borrowers, even though they are not sure whether the borrowers are double dipping (and even though the MFIs dislike double dipping by rich borrowers).

We now consider the range \( w > w^* \). Again, the second MFI’s choices are between R and P. It estimates the output from these strategies as

\[
R: \frac{1}{2}[f(l) + f(w) - r(1 - w)] + \frac{1}{2}[2f(w + \frac{1}{2}) - r]
\]

\[
P: f(w + \frac{1}{2}) + f(w) - r
\]

The condition for R to exceed P boils down to

\[
f(l) + rw > 2f(\frac{1}{2}) + f(w).
\]

Substituting in for \( f(.) \) and simplifying, this is equivalent to

\[
\frac{y}{2} > w[x + yw - r]
\]

Note that if \( r > x + yw \), (9) automatically holds as \( y \) is positive. If \( r < x + yw \), note that the RHS of (9) is increasing in \( w \). Therefore, if the inequality holds for \( w = 1/2 \), it holds for all \( w \). The condition for (9) to hold at \( w = 1/2 \) becomes

\[
\frac{y}{4} > \frac{x - r}{2}
\]

which always holds as \( x < r \) (recall that \( x < 1 \), while \( r \) must be at least 1) while \( y \) is positive. Therefore, inequality (9) always holds, and R is the second MFI’s best response. As the MFIs are symmetric, there exists a Nash equilibrium for the range \( w > w^* \), such that both MFIs lend at random to rich borrowers and there may be double dipping in equilibrium even though this is disliked by these MFIs.

QED

Proof of Proposition 5. When MFIs co-ordinate, they co-ordinate on the equilibrium with highest overall borrower welfare. To compare borrowers’ welfare in the different equilibria, we consider two rich and two poor borrowers. First we focus on the subset of wealth levels \( w^* < w < w_0 \), comparing welfare in the two possible equilibria (P1,P1) and (R1,R1). In the first of these, both MFIs lend to the same poor borrower, allowing him to double dip, so he executes a project of size 1, and borrows 1: the two rich borrowers each get their outside option \( f(w) \). Hence the total welfare in this equilibrium is given by

\[
W(P1, P1) = f(1) - r + 2f(w)
\]
Meanwhile, in the (R1,R1) equilibrium, both MFIs would allow the same rich borrower to double dip. He executes a project of size 1, while only borrowing 1-w: the second rich borrower gets his outside option, while poor borrowers get nothing. Thus we have
\[ W(R1, R1) = f(1) - r + rw + f(w) \]  
(11)

By comparing (10) and (11), we see immediately that welfare is higher in the (P1,P1) equilibrium iff
\[ r < \frac{f(w)}{w} = x + yw = r^\wedge \]
(12)

Therefore, for \( w \) between \( w^* \) and \( w \), the donor can ensure that the MFIs co-ordinate on the (P1,P1) equilibrium rather than the (R1,R1) equilibrium. It can do this by setting \( r \) at or below \( r^\wedge \) (it can easily be checked that \( r^\wedge \) is greater than 1 for all \( w > w^* \) so this is feasible). It might well do this given its preference that the poor be targeted.

Now consider \( 0 < w < w^* \), so that the candidate equilibria are (P1,P1) and (R1,R1). We have
\[ W(P1, P1) = f(1) - r + 2w \]
(13)
\[ W(R1, R1) = f(1) - r + rw + w \]
(14)

Given that \( r \) must be at least 1, it is easy to see that (14) exceeds (13), with equality at \( r = 1 \). Therefore, the MFIs will co-ordinate on the equilibrium where they lend to the same rich borrower, allowing him to double dip.

Now we consider the range \( w > w^* \), where the candidate equilibria are (P1,P1) and (R). We have
\[ W(P1, P1) = f(1) - r + 2f(w) \]
(15)
\[ W(R) = \frac{1}{2} [f(1) + f(w) - r(1-w)] + \frac{1}{2} [2f(w + \frac{1}{2}) - r] \]
(16)

We can show that (15) > (16) if and only if \( r < r^\wedge \) and \( w \) is greater than a threshold \( w^\sim \) where
\[ w^\sim = \frac{2y + r - x - \sqrt{(2y + r - x)^2 - 2y^2}}{2y} \]
while (16) > (15) otherwise. Therefore, the MFIs co-ordinate on the (P1,P1) equilibrium when \( w > w^\sim \) and \( r < r^\wedge \) and co-ordinate on the R equilibrium otherwise. By setting \( r < r^\wedge \) (which is feasible since \( r^\wedge > 1 \) for all \( w > w^* \)) the donor can ensure co-ordination on the (P1,P1) equilibrium when \( w > w^\sim \).

Finally we examine the range \( w^* < w < w^\sim \), where again the candidate equilibria are (P1,P1) and (R). We have
\[ W(P1, P1) = f(1) - r + 2w \]
\[ W(R) = \frac{1}{2} [f(l) + w - r(l - w)] + \frac{1}{2} [2f(w + \frac{1}{2}) - r] \]

The condition for \( W(R) \) to exceed \( W(P1,P1) \) boils down to

\[ f(l) + 3w < 2f(w + \frac{1}{2}) + rw \] (17)

Note that by definition, for \( w \) in this range, the MFIs would have preferred to prevent double dipping by the rich, therefore we have

\[ 2f(w + \frac{1}{2}) > f(l) + w + rw \] (18)

As \( r \) must be at least 1, we have

\[ f(l) + 3w < f(l) + w + 2rw \]

\[ < 2f(w + \frac{1}{2}) + rw \] (from (18))

Therefore, (17) holds and \( W(R) > W(P1,P1) \). For \( w' \leq w < w^* \), the MFIs co-ordinate on the (R) equilibrium. QED

References


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