

Funding Microfinance Under Asymmetric Information

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Abstract

We consider a model where poverty minimizing donors fund microfinance lenders that are heterogeneous in cost. Under asymmetric information the donors face a choice whether to issue grants or to charge the lenders for funds. While charging for funds leads to higher interest rates, a higher rate can induce separation by squeezing the higher cost lenders. Whether separation is good for aggregate poverty reduction or not depends on the quantity of supply of funds. When the supply is small grants are best, but when the supply is large enough it is better that lenders pay for external funding.

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1. Introduction

Over the years, microfinance has continued to attract a growing amount of funds and clients. Rather recently though, the composition of the funding has begun to change. While early microfinance operations relied almost exclusively on grants, over time, an increasing number of investors in microfinance have demanded a financial return. While the returns paid on such investments are generally below market returns, this represents a sharp departure from the more traditional, grant based approach.¹ This trend has sparked a debate about how it will impact the clients of microfinance. On the one hand, there are those who argue that the additional funds, and the fact that lenders must pay for these funds, is exactly what microfinance needs to make a true dent in global poverty. On the other hand, there is a concern among others that the presence of these new investors will change microfinance in ways that offer less benefit to the poor.²

One of the main questions in this debate is about the role of the new money in microfinance. If new investors inject additional funds into microfinance, it is fairly uncontroversial to say that microfinance can accomplish more poverty reduction. However, this misses two important details. One is that, relative to grants, the additional funds are more expensive, which can clearly impact how effective microfinance lenders are at reducing poverty. The other is that the funds have an opportunity cost. If the new money is not allocated to microfinance, then it can go towards alleviating poverty by some other means, such as creating jobs, or subsidizing food expenditures. To address these two issues, we take the question about the role of the new money and break it into two parts. First, we look at whether it can make sense to charge lenders a financial return on external funds, and second, we study how much funding should be allocated to microfinance.

We build a partial equilibrium model to address both of these questions. The model has a population of donors, whose sole objective is to reduce poverty. Each donor can allocate his funds to microfinance, or an alternative poverty reducing activity. Microfinance lenders transform the external funding into loans for the poor borrowers. The lenders then collect loan repayments, which are used to cover any operating costs and/or external financial obligation to the donors. In this setting, we find that depending on the total quantity of microfinance funding in the market, there can indeed be a positive role for donors who charge lenders a financial return.

The difference between the interest rate a microfinance lender charges his borrower and the lender's own operating cost defines the lender's spread. This spread is what the lender can afford to pay for his external funds. Since the spread is decreasing in a lender's operating costs, in general, lenders with higher operating costs can afford to pay less for their external funds. This difference in what lenders are capable of paying for external funds allows the external

¹See Reille and Forster (2008) for a general overview of this trend.

²This debate is discussed by Bruck (2006) and Cull et al. (2009), among others.

donors to use the financial return charged on these funds as a kind of screening mechanism. Basically, if donors demand a high enough financial return, the high cost lender is squeezed to the point that he can no longer afford the external funding. The tradeoff is that the financial return charged by donors must ultimately be paid for by the poor borrowers.

In our model, we find that whether individual donors should charge a return to screen lenders or not, depends critically on the total quantity of microfinance funding available in the market. When funding is small, grants are best, but when the quantity of funding is sufficiently high, donors can minimize poverty by demanding that lenders pay a financial return.

We also find that the equilibrium amount of funding dedicated to microfinance may not minimize poverty, even though this is the objective of the donors. The individual decision making of the donors can in some cases, generate an equilibrium outcome in the economy that is second best. This arises in a context of multiple equilibria. For example, we find that the economy can get stuck in an equilibrium characterized by a low level of grant funding for microfinance. In this event, the donors, as well as the poor, would be better off in a different equilibrium, characterized by both a larger amount of microfinance funding and funding that requires microfinance lenders to pay a financial return.

The existing literature on microfinance has not paid much attention to the relationship between the microfinance lender and the external donor. In contrast, there is a large amount of work examining the contracting between lenders and borrowers. This includes papers such as Stiglitz (1990), Belsey and Coate (1995), Ghatak and Guinnane (1999) and Rai and Sjostrom (2004). There are also a small, but growing number of papers focused on the relationship between different microfinance lenders. For example, McIntosh and Wydick (2005) find that competition between lenders can make it difficult to reduce poverty by way of cross subsidization. Additionally, Jain and Mansuri (2005) and De Janvry et al. (2010) look at the impact of sharing credit information between competing microfinance lenders.

The main focus of our paper is on the relationship between external donors and microfinance lenders.³ Both types of players are assumed to have a similar objective, in that they are poverty minimizers. However, we make two critical assumptions. First, we assume that the microfinance lenders have heterogeneous operating costs. This assumption is supported by the empirical evidence from surveys such as Rosenberg et al. (2009), Cull et al. (2009) and Gonzalez (2010), which find a wide variation in lenders' operating costs, often within the same geographical region. The implication for our model is that two different lenders, lending to the same type of client, will have a different impact on poverty. This turns out to be important because it means that there is a cost associated with subsidized funding. While the question of inefficiencies in microfinance has not

³In a related paper, Ghosh and Van Tassel (2011) model a relationship between investors and lenders, and find that profit maximizing investors can contribute to poverty reduction. However, unlike the current paper, their model is based on a fixed supply of funds, an exogenous interest rate, and an assumption that investors are motivated by profit, not poverty reduction.

received much attention in the theoretical literature, in the wider literature on charities and non-governmental organizations, this issue is a regular part of the discussion. For example, papers like Aldashev and Verdier (2010), Rowat and Seabright (2006) and Fruttero and Gauri (2005) use models that are based on the premise that institutions, although all motivated to help the poor, can vary in the quality of their poverty reducing activities.

Second, we assume that the external donors have imperfect information about the quality of the lenders. In contrast to market settings where higher costs are weeded out through competition, microfinance has traditionally relied on subsidized funding. The subsidies can allow inefficient lenders to absorb high costs using cheap funds. This problem has a parallel in the literature on aid and charitable giving, where in the absence of a hard financial return, earned in competitive markets, it can be difficult for an investor or donor to assess the performance of the aid recipient. In recent years, a few external rating agencies such as MicroRate and Mix Market have emerged in order to improve transparency in microfinance. The significance of these kinds of ratings is evidenced by the empirical findings of Garmaise and Natividad (2010), who find that when microfinance institutions receive favorable external ratings, there is a significant reduction in their cost of financing. While these kinds of ratings certainly help to reduce the opaqueness of the industry, the coverage can be limited and in some cases, based on self-reported data. This is emphasized by Rosenberg et al. (2009), who argue that in order to measure costs and efficiency at the institution level, one often must conduct on-the-ground investigations.

We have organized the paper as follows. In Section 2, we have a model of an economy where individual donors choose between allocating their funds to microfinance and some alternative organization. The alternative organization is exogenous to the model, and can be thought of as an NGO that reduces poverty in some non-microfinance way. If the donors allocate funds to microfinance, then microfinance lenders use the funds to issue loans, while trying to maximize their borrowers' incomes. In Section 3 we then establish a benchmark outcome for the economy, by deriving equilibrium under perfect information. Section 4 introduces asymmetric information into the model. First, we focus on how microfinance can be funded using either a pooling contract or a separating contract. Second, we derive equilibrium behavior, and third, we contrast the equilibrium outcomes in terms of poverty reduction. Finally, in Section 5 we have the conclusion.

2. The Model

Consider an economy with a population of \bar{F} donors, and two different markets, denoted A and B . Each donor has \$1 in funds and must choose whether to allocate his \$1 to market A or B . The donor's objective is to minimize poverty in the economy. We describe the donor's payoff function in more detail below.

If the donor chooses market A , then his \$1 goes to an organization that reduces poverty at a constant Ω per dollar. If the donor chooses market B , then his funds are used for microfinance. Microfinance acts as an intermediary

between the donors, and a population of m poor agents located in market B . Each of the agents owns a production project that requires an investment of \$1. If agent $j = 1, \dots, m$ invests \$1 in his project, his project generates a certain revenue, R_j . Project revenue varies among the agents. For all $j > 1$, $R_j - R_{j-1} = b$, where $b > 0$. This implies $R_m > R_{m-1} > \dots > R_2 > R_1$, and to make the projects worthwhile, we assume that $R_1 > 1$. All agents begin with zero wealth, and must obtain loans in order to invest in their projects.

There is a large number of microfinance lenders located in market B . Each lender can provide at most, one loan to a single agent. The lender's objective is to maximize his borrower's income.⁴ In order to issue a loan, the lender first must obtain \$1 in funding from a donor. If lender i receives funds, then the lender issues a single loan, and selects a gross interest rate r_i to charge his borrower. We assume that there are two types of lenders in the market. One type of lender has an operating cost of c per loan, and the other type of lender has zero operating cost. Let $c \in (0, 1]$. Among the population of lenders, fraction λ have zero cost, and fraction $1 - \lambda$ have cost c , where $0 < \lambda < 1$. We assume that operating costs are paid by the lender using the loan repayment from his borrower.

If agent j takes out a loan at interest rate r_i , then the agent repays $\min\{r_i, R_j\}$ to the lender, and earns an income of $R_j - \min\{r_i, R_j\}$. If the agent does not take out a loan, then the agent earns an income of zero.⁵ Any income earned by an agent due to a microfinance loan is measured as poverty reduction.

$$\begin{aligned} \text{Assumption A1} & \quad R_1 \leq \Omega \\ \text{Assumption A2} & \quad R_m \geq \Omega + (1 - \lambda)c \\ \text{Assumption A3} & \quad R_m > (2 - \lambda)c > R_1 \end{aligned}$$

Assumptions A1 and A2 are used to generate an interior solution, in terms of donors allocating funds to both markets. Assumption A3 bounds operating costs (adjusted by average lender quality), using the agents' project revenues. This assumption ensures that the heterogeneity in lender quality is neither irrelevant, nor too significant, from the donor's point of view.

Consider the following game. First, each donor simultaneously chooses whether to allocate his \$1 to market A or B .⁶ If a donor chooses to give

⁴We should emphasize that while both donor and lender are trying to minimize poverty, the two objective functions are different. The lender's objective is narrower than the donor's, in that the lender is focused on his borrower, and the donor is focused on overall poverty. If lenders focused on overall poverty rather than their own borrowers, then inefficient lenders would probably opt to exit the industry. It is our view that this is unrealistic, given the evidence that there are significant quality differences among exiting charities, NGOs, and microfinance lenders, and yet, they all choose to continue working.

⁵This implies that all production projects are worthwhile, at least in the sense that the revenue net of the \$1 investment (at zero interest) exceeds the agent's alternative. However, in general, if funding for lending is subsidized it may end up going to inefficient projects. Incorporating this possibility into the model would likely add new tradeoffs associated with subsidized funding.

⁶Using multiple donors, each with \$1 is a simple way to model the diverse population of contributors that give to microfinance. If instead, we assumed that there was only one

his funds to market B , then the donor also must select a gross financial return, $\mu \geq 0$, to charge lenders for his \$1 in funds. These individual allocation decisions by the donors create an aggregate supply of funds for microfinance, which can be partitioned according to μ . Before the funding is actually distributed to the lenders, each lender is given a choice whether to solicit funds or not, for each μ . The available funds are then distributed among the lenders who have solicited the funds, starting with the lowest μ . At most, each lender can receive \$1 in funds, so once a lender receives funds, he is not eligible for any additional funding. If a lender does not receive funds, then the lender is unable to lend, and accomplishes zero poverty reduction.

After the donors' aggregate funds, call it F , are distributed to the lenders, exactly F different lenders are capable of issuing \$1 loans. We assume that the lenders can observe each agent's individual project revenue.⁷ Since the lenders aim to maximize borrower income, the agents with the highest project revenues are the most desirable agents to lend to. We let the lenders compete for borrowers. Borrowers always want the lowest interest. Starting with agent R_m , all lenders with funds offer an interest rate, agent R_m then chooses one offer, and the remaining lenders then move to the next agent, namely R_{m-1} , making their offers and so on. This process continues until the last lender with funds, makes an offer to agent $j = m - (F - 1)$. The result is that the agents with the highest project revenues, namely R_m, R_{m-1}, \dots , and $R_{m-(F-1)}$, all receive loans.

Once all the loans are distributed to the agents, the agents invest, revenue is generated, and the agents make their loan repayments to the lenders. Lenders then use repayment revenue to cover any operating cost, as well as any financial obligation to the donors. The donor's individual payoff is equal to the total reduction in poverty in the economy at the end of the game. When the donor makes his initial allocation decision, his objective function consists of the total reduction in poverty in market A , plus the aggregate expected net income earned by the agents in market B .

3. Perfect Information

In this section, we establish a benchmark by assuming that the donors can observe the types of individual lenders. We also assume that given this information, the donors can discriminate between the lenders when they supply funds to microfinance.

To maximize the impact of their funds, under perfect information, the donors only give funds to the zero cost lenders. That is, no high cost lenders receive funding. Furthermore, to keep agent income as high as possible, the donors also demand that the lenders repay $\mu = 0$ on the funds. Throughout this paper, we refer to this type of funding as *grant funding*.

donor, then some results would indeed change. As discussed in Section 4, equilibrium can be inefficient in terms of poverty reduction, and this would probably be corrected if the donors could make a coalition level decision.

⁷Clearly this is a strong assumption. We discuss how it might be relaxed in Section 4.1.

After funding F is distributed to zero cost lenders, the lenders issue their loans to the agents, and the aggregate revenue generated from the agents' projects is

$$\begin{aligned}
 (1) \quad & R_m + R_{m-1} + R_{m-2} + \cdots + R_{m-(F-1)} \\
 &= R_m + (R_m - b) + (R_m - 2b) + \cdots + (R_m - (F-1)b) \\
 &= (R_m - 0.5b(F-1))F.
 \end{aligned}$$

We define this aggregate revenue as $\Gamma(F)$. Since lenders are trying to maximize agent income, it is optimal for the lenders to charge zero (gross) interest on their microfinance loans.⁸ In this case, it doesn't matter which lender loans to which agent. Under this kind of loan contract, the agents' aggregate income is simply equal to the aggregate revenue. At $F = 1$, the aggregate income is simply R_m , which under Assumption A2, exceeds Ω . Thus, in equilibrium, at least some funding must go to microfinance. As F increases, the marginal agent income on the F th project is $\Gamma(F) - \Gamma(F-1)$, or $\Delta\Gamma$, which is $R_m - b(F-1)$. Clearly this is decreasing in F . To find the equilibrium allocation of funding for microfinance, we set $R_m - b(F-1)$ equal to Ω , and solve for F , which gives us

$$(2) \quad F^* = \frac{1}{b}(R_m - \Omega) + 1.$$

This level of microfinance funding exceeds 1, as mentioned above, and does not exceed m as long as $R_m - (m-1)b \leq \Omega$, or $R_1 \leq \Omega$. This latter inequality holds under Assumption A1. We can now state the following result.

Proposition 1. Under perfect information, donors allocate grant funding $\min\{F^, \bar{F}\}$ to microfinance, and $\max\{0, \bar{F} - F^*\}$ to market A.*

Each donor has a choice where to allocate his funds, and what to charge lenders for the funds. With perfect information, the donor only gives his funds to the more efficient type of lender, and there is no reason for the donor to ask the lender to pay a financial return. Any financial return that a donor collects from a zero cost lender must be subtracted from the agent's income, which makes the agent and the donor, worse off. In the economy, donors allocate funds to microfinance until the last project funded by microfinance generates a reduction in poverty that is equivalent to what can be accomplished in the other market. At this point, all additional funding from the donors is redirected towards the organization in market A. The resulting allocation of funds minimizes poverty in the economy.

4. Asymmetric Information

⁸We acknowledge that a zero gross interest rate is unlikely to be observed in actual market settings. However, a zero interest rate is due to our assumption that the efficient microfinance lenders have zero operating costs, which is also unlikely. We could easily modify the model so that efficient lenders have positive costs, which would create positive interest rates. This would add no new insight, at the cost of additional notation.

We now turn our attention to a case of asymmetric information. In particular, we assume that the donors are unable to observe an individual lender's type. Under this assumption, the donors cannot condition the availability of their funding directly on a lender's cost. This means that when donors use grants to fund microfinance, both high cost and zero cost lenders can solicit funding. Relative to the case of perfect information, this obviously reduces the efficiency of microfinance at reducing poverty. In the following section we examine the impact of asymmetric information on the donors' allocation decisions. To organize the discussion, we break the analysis into three parts. First, in Section 4.1 we examine the payoffs to the donors from microfinance, ignoring market A . In Section 4.2 we then describe two different equilibria. Finally, in Section 4.3, we compare the two equilibria in terms of aggregate poverty reduction in the economy.

4.1 The Payoff From Microfinance

When a donor chooses to allocate his funds to microfinance, he must decide what kind of financial return to ask for. One option is to use a grant. With grants, the microfinance lenders do not have to charge their borrowers interest for the purpose of meeting an external obligation to the donors. However, the high cost lenders still must charge some interest on their loans. To cover costs, while trying to maximize agent income, these lenders opt to charge the interest rate $r = c$. Regardless of the amount of loans issued, this interest rate will always be affordable for the agents. To see this, note that the agent with the lowest revenue, namely $R_{m-(F-1)}$, can afford to pay $r = c$ as long as $c \leq R_m - (F-1)b$. Since at most, $F = m$, the lowest possible project revenue is $R_m - (m-1)b$, or simply, R_1 . Given that $c \leq 1$, and that $R_1 > 1$, it follows that $c < R_1$.

When donors allocate F in the form of grants to microfinance, all lenders solicit funding from the donors. The funds are then randomly distributed with fraction λ going to the zero cost lenders. After lenders receive funding and issue their loans, the aggregate revenue generated by the agents' projects is $(R_m - 0.5b(F-1))F$, as we calculated in Section 3. All high cost lenders charge their borrowers the interest rate $r = c$. To calculate the agents' aggregate income from microfinance lending, we subtract the aggregate operating cost, $(1-\lambda)Fc$, from aggregate project revenue. Hence, when donors allocate F to microfinance, and demand a return of $\mu = 0$, the aggregate reduction in poverty is

$$(3) \quad \Gamma_0(F) \equiv (R_m - 0.5b(F-1))F - (1-\lambda)Fc.$$

The function Γ_0 , has similar properties to Γ , as discussed in Section 3. In this case, the marginal income on the F th project funded is $\Delta\Gamma_0 = R_m - b(F-1) - (1-\lambda)c$, which is clearly decreasing in F . We examine Γ_0 in more detail below.

Grants are not the only way for donors to fund microfinance. While donors cannot directly exclude high cost lenders from soliciting funds, the donors can demand a financial return on their funds. Whether lenders can afford to pay this financial return depends on a few things. We now explore a strategy where the donor demands a high enough financial return on his funds, such that high cost lenders are squeezed to the point where they cannot afford to pay for the external funds.

Consider a profile of strategies where funding F is allocated to the lenders and where all donors demand an identical return, $\mu > 0$. Furthermore, consider lender strategies where only zero cost lenders solicit these funds. That is, no high cost lenders request funds at this μ . In order for this kind of lender strategy to hold as equilibrium behavior, it is necessary that a high cost lender does not have an incentive to deviate, in terms of soliciting funding.

To check this, say a high cost lender does deviate by soliciting funds and that he is then awarded \$1 in funding. To cover his cost, c , and his external financial obligation, μ , the lender can then offer agents an interest rate $r = c + \mu$. This is the lowest interest rate the high cost lender can offer to the agents. Since the other (funded) lenders are zero cost lenders, they can all afford to offer a lower interest rates than the high cost lender. That is, they can offer $r = \mu$. This means that when lenders compete for agents, by offering an interest rate, the zero cost lenders will win the agents with the highest project revenues. Consequently, the high cost lender ends up getting the agent with the lowest project revenue, namely $R_{m-(F-1)}$.

With this in mind, we can set the financial return that is charged by donors right at $\mu = R_{m-(F-1)} - c$. Given this μ , the lowest rate the high cost lender can offer the agent is the interest rate $r = c + \mu = R_{m-(F-1)}$. At this interest rate, the lender collect's the agent's entire project revenue as a loan repayment. This means that the lender accomplishes zero poverty reduction when he makes his loan. Anticipating this outcome, the high cost lender has no ex ante incentive to make the initial deviation.⁹

We now focus a set of strategies where all donors demand the same financial return from lenders. For a given level of microfinance funding, F , the donors demand a return of exactly $\mu = (R_m - (F - 1)b) - c$. Note that this return is decreasing in F . Consider a profile of strategies for the game where only zero cost lenders solicit funding. Consequently, only low cost lenders receive

⁹The assumption that lenders can observe the borrowers' individual project revenues ensures that the high cost lender is matched with the lowest revenue agent. This puts a limit on what the lender can afford to pay for funds, which ultimately induces separation. One may be able to weaken the assumption and deliver similar results. For example, if lenders are unable to observe revenues, then matching could be random. In this case, the high cost lender would face a chance of being matched with a high revenue agent, allowing the lender to pay more for his external funds. However, the lender would also face a chance of being matched with a low revenue agent. If the cost of funds were high enough, then the lender might find himself in a situation where he cannot meet his external financial obligation. This raises questions about whether the externally funded lender can or would want to enter into contracts that might ultimately lead to insolvency. In the right context, this risk of insolvency could dissuade high cost lenders from soliciting costly external funds.

funds. As we explained above, no individual high cost lender has an incentive to deviate and solicit funds. The low cost lenders issue F loans and charge the lowest interest rate they can, while satisfying their external obligation to the donors. That is, the lenders charge $r = R_m - (F - 1)b - c$. Under this type of loan contract, the aggregate income earned by the agents is

$$(4) \quad \begin{aligned} & (R_m - 0.5b(F - 1))F - Fr \\ &= (R_m - 0.5b(F - 1))F - F(R_m - (F - 1)b - c) \\ &= 0.5F(F - 1)b + Fc. \end{aligned}$$

We denote this aggregate income as $\Gamma_\mu(F)$. At $F = 1$, $\Gamma_\mu = c$, and on the F th project funded, the marginal income is $\Delta\Gamma_\mu = b(F - 1) + c$, which is clearly increasing in F . Hence, the aggregate agent income is rising, and the marginal income is also rising. Note that with regard to marginal income, this is the opposite of what we found for grant funding. The reason for this is that as funding increases, the supply of loans in the microfinance market increases. This in turn, reduces the maximum interest rate a high cost lender can get away with charging. When the maximum interest rate falls, the high cost lender is squeezed, and the financial return the lender can afford to pay external investors goes down. Since zero cost lenders effectively signal their type by matching this financial return, the cost of signaling goes down as the supply of microfinance funding rises.

We now have described two basic ways for donors to fund microfinance. One is to use grants, and the other is to demand a financial return that screens out high cost lenders. In general, grants yields the higher income when $\Gamma_0 > \Gamma_\mu$, or

$$(5) \quad (R_m - 0.5b(F - 1))F - (1 - \lambda)Fc > 0.5F(F - 1)b + Fc.$$

At $F = 1$, this inequality collapses to $R_m > (2 - \lambda)c$, which holds due to Assumption A3. Thus, when microfinance funding is low, donors are better off using grants to fund microfinance. However, as the funding for microfinance grows, the marginal impact from grants diminishes, while the marginal impact from non-grants increases. Thus, at some point they must cross. In particular, $\Gamma_0(F) = \Gamma_\mu(F)$ at $\tilde{F} \equiv \frac{1}{b}(R_m - (2 - \lambda)c) + 1$.

Lemma 1. $\tilde{F} \in (1, m)$.

We already proved that $\tilde{F} > 1$. The inequality $\tilde{F} < m$ is equivalent to $R_1 < (2 - \lambda)c$, which holds due to Assumption A3.

This finding implies that in the market for microfinance, there exists a critical level of funding, such that once the supply of funds exceeds this level, the donors are better off demanding that microfinance lenders pay a financial return for their external funds. At low levels of F , donors do best by relying on grants, but at higher levels of F , non-grant funding generates a higher reduction in poverty. The quantity of microfinance funding in the market determines how

high of an interest rate the high cost lender can charge, and this maximum rate in turn, determines just how costly it is to use financial returns as a way of screening lenders. When funding is low, the maximum interest rate is high, and so, the cost of screening is high. In this case, it is not worthwhile for donors to use financial returns to screen lenders. However, when the supply of microfinance funding is large enough, namely above \tilde{F} , the maximum interest rate is low, and hence, the cost of screening is low. In this case, the benefits of preventing the high cost lender from getting funds is worth the cost of forcing zero cost lenders to pay a financial return on their external funds.

When donors demand that lenders pay for external funds, this forces zero cost lenders to begin charging their borrowers interest. Under grant funding these lenders charge zero interest, but once donors demand $\mu = R_{m-(F-1)} - c$, all zero cost lenders charge a positive interest rate. Thus, some agents end up paying higher rates.¹⁰ The agents who happen to get loans from high cost lenders pay $r = c$ under grants, and $r = R_{m-(F-1)} - c$ under non-grant funding. Thus, for these agents the interest rate can go up or down, depending on $R_{m-(F-1)}$. This means that when lenders switch from grant funding to non-grant funding, while there are aggregate benefits from sorting lenders, some individual borrowers end up paying higher interest rates.

This relationship between poverty and the supply of microfinance funding offers an interesting way to interpret the evolution of microfinance funding. In the early days of microfinance, when the supply of funds to a given market was relatively small, funding was mostly in the form of grants. Typically governments, aid organizations, and non-governmental organizations distributed funding and attached little or no repayment obligation. Over the years, as more donors and investors were attracted to microfinance, the supply of funds in many microfinance markets grew. At the same time, a growing proportion of investors began demanding financial returns from microfinance. While in general, investors can obviously benefit from a financial return, microfinance investors often claim that it is not the financial earnings that motivate them. Rather, it is the fact that the poor interact with an intermediary that must pay for its external funds. That is, investors sometimes claim to have a preference for microfinance borrowers to work with an intermediary that is paying for its external funds. Interestingly, our model suggests that this evolution of microfinance funding, from small grants, to larger, non-grants, can exactly coincide with poverty minimization.

4.2 Equilibrium

We now look at equilibrium in the economy. We consider grants first and then look at the case where donors charge for funding. To organize things we break the analysis into two sub-sections.

¹⁰For this reason, it is correct to argue that agents are the ones that ultimately pay for the cost of the signal. Note that we assume the money the lenders pay the donors is terms of μ does not enter into the donors' objective functions. This would most likely change in a dynamic model, where the financial returns could be re-invested by the donors.

4.2.1 Equilibrium Under Grants

When donors allocate funds to microfinance, one approach is to use grants. The range of possible funding values for microfinance is somewhere between \$1 and m . Using grants, the donors allocate funding to microfinance until the last project funded generates an expected income equal to Ω . The remaining donors, namely $\bar{F} - F$, allocate their funds to market A . That is, the funding for microfinance should satisfy $\Delta\Gamma_0(F) = \Omega$, which occurs at

$$(6) \quad F_0^* = \frac{1}{b}[R_m - \Omega - (1 - \lambda)c] + 1.$$

This optimal level of funding is at least \$1 if $R_m \geq \Omega + (1 - \lambda)c$, which is true due to Assumption A2. Furthermore, $F_0^* < m$ if $R_1 < \Omega + (1 - \lambda)c$, which is implied by Assumption A1.

The resulting payoff to the donors is $\Gamma_0(F_0^*) + (\bar{F} - F_0^*)\Omega$. In order to support this allocation as an equilibrium, it is necessary that individual donors do not have an incentive to deviate. There are three general types of deviations that a donor can make. One type of deviation is for a donor to reallocate his \$1 from microfinance to market A , or to move his \$1 from market A , to microfinance, in the form of a grant. Since $\Delta\Gamma_0(F) = \Omega$ at F_0^* , and $\Delta\Gamma_0$ is decreasing in F , the donor is clearly worse off, or at least no better off from either one of these deviations.

The second type of deviation is where a donor, who is funding microfinance, continues to fund microfinance, but demands that the lender pay a financial return. While this return can vary, unless the donor demands a return that screens out high cost lenders, the donor is worse off by collecting a financial return. With this in mind, suppose the deviating donor demands that the lender pay a gross return on his \$1 of exactly $\mu = R_m - (F_0^* - 1)b - c$. Note that, as we discussed in Section 4.1, if a high cost lender takes this \$1 in funds, his subsequent interest rate offer to the agents will be the highest of all offers made. This implies he will end up with the agent with the lowest project revenue, namely $R_m - (F_0^* - 1)b$, and so, will accomplish zero poverty reduction. In contrast, a zero cost lender prefers to solicit this expensive money, and reduce poverty by some amount, rather than accomplish nothing.

After the deviation by the donor, the total amount of loans issued to the agents is still F_0^* . The aggregate project revenue is $(R_m - 0.5b(F_0^* - 1))F_0^*$. Thus, after the deviation, the agent's aggregate project revenue does not change. There are two changes though. First, one of the borrowers receives a loan from the zero cost lender, who funds the loan using the \$1 supplied by the deviating donor. This lender charges his borrower an interest rate $r = \mu$, or $r = R_m - (F_0^* - 1)b - c$. The second change is that now, only $(1 - \lambda)(F_0^* - 1)$ of the lenders are expected to have to pay operating costs. The resulting aggregate income for the agents after the deviation is

$$(7) \quad (R_m - 0.5b(F_0^* - 1))F_0^* - (1 - \lambda)(F_0^* - 1)c - [R_m - (F_0^* - 1)b - c].$$

The donor will not deviate if

$$(8) \quad (R_m - 0.5b(F_0^* - 1))F_0^* - (1 - \lambda)(F_0^* - 1)c - [R_m - (F_0^* - 1)b - c] + (\bar{F} - F_0^*)\Omega \leq \Gamma_0(F_0^*) + (\bar{F} - F_0^*)\Omega.$$

This inequality reduces to $F_0^* \leq \bar{F}$, or simply, $c \leq \Omega$. This inequality holds because $c \leq 1$, $R_1 > 1$, and Assumption A1 states that $\Omega \geq R_1$.

The last kind of deviation is where a donor, who is allocating his funds to market A , deviates by moving his funds to microfinance, and demands a financial return. In this case, given that the total funding for microfinance after the deviation is $F_0^* + 1$, the deviating donor demands a financial return of $\mu = R_m - ((F_0^* + 1) - 1)b - c$. This implies that the \$1 from the deviating donor must go to a zero cost lender, as we argued earlier. Also, now $F_0^* + 1$ projects are funded, generating an aggregate production revenue of $(R_m - 0.5bF_0^*)(F_0^* + 1)$. One agent must pay the interest rate $r = R_m - ((F_0^* + 1) - 1)b - c$, and $(1 - \lambda)F_0^*$ agents are expected to pay the interest rate $r = c$. Hence, after the deviation, the aggregate agent income is

$$(9) \quad (R_m - 0.5bF_0^*)(F_0^* + 1) - (1 - \lambda)F_0^*c - [R_m - F_0^*b - c].$$

A donor will not make this kind of deviation as long as

$$(10) \quad (R_m - 0.5bF_0^*)(F_0^* + 1) - (1 - \lambda)F_0^*c - [R_m - F_0^*b - c] + (\bar{F} - F_0^* - 1)\Omega \leq \Gamma_0(F_0^*) + (\bar{F} - F_0^*)\Omega.$$

This inequality reduces to $c \leq \Omega$, which we already know is true. We can now state the following result.

Proposition 2. There is an equilibrium where donors allocate grant funding equal to $\min\{F_0^, \bar{F}\}$ to microfinance, and allocate $\max\{\bar{F} - F_0^*, 0\}$ to market A .*

In this equilibrium, grant funding is allocated to microfinance until the last project funded generates an expected poverty reduction equal to what can be accomplished in market A , namely Ω . Of course, if $\bar{F} < F_0^*$, then all funds go to microfinance. Relative to the amount of funding allocated to microfinance under perfect information, observe that $F^* - F_0^* = \frac{1}{b}(1 - \lambda)c > 0$. This means that relatively less funding goes to microfinance under asymmetric information. As λ approaches 1, there is no distortion, but for all $\lambda < 1$, $F^* > F_0^*$, and the distortion is increasing as λ falls. The intuition is simple. Since the donors cannot prevent high cost lenders from soliciting grant funding under asymmetric information, microfinance is less efficient at reducing poverty relative to the case of perfect information. Hence, less funding is allocated to microfinance.

4.2.2 Equilibrium Under Financial Returns

The other way for donors to fund microfinance is to demand that lenders pay a financial return, as we discussed in Section 4.1. We now look at whether we can sustain this kind of funding in equilibrium. Consider a scenario where donors allocate funding $F = \bar{F}$ to microfinance, and demand a financial return of $\mu = R_{m-(F-1)} - c$. As we pointed out before, if only zero cost lenders solicit this type of funding, no individual high cost lender has an incentive to pursue this expensive funding. When all donors invest in microfinance, the total reduction in poverty for the economy is simply $\Gamma_\mu(\bar{F})$, at least for the case where $\bar{F} \leq m$. If it happens to be the case that $\bar{F} > m$, then m donors invest in microfinance, and $\bar{F} - m$ donors invest in market A .

There are two relevant deviations to consider. Say that $\bar{F} \leq m$. One option is for a donor to switch his allocation to market A . To prevent this deviation, it is necessary that

$$(11) \quad \begin{aligned} \Gamma_\mu(\bar{F}) &\geq \Gamma_\mu(\bar{F} - 1) + \Omega, \text{ or} \\ \bar{F} &\geq \frac{1}{b}(\Omega - c) + 1. \end{aligned}$$

That is, there is no deviation as long as \bar{F} is high enough. The other deviation is for a microfinance donor to convert his funding to grant funding. When the donor switches to a grant, both zero cost and high cost lenders solicit the \$1 in funds. Thus, the deviating donor's \$1 in funds goes to a zero cost lender with probability λ , and a high cost lender with probability $1 - \lambda$. The total project revenue for the agents doesn't change, but now only $\bar{F} - 1$ lenders, all of whom are zero cost, charge the interest rate $r = R_m - (\bar{F} - 1)b - c$, and for one of the lenders, there is a probability $1 - \lambda$ that the lender will charge $r = c$. Thus, the aggregate expected income of the agent is

$$(12) \quad (R_m - 0.5b(\bar{F} - 1))\bar{F} - (\bar{F} - 1)(R_m - (\bar{F} - 1)b - c) - (1 - \lambda)c.$$

The donor will not have an incentive to make the deviation if

$$(13) \quad \Gamma_\mu(\bar{F}) \geq (R_m - 0.5b(\bar{F} - 1))\bar{F} - (\bar{F} - 1)(R_m - (\bar{F} - 1)b - c) - (1 - \lambda)c.$$

This inequality reduces to $\bar{F} \geq \tilde{F}$.¹¹

Hence, to prevent either type of deviation, the funding \bar{F} must be sufficiently high. In particular, it is necessary that $\bar{F} \geq \frac{1}{b}(\Omega - c) + 1$, and that $\bar{F} \geq \tilde{F}$. If we compare these two lower bounds on the allowable size of \bar{F} , one can easily confirm that $\frac{1}{b}(\Omega - c) + 1 \leq \tilde{F}$, or equivalently, $\Omega \leq R_m - (1 - \lambda)c$. This is true due to Assumption A2. Thus, \tilde{F} is the relevant lower bound to consider. We can now state the following result.

Proposition 3. Suppose that $\bar{F} \geq \tilde{F}$. Then there is an equilibrium where donors allocate funding $\min\{\bar{F}, m\}$ to microfinance, demanding a return on

¹¹Note that for the case where $\bar{F} > m$, it is straightforward to show that there is no incentive to deviate under identical conditions to the case where $\bar{F} \leq m$, as demonstrated immediately above.

funds of $\mu = R_m - (\min\{\bar{F}, m\} - 1)b - c$, and allocate funding $\max\{0, \bar{F} - m\}$ to market A .

In this equilibrium, the donors allocate all available funding to microfinance until there are no more projects left to fund. If available funding in the economy exceeds m , then the remaining funds $F - m$ are allocated to market A . The reason donors supply as much funds as they can to microfinance is that the marginal income earned by agents is rising in F . Thus, if microfinance funding is optimal at F , it is also optimal at $F + 1$. A key aspect of this equilibrium is that the donors require lenders to pay a return on external funds. In particular, the donors demand a high enough financial return such that only the most efficient microfinance lenders solicit funding. While this eliminates operating costs from microfinance operations, to meet the external obligation, the efficient lenders must charge borrowers positive interest. All else equal, this results in less income for the agents. The tradeoff between operating costs and "high" interest loans is worthwhile for the donors as long as the supply of funds to microfinance exceeds \bar{F} .

The separation in our model is initiated by the donors. An alternative way to model this would be to let the microfinance lenders themselves announce the return instead of the donors. While a formal treatment is beyond the scope of the current paper, we can comment on how such a signal might work. In general it should depend on how donors choose to respond to the signal. While a low cost lender may want to signal, it is not obvious that donors will always be interested. For example, if λ is close to 1, then a donor may prefer to ignore the signal and only fund lenders that request grants. While a grant does pool lender types, for λ values close to 1 this isn't much of a problem. In this case, the donor may actually prefer the pooling contract to having the lenders signal using income taken from the agents' incomes.

4.3 Poverty Reduction in the Economy

An important difference between the two equilibria described by Propositions 2 and 3 is the way that microfinance is funded. As we explained in Section 4.2.1, grant based funding can be sustained in equilibrium for any \bar{F} . However, to sustain non-grant based funding in equilibrium, it is necessary that $\bar{F} \geq \tilde{F}$. This means that when $\bar{F} < \tilde{F}$, only grants can be used and when $\bar{F} > \tilde{F}$, we can have either equilibria.

One way to evaluate the two different kind of equilibria is to compare the effects on poverty reduction in the economy.¹² In particular, we can compare poverty reduction in the economy under grant and non-grant based equilibria, for each value of \bar{F} , within the domain $[F, m]$. We focus on $[\tilde{F}, m]$ because it is these values of \bar{F} for which there are multiple equilibria.

We defined \tilde{F} as the funding level where grants accomplish exactly the same amount of poverty reduction in the microfinance market as non-grants. When

¹²In contrast, in Section 4.1 we only looked at poverty reduction from microfinance.

donors can choose between microfinance and market A , it then follows that if \bar{F} is less than or equal to \tilde{F} , the grant based equilibrium does no worse than the non-grant based equilibrium. Note that we are now talking about economy wide poverty reduction, not just poverty reduction in the microfinance market.

Now we can examine what happens if total funding in the economy happens to exceed \tilde{F} . As \bar{F} increases above \tilde{F} , $\Gamma_0(F_0^*) + (\bar{F} - F_0^*)\Omega$ increases at a constant rate of Ω per \$1. Any additional funding, above \tilde{F} , is optimally allocated to market A .

In contrast, $\Gamma_\mu(\bar{F})$ increases at the rate $\Delta\Gamma_\mu = b(F - 1) + c$, which itself is increasing in F . Right at $F = \tilde{F}$, $\Delta\Gamma_\mu = R_m - (1 - \lambda)c$, which equals or exceeds Ω , due to Assumption A2. Furthermore, since $\Delta\Gamma_\mu$ is increasing in F , at $F > \tilde{F}$, $\Delta\Gamma_\mu > \Omega$. That is, the aggregate poverty reduction in the economy grows faster under the non-grant funding equilibrium. This implies that eventually, for a large enough quantity of funding in the economy, non-grant based poverty reduction should overtake the grant based poverty reduction.

By the above arguments, it follows that at some value of F , call it \hat{F} , where $\hat{F} \geq \tilde{F}$, it must be the case that $\Gamma_0(F_0^*) + (\hat{F} - F_0^*)\Omega = \Gamma_\mu(\hat{F})$ and for $F > \hat{F}$, $\Gamma_0(F_0^*) + (F - F_0^*)\Omega < \Gamma_\mu(F)$. This is relevant as long as $\hat{F} < m$.

Solving for \hat{F} gives us

$$(14) \quad \hat{F} = \frac{1}{b} \left[0.5b + \Omega - c + \sqrt{(c - 0.5b - \Omega)^2 - 2b(F_0^*\Omega - \Gamma_0(F_0^*))} \right].$$

Note To Editor: Insert Figure 1 here.

When $\bar{F} > \hat{F}$ and $\bar{F} < m$, then $\Gamma_\mu(\bar{F})$ exceeds $\Gamma_0(F_0^*) + (\bar{F} - F_0^*)\Omega$. This gives us a range of funding values, namely $(\hat{F}, m]$, for which non-grant funding is better than grant funding in terms of poverty reduction for the economy. Figure 1 offers an illustration of total poverty reduction in the economy as a function of funding, F . One can see that if $\bar{F} < \hat{F}$, the poverty reduction accomplished using grants exceeds that of non-grants. However, for $\bar{F} > \hat{F}$, $\Gamma_\mu(\bar{F})$ lies above the total reduction in poverty that can be accomplished using grant funding.

Finally, we need to confirm whether \hat{F} is less than m . If we plug in the value of \hat{F} , as given by equation (14), then $\hat{F} < m$ reduces to the following restriction on the parameter values:

$$(15) \quad (R_m - \Omega - (1 - \lambda)c)^2 + b(R_m - \Omega - (1 - \lambda)c) < b^2m^2 + 2bm(c - 0.5b - \Omega).$$

While this inequality is difficult to interpret, it does hold for certain parameter values. To see this, consider the following example. Suppose that $m = 100$, $R_m = 2$, $c = 0.75$ and $b = 0.01$, implying that $R_1 = 1.01$. In this case, we can identify values for the parameters λ and Ω , where $\hat{F} < m$. This is illustrated in Figure 2, where the shaded region represents all pairs (λ, Ω) for which $\hat{F} < m$.

Note To Editor: Insert Figure 2 here.

We can now state the following result.

Corollary 1. If $\widehat{F} < m$, then the grant based equilibrium minimizes poverty when $\overline{F} < \widehat{F}$, and when $\overline{F} > \widehat{F}$, the non-grant based equilibrium minimizes poverty. On the other hand, if $\widehat{F} > m$, then the grant based equilibrium always minimizes poverty.

We can use this result to evaluate the case of multiple equilibria in the economy. It is perhaps most rewarding to do this in the context of the debate that is mentioned in the introduction of the paper. When $\overline{F} < \widehat{F}$, we find that the grant based equilibrium is best for poverty reduction, and furthermore, the non-grant based equilibrium is not feasible. In contrast, when the total available funding for microfinance is higher, such that $\overline{F} > \widehat{F}$, microfinance can be funded two different ways. To analyze this scenario, we break it into two different cases.

First, consider the case where $\overline{F} > \widetilde{F}$, but $\overline{F} < \widehat{F}$. This means that both equilibria can be supported, but grants are relatively better at reducing poverty in the economy. That is, while the economy can support the non-grant based funding as equilibrium behavior, it is premature to do this at funding values less than \widehat{F} .

The second, and perhaps more interesting case is where $\overline{F} > \widehat{F}$. For this case, while grant based funding can be supported in equilibrium, it is not optimal for poverty reduction in the economy. Donors and the poor are better off if they use non-grant based funding in equilibrium. To accomplish this, an additional amount of funds, $\overline{F} - F_0^*$ must be reallocated from market A , to microfinance.¹³ Also, the donors must begin charging microfinance lenders a sufficiently high financial return. Clearly, this kind of change cannot be accomplished through an individual donor's deviation. What is necessary, in terms of moving from grants to non-grants, is a coalitional deviation.

When $\overline{F} > \widehat{F}$, we find that microfinance can get stuck so to speak, at a non-optimal, low level of grant funding. Moving to the new equilibrium requires two changes in donor behavior. One is that more money must be invested in microfinance and the other is the donors' investments in microfinance be converted from grants to non-grants. While our model neatly identifies the gains from such a change, at least for a coalition of donors, in practice this may be more difficult. Significantly raising the investment level in microfinance and demanding that lenders pay a financial return on external funds represents a sharp departure from the more traditional approach of grant based funding. Given the success donors have had with using grants at low levels of investment, it is understandable that some donors may hesitate to take such a leap.

In terms of the evolution of microfinance, our findings suggest that there is a point in time, as funding grows, where the traditional model of funding microfinance must undergo a somewhat radical change. According to our model,

¹³This is for the case where $\overline{F} \leq m$.

while it is best that funding is initially in the form of grants, once funding reaches a certain size, it is better that microfinance funding transform itself. The problem is that when investment is based on the decentralized, individual decisions of different donors, this transformation may be difficult to implement. In this sense, one interpretation of the current debate about how microfinance is funded is that it is a kind of tug of war between the two equilibria.

5. Conclusion

Central to our study is the notion that there is asymmetric information between a set of external donors and microfinance lenders. While this was perhaps less of a problem in the early days of microfinance, more recently the supply of external funding has grown tremendously in terms of its size, the number of donors, and its international scope. Given that investors often tolerate below market returns on this funding, there is the possibility that some microfinance lenders rely on cheap funding to cover high, inefficient costs. Papers such as Morduch (1999) and Gonzalez (2010) acknowledge this point, arguing that differences in administrative and operating costs across microfinance institutions cannot always be explained away by the size of loans or the rural versus urban settings.

It is in this context that we develop a model in order to formally examine how both the cost and supply of external funding impacts the quality of microfinance lending. When external funding takes the form of grants, this keeps lenders' costs low, which all else equal, translates into higher incomes for the poor borrowers. As lenders are forced to pay more for their external funding, the borrowers must pay higher interest rates on their loans. However, if the cost of external funding is sufficiently high, then the more inefficient lenders are nudged out of the market and separation occurs. The result is that the average quality of microfinance lender increases, which can compensate for the higher cost of external funds.

Whether separation translates into benefits for the poor depends on exactly how much funding is supplied to microfinance. When the quantity of supply of funds is relatively small, lenders enjoy large interest rate spreads between what they can charge borrowers and what they must pay for their external funds. In this case, it is relatively costly to induce separation. The poor are better off being served by a mix of low and high cost lenders that are funded using external grants. However, as the quantity of external funds for microfinance increases, the lenders' interest rate spread narrows and this lowers the cost of separation. When the supply of funds is large enough, having microfinance lenders pay for external funding can actually lead to lower aggregate poverty in the economy.

References

- Aldashev, G. and T. Verdier (2010) Goodwill bazaar: NGO competition and giving to development, *Journal of Development Economics*, 91, 48-63.
- Armendariz, B. and A. Szafarz (2009) On mission drift in microfinance institutions, CEB working paper, Universite Libre de Bruxelles.
- Besley, T. and S. Coate (1995) Group Lending, Repayment Incentives and Social Collateral, *Journal of Development Economics*, 46, 1-18.
- Bruck, C. (2006) Millions for Millions, *The New Yorker*, October 10.
- Cull, R., A. Demirguc-Kunt, and J. Morduch (2009) Microfinance Meets the Market, *Journal of Economic Perspectives*, 23, 167-192.
- De Janvry, A., C. McIntosh, and E. Sadoulet (2010) The supply and demand side impacts of credit market information, *Journal of Development Economics*, 93, 173-188.
- Fruttero, A. and V. Gauri (2005) The strategic choice of NGOs: Location decisions in rural Bangladesh, *Journal of Development Studies*, 41, 759-787.
- Garmaise, M.J. and N. Gabriel (2010) Information, the cost of credit, and operational efficiency: An empirical study of microfinance, *Review of Financial Studies*, 23, 2560-2590.
- Ghatak, M. and T.W. Guinnane (1999) The Economics of Joint Liability: Theory and Practice, *Journal of Development Economics*, 60.
- Ghosh, S. and E. Van Tassel (2011) Microfinance and competition for external funds, *Economics Letters*, 112, 168-170.
- Gonzales, A. (2010) Analyzing microcredit interest rates, MIX Data Brief No. 4, Microfinance Information Exchange, February.
- Jain, S. and G. Mansuri (2005) Information Sharing among Competing Microfinance Providers, Working Paper, University of Virginia.
- Kreps, D.M. and J.A. Scheinkman (1983) Quantity precommitment and Bertrand competition yield Cournot outcomes, *Bell Journal of Economics*, 14, 326-337.
- Malkin, E. (2008) Microfinance success sets off a debate in Mexico, *New York Times*, April 5.
- McIntosh, C. and B. Wydick (2005) Competition and Microfinance, *Journal of Development Economics*, 78, 271-298.
- Morduch, J. (1999) The Microfinance Promise, *Journal of Economic Literature*, 37, 1569-1614.
- Rai, A.S. and T. Sjostrom (2004) Is Grameen Lending Efficient? Repayment Incentives and Insurance in Village Economies, *Review of Economic Studies*, 71, 217-234.
- Reille, X. and S. Forster (2008) Foreign Capital Investment in Microfinance, Consultative Group to Assist the Poor, Focus Notes No. 44, February.
- Rosenberg, R., A. Gonzales, and S. Narain (2009) The new moneylenders: Are the poor being exploited by high microcredit interest rates? Consultative Group to Assist the Poor, Occasional Paper No. 15, February.
- Rowat, C. and P. Seabright (2006) Intermediation by aid agencies, *Journal of Development Economics*, 79, 469-491.

Stiglitz, J. E. (1990) Peer Monitoring and Credit Markets, *The World Bank Economic Review*, 4, 351-366.

Yunus, M. (2007) *Creating a world without poverty*, Public Affairs, New York.