Discussion Paper Series

On the Macroeconomics of Microfinance

By

Soyolmaa Batbekh and Keith Blackburn

Centre for Growth and Business Cycle Research, Economic Studies,
University of Manchester, Manchester, M13 9PL, UK

September 2008
Number 106

On the Macroeconomics of Microfinance*

Soyolmaa Batbekh and Keith Blackburn
Centre for Growth and Business Cycles Research
Economic Studies, University of Manchester

Abstract

Microfinance (small scale lending to the poor) is integrated into a dynamic macroeconomic model of income distribution. Two-period-lived agents, belonging to overlapping generation of dynastic families, choose between three alternative occupations - subsistence production, small-scale project investment and large-scale project investment. Subsistence activity is costless and riskless, whilst project investment is the opposite and may require external funding from financial institutions with imperfect powers of contract enforcement. In the absence of microfinance, only large-scale, collateralised loans are available through the traditional banking sector. Under such circumstances, initial inequalities persist as only the wealthy are able to acquire these loans, and as the small-scale enterprise is either not feasible or not profitable. With the introduction of microfinance, this venture is made both possible and attractive through the provision of non-collateralised loans and other features of microlending arrangements. Poverty and inequality are reduced as a result.

1 Introduction

Since its inception in the 1970s, microfinance has become a major part of the global quest to reduce poverty and inequality.[1] Typically defined as small-scale lending to the poor, microfinance is seen as offering hope to large

*Address for correspondence: Keith Blackburn, Economic Studies, University of Manchester, Manchester M13 9PL, England. **Tel:** 0161-275-3908. **Fax:** 0161-275-4928. **E-mail:** keith.blackburn@manchester.ac.uk.

[1]For excellent reviews of the theory and practice of microfinance, see Armendáriz de Aghion and Morduch (2005), Ghatak and Guinnane (1999) and Morduch (1999).

sections of populations that would otherwise be denied opportunities to escape from destitute and impoverished lifestyles. The spread of microfinance throughout the world has been striking, particularly over recent years. Thus it has been estimated that, during the past decade, the number of microfinance institutions has risen from around 600 to over 3000, whilst the number of microfinance clients has grown from around 13 million to over 100 million (e.g., Daley-Harris 2006).[2] Currently, the total value of investments in microfinance is put in the order of $4.5 billion and the total value of microloans is put in the region of $25 billion. To many observers, such developments are vindication of the acceptance of microfinance as a radically new initiative for accomplishing poverty reduction and nurturing social change.[3]

Financial markets are especially prone to problems of moral hazard and adverse selection because of the inevitable informational asymmetries between borrowers and lenders. The former, knowing more about their own individual attributes and circumstances (such as their abilities and payoffs), may behave in ways that conflict with the interests of the latter, creating tensions in a principal-agent relationship that must somehow deliver a mutually acceptable financial arrangement. At least potentially, the problems could be eliminated if lenders had cheap access to information about borrowers and strong mechanisms of contract enforcement. The same is true if borrowers had possession of some marketable asset (or assets) that could be offered to lenders as collateral. Indeed, a standard debt contract is simply one in which an individual borrower gives collateral to a lender as security against a loan, the loan being paid back with interest or the collateral being seized if repayment cannot be made. Unfortunately, the above options are rarely available in poor communities, where the cost of information gathering is high, the power of enforcement is weak and the ownership of wealth is trivial or non-existent. For these reasons, such communities do not present themselves as an attractive client base for traditional profit-maximising financial institutions (i.e., commercial banks): the costs are too great, the risks too high and the loans too small to make them viable customers.

Microfinance is meant to remedy the above situation through the use of innovative mechanisms that substitute for the absence of collateral. The most celebrated mechanism has been that of group lending with joint liability (as

[2]Classic examples of microfinance institutions are the Grameen Bank in Bangladesh (the first of its kind), BancoSol in Bolivia, Bank Rakyat in Indonesia and the networks of village banks in various countries inspired by the initial programme of FINCA (Foundation for International Community Assistance) in Latin America.

[3]As further testimony to this, 2005 was declared by the United Nations to be the International Year of Microcredit, whilst 2006 saw the founder of microfinance, Mohammad Yunus, being awarded the Nobel Peace Prize.

opposed to individual lending with limited liability) which aims to exploit the local information, social capital and peer influences that exist among clients of closely-tied communities. The basic idea is that lending to individuals in a group can foster collective responsibility if the lending is made contingent on the behaviour of the group. Thus each member of a group is allowed to acquire a loan for himself on the understanding that all members will share the burden if any one of them defaults for whatever reason, whether by accident or design: if not (i.e., if one member defaults and the others do not pay off the debt) then all are denied loans subsequently. Through peer pressure and the threat of social sanctions (e.g., dishonourment and exlcusion by the community), this arrangement is meant to provide individuals with strong incentives to repay loans whenever they can. It is also a means of encouraging individuals to monitor their group partners closely and to choose their group membership judiciously. In these ways, the costs of acquiring information and enforcing contracts are effectively transferred from lenders to borrowers. The formal analytics of all this can be found in a large theoretical literature on the microeconomics of group lending (e.g., Armendáriz de Aghion 1999; Armendáriz de Aghion and Gollier 2000; Banerjee *et al.* 1994; Besley and Coate 1995; Chowdury 2005; Gangopadhyay *et al.* 2005; Ghatak 1999, 2000; Stiglitz 1990; Varian 1990).[4]

Whilst the use of group lending is still an important aspect of microfinance business, there has been a gradual, but noticable, trend in this business towards more traditional individual-based lending as microfinanciers have expanded and diversified their services (e.g., Armendáriz de Aghion and Morduch 2000).[5] This may reflect a number of factors, of which we mention just a few. First, it has been suggested that group lending may be best at low scales of operation (i.e., for small projects and small loans), but that individual lending works better at higher levels of enterprise, even if the larger projects and larger loans are still relatively small, and even when borrowers are still relatively poor (e.g., Madajewicz 2003a,b). Second, questions have been raised about the reliance of group lending on peer pressure which may create tensions within a group (especially amongst the poorest and most vulnerable members) and which often seems less important than the concerns and influences of the broader village community (e.g., Montgomery 1996). Third, other doubts have been expressed about the credibity

[4]It is worth noting that group lending was in operation before the emergence of microfinance. Credit cooperatives of one form or another were the original practitioners, enabling the pooling of resources amongst neighbours and friends in poor communities. For further discussion, see Armendáriz de Aghion and Morduch (2005).

[5]This is true of even the most well-known examples of group-lending institutions, such as the Grameen Bank and BancoSol.

and effectiveness of peer pressure when group lending involves small clusters of close friends or family relatives who have natural allegiances to each other (e.g., Armendáriz de Aghion and Morduch 2005). Fourth, as vindication of these concerns, there is evidence to suggest that groups of strangers do just as well (and sometimes better) than groups of close acquaintances in making loan repayments, which again calls into question the role of social ties, social capital and social sanctions that group lending emphasises (e.g., Abbink *et al.* 2002; Ahlin and Townsend 2007; Sharma and Zeller 1997; Wydick 1999).[6] Fifth, and finally, there are some studies which show that borrowers prefer not to be obligated to others in group lending arrangements, but favour, instead, acceptance of responsibility for themselves (Women's World Banking 2003). Whatever the reasons, microfinance has been moving beyond joint liability group lending with a gradual inclination towards limited liability individual lending. The latter is obviously more attractive in some circumstances than in others - notably, when the costs of peer monitoring are high and the social penalties for non-group-compliance are weak (as is the case, for example, in more sparsely, more heterogeneously and more anonymously populated regions).[7]

Whether group lending or individual lending, the key objective of microfinance institutions is the same - namely, to provide affordable credit to those members of the population who would otherwise be denied loans and, in doing so, alleviate poverty and inequality. Likewise, whether group-based contracts or individual-based contracts, certain aspects of microfinance arrangements do not change substantially. Most striking, of course, is the non-requirement of collateral which is a crucial element in the anti-poverty mission of microfinanciers. Indeed, to seize the assets of the poor when repayment difficulties arise due to no fault of their own would run very much counter to this mission. Another notable feature is the combination of frequent, public and group-based meetings between borrowers and lenders. Such meetings can have a number of advantages, even if loans are made on an individual basis. By taking place regularly, they can provide lenders with an early warning system about potential problems. By involving public repayments, they can strengthen lenders' ability to exert pressure on potential defaulters. And by gathering clients together, they can reduce lenders' transactions costs. There

[6] To be fair, there is also evidence to the contrary, suggesting that repayment rates are higher the stronger are the social connections within groups (e.g., Cull *et al.* 2007; Karlan 2007; Wenner 1995; Zeller 1998).

[7] Even without peer monitoring and social sanctions, microfinanciers can give appropraite incentives to borrowers in a number of ways, such as rewarding those in good standing with larger future loans (progressive lending) and penalising those in bad standing by denying them future loans.

are benefits to borrowers as well, especially from the group aspect. Meeting as a group can facilitate education, training and skill acquisition through the sharing of ideas and experiences which may be particularly helpful for individuals with little business knowledge. As such, productivity can be improved and default risk can be reduced. It is notable that clients of microfinance institutions often report that they look forward to meetings because of the social aspects and the opportunity to exchange thoughts and learn from each other (Women's World Banking 2003). As regards the funding of microcredit, this tends to differ between institutions, with some being more reliant on subsidies and others being more commercially oriented. In the case of the latter, funds are obtained by borrowing from the wider community in much the same way that traditional banks operate. To this extent, profit and financial self-sufficiency are important considerations and recent years have witnessed a growing emphasis on these in the microfinance debate. At the same time, they are not the only objectives and the pursuit of them is moderated by social concerns.

As indicated earlier, most of the academic literature on microfinance has been microeconomic in nature. The purpose of the present paper is to give a macroeconomic perspective by integrating microfinance into a dynamic general equilibirum model of income distribution. This model describes an overlapping generations economy in which agents choose between three alternative occupations - subsistence production, small-scale project investment and large-scale project investment. Subsistence activity is costless and riskless, whilst project investment is the opposite. To undertake a project, it may be necessary for agents to acquire external funding from financial institutions. We assume that lending takes place on an individual basis, as is the normal practice of traditional banking and the recent trend in microfinance. Financial market imperfections arise from lack of contract enforcement which gives an opportunity for borrowers to strategically default on their loans. Our modelling of microfinance incorporates several of the key features in microbusiness operations alluded to above - specifically, the non-collateralisation of loans, the tempering of profit motives by social concerns and the externality effects of group meetings. These features are crucial for making small-scale investment an attractive option for agents. Against this background, we show that, in the absence of microfinance, the population is divided into those who are able to acquire large-scale (collateralised) loans from the traditional banking sector and those who are unable to do this and are forced into subsistence. Under such circumstances, initial inequalities persist and the population remains polarised into the rich and the poor. We then show how the introduction of microfinance can reduce (and possibly eliminate) inequalities by creating new opportunities - small-scale invest-

ments - for the poor. By taking on such investments, individuals with little or no wealth to begin with can make themselves better off and may even end up in a position to access large-scale credit. Our analysis has the implication that the interest rate charged on microfinance loans is greater than the interest rate charged on traditional bank loans. This is what one typically observes in practice. Indeed, microloan interest rates can be extremely high (as much as 30-40 percent), yet the demand for microloans thrives.

The remainder of the paper is organised as follows. In Section 2 we set out the basic model. In Section 3 we study the outcomes of the model when microfinance is absent. In Section 4 we do the same when microfinance is introduced. In Section 5 we make a few concluding remarks.

2 The Basic Set-up

Time is discrete and indexed by $t = 0, ..., \infty$. We consider a small open economy in which a continuum of mortal, reproductive agents make up a constant population of unit mass. Agents live for two periods with certainty and belong to dynastic families of overlapping generations connected by altruism. Each agent has one parent and one child, inheriting wealth from the former when young and bequeathing wealth to the latter when old. The initial distribution of wealth is given and accounts for initial inequalities in the economy. Young agents engage in productive activity based on a choice of occupation which gives access to a technology for generating output. For certain types of occupation to be undertaken, it may be necessary to acquire loans from financial institutions under the terms and conditions of mutually agreeable financial contracts. The output from an occupation is realised when an agent is old, at which time loans are repaid and consumption takes place. We proceed with our formal description of the economy with reference to the circumstances facing an agent of generation t.

The lifetime utility of an agent, U_t, depends on her own consumption, c_{t+1}, and the bequests that she leaves to her offspring, b_{t+1}.[8] Specifically,

$$U_t = \Gamma c_{t+1}^{\gamma} b_{t+1}^{1-\gamma}, \tag{1}$$

where $\Gamma = \frac{1}{\gamma^{\gamma}(1-\gamma)^{1-\gamma}}$ and $\gamma \in (0,1)$. Let x_{t+1} be the total realised income available to the agent over her lifetime. Then the allocations of consumption

[8] As in other models, we account for intergenerational altruism in the simplest way by assuming that parents derive utility from the size of their bequests, as opposed to the utility of their offspring. As in other models, as well, we keep the analysis tightly-focused and maintain tractability by assuming that dynasties last forever with given proclivities towards both altruism and fertility.

and bequests that maximise (1) are $c_{t+1} = \gamma x_{t+1}$ and $b_{t+1} = (1-\gamma)x_{t+1}$, implying $U_t = x_{t+1}$.

In the first period of life an agent inherits wealth from her parent which she is able to invest in a safe, divisible asset that pays a fixed rate of return of r, equal to the exogenous world rate of interest. The agent also takes on a production activity, of which there are three types. The first type involves the use of some basic (or traditional) technology in some routine activity that is both costless and riskless: this is a subsistence occupation that requires zero capital outlay and that yields a fixed amount of output, $s > 0$, with certainty. The second and third types both entail the operation of more advanced (or modern) technologies in more speculative ventures that are expected to be more productive, but that are also both costly and risky: these are entrepreneurial occupations that require fixed capital outlays and that yield stochastic amounts of output. One of them is a large-scale project for which the initial cost is $K > 0$ and output is $A(1 + \upsilon_{t+1})$, whilst the other is a small-scale project for which the initial cost is k and output is $a(1 + \nu_{t+1})$. The appropriate parameter restrictions are $K > k > 0$ and $A > a > 0$, meaning that the larger-scale venture is more costly, but also more productive, than the smaller scale venture. Each of the terms υ_{t+1} and ν_{t+1} is an identically and indepedently distributed random variable (a technology shock). For simplicity, we assume uniform distributions such that υ_{t+1} lies in the interval $[-u, u] \in (-1, 1)$ with probability density function $f(\upsilon_{t+1}) = \frac{1}{2u}$, whilst ν_{t+1} lies in the interval $[-v, v] \in (-1, 1)$ with probability density function $g(\nu_{t+1}) = \frac{1}{2v}$. Evidently, since the expected values of υ_{t+1} and ν_{t+1} are both zero, the expected returns from the two projects are simply A and a. Unlike subsistence activity, each of these risky projects requires an initial outlay of expenditure for which some agents may need to acquire loans from financial institutions with the obligation to repay those loans in the future.

In the second period of life an agent realises the outcomes of her previous endeavours. Let z_{t+1} denote the net payoff from whatever project was undertaken. Then the generic expression for the agent's final income is

$$x_{t+1} = (1 + r)b_t + z_{t+1}. \tag{2}$$

The basic problem confronting an agent is to choose an occupation that maximises her expected utility or, equivalently, her expected income. Whether she is actually able to do this is a matter of non-trivial significance as there may be circumstances under which an agent is prevented from making her optimal choice. These circumstances are revealed shortly. For now, we merely note that an agent can always fall back on costless subsistence activity, whether by choice or by force. The net payoff from doing this is simply

$z_{t+1} = s$, implying a final income of

$$x_{t+1} = (1 + r)b_t + s \tag{3}$$

3 The Economy Without Microfinance

The first scenario that we consider is one in which agents can acquire loans only from established financial intermediaries (banks) that, for one reason or another, are willing to fund only large-scale investment projects. Any applicant for a loan is therefore an agent whose inherited wealth is less than the cost of these projects: that is, an agent for whom $b_t < K$. Following others (e.g., Banerjee and Newman 1993), we assume that such an agent puts up all of her wealth as collateral against a loan of size of K that allows her to take on the project. Financial intermediaries are always able to provide loans by borrowing funds in perfectly elastic supply at the world interest rate, r. In the absence of bankruptcy and other such considerations, competition between intermediaries drives the rate of interest on loans down to r, in which case an agent makes a loan repayment of $(1 + r)K$ and retains all of her collateral.

Given the above, we may write an agent's net payoff from investing in the large-scale risky project as $z_{t+1} = A(1 + \upsilon_{t+1}) - (1 + r)K$. The absence of bankruptcy is assured by assuming that $A(1 - u) > (1 + r)K$, implying that the agent is always able to repay her loan out of whatever output is produced from the project. It follows that the agent's actual and expected final incomes from this venture are

$$x_{t+1} = (1 + r)b_t + A(1 + \upsilon_{t+1}) - (1 + r)K, \tag{4}$$

$$E(x_{t+1}) = (1 + r)b_t + A - (1 + r)K. \tag{5}$$

These expressions also apply to agents who are able to finance the venture by themselves - that is, agents for whom $b_t \geq K$ - since $(1 + r)K$ is then the opportunity cost of this investment. We assume that this type of risky project is always preferred to subsistence activity. From (3) and (5), the condition for this is $A - (1 + r)K > s$. We impose a slightly stronger restriction, $A(1-u)-(1+r)K > s$, which both satisfies the condition for no bankruptcy and ensures that the actual (as well as the expected) net payoff from the project is always greater than the payoff from subsistence.

Since loans are not available for financing the small-scale risky project, agents who undertake this venture must have sufficient wealth to finance it themselves. These are agents for whom $b_t \geq k$. As above, $(1 + r)k$ is then the opportunity cost of making this investment, the net payoff from which

is $z_{t+1} = a(1+\nu_{t+1}) - (1+r)k$. The corresponding expressions for actual and expected final incomes are $x_{t+1} = (1+r)b_t + a(1+\nu_{t+1}) - (1+r)k$ and $E(x_{t+1}) = (1+r)b_t + a - (1+r)k$. We assume that, in contrast to the above, agents never find it profitable to self-finance small-scale production as they always expect to be worse off by doing this than by choosing another occupation, even susbsistence activity. The relevant condition for this is $a - (1+r)k < s$.

3.1 Eligibility for Loans

As in other analyses (e.g., Banerjee and Newman 1993; Blackburn and Bose 2003; Galor and Zeira 1993), we introduce capital market imperfections by allowing agents an opportunity to deliberately default on their debt obligations - that is, a borrower may abscond with the output from a project without ever paying back her loan. It is this feature - the imperfect enforcement of loan contracts - that explains why some agents may be credit rationed and unable to realise their preferred choice of occupation.

We assume that, if an agent takes flight and avoids her loan repayment, then any income accruing to her is inaccessible to lenders who either fail to track her down, or fail to apprehend her before she has the chance of disposing of her income. At the same time, the agent loses all of her collateral, $(1+r)b_t$, and incurs a cost of h associated with her actions (e.g., because effort or resources must be spent on avoiding arrest). The final income of defaulter is therefore $A(1+\upsilon_{t+1}) - h$. Evidently, the expected income from defaulting, $A - h$, must be no greater than the expected income from not defaulting, $E(x_{t+1})$ in (5), if defaulting is not to occur. This condition implies $-h \leq (1+r)b_t - (1+r)K$, from which we may determine a critical value of wealth, $\widehat{b}$, above which loans are granted and below which loans are refused: that is,

$$\widehat{b} = K - \frac{h}{1+r}. \tag{6}$$

Clearly, since loans are given only to agents who would never default (i.e., agents whose inherited wealth is greater than $\widehat{b}$), and not to agents who would always default (i.e., agents whose inherited wealth is less than $\widehat{b}$), defaulting never actually occurs.

3.2 Dynamics of Income Distribution

Based on the foregoing analysis, we are able to determine the rules governing changes in the fortunes of each dynastic family. These lineage dynamics

describe the transition of individual wealth from one generation to the next according to the choice of occupation that is made each period. From these dynamics, we may then infer the long-run distribution of income, starting from any given initial distribution.

We begin by recalling that each agent of generation t bequeaths a fraction of her realised income to her offspring: that is, $b_{t+1} = (1-\gamma)x_{t+1}$. For agents who undertake the large-scale risky project, x_{t+1} is given by (4) with $b_t \geq \widehat{b}$. For all other agents who engage in subsistence activity, x_{t+1} is given by (3) with $b_t < \widehat{b}$. It follows that the intergenerational evolution of wealth for an individual dynasty is described by

$$b_{t+1} = \begin{cases} (1-\gamma)[(1+r)b_t + A(1+\upsilon_{t+1}) - (1+r)K] & \text{if } b_t \geq \widehat{b}, \\ (1-\gamma)[(1+r)b_t + s] & \text{if } b_t < \widehat{b}. \end{cases} \tag{7}$$

These transition equations are portrayed in Figure 1, where we assume that $(1-\gamma)(1+r) \in (0,1)$ so that the transition process is stable in each case. Lines (i) and (ii) depict the upper and lower bounds on wealth transition for $b_t \geq \widehat{b}$ (corresponding, respectively, to $\upsilon_{t+1} = u$ and $\upsilon_{t+1} = -u$), whilst line (iii) shows the transition of wealth for $b_t < \widehat{b}$. Associated with these paths are the fixed points $b_u^* = \frac{(1-\gamma)[A(1+u)-(1+r)K]}{1+(1-\gamma)(1+r)}$, $b_{-u}^* = \frac{(1-\gamma)[A(1-u)-(1+r)K]}{1+(1-\gamma)(1+r)}$ and $b_s^* = \frac{(1-\gamma)s}{1+(1-\gamma)(1+r)}$, where $b_{-u}^* > b_s^*$ by virtue of our earler assumption that $A(1-u) - (1+r)K > s$. Under further parameter restrictions, we also have $b_{-u}^* > \widehat{b}$ and $b^* < \widehat{b}$: the first feature serves to simplify and sharpen our analysis by ensuring that any lineage which succeeds in acquiring a loan will never return to subsistence (i.e., once an investor, always an investor); given this, the second feature then makes our analysis non-trivial by precluding the situation in which all lineages (including even those that are denied loans to begin with) automatically end up as entrepreneurs.

The long-run distribution of income is straightforward to characterise for this economy. The only agents who become entrepreneurs are those who are relatively well-off to begin with, having a level of wealth that exceeds the critical value. All other agents with wealth below this value remain forever in subsistence. Thus initial inequalities persist and the population is polarised into the rich and the poor.

4 The Economy With Microfinance

The second scenario that we consider is one in which agents have an opportunity to acquire investment funding from institutions that lie outside

the traditional banking sector. These other organisations specialise in the business of microfinance, providing loans specifically for use by the poorer members of the population to undertake small-scale projects. As indicated earlier, such organisations operate in ways that distinguish them from the larger, more established financial institutions. Three aspects, in particular, are worth recalling. The first is that profit maximisation is tempered by social concerns over poverty and inequality, which influences the nature of financial contracts. The second is that loans are typically unsecured by any collateral, which also affects the terms and conditions of borrowing. And the third is that business is often conducted in a collective environment, which fosters interactions between borrowers in regular meetings with lenders. We aim to capture these features in our analysis.

According to our previous description of events, no agent who is denied access to the large-scale risky project would be either able or willing to undertake the smaller-scale risky investment. We now assume that the opportunity to borrow from microfinance institutions makes this investment both possible and attractive to all such agents. We motivate the increased appeal of the project by entertaining the notion that there are positive externalities (spillover effects) from the contact and communication that agents have with each other in their dealings with microfinanciers. Such interactions foster the transmission and exchange of ideas, knowledge and experience which improves the productivity of all those involved. The upshot is an increase in the expected yield from the project which now delivers $a'(1+\nu_{t+1})$ units of output, where $a' > a$. Under appropriate parameter restrictions (to be revealed below), this implies an expected net income which is greater than the income from subsistence.

Given the above, any agent for whom $b_t < \widehat{b}$ will seek to exploit the investment opportunities made available by microfinance organisations. Like established banks, these organisations make loans of size k by borrowing funds at the world rate of interest, r. Unlike banks, however, they face the prospect that their clients may go bankrupt on the smaller-scale project which is less productive (as well as less costly) than the larger-scale venture. This uncertainty about loan repayment drives a wedge between the borrowing and lending rates of microfinanciers. Denoting the latter by i_{t+1}, the amount of repayment required is $(1+i_{t+1})k$.[9]

Under the assumption that microfinance loans are non-collateralised, the ability of agents to pay back these loans depends only on the realised in-

[9]In principle an agent could apply for a smaller loan than k by investing her own inherited wealth, b_t, in the project, in which case her loan repayment would be $(1+i_{t+1})(k-b_t)$. As we shall see, doing this would yield the same expected net income as that obtained from borrowing the full amount of k

comes from their risky investments: they do not face any claims on their inherited wealth which they are permitted to retain at all times. An agent is therefore bankrupt (non-bankrupt) whenever $a'(1+\nu_{t+1}) < (1+i_{t+1})k$ ($a'(1+\nu_{t+1}) \geq (1+i_{t+1})k$). As indicated earlier, one may regard the non-collateralisation of microfinance loans as a reflection of lenders' social concerns to avoid worsening the plight of the poor should their investments fail through no fault of their own. To reinforce this aspect, we assume that agents are guaranteed their subsistence level of income if ever the net payoff from the project falls below this level - that is, if ever $a'(1+\nu_{t+1})-(1+i_{t+1})k < s$. The surplus that is left, $a'(1+\nu_{t+1})-s$, is then appropriated by lenders. This insurance-type arrangement is always feasible if $a'(1-v) > s$. It follows that, for any given i_{t+1}, there is a critical value of ν_{t+1} above (below) which loans are repaid (not repaid). This is the value $\widehat{\nu}_{t+1}$ which satisfies

$$a'(1+\widehat{\nu}_{t+1}) = (1+i_{t+1})k + s. \tag{8}$$

Naturally, $\widehat{\nu}_{t+1}$ is increasing in i_{t+1}: *ceteris paribus*, the higher is the interest rate on loans, the more productive must be the investment if loan repayment is to be possible. We may now infer that an agent's net income from the small-scale risky project is either $z_{t+1} = a'(1+\nu_{t+1})-(1+i_{t+1})k$ if $\nu_{t+1} \geq \widehat{\nu}_{t+1}$ or $z_{t+1} = s$ if $\nu_{t+1} < \widehat{\nu}_{t+1}$. The agent's actual and expected final incomes from the project are therefore

$$x_{t+1} = \begin{cases} (1+r)b_t + a'(1+\nu_{t+1}) - (1+i_{t+1})k & \text{if } \nu_{t+1} \geq \widehat{\nu}_{t+1}, \\ (1+r)b_t + s & \text{if } \nu_{t+1} < \widehat{\nu}_{t+1}, \end{cases} \tag{9}$$

$$E(x_{t+1}) = (1+r)b_t + \int_{\widehat{\nu}_{t+1}}^{v} [a'(1+\nu_{t+1}) - (1+i_{t+1})k]g(\nu_{t+1})d\nu_{t+1} + \int_{-v}^{\widehat{\nu}_{t+1}} sg(\nu_{t+1})d\nu_{t+1}. \tag{10}$$

As before, imperfect enforcement of loan contracts means that agents may strategically default on their debt obligations with microfinanciers. They may do so by absconding with the output from their projects at a cost of h. Based on our earlier remarks, we assume that there is also some other, non-pecuniary cost, q, associated with defaulting in this case (e.g., the moral shame, or social stigma, endured from the rest of the microfinance community). On the other hand, agents who engage in such behaviour, unlike those who default on bank loans, do not lose any of their inherited wealth since this is not put up as collateral which can be seized. Given all of this, the net payoff to a defaulter on a microfinance loan is $a'(1+\nu_{t+1})-h-q$, implying a final utility of $(1+r)b_t + a'(1+\nu_{t+1})-h-q$. Like previously, the expected

value of this, $(1+r)b_t + a' - h$, must be no greater than the expected utility from not-defaulting, $E(x_{t+1})$ in (10), if defaulting is not occur. Unlike previously, this condition does not depend on an agent's inherited wealth, but rather implies (as we shall see below) a restriction on parameter values. Naturally, we assume that this restriction is satisfied (otherwise there would be no microfinancing), in which case there is no problem for an agent in obtaining a loan to run the small-scale project. What does pose a problem - for microfinanciers - is the risk that agents may be unable to repay their loans which needs to be taken into account when setting the interest rate on borrowing, a matter to which we now turn.

4.1 Interest Rate Determination

The loan contract between a microfinancier and a borrower stipulates that the latter pays the former $(1+i_{t+1})k$ in the event that $\nu_{t+1} \geq \widehat{\nu}_{t+1}$ and $a'(1+\nu_{t+1}) - s$ in the event that $\nu_{t+1} < \widehat{\nu}_{t+1}$.[10] Competition between microfinanciers means that they operate at zero expected profit. Since the cost of providing a loan is $(1+r)k$, this break-even condition implies

$$(1+r)k = \int_{\widehat{\nu}_{t+1}}^{v} (1+i_{t+1})kg(\nu_{t+1})d\nu_{t+1} + \int_{-v}^{\widehat{\nu}_{t+1}} [a'(1+\nu_{t+1}) - s]g(\nu_{t+1})d\nu_{t+1}. \quad (11)$$

Observe that this condition allows us to re-write (10) as simply $E(x_{t+1}) = (1+r)b_t + a' - (1+r)k$, in which case we may deduce from above that $h + q > (1+r)k$ is the parameter restriction which prevents defaulting on microfinance loans, and from (3) that $a' - (1+r)k > s$ is the restriction which makes the acquisition of these loans preferable to subsistence activity.

Subtraction of (11) from (8) yields

$$(1+i_{t+1})k = (1+r)k + \int_{-v}^{\widehat{\nu}_{t+1}} [a'(1+\widehat{\nu}_{t+1}) - s]g(\nu_{t+1})d\nu_{t+1} - \int_{-v}^{\widehat{\nu}_{t+1}} [a'(1+\nu_{t+1}) - s]g(\nu_{t+1})d\nu_{t+1}. \quad (12)$$

This expression shows the interest rate spread between lending and borrowing

[10] For simplicity, we abstract from any verification costs that lenders may incur when borrowers claim bankruptcy. Incorporating such costs merely complicates the analysis without changing the main results.

in the microfinance sector.[11] The size of spread depends on how much a lender expects to lose when a borrower does not make her full loan repayment. To be sure, observe from (8) that the first integral term on the right-hand-side of (12) is equal to $\int_{-v}^{\widehat{\nu}_{t+1}}(1+i_{t+1})kg(\nu_{t+1})d\nu_{t+1}$ which measures the expected amount of non-repayment in the event of $\nu_{t+1} < \widehat{\nu}_{t+1}$. Conversely, the second integral term on the right-hand-side of (12) gives the expected amount of income that is claimed in this event, net of insurance income. Accordingly, (12) implies that the contractual interest rate on microfinance loans is set as a simple mark-up over microfinanciers' cost of borrowing, where the size of mark-up is equal to the expected net income lost due to non-repayment of loans. Given the distribution of ν_{t+1}, this mark-up rule may be simplified to

$$(1+i_{t+1})k = (1+r)k + \frac{a'(\widehat{\nu}_{t+1}+v)^2}{4v}. \tag{13}$$

As above, there is a positive relationship between i_{t+1} and $\widehat{\nu}_{t+1}$: *ceteris paribus*, microfinaciers set a higher contractual interest rate the more likely it is that bankruptcy will occur (an event that transpires with probability $\int_{-v}^{\widehat{\nu}_{t+1}} g(\nu_{t+1})d\nu_{t+1} = \frac{\widehat{\nu}_{t+1}+v}{2v}$). Evidently, our model yields the result that the rate of interest charged on small-scale loans by microfinance institutions is greater than the rate of interest charged on larger-scale loans by more traditional financial institutions - a result consistent with empirical observation, as alluded to earlier.

The expressions in (8) and (13) define a simultaneous equations system in i_{t+1} and $\widehat{\nu}_{t+1}$. As shown in the Appendix, the solution to this system is unique and feasible under the parameter restriction $a' > (1+r)k + s > a'(1-v)$.[12] This solution, in which $\widehat{\nu}_{t+1} = \widehat{\nu}$ and $i_{t+1} = i$ for all t, is summarised as follows:

$$\widehat{\nu} = v - \frac{2\sqrt{a'v[a'-(1+r)k-s]}}{a'}, \tag{14}$$

$$(1+i)k = a'(1+\widehat{\nu}) - s = (1+r)k + \frac{a'(\widehat{\nu}+v)^2}{4v}. \tag{15}$$

The properties of these expressions are quite intuitive. For example, both $\widehat{\nu}$ and i are increasing functions of v and s. The parameter v - which determines the spread of the distribution of ν_{t+1} - provides a measure of uncertainty

[11] Results of this sort are fairly standard for the type of uncertain financial environment that we are considering (e.g., Agenor and Aizenman 1998a,b; Aizenman and Powell 2003; Azariadis and Chakraborty 1999).

[12] The first inequality in this restriction is recalled to be the condition for small-scale project investment to be preferred to subsistence production.

associated with the small-scale project. The influence of uncertainty derives from the fact that the loan repayment schedule offered by lenders to borrowers is a non-linear (specifically, concave) function of ν_{t+1}. To be sure, recall that the repayment is $a'(1+\nu_{t+1})-s$ if $\nu_{t+1}<\widehat{\nu}$, but $1+i$ if $\nu_{t+1}\geq\widehat{\nu}$. The expected repayment is therefore reduced by a mean-preserving spread in the distribution of ν_{t+1} (i.e., an increase in v).[13] Lenders compensate for this by charging a higher interest rate on loans which increases the likelihood that non-repayment will occur. The parameter s - which is the income that agents could earn from subsistence - captures the insurance element of the loan contract. An increase in s increases the expected cost of providing such insurance, which raises the interest rate on loans and makes bankruptcy more likely.

4.2 Dynamics of Income Distribution

As before, we may proceed to determine the evolution of income distribution based on the foregoing analysis. A set of lineage dynamic equations will again describe the inter-generational transition of wealth, from which we may deduce the extent to which initial inequalities might persist or vanish over time. Our primary interest is in how the limiting distribution under present circumstances (i.e., with microfinance) compares with the limiting distribution of the previous environment (i.e., without microfinance).

We begin by recalling once more that each agent of generation t bequeaths a proportion of her final income to her offspring according to $b_{t+1}=(1-\gamma)x_{t+1}$. We also recall that, for agents who undertake the large-scale risky project, x_{t+1} is given by (4) with $b_t\geq\widehat{b}$. For all other agents who undertake the small-scale risky project, x_{t+1} is given by (9) with $b_t<\widehat{b}$ and where $\widehat{\nu}$ and i satisfy (14) and (15). The dynamics of lineage wealth are therefore described by

$$b_{t+1}=\begin{cases}(1-\gamma)[(1+r)b_t+A(1+\upsilon_{t+1})-(1+r)K] & \text{if } b_t\geq\widehat{b},\\ (1-\gamma)[(1+r)b_t+a'(1+\nu_{t+1})-(1+i)k] & \text{if } b_t<\widehat{b} \text{ and } \nu_{t+1}\geq\widehat{\nu},\\ (1-\gamma)[(1+r)b_t+s] & \text{if } b_t<\widehat{b} \text{ and } \nu_{t+1}<\widehat{\nu}.\end{cases} \tag{16}$$

These dynamics are illustrated in Figure 2 (assuming the previous parameter configurations). Lines (i) and (ii) are the same as before. Lines (iii) and (iv) depict the upper and lower bounds on wealth transition for $b_t\geq\widehat{b}$ (corre-

[13] This is simply an example of the well-known result of Rothschild and Stiglitz (1971) that the expected value of a concave (convex) function of some random variable is decreased (increased) be a mean-preserving spread in the distribution of that variable

sponding, respectively, to $\nu_{t+1} = v > \widehat{\nu}$ and all $\nu_{t+1} < \widehat{\nu}$). The fixed point associated with the former is given by $b_v^* = \frac{(1-\gamma)[a'(1+v)-(1+i)k]}{1+(1-\gamma)(1+r)}$.

The key difference from the situation without microfinance is the greater range of possible outcomes for agents who are denied loans for large-scale investment. Previously, agents for whom $b_t < \widehat{b}$ were destined to remain in susbsistence, being either unable or unwilling to undertake the smaller-scale project. With microfinancing, this project becomes both accessible and attractive, and no agent would ever regret her decision to take it on. In other words, the existence of microfinance creates new opportunities for the poorer members of the population, all of whom expect to be better off, and none of whom are ever actually worse off, than they would otherwise be. Compared to the situation without microfinance, inequality is lower. There is even the possibility that microfinance could eventually turn the poor (or some of the poor) into large-scale project investors, thus eradicating poverty and inequality altogether (or more substantially). This is illustrated by line (v), where a sufficiently high value of a' allows the threshold level of wealth, $\widehat{b}$, to be breached.

5 Conclusions

Microfinance has offered a radical alternative to traditional measures (e.g. foreign aid programmes) aimed at fighting poverty and inequality. Especially over the past few years, the mission and methods of microfinance have captured the imaginations of academics, activists and policy makers alike. This is by no means to suggest that microfinance is a panacea - there are certainly examples to prove otherwise. Yet the extent to which microfinance has spread througout the world is some testament to its qualified success and sustainability.

In this paper we have sought to take a further step towards understanding the implications of microfinance by studying it from a macroeconomic perspective that has hitherto been largely ignored. We have done so by integrating certain key aspects of microfinance operations into a dynamic general equilibrium model of income distribution. These aspects include the non-collateralisation of loans, the concern over social issues and the externality effects of group meetings. In further accordance with real-world practice, our analysis yields the result that the interest rate charged on microloans is greater than the interest rate charged on normal bank loans. In spite of this, we have shown how microlending arrangements can reduce (and possibly eradicate) initial inequalities by creating incentives and opportunities for the poor to move beyond subsistence living.

References

Abbink, K., B. Irlenbusch and E. Renner, 2002. Group size and social ties in microfinance institutions. Working Paper, University of Nottingham.

Agenor, P.R. and J. Aizenman, 1998a. Contagion and volatility with imperfect credit markets. *IMF Staff Papers*, 45, 207-235.

Agenor, P.R. and J. Aizenman, 1998b. Volatility and the welfare costs of financial market integration. In P.R. Agenor, M. Miller, D. Vines and A. Weber (eds.), *The Asian Financial Crisis: Causes, Contagion and Consequences*, Cambridge University Press.

Ahlin, C. and R. Townsend, 2007. Using repayment data to test across models of joint liability lending. *Economic Journal*, 117. 11-51.

Aizenman, J. and A. Powell, 2003. Volatility and financial intermediation. *Journal of International Money and Finance*, 22, 657-679.

Armendáriz de Aghion, B., 1999. On the design of a credit agreement with peer monitoring. *Journal of Development Economics*, 60, 79-104.

Armendáriz de Aghion, B and C. Gollier, 2000. Peer group formation in an adverse selection model. *Economic Journal*, 110, 632-643.

Armendáriz de Aghion, B. and J. Morduch, 2000. Microfinance beyond group lending. *Economics of Transition*, 8, 401-420.

Armendáriz de Aghion, B. and J. Morduch, 2005. *The Economics of Microfinance*. MIT Press, Cambridge MA.

Azariadis, C. and S. Chakraborty, 1999. Agency costs in dynamic economic models. *Economic Journal*, 109, 222-241.

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

Banerjee, A.V. and A.F. Newman, 1993. Occupational choice and the process of development. *Journal of Political Economy*, 101, 274-298.

Besley, T. and S. Coate, 1995. Group lending, repayment incentives and social collateral. *Journal of Development Economics*, 46, 1-18.

Blackburn, K. and N. Bose, 2003. A model of trickle-down through learning. *Journal of Economic Dynamics and Control*, 27, 445-466.

Chowdury, P.R., 2005. Group lending: sequential financing, lender monitoring and joint liability. Journal of Development Economics, 77, 415-139.

Cull, R., A. Demigürç-Kunt and J. Morduch, 2005. Contract design and microfinance performance: a global analysis. Economic Journal, 117, 107-133.

Daley-Harris, S. 2006. State of the microcredit summit campaign report 2006. Microcredit Summit Campaign, Washington, DC.

Galor, O. and J. Zeira, 1993. Income distribution and macroeconomics. *Review of Economic Studies*, 60, 35-52.

Gangopadhyay, S., M. Ghatak, and R. Lensink, 2005. Joint liability lending and the peer selection effect. Economic Journal, 115, 1005-1015.

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

Karlan, D.S., 2007. Social connections and group banking. Economic Journal, 117, 52-84.

Madajewicz, M., 2003a. Joint liability contracts versus individual liability contracts. Working Paper, Columbia University.

Madajewicz, M., 2003b. Does the credit contract matter? The impact of lending programmes on poverty in Bangladesh. Working Paper, Columbia University.

Montgomery, R., 1996. Disciplining or protecting the poor? Avoiding the social costs of peer pressure in microcredit schemes. *Journal of International Development*, 8, 289-305.

Morduch, J., 1999. The microfinance promise. Journal of Economic Literature, 37, 1569-1614.

Rothschild, M. and J.E. Stiglitz, 1971. Increasing risk II: its economic consequences. *Journal of Economic Theory*, 3, 66-84.

Sharma, M. and M. Zeller, 1997. Repayment performance in group-based credit programmes in Bangladesh: an empirical analysis. World Development, 25, 1731-1742.

Stiglitz, J., 1990. Peer monitoring and credit markets. *World Bank Economic Review*, 4, 351-366.

Varian, H., 1990. Monitoring agents with other agents. *Journal of Institutional and Theoretical Economics*, 146, 153-174.

Wenner, M., 1995. Group credit: a means to improve information transfer and loan repayment performance. *Journal of Development Studies*, 32, 263-281.

Women's World Banking, 2003. What do microfinance customers value? *Women's World Banking*, New York

Wydick, B., 1999. Can social cohesion be harnessed to to repair market failures? Evidence from group lending in Guatemala. Economic Journal, 109, 463-475.

Zeller, M., 1998. Determinants of repayment performance in credit groups: the role of programme design, intra-group risk pooling and social cohesion. Economic Development and Cultural Change, 46, 599-620.

Figure 1
Income Distribution Without Microfinance

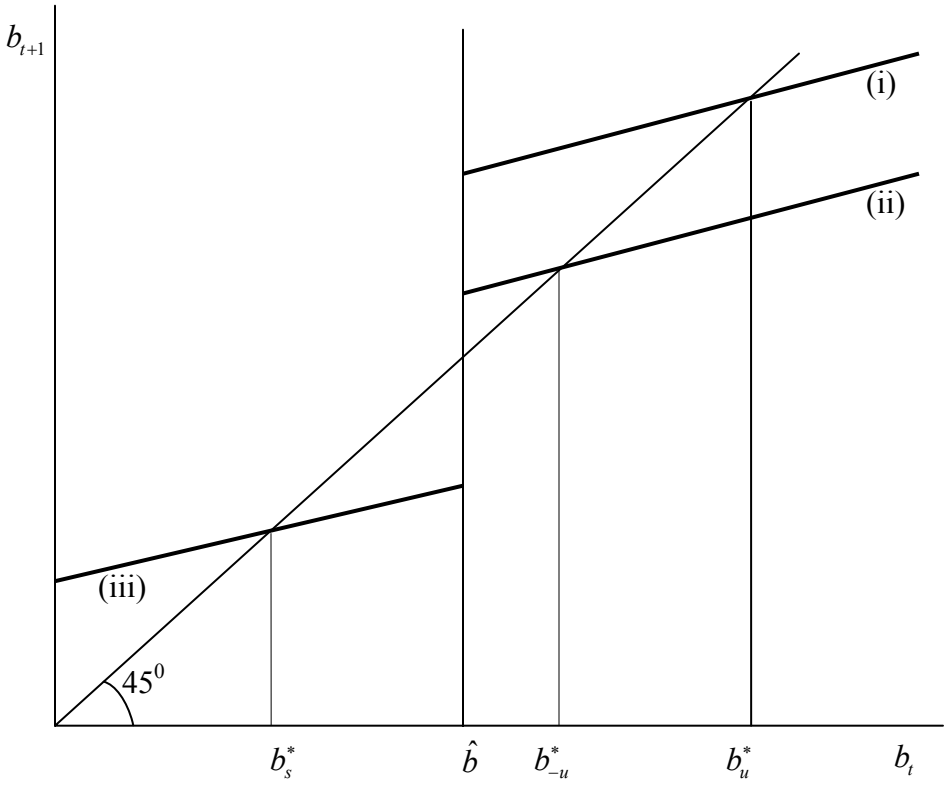

Figure 2
Income Distribution With Microfinance