Micro-finance Competition with Motivated MFIs

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Abstract: In this paper we examine the effects of increased competition among motivated MFIs, focussing on the implications of such competition for borrower targeting. We find that it depends in a subtle way on the interaction of several factors, namely the extent of inequality, the nature of the technology and the possibility of double-dipping. While, in the absence of competition, even a motivated MFI may prefer to lend to the not-so-poor in preference to the poor borrowers, in the presence of double-dipping, competition may in fact encourage lending to the poor. Interestingly, the presence of double-dipping is critical for MFI competition to have such a positive effect. Further, in the presence of double-dipping, MFI coordination may worsen borrower targeting whenever borrower inequality is at an intermediate level.

Keywords: Micro-finance competition, motivated MFIs, inequality, borrower targeting, technology, double-dipping, co-ordination.

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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). From 2004-2009, 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 2008-09 (Parameshwar et al. 2009).[2]

This rapid expansion has given rise to new issues and concerns though. 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."[3] 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).[4]

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.[5] 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 major MFIs, Prizma and Mikra, to move "downmarket" and make the decision to specialize in very poor

[1] Even around 2000, there were around 8-10 million households under similar lending programs all across the world (Besley and Ghatak, 2005), including countries in Latin America, Africa, Asia and even the United States of America (see Morduch, 1999).
[2] "Inverting the Pyramid: Indian Microfinance Coming of Age", 3rd edition.
[3] 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.
[4] In the Indian state of Karnataka, for example, there were 7.31 million micro-finance accounts by the end of 2009 (Srinivasan, 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).
[5] 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.

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 its effect on borrower targeting.[6]

In this paper we examine the effects of increased competition among motivated MFIs, focussing on its implications for borrower targeting. We find that this depends in a subtle way on the interaction of several factors, namely borrower inequality, the nature of the technology and the possibility of double-dipping. We analyse 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[7] 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 registration.[8] 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

[6] 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, 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 overindebtedness and default have affected less than 5% of the Indian microfinance sector's portfolio.

[7] 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.

[8] UNICIRDAP (1992) also says that "the rural poor are given higher priority by NGOs" (page 20) as compared to governments.

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. Banerjee et al. (1994), Ghatak (1999, 2000), Ghatak and Guinanne (1999), Roy Chowdhury (2005, 2007), Tassel (1999), etc).

We consider a framework with two kinds of borrowers, poor and not-so-poor, with the poor having no saving, and the not-so-poor (henceforth rich for expositional reasons) having a positive saving 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, as well as the interest rate to be charged from the 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 modelled as two MFIs receiving half units of capital each.[9]

One of our central results is that while, in the absence of competition, even a motivated MFI may prefer to lend to the not-so-poor in preference to the 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 micro-finance 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 be operated at the maximal scale. In the presence of double dipping, this can be achieved if a poor borrower receives both the loans, so that there is an equilibrium where both the MFIs lends to the same poor borrower knowing that in equilibrium this borrower is getting another loan from the other 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 the efficient level by the

[9] 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.

poor borrowers. Now convexity dictates that the loan goes to a rich borrower, since given that he already has some capital to begin with, 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 involve double-dipping. For other ranges of inequality though, the MFIs prefer that there be no double-dipping. In this case the equilibria involve randomisation 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 details. First, these show that one possible negative implication of MFI competition, both with and without double-dipping, is worsening of borrower targeting. This adds to the literature which identifies other 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.

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 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 Bangladesh are actually very poor.[10] According to Nagarajan (2001), out of over 100 NGO MFIs in the region of Central Asia, less than 12% actually targeted the poorest.[11,12] Further, in the present paper, the intuition behind such targeting relies on the interaction between several factors, namely the MFIs being motivated, the presence 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 the MFIs suffering from mission-drift. Aubert et al. (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 worsen borrower targeting. In fact, in the presence of double-dipping, and in the absence of MFI coordination, competition may improve borrower targeting. Given that the literature generally views double-dipping as something of a

[10] Defined as below the poverty line.

[11] 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.

[12] 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.

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 favour of such coordination.[13] 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 worsens borrower targeting whenever the inequality is at an intermediate level. For other ranges of inequality though, there is coordination on the poor borrower, so that the outcome is the same as that 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, 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).[14] 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 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.

[13] In Kolar, Karnataka, India for example, Srinivasan (2009) shows that such increased coordination has followed increased competition and default by borrowers.
[14] Gini coefficient data are from the Human Development Report 2007-08, UNDP.

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.[15] McIntosh and Wydick (2005) show that non-profit 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, 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.

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 in the presence of double-dipping, whereas Section 6 looks at MFI competition in the absence of double dipping. Section 7 has some concluding discussions, while some of the proofs are collected together in the Appendix.

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 donor, all of whom are motivated, are interested in lending to them and therefore not part of our framework. 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.

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.[16] Thus we interpret an increase in the convexity of the technology, modelled 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:

[15] 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.
[16] Sen (1962) also examines the issue of choice of techniques, though in a different context.

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.[17] 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. Note that 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 the efficient scale, unless they borrow, 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 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). 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≥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(s).

[17] 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.

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 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 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.

3 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

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

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.[18] Thus the surplus generated by lending to a rich borrower is

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

Now if w<w*, we have

[18] 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.

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

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.[19] 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, 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

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

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 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

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

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.

[19] 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.

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

(a) *The MFI will target a rich borrower when inequality between the poor and not-so-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.* $r<yw+x$.

(c) *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, i.e. 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.

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 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 ½. 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 concreteness, let there be two poor borrowers, P1 and P2, and two rich borrowers, R1 and R2.[20] 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 ½ 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 ½ from one MFI and ½-w from the second.[21] 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 – ½ 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 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.

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.

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 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. As discussed in the introduction, this depends on two factors, first, the convexity of the technology, and

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

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

second, that the MFIs act independently. Consider a situation where one of the poor borrowers has already obtained a loan of ½. Given that the other poor borrower has no savings, and even the savings of the rich are less than ½, 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.

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 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.

5 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

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

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

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

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.[22] 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 3. *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* $w^*<w<\underline{w}$*.*

(b) *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.*

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 $w<\underline{w}$ 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.[23]

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 ½, while if they do double dip they have to pay interest on a larger amount of 1-w.[24] 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.

5.1 MFI Coordination

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-

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

[23] The MFI must compute 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.

[24] 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).

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?

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 $\underline{w}<w<w\sim$, 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. $\underline{w}<w<w\sim$. Otherwise, competition has no effect on targeting.

Proposition 4. *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 ($w^*<w<\underline{w}$) or very high ($w>w\sim$), 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.*

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 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 ($\underline{w}<w<w\sim$). Competition policy will not matter for other ranges of inequality.*

Proof. As $\underline{w}>w^*$, we recall that in the single MFI case a poor borrower would have been targeted for the range $\underline{w}<w<w\sim$. 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**

6 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 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.[25,26] As regarding the second assumption, this is not innocuous. Such a 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, efforts are on to create a regulatory framework for MFIs with the explicit objective of preventing double-dipping (Srinivasan, 2009).[27] 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 3 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 ½. 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 ½. 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 would use up the whole loan of ½. This would enable a poor client to start a project of scale ½, but would enable a rich one to expand his 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.

[25] 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.

[26] 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.

[27] 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.

Proposition 6. *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.*

Propositions 1, 2, 3, 4 and 6 have been summarized in a diagrammatic form in Figures 1 and 2 for the sake of easy comparison.

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.

To summarise, 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 lend to poor borrowers always exists. Even with co-ordination, for certain levels of inequality, the MFIs will lend to poor borrowers unless r is very high.

6.2 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.

7 Discussion and Conclusion

We begin by briefly discussing some robustness issues.

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, 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, 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 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 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.

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[28] 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[29].

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 can be

[28] 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 $w<w^*$.

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

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 co-ordination among MFIs may encourage the MFIs to co-ordinate 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.

Generalising the 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 productivity falls off sharply. Our results should go through qualitatively for all production functions satisfying these properties.

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, and furthermore, MFI competition may have an adverse impact in terms of borrower targeting. In the presence of double-dipping however, MFI competition may improve targeting. Moreover, our analysis identifies conditions under which MFI coordination may worsen 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 be harmful, and may have a role in improving borrower targeting. Thus one needs to be careful while making blanket policy recommendations, either favouring 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.

8 Appendix

Proof of Proposition 2. 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 2f(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

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

or ½>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

$$y + x + w > y(w + \frac{1}{2})^2 + x(w + \frac{1}{2}) + \frac{x}{2} + (\frac{y}{2})^2$$

or $w(1 - x) > y[w(1 + w) - \frac{1}{2}]$. (5)

Note that the derivative of the LHS of inequality (5) 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 (5) holds at the highest possible value of w, here w=w*=(1-x)/y, inequality (5) will also hold for all values of w between 0 and w*. At w*, the

LHS has the value $[(1-x)^2]/y$ while the RHS has the value $1-x + [(1-x)^2]/y - y/2$. 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 3. 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

$$f(1) - r(1-w) > f(w + \frac{1}{2}) - \frac{r}{2}$$

or

$$r < \frac{f(1) - f(w+1/2)}{1/2 - w} . \qquad (6)$$

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 (6). The condition for f(1) to be less than this RHS boils down to

$$\frac{f(w+1/2)}{w+1/2} < f(1)$$

or $x + y(w + \frac{1}{2}) < x + y$

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 (6), we infer that (6) 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 $w>w^*$:

$$R1: f(1) + f(w) - r(1-w),$$

$$R2: 2f(w + \frac{1}{2}) - r .$$

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 ½ and start projects of size w+1/2. We can show that there is a cutoff $\underline{w}=\frac{-(2y+x-r)+\sqrt{(2y+x-r)^2+2y^2}}{2y}$, such that R1 is preferred for w<$\underline{w}$, while R2 is preferred for w>$\underline{w}$.

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 *either* w*<w<$\underline{w}$ *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<$\underline{w}$. If the first MFI lends to a rich borrower, the second now has to choose between R1, R2 and P1. Thus it compares

$$R1: f(1)+f(w)-r(1-w),$$

$$R2: 2f(w+\frac{1}{2})-r,$$

$$P1: f(w+\frac{1}{2})+f(\frac{1}{2})+f(w)-r.$$

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<$\underline{w}$, 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'<w*, the second MFI's choices between R1, R2 and P1 will yield

$$R1: f(1)+w-r(1-w),$$

$$R2: 2f(w+\frac{1}{2})-r,$$

$$P1: f(w+\frac{1}{2})+f(\frac{1}{2})+w-r.$$

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'<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>$\underline{w}$>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

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

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

$$P: f(w+\frac{1}{2}) + f(\frac{1}{2}) + w - r.$$

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

$$f(1) + rw > 2f(\frac{1}{2}) + w,$$

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>$\underline{w}$>w*. Again, the second MFI's choices are between R and P. It estimates the output from these strategies as

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

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

The condition for R to exceed P boils down to

$$f(1) + rw > 2f(\frac{1}{2}) + f(w).$$

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

$$\frac{y}{2} > w[x + yw - r] \qquad (7)$$

Note that if r>x+yw, (7) automatically holds as y is positive. If r<x+yw, note that the RHS of (7) is increasing in w. Therefore, if the inequality holds for w=1/2, it holds for all w. The condition for (7) 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 $w>\underline{w}>w^*$, 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 4. 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 $w^*<w<\underline{w}$, 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

$$W(P1,P1) = f(1) - r + 2f(w)\,. \tag{8}$$

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

$$W(R1,R1) = f(1) - r + rw + f(w)\,. \tag{9}$$

By comparing (8) and (9), we see immediately that welfare is higher in the (P1,P1) equilibrium iff

$$r < \frac{f(w)}{w} = x + yw = r^\wedge \,. \tag{10}$$

Therefore, for w between w* and $\underline{w}$, 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^ (it can easily be checked that r^ 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 $0<w<w'<w^*$, so that the candidate equilibria are (P1,P1) and (R1,R1). We have

$$W(P1,P1) = f(1) - r + 2w\,, \tag{11}$$

$$W(R1,R1) = f(1) - r + rw + w\,. \tag{12}$$

Given that r must be at least 1, it is easy to see that (12) exceeds (11), 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 $w>\underline{w}>w^*$, where the candidate equilibria are (P1,P1) and (R). We have

$$W(P1,P1) = f(1) - r + 2f(w)\,, \qquad (13)$$

$$W(R) = \frac{1}{2}[f(1) + f(w) - r(1-w)] + \frac{1}{2}[2f(w+\frac{1}{2}) - r]\,. \qquad (14)$$

We can show that (13)>(14) if and only if r<r^ and w is greater than a threshold w~ where $w\sim = \frac{2y + r - x - \sqrt{(2y+r-x)^2 - 2y^2}}{2y}$ while (14)>(13) otherwise. Therefore, the MFIs co-ordinate on the (P1,P1) equilibrium when w>w~ and r<r^ and co-ordinate on the R equilibrium otherwise. By setting r<r^ (which is feasible since r^>1 for all w>w*) the donor can ensure co-ordination on the (P1,P1) equilibrium when w>w~.

Finally we examine the range w'<w<w*, where again the candidate equilibria are (P1,P1) and (R). We have

$$W(P1,P1) = f(1) - r + 2w\,,$$

$$W(R) = \frac{1}{2}[f(1) + w - r(1-w)] + \frac{1}{2}[2f(w+\frac{1}{2}) - r]\,.$$

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

$$f(1) + 3w < 2f(w+\frac{1}{2}) + rw \qquad (15)$$

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

$$2f(w+\frac{1}{2}) > f(1) + w + rw \qquad (16)$$

As r must be at least 1, we have

$$\begin{aligned} f(1) + 3w &< f(1) + w + 2rw \\ &< 2f(w+\frac{1}{2}) + rw \quad \text{(from(16))} \end{aligned}$$

Therefore, (15) holds and W(R)>W(P1,P1). For w'<w<w*, the MFIs co-ordinate on the (R) equilibrium. **QED**

Proof of Proposition 6. From an individual MFI's perspective, the net utility surplus from lending ½ to a poor borrower is

$$S(P,\frac{1}{2}) = f(\frac{1}{2}) - \frac{r}{2} = \frac{y}{4} + \frac{x}{2} - \frac{r}{2}\,, \qquad (17)$$

as this poor borrower would also have to pay back interest on a loan size of only ½.

If the MFI lends to a rich borrower, this rich borrower can now implement a project of size w+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 ½ to a rich borrower is

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

$$= f(w+\frac{1}{2}) - w - \frac{r}{2} = x(w+\frac{1}{2}) + y(w+\frac{1}{2})^2 - w - \frac{r}{2}, \forall w < w^*. \qquad (18)$$

Note that

$$S(R,\frac{1}{2})_{\|w>w^*} > S(P,\frac{1}{2}),$$

as f(w+1/2) >f(w) + f(1/2) for any convex f(.). 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 (17) and (18),

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

given that x+y>1. Therefore, even when w<w*, an individual motivated MFI targets a rich borrower in the presence of competition.**QED**

References

Aghion, B., Morduch, J. *The economics of micro-finance.* The MIT Press: Cambridge, Massachusetts, London, England; 2005.

Aldashev, G., Verdier, T., 2010, Goodwill bazaar and giving to development. *Journal of Development Economics* 91, 48-63.

Aubert, C., de Janvry, A., Sadoulet, E., 2009, Designing credit agent incentives to prevent mission drift in pro-poor microfinance institutions. *Journal of Development Economics* 90, 153-162.

Banerjee, A., Besley, T., Guinnane, T.W., 1994. Thy neighbor's keeper: The design of a credit cooperative with theory and a test. *Quarterly Journal of Economics* 109, 491-515.

Basu, P., Srivastava, P., 2005. Scaling-Up Microfinance for India's Rural Poor. World Bank Policy Research Working Paper No 3646.

Besley, T., Ghatak, M., 1999. Public-Private partnerships for the provision of public goods: Theory and an application to NGOs, DEDPS ; 17; London School of Economics.

Besley, T., Ghatak, M., 2005. Competition and incentives with motivated agents. *American Economic Review* 95; 616 - 636.

Daley-Harris, S., 2005. State of the microcredit summit campaign report 2005. The Microcredit Summit Campaign, Washington DC.

Farrington, J., Lewis, D.J. *Non-governmental Organizations and the State in Asia*. London, Routledge; 1993.

Ghatak, M., 1999. Group lending, local information and peer selection. *Journal of Development Economics* 60, 27-50.

Ghatak, M., 2000. Screening by the company you keep: Joint liability lending and the peer selection effect. *Economic Journal* 110, 601-631.

Ghatak, M., Guinnane, T.W., 1999. The economics of lending with joint liability: Theory and practice. *Journal of Development Economics* 60, 195-228.

Harper, M., 2005. ICICI Bank and Microfinance in India. Working Paper.

Hoff, K., Stiglitz, J.E, 1998. Money-lenders and bankers: price-increasing subsidies in a monopolistically competitive market. *Journal of Development Economics* 55, 485-518.

Human Development Report 2007-08, UNDP.

Kai, H., 2009. Competition and wide outreach of microfinance institutions. MPRA Paper no. 17143.

McIntosh, C., Wydick, B., 2005. Competition and Microfinance. *Journal of Development Economics* 78, 271-298.

McIntosh, C., de Janvry., A, Sadoulet, E., 2005. How Rising Competition Among Microfinance Lenders Affects Incumbent Village Banks. *Economic Journal* 115, 987-1004.

Morduch, J., 1999. The micro-finance promise. *Journal of Economic Literature* 37, 1564-1614.

Nagarajan, G., 2001 "Poverty Outreach", chapter 5 in Forster, S, Greene, S, Pytkowska, J, eds *The State of Microfinance in Central and Eastern Europe and the New Independent States*, Microfinance Centre Project, CGAP Washington DC.

Navajas, S., Conning, J., Gonzalez-Vega, C., 2003, Lending Technologies, Competition and Consolidation in the Market for Microfinance in Bolivia. *Journal of International Development* 15, 747-770.

Parameshwar, D., Aggarwal N., Zanchi ,R., Shankar, S.S., 2009, *Inverting the Pyramid: Indian Microfinance Coming of Age*.3rd edition. Intellecap.

Rabbani, M., Prakash, Sulaiman, M., 2006, Impact Assessment of CFPR/TUP: A Descriptive Analysis Based on 2002-2005 Panel Data. CFPR/TUP Working Paper Series No 12. RED, BRAC and Aga Khan Foundation, Canada.

Rahman, R.I, 2003, Future Challenges Facing the MFIs of Bangladesh : Choice of Target Groups, Loan Sizes and Rates of Interest. Working Paper, BIDS, Dhaka.

Rhyne, E., Christen, R.P., 1999, Microfinance Enters the Marketplace. USAID, Washington DC.

Roy Chowdhury, P., 2005. Group-lending, sequential financing, lender monitoring and joint liability. *Journal of Development Economics* 77, 67-82.

Roy Chowdhury, P., 2007. Group-lending with sequential financing, contingent renewal and social capital. *Journal of Development Economics* 84, 487-506.

Sen, A.K, 1962. *The Choice of Techniques*. Oxford, Basil Blackwell.

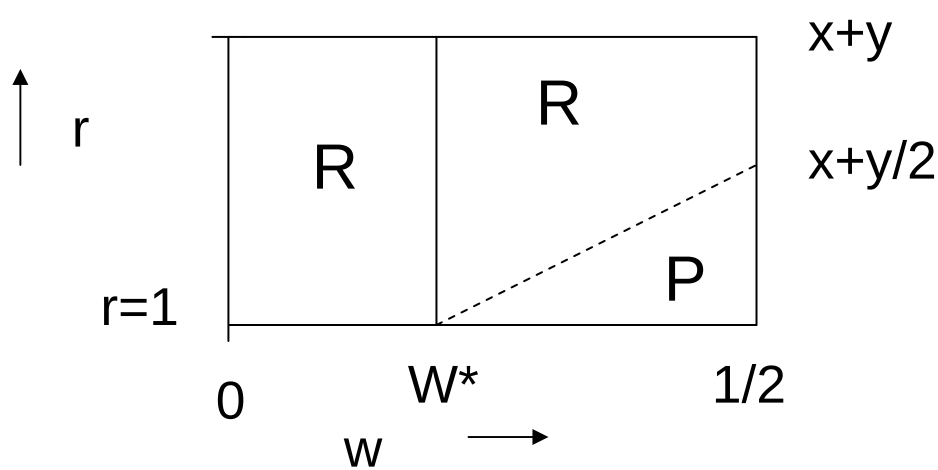
Srinivasan, N., 2009. Microfinance India, State of the Sector report 2009. Sage India.

Tassel, E.V., 1999. Group-lending under asymmetric information. Journal of Development Economics 60, 3-25.

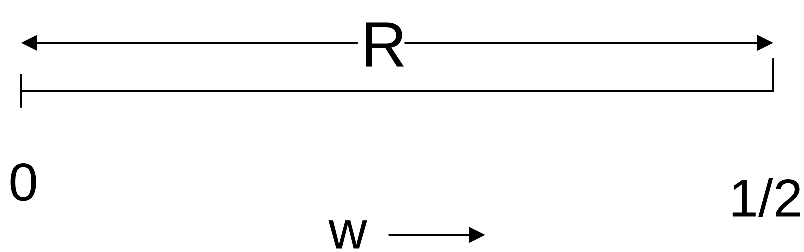
United Nations Interagency Committee on Integrated Rural Development for Asia and the Pacific. Partners in Rural Poverty Alleviation: NGO Cooperation. United Nations, New York; 1992.

Figure 1

No Competition (Prop 1)

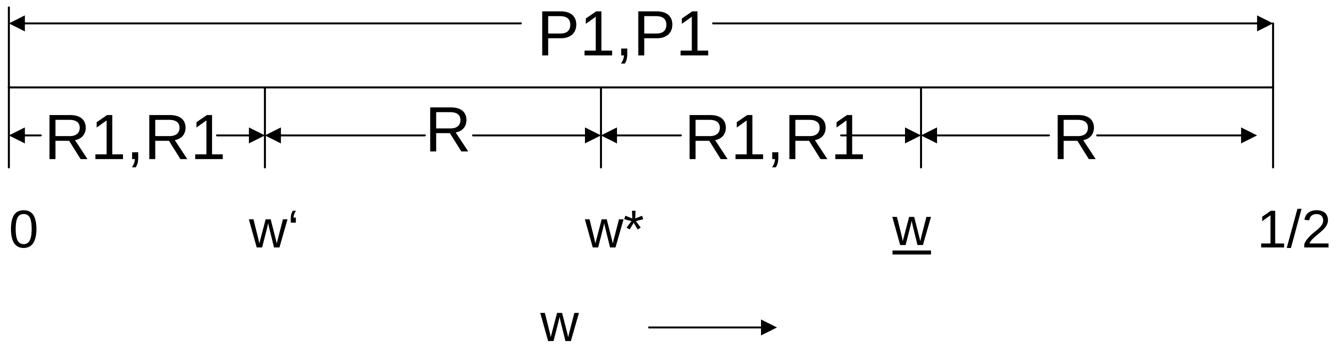


Competition, no double dipping (Prop 6)

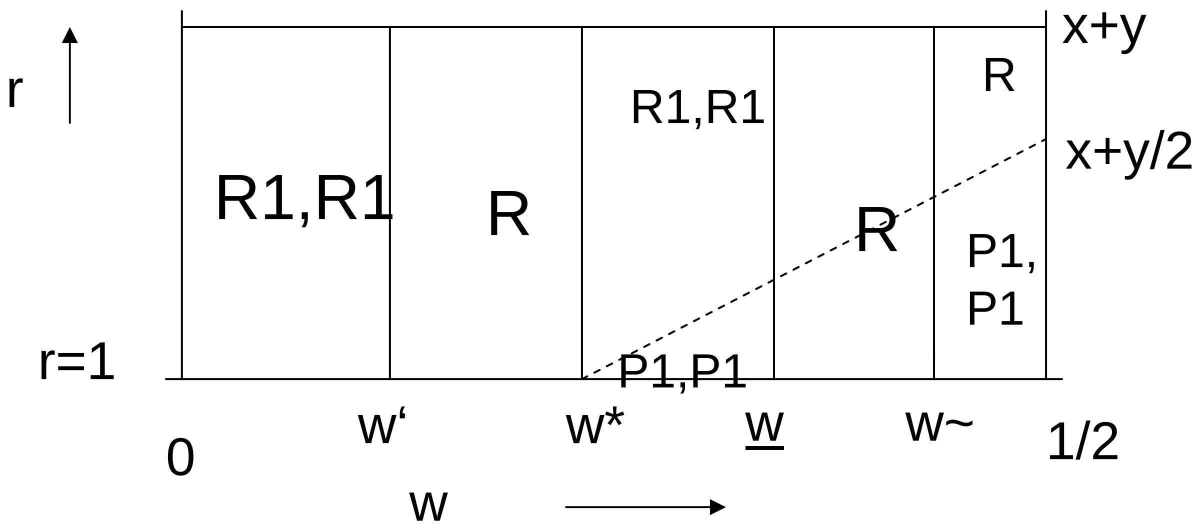


R: Lending to a rich borrower
P: Lending to a poor borrower

Competition, double dipping and multiple equilibria (Props 2,3)



Equilibria with double dipping and co-ordination (Prop 4)



P1,P1:double dipping by a poor borrower
R1,R1:double dipping by a rich borrower
R : lending to the rich, double dipping may or may not occur

Figure 2