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ABSTRACT

Kin Groups and Reciprocity: A Model of Credit Transactions in Ghana*

This Paper studies kinship-band networks as capital market institutions. It explores two of the channels through which membership in a community where individuals are genealogically linked, such as a kin group, can affect their access to informal credit. The first is that incentives to default are lower for community members who can expect retaliation to fall on their offspring as well as on themselves (social enforcement). The second is that lenders prefer to lend to those members from whom they can expect reciprocation in the form of future loans for themselves or for their children (reciprocity). The possibility to engage in reciprocal transactions affects the terms of the loans in nontrivial ways. The social enforcement and reciprocity effects are incorporated in an overlapping generations repayment game with endogenous matching between lenders and borrowers, and are tested using household-level data from Ghana.

JEL Classification: J41, O16 and O17
Keywords: informal credit, kinship, reciprocity and social norm

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Ahwe-wo-da-bi ba na wahwe no.

One shows benevolence to the child of his benefactor.

(Twi proverb, Ghana)

1 Introduction

Nonmarket institutions have been the object of growing attention in recent years for their potential in coping with problems of imperfect monitoring and limited enforcement in environments where the formal legal system is not capable of doing so. An early example of such institutions is the Maghribi traders' coalition studied by Greif (1993), which enabled medieval traders to overcome the commitment problem inherent in agency relations. Other examples include rotating savings and credit associations, credit cooperatives and group lending schemes, which have been shown to overcome some of the incentive problems that arise in individual credit transactions.[1]

This paper studies a particular nonmarket institution which is *not* created with the purpose of serving a given economic function: the *kin group*. kin groups are networks of unilineal families sharing common cultural traditions, ethnic identity, and often ancestors. They are a cornerstone of the social structure in many areas of the developing world and serve important economic functions, including that of providing informal insurance and credit to their members. In contrast to other associations in which participants join or leave voluntarily and possibly select each other, one cannot *choose* which kin group to belong to, nor can he or she leave the group without affecting the future of the entire lineage. What makes these groups particularly interesting from a theoretical point of view is that their members are *dynastically linked* in a way that is observable by everybody, so that the actions of parents can fall upon their children for good or for bad.

This paper analyzes the consequences of the above features on the functioning of informal credit markets in developing countries, by focusing on two sets of issues. First, how does membership in a kin group affect the possibility of enforcing binding agreements in the absence of legal enforcement? Second, what pattern of transactions (and what conditions on the transactions) can we expect to

[1] See the surveys by Besley (1995) and Ghatak and Guinnane (1999).

see among members of a kin group? Although the theory and empirical section will explicitly refer to informal credit in 'village economies', the basic framework and results can be applied to other settings in which similar 'dynastic' organizations exist.[2]

The first part of the paper develops a simple model of informal credit among members of a kin group. The dynastic structure of the group is modeled in an overlapping generations framework. Each player has a descendant whose type (rich or poor) is random but once realized is observable by everyone, and depends on this descendant for support in old age. Young players make three sets of choices: the first regards the matching between poor and rich individuals (i.e., who is able to borrow from whom), the second is whether to repay existing debts, and the third is whether to transfer money to the parent.

Despite the short term interaction between lender and borrower, by exploiting the fact that players depend on their offspring in the second period of their life it is possible to induce borrowers to repay their debts in two alternative ways. One is for the child to refuse to support the parent whenever the latter deviates from the equilibrium strategy (e.g., defaults on a loan). This is called 'direct' punishment code. An alternative way is to deny credit to the child of a defaulter, thus indirectly harming the parent in the event the child is born poor and cannot afford to send a transfer. This is termed 'indirect' punishment code. As will be argued in the next section, both mechanisms have an empirical correlate in the functioning of intra-kin relations in African countries.

A second result yielded by the model regards the choice of the matching between lenders and borrowers under credit rationing. The Pareto frontier is derived and the best Pareto efficient matching rule for lenders is shown to be one in which all children of previous period lenders are guaranteed a loan with probability one. This matching rule relies on a scheme of *reciprocity among lenders* such that, by lending to the child of an old lender, a rich individual creates an obligation for somebody else to reciprocate in the future and grant a loan to her child. Notice that this rule conditions the matching on a characteristic which is totally irrelevant from the point of view of the credit contract. In fact in the absence of savings or bequests the parent's wealth (i.e. lender status) does

[2] Thnk, for example, of intergenerational social security schemes in a context where the State social security system is weak, or of mafia-type organizations for the control of the underground economy.

not affect the likelihood that the child will repay. All 'poor' types are the same and have access to the same technology, so there should be no reason why a lender would not randomize among them. Nonetheless, it is shown that rich types can achieve a Pareto improvement upon random matching by conditioning upon this apparently irrelevant characteristic.

The reciprocity element has important consequences on the *terms* of the loans among kinsmen. It is shown that the equilibrium interest rate is lower on 'reciprocal' loans than on 'market' loans (i.e., those allocated randomly). This occurs not because of altruism, but to meet the borrowers' incentive compatibility constraint. When lenders grant loans to each other's child, borrowers have less to gain from repaying because their children face a lower probability of getting a loan. Lowering the interest rate is a way to make the decision to repay less costly in the present.

Finally, the model studies the pattern of lending to be expected when the population is formed by the local kin group together with 'outsiders'. The latter differ from the local population only in that they have a positive probability of moving out of the community in each period. The equilibrium in this case involves 'segmentation' along kinship lines, whereby members of the local kin group lend to each other, and outsiders transact with other outsiders but with less scope for reciprocity and social enforcement.

The second part of the paper tests the main empirical predictions of the model using household level data from rural Ghana for the years 1987/88 and 1988/89. The data contains detailed information on loans contracted and given out by each household, including the relationship to the partner in the transaction (e.g., whether it is a relative, a moneylender, a bank, etc.). The main empirical results are the following.

Ceteris paribus, migrants are less likely to borrow from their relatives than from formal institutions such as banks. They are *not* less likely to borrow from other informal sources such as moneylenders and private individuals, suggesting that there may be something specific to kinship that puts migrants at a disadvantage. This result is robust to controlling for the availability of information on migrants and for the extent of information flows within the community. A second result is that people with children have a lower probability of default. The effect of having children is large and significant if the loan is taken from a relative, while it is insignificantly different from zero if it is

from another source, indicating that the reason may indeed have to do with social enforcement and reciprocity. The result also holds when controlling for the role of children as income generators and for the residential stability of the household. A third set of results regards the presence of interest on the loans. Strikingly, less than 5 percent of the loans from relatives and potential kinsmen carry any interest at all. This figure by itself suggests that some other form of reciprocation must be expected by the lender in the future. Multivariate analysis shows that again family structure plays a role: households with children are less likely to be charged an interest, but having children does not matter if the loan is not from a relative. This finding is robust to controlling for the fact that children may indirectly provide interest payments (e.g., by offering unpaid labor to the lender). Finally, the panel nature of the data allows to test the effectiveness of reciprocity in the short run. Households who contributed resources to others in the first year of the survey, either by giving loans or by sending remittances, have more access to loans in the second year, both in the sense of being more likely to get a loan and of being able to borrow larger amounts. Overall, the pieces of empirical evidence gathered are suggestive of the presence of reciprocity and social enforcement mechanisms in intra-kin loans.

This paper is related to several strands of the literature. The literature on informal credit has long acknowledged the importance of social pressure for enforcing agreements. Among others, Udry (1990) documents the key role of village authorities or senior family members in enforcing informal credit contracts in northern Nigeria. Besley and Coate (1995) refer to the social sanctions imposed by members of close-knit communities on defaulters as 'social collateral', and show that this form of collateral can improve repayment rates. While previous work has taken social pressure as given modelling it as a direct utility loss, the present paper endogenizes 'social collateral' by modelling *the way* in which social sanctions are carried out. This has important consequences in that it shapes the nature of credit arrangements and creates a link between family structure and credit contracts which would not be there otherwise.

The notion of reciprocity has been established in models of informal insurance with limited commitment, such as Coate and Ravallion (1993) and Ligon, Thomas and Worrall (2000, 2001). Those models consider repeated interaction between two given partners, and reciprocity occurs because

the household who gives a net transfer today expects reciprocation from the other household in the future. The notion of reciprocity employed in this paper differs from the above work in that it is 'generalized' as opposed to 'bilateral': current players can expect reciprocation also from someone who is not a direct beneficiary today. This is an important difference because it makes reciprocal arrangements possible in short term interactions, but requires a larger pool of players. Within the informal insurance literature, it is helpful to contrast this paper with the work of Ligon, Thomas and Worrall (2001). Despite the similarity of the 'lending' element, the focus of the present paper is not to establish to what extent risk pooling is achieved, but to investigate how the dynastic structure of kinship can determine *who* will get a loan in the presence of credit rationing and at the same time can affect the terms of the loan transactions. Aggregate income in this model is deterministic and the only random element in each period is the realization of types (lenders and borrowers). In Ligon et al. (2001) the partners in the transaction are fixed, while in this paper who manages to become a partner in a credit transaction is determined endogenously and the sustainability as well as the terms of the equilibrium contracts depend, among other things, on the matching rule adopted in the community at large.

Finally, the model proposed here builds on the literature on repeated games played by overlapping generations of players, e.g., Kandori (1992a,b) and Smith (1992). One common feature is the notion of "community enforcement", according to which, when agents change their partners over time, other people than those directly hit by a deviation punish the player who has deviated. An important difference, however, is that in that literature no genealogical link exists among the players, so no individual can be held accountable for the actions *of a predecessor*. As a consequence, the punishment for deviating has to target the defector directly and the possibility for cooperation depends on the length of the overlapping period. In this paper the overlapping period is reduced to the minimum and the possibility of enforcement relies on the dynastic links among players. To the best of my knowledge, this is the first attempt to employ overlapping generation games in such 'non-anonymous' way.

The remainder of the paper is organized as follows. Section 2 briefly introduces the notion of kin groups and their economic functions as they emerge from the anthropological literature and from related studies in economics. Section 3 develops the theoretical framework and the testable

implications of the model. Section 4 describes the data and illustrates the main trends in the patterns of lending and borrowing among the surveyed households. In section 5 the various predictions of the model are tested through multivariate analysis. Finally, section 6 contains some concluding observations.

2 Kin groups, reciprocity and enforcement

The notion of kinship is rather complex and much debated upon in the anthropological literature[3]. For the purposes of this analysis, kin groups will be defined as an intermediate level of social organization between clans and tribes. While a *clan* is a unilineal group of relatives living in one locality, a *kin group* is formed by various clans and comprises "socially recognized relationships based on supposed as well as actual genealogical ties" (Winick 1956: 302). When they are not true genealogical connections, the social ties that bind together members of the same kin group are "modelled on the 'natural' relations of genealogical parenthood" (Keesing 1975: 13). On the other hand, a kin group is smaller than a *tribe*, which consists of "a number of kin groups bound together by a common language and common rules of social organization" (Goodall (1987)).

Thanks to their intermediate size, large enough to constitute an adequate risk pool but not so much to hinder the monitoring and enforcement of members' obligations, kin groups can perform a number of economic functions. One of the most important functions is that of providing *informal insurance* to the members of the group, often in the form of sharing non-storable production surplus (Scott (1976), Posner (1980)) or in the form of consumption credit. As noted by Fafchamps (1992), solidarity mechanisms emerge naturally in societies with high idiosyncratic risk, and kinship is one of the main networks through which mutual insurance operates. Bates (1990) reports evidence from several studies that in many parts of East and Central Africa varying degrees of kinship ties reflect different needs to cope with risk.

Two key features allow these informal insurance mechanisms to work: reciprocity and enforcement. The reason why people share their crops or livestock with others is that they expect the recipients to do the same in the future. Even though the exact time and extent of the 'repayment'

[3] For references, see Harris (1990).

may not be known at the date of the first transaction —*'generalized' reciprocity*, in the anthropological terminology— the same act of giving creates an obligation to reciprocate. When risk is shared through consumption loans, the principle of reciprocity applies in a similar way. For example, Platteau and Abraham (1987) document the prevalence of interest-free loans among fishermen in South India and observe that any recipient of such loans implicitly commits to lend to past creditors in the future, even after the original loans have been repaid. Among members of a kin group the scope for reciprocity is even larger, in that reciprocation can be carried out not only by the original beneficiary but also by his or her offspring and can be directed to the original benefactor as well as to his or her offspring. In Ghana, for example, it is common that when young people receive support from older relatives (for example financing their studies), they reciprocate by helping their younger relatives once they start earning money, rather than by repaying the person who gave them the money in the first place.[4]

The second requirement for the viability of informal insurance mechanisms is that they must be enforceable despite the absence of legally binding agreements. There is evidence that members of particular ethnic groups have been able to enforce contracts by establishing information-sharing networks and by sanctioning any defector with exclusion from future trade (e.g., Greif (1993), Fafchamps (2000)). In addition to being close-knit communities where information circulates freely and members are highly interdependent, kin groups have an additional feature that increases their ability to enforce transactions within the group. Kinsmen in traditional societies tend to obey the principle of *collective responsibility*, whereby members of the same clan are held collectively responsible for each other's action (Posner (1980)). Social stigma or retaliation from the injured parties can thus fall on the defectors as well as on other members of their clan, increasing the cost of breaching the contract. In an anthropological study of social organization in Ghana, Field (1940: 109) reports that "responsibility for wrongdoing is a family affair. (...) The solidarity of the family, and the helplessness and destitution of an individual at variance with his family, was beyond all else what kept the individual law-abiding". In the theoretical model below, this idea is captured by having lenders deny credit to the children of defaulters ('indirect' punishment code). Furthermore, as a reaction to

[4] Personal communication from Gracia Clark.

the damage caused to the whole lineage by the 'deviant' member, sometimes it is the kin itself that sanctions the behavior of its member. As documented in a recent study on social control in Ghana, "the paramount need for members of the lineage to avoid being thrown into the socially shameful state of penurious insolvency (...) gave each lineage member a moral mandate to keep surveillance over the actions of other members. (...) Traditional society's response to the notion of the collective responsibility of the group for the wrongs of individual members produced a reaction which yielded a number of measures formally invoked *by the lineage*. These include the *collective withdrawal of financial or moral support* for the culprit".[5] In the model this will be formalized by allowing children to deny financial support to a defaulting parent ('direct' punishment code).

3 The model

3.1 Setup[6]

Consider an economy in which n individuals are born in each period. A fraction α of them is born with an endowment $\overline{e}$, and the remaining fraction $(1-\alpha)$ with an endowment $\underline{e}$, where $\overline{e} > \underline{e}$. Let αn be an integer number and let $\overline{E}$ and $\underline{E}$ denote, respectively, the sets of type-$\overline{e}$ (rich) and type-$\underline{e}$ (poor) individuals.

People live for two periods. In the first period they engage in credit transactions, produce a non-storable good, and have a child. In the second they consume the amount $b > 0$ if their child grants it to them, and zero otherwise.[7] Throughout the model, we refer to the parent as 'she' and

[5] Abotchie (1997), pp.14, 90. Emphasis added.

[6] The theoretical framework will abstract from problems of adverse selection and moral hazard, as well as from an explicit modeling of the insurance function of informal loans and transfers in village economies. These issues are well understood in the theoretical literature and there does not seem to be much specific to dynastic groups that would justify addressing them again in this paper. Where relevant, these elements will be accounted for in the empirical analysis.

[7] Given non-storability, people cannot save from the first period to the next and must rely on this 'intergenerational social security' scheme. In principle, any young individual from the generation born in t could be matched with someone born in $t-1$ for this purpose. However, if we realistically assume that information flows more easily within the same family, information costs are minimized by matching children with their parents. In what follows we shall therefore restrict our attention to this type of setting.

to the child as 'he'. Children are born at the end of the 'young' phase and their endowment is uncorrelated with their parent's. This means that a parent only knows that her child will receive endowment $\overline{e}$ with probability α, and $\underline{e}$ with probability $1-\alpha$.

All young individuals have access to the same production technology, which yields a deterministic surplus g over the input costs. However, the productive activity has a fixed cost that exceeds $\underline{e}$, say $\underline{e}+l$, so that in every period the poor need to borrow from the rich in order to undertake production. For simplicity, the amount the former need to borrow and the interest rate are fixed at $l > 0$ and $r > 0$. The assumption of exogeneity of the interest rate will be relaxed later. To make the problem interesting, the following assumptions are made:

(A1): $\alpha < 1/2$

(A2): $2l \leq (\overline{e} - \underline{e}) < 3l$

(A3): $\overline{e} < 2(\underline{e} + l)$

(A4): $\underline{e} + g \geq rl + b; \quad \underline{e} < b.$

Assumption 2 says that each rich individual can lend at most to one other person. Given this, assumption 1 implies that there will be credit rationing in equilibrium. Assumption 3 guarantees that the endowment of a rich individual (large enough to lend l to someone else) is not sufficient to undertake two projects on his own. Finally, by assumption 4 the income of a poor who obtains a loan, $\underline{e} + l + g$, is enough to both repay the loan inclusive of the interest and to transfer b to his parent, while the mere endowment $\underline{e}$ is not enough to support the parent.

All agents share the same preferences represented by the instantaneous utility function $u(\cdot)$, where $u'(\cdot) > 0$, $u''(\cdot) \leq 0$, and without loss of generality $u(0) = 0$. Individuals discount future utilities with a factor $\delta \leq 1$. No altruism is assumed.

The temporal structure of the model is as follows. In the first period of their lives, people receive their initial endowments from nature, which become common knowledge. A matching then occurs between type $\overline{e}$ individuals and type $\underline{e}$ ones. Each matched individual jointly decides whether to lend –or repay, if he is a borrower– and whether to transfer b to his parent after production is realized. Partial default and partial transfers are ruled out. Unmatched individuals do not borrow nor send

transfers. At the end of the first period each individual consumes his residual income and then has a child. In the second and last period of their lives, old players consume b if their children decide to support them and zero otherwise. The timeline of the model is summarized in the following table.

t						$t+1$
Endow	*Match*	*Produce*	*Actions*	*Consume*	*Child*	*Consume*
$\overline{e}$	Yes	g	lend, transfer	residual income	Yes	$b; 0$
$\underline{e}$	Yes	g	repay, transfer	residual income	Yes	$b; 0$
	No	–	–	$\underline{e}$	Yes	$b; 0$

Strategies and equilibrium concept

Although people live for two periods, their strategic behavior is confined to the first period of their lives. Throughout the model, the subscript t will denote a generation born at time t. Players' action space is characterized by the following elements.

First, type-$\overline{e}$ players can choose whether to Lend (L) or Not Lend (NL), and types $\underline{e}$ whether to Borrow and Repay (shortly, R for Repay) or Not Repay (NR). Second, all players choose whether to Transfer (T) or Not Transfer (NT). Third, players can choose *who* to lend to or borrow from. This will formalized by allowing players to choose a matching rule between types-$\overline{e}$ (lenders) and types-$\underline{e}$ (borrowers). The notation $\mu(i_t) = j_t$ will indicate the borrower j_t who is matched with lender i_t.

In the absence of legal enforcement methods, the stage game has only one Nash equilibrium: $s_i = (NL,\ NT)$ for $i \in \overline{E}$, $s_j = (NT,\ NR)$ for $j \in \underline{E}$. The infinitely repeated version of this game, where two-period-lived players successively play the stage game, has a multiplicity of subgame perfect equilibria. I am interested in equilibria in which all borrowers repay their loans and all young individuals support their parents. Following Abreu (1988), I describe strategy profiles as rules specifying an initial path and punishments for any deviation from the initial path. I will use the following criteria to select the equilibria on which to concentrate.

(i) *Stationarity.* Every generation faces the same problem of the previous generations, so that for a given history, any strategy that is optimal for an individual i_t must be optimal for an individual

j_{t+1} of the same type.[8]

(ii) '*Minimal*' strategies. The punishment to player i_t for deviating from the equilibrium path must not extend beyond period $t+1$. This is without loss of generality, given that in this model any outcome that can be achieved by extending the punishment for i_t's deviation to periods $t+k$, $k>1$, can be achieved by punishing in period $t+1$ only.[9]

3.2 Social enforcement

This section shows how the dynastic structure of the model can be used to support an equilibrium in which all rich individuals lend, all borrowers repay, and every matched player sends transfers to his parent. Formally, the actions chosen on this equilibrium path are:

$$\begin{aligned} &a_i = (L,T) \text{ for all } i \in \overline{E}; \\ &a_j = (T,R) \text{ for all } j \in \underline{E} \text{ such that } j = \mu(i) \text{ for some } i \in \overline{E}; \\ &a_j = (NT,NR) \text{ for all } j \in \underline{E} \text{ such that } j \text{ is unmatched.} \end{aligned} \tag{1}$$

I will momentarily abstract from the strategic choice of the matching rule and concentrate on equilibria where lenders randomize among potential borrowers in every period. This type of rule, which I refer to as *uniform random matching* (URM), is such that all poor individuals have the same probability $\alpha/(1-\alpha)$ of obtaining a loan and the matching in each stage is independent.

[8] The focus on stationary strategies is common in the literature on overlapping generation games (e.g., Cremer (1986), Kandori (1992b), Smith (1992)). While in the informal insurance literature with imperfect enforcement and infinitely lived agents non-stationary equilibria allow to reach Pareto improvements upon stationary ones (e.g., Ligon, Thomas and Worrall (2001) and Kletzer and Wright (2000)), in this model this is not the case. As will be clear from what follows, this is related to the fact that players overlap for only one period and the only actions that affect their incentives are those of the contiguous generation.

[9] Any strategy to induce cooperation must condition i_t's action on i_{t-1}'s choice. If it were not so, in the first period of his life i_{t-1} would know that his utility in old age will not depend on his own actions, so i_{t-1} would deviate. Conditioning on i_{t-k}'s ($k>1$) choice in addition to i_{t-1}'s, would not improve anyone's incentives. It would not affect i_{t-k}'s incentives because by stationarity i_{t-k+1}'s action is already conditional on i_{t-k}'s choice; nor would it affect i_t's incentives, which only depend on period t and $t+1$ outcomes. Notice that this criterion rules out 'unrelenting' strategies where any deviation is punished with (*NL, NT*) forever. Such strategies in fact have the strong limitation of not being Pareto efficient in a dynamic sense.

The key to enforcing cooperation is to design punishments that will make a unilateral deviation from the equilibrium path unprofitable for any single player after any history. I consider two main ways in which such punishments can be designed, one 'direct' and one 'indirect'.[10]

Direct punishment

The *direct* punishment requires that if a player deviates at time t, her child will refuse to transfer b in the following period. According to this scheme the child is responsible for punishing the parent not only when she has not transferred b to her own parent, but also when she has failed to repay or give a loan. The following proposition provides the conditions under which cooperation can be enforced through this penal code.

Proposition 1 *For values of δ satisfying*

$$\delta \geq \frac{u(\underline{e} + l + g) - u(\underline{e} + g - rl - b)}{2\alpha u(b)} \tag{2}$$

the equilibrium path described in (1) can be supported under URM through the penal code:

If k_t deviates from a_k $(k = i, j)$, k_{t+1} will play NT instead of T in a_k.

If k_{t+1} fails to carry out the above punishment, he is subject to the same penal code.

Proof.

The expected lifetime utility of a type-$\overline{e}$ player from conforming to the equilibrium is

$$u(\overline{e} + g + rl - b) + \delta \left[\alpha u(b) + (1 - \alpha) \left(\frac{\alpha}{1 - \alpha} \cdot u(b) + \frac{1 - 2\alpha}{1 - \alpha} \cdot 0 \right) \right]$$

where the terms in square brackets represent the parent's expected transfers from her child in period two, α being the probability that the child is born rich. The most profitable deviation —to (L, NT)— yields $u(\overline{e} + g + rl)$. Therefore a type-$\overline{e}$ player has no incentive to deviate unilaterally if

$$\delta \geq \frac{u(\overline{e} + g + rl) - u(\overline{e} + g - rl - b)}{2\alpha u(b)} \equiv \delta_{\overline{e}}.$$

[10] I will focus on punishments that are intrinsically 'economic' and tightly connected with the credit market. Social pressure mechanisms such as shame or ostracism may be equally important, and could be modeled as a direct utility loss. For a concise review, see e.g. Posner (1997).

For type-$\underline{e}$ players the expected lifetime utility from conforming is $u(\underline{e}+g-rl-b)+\delta 2\alpha u(b)$. The most profitable deviation —to (NT, NR)— yields $u(\underline{e}+l+g)$. Therefore a type-$\underline{e}$ player has no incentive to deviate unilaterally if

$$\delta \geq \frac{u(\underline{e}+l+g)-u(\underline{e}+g-rl-b)}{2\alpha u(b)} \equiv \delta_{\underline{e}}.$$

Given assumption (A2) and $u''(\cdot) \leq 0$, we have $\delta_{\underline{e}} > \delta_{\overline{e}}$ so condition (2) in proposition 1 is sufficient to ensure that the equilibrium is subgame perfect for both types of players.[11] □

Indirect punishment

An alternative, *indirect* punishment requires that children only police deviations of their parents from the intergenerational social security scheme, and that defections on the credit side are sanctioned by the credit market itself. Consider the following penal code: the child of a borrower who defaulted or of a type-$\overline{e}$ player who did not lend in period t is denied a loan in $t+1$. This code constitutes an indirect penalty for the parent because, unless born rich, the child will not have enough resources to transfer b in $t+1$. The following proposition gives the conditions under which this mechanism is sufficient to enforce cooperation.

Proposition 2 *For values of δ satisfying*

$$\delta \geq Max\left\{\frac{u(\underline{e}+l+g)-u(\underline{e}+g-rl-b)}{2\alpha u(b)}, \frac{u(\underline{e}+l+g-b)-u(\underline{e}+g-rl-b)}{\alpha u(b)}\right\} \tag{3}$$

the equilibrium path described in (1) can be supported under URM through the penal code:

If i_t (j_t) plays NL (NR), i_{t+1} (j_{t+1}) will be unmatched if they are $\underline{e}$-types. If i_t (j_t) plays NT, i_{t+1} (j_{t+1}) will play NT.

Anyone who fails to carry out the above punishment will be subject to it.[12]

[11] Note that it is always in the child's interest to punish the parent for deviating, because this involves consuming b himself rather than transferring it.

[12] Note that under our assumptions lenders always have an incentive to carry out the punishment. If the number of defectors is no greater than αn, they can find enough 'unspotted' people to lend to. If the number of defectors exceeds αn, and given that the penal code prescribes that the child of a lender who fails to punish is denied a loan, δ exceeding the second value in (3) is sufficient (although not necessary) to make punishing incentive compatible for

Proof: All proofs are in appendix A.

The first threshold value in (3) guarantees that unilateral deviations from the social security scheme are unprofitable; the second refers to deviations on the credit market. Notice that if the latter value is higher than the former, the indirect punishment scheme will require more patient players than the direct one. This occurs because under the indirect scheme parents who defaulted on the credit market face a positive probability of being unpunished: their children will in fact still transfer b to them if they are born rich.

Both the direct and the indirect codes exploit the fact that the link between parents and children constitutes a form of *social collateral* on the credit market. They should be seen as alternative ways of enforcing agreements. For simplicity, the results in the following sections are presented using the 'direct' punishment code of proposition 1. All results apply to the 'indirect' scheme of proposition 2, provided the threshold value for the discount factor is adjusted accordingly.

3.3 Pareto efficient matching rules

The next step is to endogenize the choice of the matching rule. Every matching rule μ induces a probability p that a type-$\underline{e}$ will get a loan in equilibrium. All potential borrowers are *ex ante* equal, except for the fact that they may be born from a type-$\underline{e}$ or from a type-$\overline{e}$ parent. Matching rules can therefore discriminate among players according to the type of their parent, so p can differ for children of lenders and of borrowers.[13] Furthermore, a rule should specify who is matched with whom for every possible realization of types, i.e. when all αn children of today's lenders are born with endowment $\overline{e}$, when only $\alpha n - 1$ of them are, etc.

Let $\underline{p}$ ($\overline{p}$) denote the overall probability that a poor individual born from a type-$\underline{e}$ (type-$\overline{e}$) obtains a loan, and let $\underline{p}|k$ ($\overline{p}|k$) denote the analogous probabilities *conditional* on k children of

lenders. Alternatively, a simple way to give lenders the incentive to carry out the punishment would be to specify that borrowers who receive such loans should not held accountable for repaying them. Similar 'cheat the cheater' strategies have been considered, among others, by Greif (1993) and Kletzer and Wright (2000).

[13] I will only consider matching rules that treat individuals *within a given category* in the same way, i.e. all children of type-$\overline{e}$ parents face the same probability of getting a loan, and the same for the children of type-$\underline{e}$ parents.

previous period lenders being type-$\overline{e}$. From combinatorial calculus we have:[14]

$$\underline{p} = \sum_{k=0}^{\alpha n} \frac{\binom{\alpha n}{k}\binom{n-\alpha n-1}{\alpha n-k}}{\binom{n-1}{\alpha n}} \left(\underline{p}|k\right) \tag{4}$$

$$\overline{p} = \sum_{k=0}^{\alpha n-1} \frac{\binom{\alpha n-1}{k}\binom{n-\alpha n}{\alpha n-k}}{\binom{n-1}{\alpha n}} \left(\overline{p}|k\right). \tag{5}$$

As shown in appendix A, Pareto efficient matching rules must induce probabilities $\underline{p}$ and $\overline{p}$ that maximize the expected lifetime utility of one type of individual, subject to the constraint of assuring the other type a given utility level, to the constraint that cooperation is incentive compatible for both types, and to feasibility constraints on the number of available loans.[15] Let $U_{\overline{e}}(\overline{p})$ and $U_{\underline{e}}(\underline{p})$ indicate the expected lifetime utilities of a type-$\overline{e}$ and a type-$\underline{e}$ individual, respectively. The following proposition characterizes the Pareto frontier.[16]

Proposition 3 *The Pareto frontier is a line with slope $-(1-\alpha)/\alpha$ whose endpoints are the combinations $(U_{\overline{e}}(\overline{p}), U_{\underline{e}}(\underline{p}))$ obtained by substituting in (5) and (4) the following values:*

Best equilibrium for type-$\overline{e}$ players:

$$\overline{p}|k = 1, \;\; \underline{p}|k = \frac{k}{(1-2\alpha)n+k}. \tag{6}$$

Best equilibrium for type-$\underline{e}$ players:

$$\overline{p}|k = Max\left\{0, \frac{(3\alpha-1)n-k}{\alpha n-k}\right\}, \;\; \underline{p}|k = Min\left\{\frac{\alpha n}{(1-2\alpha)n+k}, 1\right\}. \tag{7}$$

[Insert figure 1]

The Pareto frontier is depicted in figure 1. The variables on the two axes are the ex ante expected utilities for the two types. Intuitively, the frontier is linear because we are considering only equilibria in which the total amount of resources gets invested and the "size of the pie" is fixed: what changes

[14] See Appendix A for the derivation of expressions (4) and (5).

[15] The analysis in this section follows a *positive* approach postulating that the rules of the game are chosen in each period by the generations who are alive and know their realized endowment, rather than "under a veil of ignorance".

[16] Proposition 3 holds for $\delta \geq Max\left\{\frac{u(\underline{e}+l+g)-u(\underline{e}+g-rl-b)}{(\alpha+\underline{p}-\alpha\underline{p})u(b)}, \frac{u(\overline{e}+g+rl)-u(\overline{e}+g+rl-b)}{(\alpha+\overline{p}-\alpha\overline{p})u(b)}\right\}$, where $\underline{p} = \sum_{k=0}^{\alpha n} \frac{\binom{\alpha n}{k}\binom{n-\alpha n-1}{\alpha n-k}}{\binom{n-1}{\alpha n}} \frac{k}{(1-2\alpha)n+k}$ and $\overline{p} = \sum_{k=0}^{\alpha n} \frac{\binom{\alpha n-1}{k}\binom{n-\alpha n}{\alpha n-k}}{\binom{n-1}{\alpha n}} Max\left\{0, \frac{(3\alpha-1)n-k}{\alpha n-k}\right\}$.

as we move along the frontier is how much of the pie each type will get. Point R in the figure corresponds to the URM equilibrium of proposition 1, in which $\overline{p}|k = \underline{p}|k = \alpha/(1-\alpha)$. Points above R are obtained by giving the children of rich players probabilities $\overline{p}|k$ higher than $\alpha/(1-\alpha)$ for $k = \alpha n - 1$, then for $k = \alpha n - 1$ and $k = \alpha n - 2$, etc. up to the point $(U_{\underline{e}}^{min}, U_{\overline{e}}^{max})$ where all poor children of types $\overline{e}$ are guaranteed a loan with probability one, whatever their number. Children of type-$\underline{e}$ players are in this case allocated only the *residual* loans. Similarly, points below R are obtained by giving the children of type-$\underline{e}$ parents probabilities $\underline{p}|k$ higher than $\alpha/(1-\alpha)$ up to the point $(U_{\underline{e}}^{max}, U_{\overline{e}}^{min})$ where all poor children of types $\underline{e}$ have priority on the allocation of loans for all values of k.

3.4 Reciprocity among lenders

From a normative point of view, the choice of a point on the Pareto frontier depends on the social welfare function adopted. From a positive point of view, however, there are reasons to believe that the best equilibrium for types $\overline{e}$ is likely to be selected. In fact, given the relative scarcity of lenders compared to borrowers ($\alpha < 1/2$), the former will generally be able to choose whom they want to lend to. Once this is taken into account, it would be suboptimal for lenders to randomize among all potential borrowers, because this way their children would face a positive probability of needing a loan and not getting it. Consider instead the following strategy for lenders:

> "*Randomize among poor children of type-$\overline{e}$ players first, and only after they all obtained a loan randomize among poor children of types-$\underline{e}$*".

If all lenders play this strategy, with probability one their children will have the resources necessary to undertake production and support them, i.e. $\overline{p}|k = 1$, $\forall k$. This corresponds to the best equilibrium for types $\overline{e}$ in proposition 3. I refer to this matching rule as one of *reciprocity among lenders* because by lending to the child of an old lender, a type-$\overline{e}$ individual creates an obligation for somebody else to reciprocate in the future and grant preferential treatment to her child. Formally, the 'matching with reciprocity among lenders' (MRL) can be expressed as follows:

$$Prob\{\mu(j_t) = i_t\} = 1 \text{ for some } i_t \in \overline{E}_t,\ \forall j_t \in \underline{E}_t | j_{t-1} \in \overline{E}_{t-1},\ \forall t.$$

This rule has three interesting features. The first is that it goes beyond the notion of 'bilateral' reciprocity, according to which the same person who receives something today is expected to give it back to the original partner in the future. In this model any young lender at a given time has an interest in reciprocating a loan given *to somebody else* in the past, because this way he enters a pool of creditors who help each other by helping each other's children. The second feature is that it shows that it can be optimal for some players to condition the matching upon an apparently irrelevant characteristic, as is the parent's type.[17] Finally, even if the distribution of endowments is randomly picked at the beginning of each period and bequests are not allowed, this rule induces initial inequalities to persist for one generation because, due to reciprocity, credit market imperfections act differentially on the children of rich and poor people. Although the children of lenders cannot choose to be lenders themselves unless nature decides so, they are at least guaranteed loans and hence a positive income stream.

3.5 Endogenous interest rates: the 'price' of reciprocity

The above analysis assumed that both the loan size l and the interest rate r were exogenous. In this section lenders are allowed to choose the interest rate as well as the matching rule.

Let us start from the benchmark case of uniform random matching and consider the choice of r in isolation. In this case lenders will set r so as to maximize their expected utility subject to the borrowers' incentive compatibility (IC) constraint, with $\overline{p} = \underline{p} = \frac{\alpha}{1-\alpha}$. The IC constraint binds in equilibrium, so the optimal interest rate under URM, r_u, must solve:

$$u(\underline{e} + g - r_u l - b) + 2\alpha\delta u(b) = u(\underline{e} + l + g). \tag{8}$$

When both the matching rule and the interest rates can be chosen, lenders face a trade-off. On the one hand, by choosing a rule that increases $\overline{p}$ they can increase their expected utility; on the other hand, the resulting decrease in $\underline{p}$ may require a reduction in r in order to maintain incentive compatibility for type-$\underline{e}$ players. The solution is described in the following.[18]

[17] Recall that, as anticipated in the Introduction of the paper, due to non-storability the parent's type cannot affect the likelihood that a borrower will repay.

[18] Proposition 4 holds for $\delta \geq \frac{u(\underline{e}+l+g)-u(\underline{e}+g-rl-b)}{(\alpha+\underline{p}^*-\alpha\underline{p}^*)u(b)}$. As before, proofs and interpretations are derived for the direct

Proposition 4 *In the best subgame perfect equilibrium for type-$\overline{e}$ players, $\overline{p}^*|k$ and $\underline{p}^*|k$ are given by (6), and r^* solves:*

$$u(\underline{e} + g - r^* l - b) + \delta(\alpha + \underline{p}^* - \alpha \underline{p}^*)u(b) = u(\underline{e} + l + g) \tag{9}$$

Corollary to Proposition 4: $r^* < r_u$.

Proposition 4 says that lenders will choose a rule of MRL and increase the interest rate up to the point where borrowers are indifferent between repaying and defaulting. In other words, the possibility of increasing current profits by charging higher interest rates does not make reciprocal arrangements less attractive for lenders. The equilibrium of proposition 4 is a corner solution in that $\overline{p}$ is set equal to 1 and r is only used as a 'secondary' channel to increase the value of the objective function. This is due to the fact that any increase in $\overline{p}$ induces a *proportional* decrease in $\underline{p}$, namely $\Delta \underline{p} = -\frac{1-\alpha}{\alpha}\Delta\overline{p}$, while due to the concavity of $u(\cdot)$ every marginal increase in r will widen the gap between $u^{'}(\overline{e} + g + rl - b)$ and $u^{'}(\underline{e} + g - rl - b)$ and lower the left hand side of the IC constraint more than proportionately.

Finally, the corollary to proposition 4 says that, *ceteris paribus*, the equilibrium interest rate under MRL will be lower than that under URM. This corollary follows in a straightforward way by comparing the IC constraints for types-$\underline{e}$ in the under the two rules, i.e. (9) and (8). Under MRL, borrowers have less to gain from repaying their loans because there is a higher chance that their children will not get a loan. In order to satisfy the borrowers' IC constraint lenders must therefore make the decision to repay less costly in the present, i.e. set a lower r. Loosely speaking, the interest forgone by the lenders can be thought of as the 'price' of reciprocity, i.e. the monetary return that lenders are willing to give up in order to be assured that their children will be able to borrow if they need to.[19]

punishment scheme.

[19] Note that, although we refer to the interest lost as a 'price' for reciprocity, the lender in fact raises her lifetime utility by lowering r.

3.6 Outsiders versus insiders

The above model has been developed considering the set of all generations belonging to the local community, $\left\{\overline{E}_t \cup \underline{E}_t\right\}_{t=1,2,..\infty}$, which we can refer to as the local *kin group*. For each member i_t of the group, one can identify ancestors i_{t-1}, i_{t-2},... and descendents i_{t+1}, i_{t+2},..., etc. Two features make this a model of transactions among kinsmen as opposed to anonymous individuals. The first is the assumption that actions are publicly observable, which confines the validity of the analysis to a closed-knit community where information flows freely. The second is that the model relies on *genealogical ties*, in the sense that the social enforcement and reciprocity mechanisms require that parents' actions can fall upon their children, for good or for bad.

The same framework can be extended to account for transactions among individuals who do not belong to the local kin group. Assume that there exists a set $\{M_t\}_{t=1,2,..\infty}$ of 'outsiders' (say, migrants) who have access to the same production technology and have the same proportion of poor and rich types, but who in each generation have an exogenous probability $\pi > 0$ of moving out of the local community at the end of the first period of their life.[20] If it is costly for members of the new community to gather information about the past behavior of an immigrant, then the social enforcement and reciprocity schemes discussed so far become harder to implement.

Let ut start by considering social enforcement under uniform random matching. As an extreme exemplification, assume that agents in the new community (both lenders and the child of the outsider, who is born after all decisions have been made by the parent) have no information about the past behavior of an immigrant. The temptation to default on a loan for an M borrower is higher because with probability π he will not be punished. In the direct punishment scheme, the denominator of condition (2) in proposition 1 is multiplied by a factor $(1-\pi)$, which means that for sufficiently high π even a perfectly patient player will deviate. If the information constraints were less severe, e.g. the child knew about the parent's actions but prospective lenders did not, the direct scheme would work as in proposition 1 but the indirect one would not. In particular, by deviating to (T, NR) a

[20] It would be interesting to endogenize the the probability of migration as a strategic choice of players, and to derive endogenously the equilibrium size of the local kinship group and of the migrant community (possibly modelling monitoring and information costs with more accuracy), but this goes beyond the scope of the present analysis.

migrant borrower would face a probability $\alpha\pi$ that, being born poor, her child gets a loan in the new community.[21] Again, this amounts to multiplying the denominator of the second term in (3) by $(1-\pi)$.

Turning to reciprocity, the mere possibility that an M borrower moves out (disregarding the incentives to deviate) is such that lenders can expect reciprocation from the child of such borrower only with probability $(1-\pi)$, while by lending to an insider the lender faces a probability one that her child will get a loan in equilibrium. This makes reciprocal arrangements possible but relatively less attractive when migrants are involved.

Notice that both the effects on enforcement and those on reciprocity apply equally to transactions between an insider and an outsider, and between two outsiders. In fact, given the probability π of moving away, a migrant is a 'risky partner' both for a local lender and for another migrant. As a consequence, we should expect to see some sort of 'segmentation' along kinship lines whereby members of the local kin group lend and borrow from each other, while outsiders transact with other outsiders or with institutional sources, but in any case with less scope for reciprocity and social enforcement.

3.7 Interpretation and extensions

An important limiting feature of the model is its two-period structure, which constrains all action to take place *among* generations. In real life individuals live many periods before they become dependent on their offspring: they are therefore concerned about their *own* future access to the credit market through reciprocation of past loans. Extending the intuition of the two-period model to a multi-period setting, one can expect the same sort of effects to apply in the early stages of an individual's life as among generations.

Our framework rules out the possibility that children inherit their parents' debts. However, social enforcement schemes similar to the ones outlined in section 3.2 could be sustained also if debt were inheritable. Conceptually, debt repayment would simply increase the intergenerational transfer from

[21] The expected lifetime utility for the parent from deviating to (T, NR) is $u(\underline{e} + g + l - b) + \delta\left[\alpha u(b) + (1-\alpha)\pi u(b)\frac{\alpha}{1-\alpha}\right]$.

children to parents, and the main difference in the model would lie in the incentives to lend faced by type-$\overline{e}$ individuals and in the relevant threshold for the discount factor.[22] The changes would instead be substantial in the reciprocity argument. Giving preferential treatment to the children of type-$\overline{e}$ parents may in fact no longer be the best Pareto efficient matching rule for lenders, given that it would reduce the probability that the children of current borrowers get a loan, and thus are able to repay those same lenders in the next period. In other words, when debt is inheritable the choice of the matching rule poses a trade off between the expected transfer that lenders receive from their children and the expected repayment they receive from the children of their borrowers.

Another assumption of the model, which is common to the related literature on informal insurance, is the *non-storability* of production. Suppose that people have access to a storage technology which is subject to depreciation: they can store an amount s in period 1 and get back $S < s$ in period 2.[23] The effect of this on the borrowers' IC constraint is to raise the expected utility from deviating, but for adequate discount factors the strategies (1) can still be supported through our direct or indirect punishment codes. In particular, the equilibrium is easier to support the more generous the intergenerational transfer b and the larger the difference between s and S. Turning to type-$\overline{e}$ players, they can now choose between (i) lending the amount $\overline{e} - (\underline{e} + l)$ and earning an interest but with the risk of default, or (ii) saving it to get a certain but smaller amount. Depending on parameter values there can still be an equilibrium in which all types-$\overline{e}$ lend and reciprocity is the

[22] As an example, consider an equilibrium in which all borrowers default on their loans in the first period of their life (but do transfer b to their parents), and an amount $R \geq (1+r)l$ is repaid by the children of defaulters in the following period. The incentives for type-$\underline{e}$ players are unaffected compared to the baseline model, except for the fact that the threshold for the discount factor increases if $R > (1+r)l$. On the other hand, the incentive constraint for type-$\overline{e}$ players now must take into account that: (i) repayments are cashed in only in the second period; (ii) there is a positive probability that the child of a borrower will not repay on the equilibrium path if he is born a type $\underline{e}$ *and* is unmatched; (iii) lenders born from poor parents now face a more stringent incentive constraint than those born from rich parents, because they have to repay their own parent's debt. As a result, the binding threshold for the discount factor in propositions 1 and 2 may no longer be that of type-$\underline{e}$ players, but possibly that of types-$\overline{e}$.

[23] If storage were not subject to depreciation, the simple intergenerational transfer scheme of this model would break down because no young player would give up a certain b for an uncertain transfer of equal amount from their offspring, when they could get b or more for sure by saving their own money.

best Pareto efficient matching rule for them.

Related to storability is the idea that parents can leave *bequests* to their children, thus affecting their likelihood of being rich or poor. Suppose that, after lending and being repaid, type-$\overline{e}$ players could choose to leave an amount $\overline{e} - (\underline{e} + l)$ to their children instead of consuming the whole residual income. This would affect significantly our reciprocity argument. In fact, thanks to bequests the 'poor' children of lenders would face a probability one of being able to undertake production without needing to apply for loans. The matching rule could then be chosen by types $\overline{e}$ so as to maximize current profits from lending. In particular, by giving preferential treatment to the children of current *borrowers*, lenders would be able to charge higher interests and still meet the borrowers' IC constraint. In a sense, the interest rate is still a 'price for reciprocity', but this time it works in the opposite direction. Poor players are willing to trade off higher interest payments for the assurance that their children will be able to get a loan, and rich players can earn more without sacrificing their offspring's prospects of undertaking production.[24]

Finally, this model entirely abstracts from a plausible feature of intra-kin relationships: *altruism*. One can extend the analysis to the case in which parents care about their children's utility and/or vice versa. Making parents' utility increase with their children's utility would not qualitatively affect our results: in fact, in our framework self-interested parents already internalize the effect of their actions on their offspring.[25] A more interesting extension is if children care about their parents' well being. Consider the 'direct' punishment code. On the one hand, for children who care about their parents the temptation to deviate and not transfer b is lower; on the other hand, the threat that children will punish parents who do not repay their loans becomes less credible. The net effect is thus ambiguous.[26]

[24] Notice that the assumption of no bequests would not be so important in a model in which people's income is subject to shocks *throughout their lives* rather than only at birth. Here it serves the purpose of conveying the idea that parents' help may not be enough throughout an individual's life and that even the child of a rich parent may need loans from third parties at some point in time.

[25] Altruism in this case increases the range of values of the discount factor δ for which equilibria like those of propositions 3 and 4 can be sustained.

[26] The effect of altruism on the threat of reverting to autarky has been analyzed by Foster and Rosenzweig (1999) in the context of informal insurance. Notice that this effect does not influence the temptation to default on loans under

3.8 Empirical implications

Ideally, to test the predictions of the model one would want to know *who* the kinsmen of lenders and borrowers are and what happens over time *across generations*. The former piece of information is missing from virtually all data sources covering loan transactions, including the one used here.[27] The latter piece of information would require panel data that spans at least two decades, something which is currently unavailable even for most industrialized countries. We are therefore forced to get at the kinship element indirectly, by relying on the following proxies.

The first is *migration status*. As argued in the previous section, the scope for social enforcement and reciprocity is lower when the transaction involves an 'outsider', such as a migrant. This is due to the fact that it is costly for potential partners (including their kinsmen) to acquire information on migrants' past actions, and that it is likely that migrants will move again in the future. One can therefore expect the migration status of an individual to be a significant predictor of her access and behavior with respect to kin group loans.

A second aspect to be considered is *family structure*. Having children enlarges the scope for sanctioning defaulters, as well as the possibilities of future reciprocation. Ceteris paribus, people with children should thus behave and be treated differently from people without descendants in the market for kin loans.[28]

A third element which can be helpful to assess the plausibility of the theory is the *multi-period* extension of the model. Where intergenerational links are impossible to trace, one can attempt to test whether the same enforcement and reciprocity mechanisms that should work for parents and children also work at different stages of an individual's life. In particular, with the two-year panel available, it is possible to test whether credit market outcomes in the second year respond to individual actions

the 'indirect' punishment code because under this code it is not the child who punishes the parent, but the lender community who denies credit to the children of defaulters.

[27] A partial exception is the study of Fafchamps and Lund (2000) on 206 rural households in the Philippines. Their dataset identifies the 'insurance network' on which each household relies (up to eight individuas) and records the transactions between these partners at three-month intervals for nine months.

[28] As will be clear below, in reality this effect is made less important by the fact that repeated lending and the willingness to give or get loans at different stages of an individual's life may act pretty much like the intergenerational links of the model.

in the first.

Starting from these premises, the following predictions of the model will be tested (more details on the tests are provided in the empirical section):

(i) *Loan sources:* Migrants should have less access to reciprocal loans for two reasons. First, their parents did not belong to the local community, so members of the local kin group have no past loans to reciprocate. Second, the migrants' own kinsmen have little incentive to lend to them because it is less likely that their children will get reciprocation from somebody who is far away and mobile. Also, ceteris paribus people with children should be more likely to borrow from kinsmen and less from other sources, thanks to the enlarged scope for enforcement and reciprocity.

(ii) *Default:* Borrowers who have children should be less likely to default because they will lose their assistance in old age (either through the direct or through the indirect punishment). As for the migration status, according to the model it should not affect default on loans from kinsmen since migrants would not be part of the reciprocal scheme anyway.

(iii) *Interest rates*: Other things being equal, interest rates should be lower on 'reciprocal' loans than on 'market' loans.

(iv) *Past contributions*: If reciprocity is effective, people who lend to their kinsmen should expect their offspring to receive such loans in the future. The short panel available allows to test a variant from the multi-period version of the model: ceteris paribus, individuals who have lent or generally contributed resources to others in the past should have access to more credit in the present.

4 The data: a descriptive analysis

The above predictions will be tested using household-level data from the Ghana Living Standard Surveys (GLSS) of 1987/88 and 1988/89. The GLSS contains detailed information on loans contracted and given out by household members during the year, as well as on other individual characteristics. The data was collected nationwide in clusters of 16 or 32 households, but no community level information is available for urban clusters. Our analysis will therefore be restricted to rural and semi-urban areas, i.e., with less than 5,000 inhabitants, yielding a 'full sample' of 1,954 households in 1987/88 and 2,116 in 1988/89. However, only 850 of these households were interviewed in both

rounds of the survey, so the 'panel sample' is inevitably smaller.

Credit transactions are relatively common in this data. In the full sample, 34% of the households borrowed in the first year, 41% in the second, and 24% in both. Similarly, 27% lent in the first year, 33% in the second, and 16% in both years. Approximately half of these households (14% in the first year and 18% in the second) were participating on both sides of the market, suggesting a possible use of loans for inter-household transfers. Indeed, when asked what the main reason for borrowing was, 41% and 29% of the loans were described as related to farm or business in the first and second year, respectively, 1% and 2% to education, and 58% and 69% to 'other' purposes, among which are consumption and transfers to friends or relatives.

A first step towards assessing the role of kin groups in credit transactions is to examine who the partners in these transactions are. As is usually the case in surveys on credit activity, the respondents did not reveal the *identity* of their lenders, but only the broad category to which the lender belonged. Due to this intrinsic limitation of the data it will be impossible to test the model by directly matching lenders and borrowers belonging to the same kin group. A conservative approximation is to consider relatives, who are a subset of the kin group, while a coarse approximation would include relatives plus non-professional private lenders (who have a positive probability of being members of the borrower's kin group but may also be just friends or neighbors).

[Insert Table 1]

Table 1 contains information on several loan characteristics for both rounds of the survey (pooled), differentiating according to the source of the loan. The first two columns simply give a breakdown of all loans according to the lender's category. As reported in column 1, the majority of the loans (almost 53%) are given by private individuals not professionally involved in the lending business. The two categories of 'relative' and 'private' (non-moneylender) together account for about 80% of the total number of loans, banks and cooperatives together for 6%, while professional moneylenders for only 5%. When these numbers are weighted by the amount of each loan, the joint contribution of banks and cooperatives increases to about 17%, and that of moneylenders to less than 9%. It is worth noting that, although the size of individual loans from relatives and private

individuals is below the sample average of 9,186 Ghanaian Cedis (see column 3), these two sources jointly cover 67% of the total value of loans.[29] This confirms the general finding from most studies of informal credit in Africa, that the vast majority of the transactions occur between relatives, friends and neighbors (see e.g., Aryeetey and Udry (1997)). In particular, the prevalence of relatives and other private sources of credit is consistent with the hypothesis that most loans may come from lenders who belong to the same kin group as the borrower. Whether this is a plausible interpretation will be explored in the econometric section.

Columns 4 to 8 describe the conditions attached to loans depending on their source. Column 4 clearly shows that the desire to earn an interest is not at the heart of the decision to supply credit from relatives or other private individuals: only 4.5% and 7.2% of the loans from these sources, respectively, carry an interest, be it explicitly specified or implicitly embodied in the amount to be repaid. The corresponding figures for moneylenders, banks and cooperatives are, respectively, 26, 83 and 50 percent.[30] About 10% of the households in the sample are of Muslim religion, and this may partly explain the low fraction of loans carrying an interest. When the interest figures are calculated for non-Muslim households only, they remain virtually unchanged compared to the whole sample. Overall, this suggests that some other form of compensation must be expected by the lender, consistently with our reciprocity story.[31]

[29] To get an idea of the magnitude of these loans, annual household expenditure in the two rounds of the survey was 341,425 GHC and the annual amount borrowed was 22,225 GHC (both figures refer to households who borrowed positive amounts and are in year 2 prices). The official exchang rate was 202 GHC per US dollar in 1988, and 270 in 1989 (Source: World Bank, World Development Indicators).

[30] When asked *explicitly* whether the loan carried an interest, the respondents answered yes only for 4% of the loans given by relatives and 4.9% of those given by private individuals. In order to account for the possibility that these unusually low figures were due to misperception on behalf of the respondents, I constructed a broader measure using a different section of the questionnaire. Respondents were asked how much the original loan was and how much they should have paid, were the loan to be repaid at the date of the interview. There were instances in which the same individual who had answered no to the interest rate question reported that a larger amount than that originally borrowed should be repaid. The data in the table reports these 'adjusted' figures, which anyway are only a couple of percentage points higher than the 'explicit' ones.

[31] The figures for loans from moneylenders seem quite low too. It cannot be excluded that misreporting or measurement error are responsible for part of the unusually low values. However, there are at least two relevant considerations

Column 5 reports the average annual interest rate on loans from the different sources, conditional on the interest rate being non-zero and weighted by the amount of each loan.[32] Private individuals, moneylenders and 'other' sources seem aligned around the figure of 42%-47%; relatives charge about 31%, and banks and cooperatives charge rates of about 20% and 10%, respectively.[33] The relatively low rates charged by banks and cooperatives are in line with the policies of formal institutions in most African countries during the sample period, where interest rate ceilings were the norm rather than the exception. Also, it should be taken into account that the rates in table 1 are annualized, and that the average duration of informal loans is much shorter than that of formal ones.[34] Notice that despite all this, interest rates on loans from relatives are about 10 percentage points lower than from other non formal sources, and that in real terms are about zero.

A common practice in African rural settings is to bring a gift together with the repayment of an informal loan, which could partially substitute for the absence or low level of the interest. However, when asked whether "additional goods or services should be provided together with the repayment", most respondents answered no. Column 6 of table 1 shows that only 2% to 3% of the loans from informal sources had this feature.

The next two columns explore the guarantees of repayment incorporated in the various loans.

to be made. First, in some cases collateral on these loans was provided in the form of land which was to be held by the creditor until the loan would be repaid, yielding substantial returns. Second, in a study of informal finance in Ghana using different data Aryeetey (1994) reports that it is common among Ghanaian moneylenders to see the interest rate as determined not only by market forces but also by tradition, or by the 'need' of the borrower. As for the 17% of bank loans that apparently carry no interest, note that all but 3 of them are loans that have not expired yet, and for which the respondent has repaid some but not all of the tranches. A possible conjecture is that the sum of the tranches may well exceed the principal, but the respondent "does not realize it" until he or she has paid in full.

[32] Although it is not specified in the questionnaire, the figures should be considered *nominal* interest rates. The annual inflation rate was 31% over the first year of the survey and 24% over the second (Source: CPI figures from GLSS documentation).

[33] Again, these rates are calculated taking into account 'implicit' interest payments embodied in the final repayment. When using the figures explcitly reported by the respondents, the average interest rates from the various sources are, in the order of the table, 39.6%, 49.9%, 47.7%, 20%, 10.7%, and 48.5%.

[34] The percentage of loans whose duration is 3 months or less is 52% for relatives, 57% for non-profesional private individuals, 43% for moneylenders and for cooperatives, and only 13% for banks.

In only 13% of the cases were households who borrowed from relatives, private individuals or moneylenders required to make regular payments, as compared to 28% and 50% for bank and cooperative loans. Moreover, the pledge of collateral is very infrequent: even banks and cooperatives use collateral clauses on less than 10% of the loans. Overall, both the low or zero interest rates and the absence of formal guarantees on loans from relatives and private individuals are consistent with the reciprocity and social enforcement mechanisms suggested by the model.

Finally, columns 9 and 10 explore the pattern of default rates on different types of loans. The GLSS does not contain explicit questions on default, but only a variable indicating whether the loan has been repaid or not at the date of the interview. Default can thus be inferred indirectly by comparing the expiration date of the loan with the date of the interview. Since only the month, but not the day, of the expiration date is known, I have constructed two different variables, DEFAULT1 and DEFAULT2, which correspond, respectively, to a stricter and a coarser interpretation of this criterion. DEFAULT1 is a dummy taking value 1 if the loan was contracted in year 1 or 2 of the survey, expired at least one month before the date of the interview, and was reported as "not repaid" at that date.[35] The more comprehensive variable, DEFAULT2, takes value 1 if the loan expired before *or during* the month of the interview, and is reported as "not repaid" at the time of the interview. While DEFAULT1 is likely to underestimate default, DEFAULT2 is likely to overestimate it, as technically respondents may have still a few days to repay the loan before it expires. In fact, in table 1 DEFAULT1 has a lower mean than DEFAULT2 (3.4% versus 15.8%). When we look at the pattern of defaults by type of lender, some interesting differences emerge. The default rate on loans from relatives is less than 6% even under the broader definition, and about 1% under the more restrictive one. DEFAULT1 yields very low default rates also for other sources (except cooperatives), but for all these sources defaults jump up to 15-20% when the other definition is considered. This could mean that the criterion used for DEFAULT2 is indeed too imprecise, but in any case it conveys a useful piece of information: it

[35] Households belonging to the panel sample were followed in the second year of the survey in the following way. A loan taken in year 1 and whose expiration date was after the first year interview but before the second year date is considered in default if (i) there was no loan from the same source reported as outstanding in year 2, or (ii) there was a loan from the same source and of greater or equal amout reported as outstanding and not repaid in year 2. Rescheduling smaller amounts with the same lender is not counted as default.

is much more common for loans from relatives to be repaid a month before or during the month of their expiration than it is for other loans. This stylized fact fits well with the need to maintain good standing within the kin group as suggested by the theoretical framework.

5 Econometric analysis

This section attempts to test the predictions of the model outlined in section 3.8 by employing multivariate analysis. Given the impossibility of testing directly the intergenerational mechanisms for lack of data, the approach followed here will be to gather a number of pieces of evidence consistent with the model, and to discuss why indeed one may view them as indirect confirmation of the theoretical analysis. Before proceeding with the results, one major qualification is in order. The model in this paper emphasizes the supply side of the credit market, giving clear-cut predictions for the effects of kin membership on the availability and conditions of credit. It does not bear similarly sharp implications for the *demand* of credit. In particular the model assumes that all households demand loans but access to credit is rationed, so a supply equation should be estimated. In reality, households differ in their demand for credit, so that if one finds that some people borrow more in equilibrium, this may be due not to the fact that they are offered more credit but that they demand more. In what follows I will try to account for this as much as possible by including in all regressions a number of individual and community characteristics that should affect the demand for credit. To the extent that possible omitted variables are not correlated with our regressors of interest, this objection should not invalidate the general findings. The set of controls included in all regressions is the following: age, sex, education, language, and migration status of the household head; household size; dummy for whether the household head has children; dummy for whether the head speaks the language of the dominant ethnic group in the community[36]; number of years the head has lived in the current place of residence and number of changes in residence; total household labor income; value of the crop lost by the household due to fire, rodents, etc; distance from the closest bank; and dummy for whether the community has more than 1,500 inhabitants. Summary statistics for all

[36] Collier and Garg (1999) have shown this variable to be associated with a wage premium on the Ghanaian labor market.

variables used in the regressions are reported in Appendix B.

5.1 Loan sources

It is natural to start by examining what individual and community characteristics affect the likelihood of borrowing from different loan sources. According to the model, ceteris paribus we should expect migrants to be less likely to borrow from their kinsmen, and people with children more.

[Insert Table 2a]

Table 2a reports multinomial logit estimates of the probability that a loan is taken from four different sources: relatives, private non-moneylenders, professional moneylenders, and banks or co-operatives (the latter being the omitted category).[37] Among the individual controls, age and income show a fairly robust pattern for all categories: the probability of borrowing from relatives and private non-moneylenders first decreases and then increases with the age of the household head, suggesting that individuals in the middle stages of their life are those who most have access to formal loans. Also, not surprisingly increases in household labor income decrease the probability that loans are taken in the informal as opposed to the formal sector. In terms of community characteristics, the distance from the nearest bank significantly (and positively) affects the probability of resorting to informal loan sources.

Turning to the variables that are the focus of this analysis, the results are mixed. The presence of children, does not have a significant effect, and this remains true also if one controls for the age of the children and/or interacts the children dummy with the age of the household head. The migrant dummy has instead a strong negative effect on the likelihood that a loan is taken from a relative, as predicted by the theory. According to the estimates in the table, when all other controls are held at the sample mean, the predicted probability that the source of the loan is .19 for a migrant and .26 for a non-migrant, which can be considered a non-negligible effect. Notice that the coefficient

[37] To limit the number of parameters to be estimated, the category "Other", which was listed separately in the original data, has been aggregated with "Private". The latter seemed in fact the most similar category on the basis of the descriptive statistics in tables 1-3. None of the results obtained for the category "Relative" are significantly affected by changing this aggregation rule.

on the migrant dummy is insignificant for other informal categories, which is comforting in that it suggests that kinship mechanisms as opposed to generic migrants' unobserved characteristics may be the underlying explanation. In what follows the robustness of this hypothesis is tested against some competing explanations.

A first possibility is that migrants borrow less from their relatives not because they do not have access to such loans, but because they can afford borrowing from formal sources at more convenient terms. For example, migrants may be in a better position to offer collateral. The GLSS contains a question on whether the respondent is free to sell her land or has to ask for permission to family members or village elders. One could conceive that migrants are less subject to the authority of local people, and can thus more freely dispose of their land and offer it as 'liquid' collateral. This conjecture does not seem to be supported by the data: the fraction of respondents who say that they are free to sell their land is virtually the same between migrants and non-migrants, namely 26 percent. Furthermore, when one looks at the *effective* use of collateral clauses on loans taken by migrants and non-migrants, an interesting pattern emerges. When all loan sources are considered, migrants indeed offer collateral about twice as often as non-migrants (3.8% of the loans for the former, 1.8% for the latter). However, this does not occur because migrants are in a better position to offer collateral to *formal* lenders: indeed the incidence of collateral for loans from banks and cooperatives is virtually identical for both migrants and local borrowers. On the contrary, the higher incidence of collateral for migrants occurs in the categories of 'relatives' (2% of the loans taken by migrants versus 0.3% by non-migrants), and 'private' lenders (3.4% versus 1.6%), and in both cases the difference is statistically significant at the 5 percent level. This reinforces the interpretation proposed in this paper, in that migrants may be asked to offer collateral by relatives and other private individuals precisely because they lack the 'social collateral' that members of the local kin group can offer.

A second alternative explanation for why migrants borrow less from their relatives has to do with the role of information. One could argue that it is not the difficulty of implementing enforcement and reciprocity schemes through kinship lines what puts migrants at a disadvantage, but the fact that asymmetric information problems are more severe for migrants than for other categories of borrowers. Though our basic set of controls includes some proxies for the availability of information (namely

the number of years the respondent has lived in the current place and the number of times she has changed residence), it is worth investigating the role of information in more detail. This is what table 2b does. Each panel in the table reports only the coefficients of interest from a multinomial logit regression in which the dependent variable is a categorical variable for loan source, and the full set of controls is the same as in table 2a.

[Insert Table 2b]

Notice first of all that to make sense of the result in table 2a, where the coefficient on migrants is negative and significant only for loans from relatives, one should argue that information problems on migrants are more severe *for relatives* than for other categories of lenders. This is not implausible, given that migrants' own relatives are likely to live elsewhere, while other informal lenders may be in the migrant's current place of residence. The GLSS section on migration includes a question on "what was the main reason (the respondent) came to the present place of residence". This allows to construct a dummy for those migrants who moved to "follow/join family" as opposed to work or other reasons. This dummy is included among the controls in the first panel of table 2b. Having family members nearby increases the probability of borrowing from them, but being a migrant remains negatively associated with the likelihood that a loan is taken from a relative. Panel B includes further information on the place where the respondent was living before coming to the current residence. It is conceivable that the smaller that place, the easier it should be to gather information. Coming from a village as opposed to a town increases the likelihood of borrowing from private individuals, but not from relatives. Indeed, the migrant dummy remains negative and highly significant only for the category of relatives. Panel C and the following attempt to control for the circulation of information in the community where the respondent currently lives. The size of the community, measured by the log of its population in 1984, does not significantly affect the results, possibly because the semi-urban dummy already captures the role of size. Panel D includes a dummy for whether "people in the community leave temporarily during certain times of the year to look for work elsewhere". The conjecture is that in communities with seasonal outmigration it is more difficult to gather information on individual actions. As can be seen from the table,

the coefficient on migrants for the category of relatives remains negative and significant after the introduction of this variable. Finally, panels E and F attempt to control for the flow of information within the community by introducing proxies for ethnic and religious fragmentation, namely the number of different ethnic groups and religions in the community. Given that no segregation index can be constructed from the data, the best approximation is to argue that it is more difficult for information to cross religious or ethnic boundaries than to be exchanged within them. In fact, both variables negatively and significantly affect the probability of borrowing from informal sources such as relatives and private individuals. Notice that the migrant dummy remains highly significant when religious fragmentation is introduced, but not when the number of ethnic groups is. This is not inconsistent with our hypothesis. In fact, migrants themselves are likely to belong to a different ethnic group than local people, so part of the effect of ethnic fragmentation does not have to do with information but with reduced scope for kinship ties (which by definition occur *within* ethnic groups). In this sense religious fragmentation seems a better indicator for our purposes: it has more to do with information flows (e.g., people meet and talk at religious ceremonies) and less with kinship.

Overall, the results in this section show that migrants are less likely to borrow from relatives than from other sources, and that while information constraints may be part of the explanation, they cannot entirely account for this finding.

5.2 Default and family structure

A second question is whether, ceteris paribus, borrowers who have children are less likely to default on their loans. Furthermore, children should matter in reciprocal relationships, but not in all informal transactions. We can thus estimate the following equation:

$$Y_{it}^{*} = C_{it} I^{R} \beta^{R} + C_{it} I^{NR} \beta^{NR} + D_t \alpha + X_{it} \delta + \varepsilon_{it} \tag{10}$$

where Y_{ic}^{*} is the latent variable underlying the probit model for default; C_{it} is the children dummy; D_t is a dummy for year 1, and X_{it} represents all other controls. The children dummy is interacted with two indicator variables: I^R is a dummy equal to 1 if the loan is taken from a relative, and I^{NR} is $1 - I^R$. The coefficients β^R and β^{NR} therefore capture the impact of having children on default when the lender is, respectively, a relative or a non-relative. The conjecture is that $\beta^R < 0$, while

β^{NR} should be 0. In other words, having children decreases the probability of default if the loan is taken from a relative, but not otherwise.[38]

[Insert Table 3a]

Table 3a tests this prediction using the two default variables defined in section 4. Recall that DEFAULT1 is the more conservative definition, while DEFAULT2 is the more comprehensive one. Estimated and marginal probit coefficients are reported for both regressions. Among the control variables in column 1, two turn out to be significant. One is the value of crop lost during the year in which the loan was taken: it is more likely to observe a default if the borrower was hit by an adverse shock. The other variable is income: ceteris paribus, higher income decreases the likelihood of defaulting. But the most interesting result concerns the existence of children. As predicted by the theory, the coefficient on children is negative and significant at the 1% level for loans taken from relatives, and insignificant for other loans. The test for the equality of the two coefficients rejects the null with a p-value of .01. This is true also when the more comprehensive definition of default is adopted (column 3). To assess the magnitude of this effect, notice that ceteris paribus having children when the loan is from a relative decreases the probability of default by 2.9 percentage points in the first definition (12.5 in the second), against an overall default rate of 3.5% (15% respectively).

[Insert table 3b]

Table 3b attempts to verify the robustness of this result against some competing explanations. The dependent variable is DEFAULT2 because, due to the very small number of defaults on loan from relatives observed with the first definition, estimates would be rather imprecise otherwise. All regressions in the panels of table 3b control for the same variables included in table 3a. A first interpretation of our previous result is that having children is also a proxy for residential stability, hence people with children may default less not because their offspring would be punished, but because they themselves are less free to run away, hence more vulnerable to sanctions. Notice first

[38] No clear implication can be derived from the model regarding the effect of loans source on default for migrants, who should not be borrowing from relatives in the first place. As a consistency check, a differential test analogous to that in (**??**) was carried out, but without significant results, as expected.

of all that the years of residence in the present community and the number of changes in residence (which may proxy for the prospects of future mobility) are already included as controls. However, it is possible to exploit some further information on the respondent's mobility prospects. Panel A includes a dummy for whether the respondent's family lives in the same place (which should reduce his or her expected mobility). This variable is not significant, nor does it affect the coefficient β_R. Panel B controls for whether the spouse of the respondent is originally from a different region (which should instead increase the prospects of mobility), and indeed those who have the 'outside option' of moving to a different region seem more likely to default. The coefficient on children for loans from relatives remains nonetheless negative and significantly different from the counterpart for other loans.

A second reason why children may affect default is that they can contribute resources to the family: they can either work (in which case their contribution is already accounted for by the income variable) or send remittances if they live elsewhere. Panel C adds as control the amount of remittances received from children. If the link between children and default were due purely to this wealth effect, it should disappear once this control is included. The coefficient β_R remains instead negative and highly significant. One could argue that remittances may not be exogenous, but the results were unchanged also when two stage least squares were used taking as instruments the age brackets of the children (relatively young children cannot contribute much, and relatively old ones are likely to contribute a lot). Furthermore, the role of children as income generators should be more relevant the less help the community can give to the household in case of need. Panels D and E include two proxies for the degree of mutual assistance in the community of the respondent: a dummy for whether "there is a system of mutual aid among the farmers of the community for field work", and the number of man days of labor that the household has received in the past twelve months as part of an exchange of unpaid labor. Neither variable turns out to be significant, nor to affect the coefficients on children.

5.3 Interest rates

Another prediction of the model was that interest rates would be lower on 'reciprocal' loans than on 'market' loans. We have already seen in table 1 that more than 92% of the loans from relatives and from private non-moneylenders (i.e., potential kinsmen) carry no interest at all.[39]

[Insert table 4a]

Table 4a estimates a probit model in which the dependent variable is a dummy equal to 1 if the loan contracted carries a positive interest rate, either explicitly (first two columns) or after adjusting to account for implicit interest payments (last two columns). Again, the coefficient on children is allowed to differ depending on whether the loan was from a relative or not, as in expression (**??**).[40] As expected, having children matters when the lender is a relative, but not when it is another source. The magnitude of the effect is substantial: in the face of an overall probability of interest of 14% (11% in the explicit case), having children when the lender is a relative decreases this probability by 10.8 percentage points (9 percentage points for the explicit interest). The difference between the two coefficients is always significant at less than 1 percent.

Other individual characteristics correlated with the probability of paying interest are income (richer people are more likely to be charged an interest), and to a lesser extent education. Contrary to what one would expect on the basis of information constraints, the more years someone has been living in a place, and the fewer times she has changed residence, the more likely she is to be charged an interest. Part of the reason may be that less mobile people have more access to loans from banks and cooperatives, institutions that are significantly more likely to charge an interest (see table 1).

[39] Given that most loans in the sample do not carry any interest, the appropriate question to ask is not whether the value of the interest rate is higher for migrants or for people without children, but whether the *probability* that a loan carries a positive interest rate is significantly higher for such individuals. Notice that the size of the loan will not appear among the explanatory variables in our regressions because what is being estimated is an equilibrium relationship, i.e. the reduced form of a system of demand and supply of credit that has been solved out for the quantity of credit.

[40] Originally both the coefficient on children and that for migrant were allowed to differ according to loan source, but the difference was never significant for the migrant dummy, so in the final specification the variable migrant is included in an 'undifferentiated' way.

As for community characteristics, the semi-urban status and the distance from the nearest bank also affect the probability of facing positive interest rates.

[Insert table 4b]

Table 4b tests the robustness of this effect against some competing explanations.[41] The possibility that having children may proxy more generally for residential stability and lower the 'risk premium' paid by the borrower does not seem warranted by the estimates in panels A and B. Neither the fact that the family of the respondent lives in the same place, nor the fact that the spouse comes from a different region significantly affect the likelihood of facing an interest, and our coefficients of interest remain statistically different. Another possibility is that children 'substitute' for interest payments, for example by offering unpaid labor to the lender. Panel C includes a dummy for whether "members of the household have taken part in any exchange of unpaid labor in the last 12 months". The coefficient on this variable is negative, as expected, but not statistically significant, and it does not undermine the children effect. To control for other implicit payments, e.g. in the form of interlinking, panel D includes a dummy for whether "during the past 12 months the household has worked as sharecroppers on someone else's land". Ceteris paribus, sharecroppers seem more likely to face an interest on the loans they take, but again this does not affect the children variable. Up to this point, no attempt has been made to control for altruism or other social norms that may affect the lender's willingness or ability to charge an interest, except for the Muslim dummy. Panel E includes a dummy for whether there is a system of mutual aid among farmers in the community (also introduced in table 3b), and the coefficient on this variable is negative and significant at the 5 percent level. Other things being equal, borrowers living in communities where there is mutual aid are almost 5 percentage points less likely to be charged positive interests. Finally, none of the proxies for information conditions used in table 2b turn out to be significant or to affect the coefficients on children.

[41] Notice that the dependent variable in table 4b accounts for both explicit and implicit interest payments. None of the results are affected if only explicit interest rates are considered. Results are available upon request.

5.4 Reciprocation of past contributions

The last step is to test the *effectiveness* of reciprocity in the multi-period version of the model, asking whether individuals who have lent or given contributions to others in the past have access to more credit in the present. This is done by estimating the reduced form of a system of demand and supply of loans, which takes the following form:

$$L_{it} = X_{it}\beta + R_{i,t-1}\gamma + \epsilon_{it} \tag{11}$$

where L_{it} is the amount borrowed in equilibrium by household i at time t; X_{it} is a vector of household controls; $R_{i,t-1}$ is the amount of 'reciprocal contributions' given by the household in the previous year (i.e. loans to other private individuals plus remittances sent); and ϵ_{it} is an error term.

Two estimation strategies will be adopted concerning (11). The first will be to assess the impact of past contributions taking into account both the probability that the household will borrow a positive amount, and the entity of the sum borrowed. In this case the dependent variable L_{it} will be censored, taking value 0 for those households that did not borrow during the survey year, and a positive value for those that contracted one or more loans. Estimation will be done with OLS (which are inconsistent in this case), with Tobit, and with Powell's (1984) censored Least Absolute Deviations estimator (LAD from now on). The latter is a semiparametric alternative to Tobit estimates, which are known to be inconsistent when the error terms are heteroscedastic.[42] The second strategy will consider the effect of past contributions on the amount borrowed *conditional* on borrowing a positive amount. The question asked in this case is: for those households who borrow, do past contributions translate into larger loans today? The dependent variable L_{it} will then take only positive values and (11) will be estimated by OLS, adjusting the standard errors for clustering at the village level. As for the coverage of the dependent variable, the second strategy allows to restrict the attention to loans taken from relatives and private individuals only while the former does not, due to the high degree of censoring which makes the implementation of the LAD estimator impossible.[43] The dependent

[42] Powell's (1984) estimator is consistent regardless of whether the distribution of the error terms is normal or homoscedastic. The only requirement is that it has median 0. The asymptotic covariance matrix is estimated by bootstrapping.

[43] Powell's (1984) estimator is implemented through the iterative linear programming algorithm proposed by Buchin-

variable in the first approach will thus include the amount borrowed from all sources (notice that even in this case, 55% of the sample used is censored).

[Insert table 5]

The first three columns of table 5 report the results when the sample includes both households who borrowed and households who did not. Among the variables that positively influence the probability and amount borrowed are household income, the years spent in the current location, and the number of changes in residence. Distance from the closest bank instead has a negative impact. With all three methods the amount of money lent to others or sent as remittance in the previous year has a positive and highly significant effect, suggesting that reciprocity may indeed be at work. Notice that neither the migrant nor the children dummy are statistically significant in these regressions. For migrants, a possible explanation is that the negative supply effect is compensated by a higher demand for credit which may not be adequately controlled for. For children, the theory itself is ambiguous in this case. The model in fact predicted that people with children should be more likely to lend to others but not necessarily get back more, because reciprocation could be given to their children.

Columns 4 to 6 of the table report OLS estimates for the subsample of households who borrowed positive amounts. The dependent variable in column 4 is the amount borrowed from all sources (col. 4). In the following two columns, this amount is split among amount borrowed from potential kinsmen (i.e., relatives and other private non-moneylenders, in col. 5), and amount borrowed from all other sources (col. 6).[44] Again past contributions show a positive and significant coefficient, and the magnitude of the effect is quite substantial. Conditional on borrowing, ceteris paribus more than 20 percent of the money contributed to others in the previous year comes back to the household in the form of higher loans from potential kinsmen. On the contrary, the amount borrowed from banks, cooperatives, moneylenders, and "other" sources is not affected by previous contributions

sky (1994). This starts by running a median regression on the full sample and discarding the observations where the predicted values $X'_{it}\beta + M_{i,t-1}\gamma$ are negative. The median regression is then repeated on the truncated sample and the discarding procedure applied again, until the set of observations in two consecutive iterations is the same.

[44] Restricting the sample to relatives only would leave only 48 observations.

(see the coefficient in column 6). This is comforting, because it suggests that such contributions do not simply proxy for the size of one's operations. On the side, notice that the value of crop lost by the household, which was insignificant in the previous regressions, displays a positive and significant coefficient in the last column. Households more adversely affected by the shock obtain higher loans from their kinsmen, suggesting that this type of arrangements may also serve an insurance function.

6 Conclusions

This paper has suggested two complementary ways in which membership in a dynastically-linked community like a kinship or ethnic group can shape individual incentives in credit transactions. First, it makes default more costly for the members in that the punishment, in the form of exclusion from future credit or other social sanctions, will fall on the defaulter's offspring as well as on him or herself, thus reducing the support that a defaulter can expect from the kin in the future. This channel has been referred to as 'social enforcement'. Second, the kin group provides a pool of potential future lenders whose willingness to lend will depend on the past behavior of the borrower's family, and particularly on whether the borrower's family has lent or transferred money to a member of the community in the past. By lending to a member of the same kin group an individual can create an obligation for reciprocation on behalf of other kinsmen, as well as of the recipient, in the form of future loans. This has been called the 'reciprocity' channel.

The empirical relevance of these effects has been documented using household-level data from Ghana. The results seem to suggest that both social enforcement and reciprocity play a role in determining access to credit from relatives and private non-moneylenders for local households, while they do not influence loans from banks, cooperatives and professional moneylenders. Two aspects which are generally correlated with access to and performance of reciprocal loans are being born in the local community and having children.

Incorporating kinship in the traditional analysis of informal credit and insurance seems important for a number of reasons. First of all, their empirical relevance: family ties and kin groups play a major role in economic transactions in most developing (and industrialized) countries. Second, from a modelling point of view the explicit consideration of the genealogical links among the players

can enrich the strategy space compared to games with anonymous players. In particular, this can increase the scope for cooperation in some cases in which the finite horizon of the game or the limited enforceability of contracts make mutually beneficial agreements difficult to sustain. Finally, community links in credit transactions have important welfare implications. If formal credit is available only to those who are able to offer collateral, credit from one's own kin group can have positive distributive effects for the landless and the poorest, alleviating the liquidity constraints faced by these segments of the population.

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Appendix A - Proofs

A.1 Proof of proposition 2

The condition for type-$\overline{e}$ players is the same as in proposition 1. For type-$\underline{e}$ players the expected lifetime utilities from conforming or from deviating to (NT, NR) are also the same, while deviating to (T, NR) now yields $u(\underline{e} + l + g - b) + \delta\alpha u(b)$. Therefore a type-$\underline{e}$ player will have no incentive to deviate unilaterally to (T, NR) if

$$\delta \geq \frac{u(\underline{e} + l + g - b) - u(\underline{e} + g - rl - b)}{\alpha u(b)}. \tag{A.1}$$

□

Notice that a similar condition could be derived if children had enough resources to transfer *some* money (albeit less than b) in case they did not get a loan.[45]

A.2 Derivation of expressions (4) and (5)

To understand how expression (4) is obtained, recall that $\underline{p}$ is the probability that the child of a type-$\underline{e}$ parent obtains a loan *conditional on being type-$\underline{e}$* himself. Therefore, the αn children endowed with $\overline{e}$ next period will be extracted from a pool of $n-1$ children. Of these, αn are born from a rich parent, and $n - \alpha n - 1$ from a poor one. The denominator of the first factor in (4), $\binom{n-1}{\alpha n}$, gives the number of ways in which αn rich children can be extracted from a pool of $n-1$. The numerator is the product of two factors: $\binom{\alpha n}{k}$, i.e. the number of ways in which k rich can be extracted from αn children of current type-$\overline{e}$ parents; and $\binom{n-\alpha n-1}{\alpha n-k}$, i.e. the number of ways in which $\alpha n - k$ rich

[45] Suppose that unmatched 'poor' children can transfer $\underline{b}$ to their parent, where $0 \leq \underline{b} < b$. Then the denominator of (A.1) becomes $\alpha u(b) - (1-\alpha)u(\underline{b})$. Whether this simply requires more patient players or makes the indirect scheme impossible to sustain depends on parameter values.

can be extracted from the pool of $n - \alpha n - 1$ children of current type-$\underline{e}$ parents. The procedure for calculating $\overline{p}$ is analogous.

A.3 Proof of proposition 3

Let $\widetilde{U}_{\underline{e}}$ denote the minimum utility that type-$\underline{e}$ individuals must be guaranteed. The Pareto problem is to maximize with respect to $\overline{p}|k$ $(k = 0, 1, ..., \alpha n - 1)$ and $\underline{p}|k$ $(k = 0, 1, ..., \alpha n)$ the following function:

$$U_{\overline{e}}(\overline{p}) \equiv u(\overline{e} + g + rl - b) + \delta \left[\alpha u(b) + (1-\alpha)u(b) \sum_{k=0}^{\alpha n - 1} \frac{\binom{\alpha n - 1}{k}\binom{n-\alpha n}{\alpha n - k}}{\binom{n-1}{\alpha n}} (\overline{p}|k) \right] \tag{A.2}$$

subject to:

$$U_{\underline{e}}(\underline{p}) \equiv u(\underline{e} + g - rl - b) + \delta \left[\alpha u(b) + (1-\alpha)u(b) \sum_{k=0}^{\alpha n} \frac{\binom{\alpha n}{k}\binom{n-\alpha n-1}{\alpha n - k}}{\binom{n-1}{\alpha n}} (\underline{p}|k) \right] \geq \widetilde{U}_{\underline{e}} \tag{A.3}$$

$$u(\underline{e} + g - rl - b) + \delta \left[\alpha u(b) + (1-\alpha)u(b) \sum_{k=0}^{\alpha n} \frac{\binom{\alpha n}{k}\binom{n-\alpha n-1}{\alpha n - k}}{\binom{n-1}{\alpha n}} (\underline{p}|k) \right] \geq u(\underline{e} + l + g) \tag{A.4}$$

$$u(\overline{e} + g + rl - b) + \delta \left[\alpha u(b) + (1-\alpha)u(b) \sum_{k=0}^{\alpha n - 1} \frac{\binom{\alpha n - 1}{k}\binom{n-\alpha n}{\alpha n - k}}{\binom{n-1}{\alpha n}} (\overline{p}|k) \right] \geq u(\overline{e} + g + rl) \tag{A.5}$$

$$(\alpha n - k)(\overline{p}|k) + [(1-2\alpha)n + k](\underline{p}|k) = \alpha n, \quad k = 0, 1, ...\alpha n \tag{A.6}$$

where the summations in square brackets are the variables $\underline{p}$ and $\overline{p}$ defined by (4) and (5) in the text. The objective function is the expected lifetime utility of a type-$\overline{e}$ individual. Expression (A.3) is the Pareto constraint, while (A.4) and (A.5) are the IC constraints for types $\underline{e}$ and $\overline{e}$, respectively. Finally, the set of equations in (A.6) are feasibility constraints on the number of available loans. The Pareto frontier is obtained by tracing the solutions to the above problem for all possible nonnegative values of $\widetilde{U}_{\underline{e}}$.

We can start by finding the endpoints of the Pareto frontier. Assume for the moment that the discount rate δ is such that, at the exogenously given interest rate $r > 0$, the incentive constraints

(A.4) and (A.5) are satisfied for any matching rule we are going to consider.[46] The best matching rule for types-$\overline{e}$ is one that *guarantees* their children a loan, i.e. $\overline{p}|k = 1$, $\forall k$. Constraints (A.6) then yield the corresponding feasible $\underline{p}|k$ for each k. For example, when 1 child of current types-$\overline{e}$ is $\overline{e}$ himself ($k = 1$), all other $\alpha n - 1$ children of rich parents will be guaranteed a loan, and there will only be one loan available for the $n - \alpha n - (\alpha n - 1)$ poor children of current types-$\underline{e}$. This rule yields $\underline{p}|k = \frac{k}{(1-2\alpha)n+k}$, for $k = 0, 1, ...\alpha n$, as stated in proposition 3. The best point on the Pareto frontier for types-$\overline{e}$ is found by substituting these values for $\underline{p}|k$ and $\overline{p}|k$ in (4) and (5) in the text. The best matching rule for types-$\underline{e}$ is found in a similar way, keeping in mind that children of poor players cannot be *guaranteed* a loan but only be given priority, given that in any period their number might exceed that of available loans.

Once we know the endpoints of the Pareto frontier, it is intuitive that it should be linear and with a slope of $-\frac{1-\alpha}{\alpha}$. In fact, we are considering only equilibria in which the total amount of resources gets invested and the "size of the pie" is fixed. What changes as we move along the frontier is how much of the pie each type will get. To show this formally, notice that from (A.2) and (A.3) $\Delta U_{\overline{e}}/\Delta U_{\underline{e}}$ will be constant if and only if $\Delta\overline{p}/\Delta\underline{p}$ is.

Consider moving from the equilibrium with uniform random matching to a point more favorable to type-$\overline{e}$ players by giving their children probability one of getting the loan when there are $\alpha n - k$ of them who are born poor. In this case

$$\Delta\overline{p} = \frac{\binom{\alpha n-1}{k}\binom{n-\alpha n}{\alpha n-k}}{\binom{n-1}{\alpha n}}\left(1 - \frac{\alpha}{1-\alpha}\right) > 0.$$

The corresponding change in $\underline{p}$ is

$$\Delta\underline{p} = \frac{\binom{\alpha n}{k}\binom{n-\alpha n-1}{\alpha n-k}}{\binom{n-1}{\alpha n}}\left(\frac{k}{n-2\alpha n+k} - \frac{\alpha}{1-\alpha}\right) < 0.$$

By simplifying the binomials we get that the ratio $\Delta\overline{p}/\Delta\underline{p}$ is independent of k and is equal to $-\frac{1-\alpha}{\alpha}$. The same result ($\Delta\overline{p}/\Delta\underline{p} = -\frac{1-\alpha}{\alpha}$) obtains if we consider a movement in the opposite direction and give the children of type-$\underline{e}$ players priority in the allocation of loans.

[46] This amounts to saying that players are so patient that even if their children had a zero probability of receiving a loan in the future, the parents would still want to conform to the equilibrium in order to get b in case their children are born rich. As we shall see, this is a sufficient but not necessary condition for our results.

Finally, the threshold values for δ in the note to proposition 3 are derived by imposing that the equilibrium strategies are incentive compatible for types $\underline{e}$ and $\overline{e}$, respectively, in the worst equilibria for each type. $\square$

A.4 Proof of Proposition 4

The problem is to maximize (A.2) with respect to $r \geq 0$, to $\overline{p}|k \in [0,1]$ and $\underline{p}|k \in [0,1]$, $(k = 0, ..., \alpha n)$, subject to constraints (A.4) and (A.6). Setting up the Kuhn-Tucker conditions and simplifying the factorials one obtains that an interior solution would require the ratio of $u'(\overline{e}+g+rl-b)$ to $u'(\underline{e}+g-rl-b)$ to equal $(1-\alpha)/\alpha$, which is inconsistent with the hypotheses that $u(\cdot)$ is concave and $\alpha < 1/2$. At any interior solution we thus have $u'(\overline{e}+g+rl-b)/(1-\alpha) < u'(\underline{e}+g-rl-b)/\alpha$. But then if the lender decreases r by dr and increases $\overline{p}|k$ by $u'(\underline{e}+g-rl-b)\left[\delta\alpha(1-\alpha)u(b)\frac{\binom{\alpha n}{k}\binom{n-\alpha n-1}{\alpha n-k}}{\binom{n-1}{\alpha n}}\frac{\alpha n-k}{n-2\alpha n+k}\right]^{-1} dr$, the borrower's IC (A.4) is still satisfied and the lender gets a utility change of $-u'(\overline{e}+g+rl-b)dr + \frac{1-\alpha}{\alpha}u'(\underline{e}+g-rl-b)dr > 0$. Therefore the lender will raise $\overline{p}|k$ up to the point where $\overline{p}|k = 1$, $\forall k = 0, ..., \alpha n$.[47]

The Corollary to Proposition 4 follows from comparing conditions (8) and (9) and observing that $\underline{p}^* < \frac{\alpha}{1-\alpha}$. $\square$

Appendix B - The data

B.1 Variable definitions

Age: age of the household head.

Age sq.: Age squared.

Amount lent/remitted last year: total amount that household (HH) lent to private individuals or sent as remittance in 1987/88, Ghanaian Cedis (GHC), constant prices September 1988.

[47] Notice that our parameterization of the basic model implies that $r > 0$ is consistent with $\overline{p} = 1$ (see the derivation of the Pareto frontier in the case of an exogneously given interest rate). If we allowed r to hit 0 before $\overline{p} = 1$, our qualitative results would be unchanged. In this case MRL would imply the highest *feasible* probability of getting a loan for the children of lenders, and the fact that $r = 0$ would even strengthen the conclusion that, compared to URM, interest payments are foregone by lenders in order to give their children access to credit.

BORROWED: total amount borrowed by HH members in 1988/89, including 0 for households that did not borrow. GHC, constant prices September 1988.

Children: dummy = 1 if HH head has children.

Community help: dummy = 1 if there is a system of mutual aid among farmers of the community for field work.

DEFAULT1: dummy = 1 if the loan expired at least one month before the date of the year 2 interview, and was reported as "not repaid" at that date.

DEFAULT2 dummy = 1 if the loan expired before or during the month of the interview (year 1 or year 2), and is reported as "not repaid" at the time of the interview.

Distance from bank: distance from closest bank to the community, in miles. Takes value 0 if there is a bank *inside* the community.

Dominant language: dummy = 1 if HH head speaks the language of the principal ethnic group in the community.

Education: highest grade of education attained by HH head.

Ewe: dummy = 1 if HH head speaks Ewe.

Exchange labor: dummy = 1 if HH members have taken part in any exchange of unpaid labor in last 12 months.

Family here: dummy = 1 if HH head moved to present residence to join family.

Female: dummy = 1 if HH head is a woman.

From village: dummy = 1 if place where HH head was living before coming to present residence was a village.

Ga-Adangbe: dummy = 1 if HH head speaks Ga or Adangbe.

HH size: number of HH members.

Income: annual labor income of all HH members, GHC, constant prices September 1988, (logarithm).

INT RATE: dummy = 1 if an interest has to be paid on the loan, either because explicitly specified or as an implicit difference between the amount borrowed and the amount to be repaid.

INT RATE (EXPL): dummy = 1 if an interest is explicitly specified on the loan.

LOANS: amount borrowed by HH members from all sources during the last 12 months. Includes only positive amounts. GHC, constant prices September 1988.

LOANS FROM KIN: amount borrowed by HH members from relatives or private non-moneylenders during the last 12 months. Includes only positive amounts. GHC, constant prices September 1988.

LOANS FROM NON-KIN: difference between LOANS and LOANS FROM KIN.

Migrant: dummy = 1 if HH head was born in place different from current residence.

Muslim: dummy = 1 if HH head is Muslim.

Other language: dummy = 1 if HH head speaks a language different from Akan, Ewe, Ga or Adangbe.

Population: number of people living in the community in 1984 (logarithm).

Remittances from children: value of all remittances received by HH from children during past 12 months. Ghanaian Cedis (GHC), constant prices September 1988. The variable is the logarithm is the original amount (where 0's have been recoded to 1's before taking the log.

Seasonal outflows: dummy = 1 if any of the people in the community leave temporarily during certain times of the year to look for work elsewhere.

Semi-urban: dummy = 1 if HH lives in a semi-urban area (i.e., between 1,500 and 5,000 inhabitants).

Sharecropper: dummy = 1 if HH has worked as sharecroppers on someone else's land during past 12 months.

Spouse different region: dummy = 1 if spouse of HH head was born in a different region than the head.

Value of crop lost: value of the crops lost by the HH during past 12 months due to insects, rodents, fire or rotting. Ghanaian Cedis (GHC), constant prices September 1988. The variable is the logarithm is the original amount (where 0's have been recoded to 1's before taking the log.

Years resident: number of years HH head has been living in current place of residence (logarithm).

 # changes residence: number of different places HH head has lived in for periods of more

than 3 months.

 # days exchange labor: number of man days of labor that HH has received as part of an exchange of unpaid labor in last 12 months.

 # ethnic groups: number of principal ethnic groups represented in the community (up to 4).

 # religious groups: number of major religions practiced by residents of the community (up to 4).

B.2 Summary statistics

	Mean	*Std Dev*
Age	41.92	14.09
Age sq.	1955.41	1348.76
Amount lent/remitted last year	10307.83	23758.02
BORROWED	5651.13	17918.51
Children	.78	.41
Community help	.84	.37
DEFAULT1	.05	.22
DEFAULT2	.15	.36
Distance from bank	9.15	9.16
Dominant language	.38	.48
Education	5.76	5.69
Ewe	.16	.37
Exchange labor	.38	.49
Family here	.25	.43
Female	.24	.43
From village	.29	.45
Ga-Adangbe	.07	.26
HH size	5.23	3.15
Income	11.24	1.21
INT RATE	.13	.37
INT RATE (EXPL)	.11	.31
LOANS	13663.06	25938.97
LOANS FROM KIN	11714.92	19286.45
LOANS FROM NON-KIN	1567.97	15627.84
Migrant	.51	.50
Muslim	.07	.24
Other language	.19	.39
Population	7.77	1.00
Remittances from children	.82	2.63
Seasonal outflows	.70	.46
Semi-urban	.32	.47
Sharecropper	.18	.39
Spouse different region	.16	.36
Value of crop lost	5.76	4.25
Years resident	2.23	.97
# changes residence	4.36	2.43
# days exchange labor	9.51	25.20
# ethnic groups	2.63	1.29
# religious groups	2.03	.75

Table 1: Loan characeristics, by source

	% number of loans [1]	*% value of loans* [2]	*Mean amount* [3]	*% with interest* [4]	*Avg. interest* [5]	*% with additional conditions*			*Default rates*[a]	
						Goods/serv [6]	*Regular pay* [7]	*Collateral* [8]	*Default1* [9]	*Default2* [10]
Relatives	20.5	14.2	6,382	4.5	31.2	2.1	12.9	0.7	1.2	5.5
Private	60.1	52.8	8,081	7.2	41.7	3.2	13.5	1.1	4.3	17.4
Moneylender	4.8	8.6	16,276	28.0	46.0	3.0	13.0	1.0	1.5	20.3
Bank	5.2	15.2	26,798	83.0	19.9	9.3	27.8	8.4	4.4	14.1
Coop	0.8	1.4	16,300	50.0	10.5	6.3	50.0	6.3	14.3	42.9
Other	8.6	7.8	8,308	12.4	47.0	2.3	19.8	0.6	0.7	20.7
All sources	100	100	9,186	12.3	50.7	3.2	14.9	1.4	3.4	15.8

Source: author's calculations on the GLSS.

Sample includes both rounds of the survey. Monetary amounts in Ghanaian cedis, constant prices Sept. 1988.

(a) Default1 counts as default all loans expired at least a month before the interview and not repaid. Default2 counts as default all loans expired before or during the month of the interview and not repaid.

Table 2a: Probability of borrowing from different sources

	Relative	Private	Moneylender
Age	-.197**	-.189**	-.135
	(.078)	(.076)	(.090)
Age sq.	.002**	.002**	.001
	(.001)	(.001)	(.001)
Female	.383	.285	.664
	(.443)	(.398)	(.530)
Education	-.041	-.058**	-.014
	(.028)	(.026)	(.039)
HH size	.019	.066	-.030
	(.055)	(.048)	(.078)
Children	.278	.556	.673
	(.419)	(.378)	(.580)
Migrant	-.632**	-.246	-.228
	(.300)	(.260)	(.411)
Ga-Adangbe	1.579**	1.408**	.707
	(.706)	(.618)	(1.014)
Ewe	.039	.090	.297
	(.504)	(.448)	(.580)
Other language	.566	-.049	.614
	(.459)	(.431)	(.578)
Dominant language	-.495	-.347	-.199
	(.332)	(.305)	(.426)
Years resident	-.277	-.286	-.412
	(.211)	(.191)	(.268)
# changes residence	-.025	.058	-.228**
	(.068)	(.054)	(.111)
Income	-.470**	-.394**	-.567**
	(.150)	(.134)	(.205)
Value of crop lost	-.065	-.063	-.104*
	(.044)	(.041)	(.056)
Semi-urban	.581*	.533*	-.129
	(.332)	(.289)	(.456)
Distance from bank	.084**	.066**	.056*
	(.028)	(.028)	(.031)
No. obs.	1434		
Pseudo Rsq	.08		

Notes: * denotes significance at the 10 percent level, ** at the 5 percent level.

Multinomial logit, omitted category is "banks and cooperatives". Sample pools loans taken in 1987/88 and 1988/89 (controls include a dummy for 1987/88). Standard errors corrected for heteroskedasticity and clustering of the residuals at the household level.

Table 2b: Migration status and loan source

		Relative	Private	Moneylender
A				
	Migrant	-.533*	-.221	-.184
		(.300)	(.263)	(.416)
	Family here	1.046**	.349	.582
		(.385)	(.363)	(.468)
B				
	Migrant	-.766**	-.407	-.163
		(.304)	(.265)	(.415)
	From village	.656	.732*	.043
		(.424)	(.382)	(.615)
C				
	Migrant	-.529*	-.209	-.099
		(.319)	(.271)	(.462)
	Population	.099	.193	.198
		(.178)	(.155)	(.285)
D				
	Migrant	-.649**	-.264	-.079
		(.296)	(.261)	(.400)
	Seasonal outflows	-.202	-.161	.534
		(.344)	(.305)	(.456)
E				
	Migrant	-.476	-.145	-.037
		(.304)	(.264)	(.410)
	# ethnic groups	-.361**	-.218*	-.218
		(.127)	(.117)	(.163)
F				
	Migrant	-.601**	-.203	-.086
		(.301)	(.263)	(.407)
	# religious groups	-.534**	-.399**	-.304
		(.193)	(.174)	(.258)

Notes: * denotes significance at the 10 percent level, ** at the 5 percent level.

Multinomial logit, omitted category is "banks and cooperatives". Sample pools loans taken in 1987/88 and 1988/89. Standard errors corrected for heteroskedasticity and clustering of the residuals at the household level.

Each panel refers to a separate regression which includes as additional controls all those listed in Table 2a. No. obs. and Rsq are 1434 and .08 for all regressions except panel B, where they are 1166 and .09, respectively.

Table 3a: Probability of default

Dependent variable:	DEFAULT1		DEFAULT2	
	Estimated	Marginal$^{(a)}$	Estimated	Marginal$^{(a)}$
β_R : Children | relative	-.870**	-.029**	-.803**	-.125**
	(.424)		(.257)	
β_{NR} : Children | non-relative	-.119	-.007	-.023	-.005
	(.259)		(.163)	
Age	.069	.004	.007	.001
	(.048)		(.027)	
Age sq.$^{(b)}$	-.074	-.004	-.003	-.0007
	(.050)		(.029)	
Female	.073	.004	.208	.048
	(.240)		(.152)	
Education	.005	.0003	.019	.004
	(.016)		(.012)	
HH size$^{(b)}$	.182	.0001	.022	.005
	(3.781)		(.022)	
Migrant	.091	.005	-.001	-.0003
	(.177)		(.127)	
Ga-Adangbe	-.173	-.008	.437*	.115*
	(.340)		(.231)	
Ewe	.277	.019	.186	.044
	(.298)		(.177)	
Other language	.152	.009	.198	.046
	(.266)		(.182)	
Dominant language	.063	.004	.097	.021
	(.189)		(.128)	
Years resident (ln)	-.009	-.0005	-.036	-.008
	(.100)		(.067)	
# changes residence	-.059	-.003	.009	.002
	(.046)		(.025)	
Income	-.147*	-.008*	.033	.007
	(.076)		(.052)	
Value of crop lost	.047**	.003**	-.016	-.003
	(.023)		(.016)	
Semi-urban	.146	.009	.176	.039
	(.189)		(.131)	
Distance from bank	.0004	.00002	-.005	-.001
	(.011)		(.009)	
No. obs.	1018	1018	1018	1018
Pseudo Rsq	.08	.08	.06	.06
Observed P		.035		.151
Predicted P		.024		.136

Notes: * denotes significance at the 10 percent level, ** at the 5 percent level.

Probit estimates. Standard errors corrected for heteroskedasticity and clustering of the residuals at the household level. Sample pools loans taken in 1987/88 and 1988/89 (and a dummy for 1987/88 is included among the controls).

(a) Marginal probit coefficients calculated at the mean. For dummies, marginal effect is calculated for discrete change from 0 to 1.

(b) Coefficients and standard errors multiplied by 100.

Table 3b: Children and probability of default

Dependent variable: DEFAULT2

	Estimated coeff.	Std. error	Marginal coeff.[(a)]	$\beta_R = \beta_{NR}$ (p-value)
A				
β_R : Children | relative	-.808**	(.255)	-.126	.00
β_{NR} : Children | non-relative	-.023	(.163)	-.005	
Family here	.031	(.157)	.007	
B				
β_R : Children | relative	-.774**	(.295)	-.118	.00
β_{NR} : Children | non-relative	.004	(.201)	.001	
Spouse different region	.355**	(.182)	.085	
C				
β_R : Children | relative	-.790**	(.255)	-.124	.00
β_{NR} : Children | non-relative	-.013	(.163)	-.003	
Remittances from children	.014	(.025)	.003	
D				
β_R : Children | relative	-.804**	(.260)	-.126	.00
β_{NR} : Children | non-relative	-.026	(.166)	.026	
Community help	.040	(.175)	.008	
E				
β_R : Children | relative	-.807**	(.270)	-.124	.00
β_{NR} : Children | non-relative	-.039	(.170)	-.008	
# days exchange labor	.004	(.003)	.001	

Notes: * denotes significance at the 10 percent level, ** at the 5 percent level.

Probit estimates. Standard errors corrected for heteroskedasticity and clustering of the residuals at the household level. Sample pools loans taken in 1987/88 and 1988/89 (a dummy for 1987/88 is included among the controls).

Each panel refers to a separate regression which includes as additional controls all those listed in Table 4. No. obs. and Rsq are, respectively, 1018 and .06 for all regressions except panel B where they are 805 and .07, and panel E where they are 975 and .07.

(a) Marginal probit coefficients calculated at the mean. For dummies, marginal effect is calculated for discrete change from 0 to 1.

Table 4a: Probability of interest rate on loans taken

Dependent variable:	INT RATE (EXPL)		INT RATE	
	Estimated	Marginal$^{(a)}$	Estimated	Marginal$^{(a)}$
β_R : Children | relative	-.877**	-.090**	-.809**	-.108**
	(.255)		(.220)	
β_{NR} : Children | non-relative	-.052	-.008	-.008	-.001
	(.150)		(.143)	
Age	.031	.005	.011	.002
	(.025)		(.022)	
Age sq.$^{(b)}$	-.028	-.004	-.005	-.001
	(.024)		(.022)	
Female	-.182	-.026	-.202	-.035
	(.143)		(.136)	
Education	.023**	.003**	.014	.002
	(.011)		(.011)	
HH size	-.020	-.003	-.029	-.005
	(.022)		(.021)	
Migrant	.093	.014	.032	.006
	(.112)		(.106)	
Ga-Adangbe	-.354	-.044	-.269	-.044
	(.253)		(.205)	
Ewe	-.295	-.039	-.358**	-.057**
	(.187)		(.176)	
Other language	.173	.029	.121	.024
	(.162)		(.156)	
Dominant language	.024	.004	.116	.022
	(.123)		(.116)	
Years resident (ln)	.127*	.019*	.133**	.025**
	(.067)		(.062)	
# changes residence	-.045*	-.007*	-.044**	-.008**
	(.024)		(.022)	
Income	.178**	.027**	.145**	.027**
	(.051)		(.050)	
Value of crop lost	.002	.0004	.013	.002
	(.014)		(.013)	
Semi-urban	-.449**	-.062**	-.352**	-.061**
	(.131)		(.122)	
Distance from bank	-.012*	-.002*	-.009	-.002
	(.006)		(.006)	
No. obs.	1434	1434	1434	1434
Pseudo Rsq	.11	.11	.10	.10
Observed P		.111		.136
Predicted P		.084		.109

Notes: * denotes significance at the 10 percent level, ** at the 5 percent level.

Probit estimates. Standard errors corrected for heteroskedasticity and clustering of the residuals at the household level. Sample pools loans taken in 1987/88 and 1988/89. (A dummy for 1987/88 and a dummy for Muslim religion are included among the controls).

(a) Marginal probit coefficients calculated at the mean. For dummies, marginal effect is calculated for discrete change from 0 to 1.

(b) Coefficients and standard errors multiplied by 100.

Table 4b: Children and probability of interest rate

Dependent variable: =1 if interest rate

	Estimated coeff.	Std. error	Marginal coeff.[a]	$\beta_R = \beta_{NR}$ (p-value)
A				
β_R : Children | relative	-.806**	(.220)	-.107	.00
β_{NR} : Children | non-relative	-.009	(.143)	-.002	
Family here	-.024	(.126)	-.004	
B				
β_R : Children | relative	-1.083**	(.267)	-.132	.00
β_{NR} : Children | non-relative	-.137	(.177)	-.027	
Spouse different region	.106	(.159)	.021	
C				
β_R : Children | relative	-.783**	(.224)	-.104	.00
β_{NR} : Children | non-relative	-.013	(.151)	-.002	
Exchange labor	-.145	.123	-.026	
D				
β_R : Children | relative	-.818**	(.217)	-.108	.00
β_{NR} : Children | non-relative	-.009	(.143)	-.002	
Sharecropper	.230*	(.138)	.047	
E				
β_R : Children | relative	-.809**	(.222)	-.107	.00
β_{NR} : Children | non-relative	-.001	(.143)	-.0002	
Community help	-.221*	(.133)	-.045	

Notes: * denotes significance at the 10 percent level, ** at the 5 percent level.

Probit estimates. Standard errors corrected for heteroskedasticity and clustering of the residuals at the household level. Sample pools loans taken in 1987/88 and 1988/89 (a dummy for 1987/88 is included among the controls). Each panel refers to a separate regression which includes as additional controls all those listed in Table 4a. No. obs. and Rsq are, respectively, 1434 and .10 for all regressions except for panel B, where they are 1112 and .11, panel C where they are 1371 and .10, and panel D where they are 1424 and .10.

(a) Marginal probit coefficients calculated at the mean. For dummies, marginal effect is calculated for discrete change from 0 to 1.

Table 5: Reciprocation of past contributions

Dependent variable:[(a)]	BORROWED			ALL LOANS	LOANS FROM KIN	LOANS FROM NON-KIN
	OLS	Tobit	LAD	OLS	OLS	OLS
	[1]	[2]	[3]	[4]	[5]	[6]
Age	-.179.4	-254.2	-277.8	-813.0	-896.5	-115.2
	(331.2)	(652.9)	(640.1)	(645.0)	(697.5)	(280.9)
Age sq.	1.77	.34	1.94	10.05	9.43	2.13
	(3.07)	(6.22)	(6.44)	(6.18)	(6.69)	(2.74)
Female	409.8	-811.8	4266.6*	441.7	-3846.8	2607.6
	(1839.8)	(4020.8)	(2435.6)	(3456.4)	(2482.7)	(2126.6)
Education	364.4	517.8	251.6	574.3	-362.9	935.2
	(293.0)	(424.6)	(230.7)	(629.3)	(287.5)	(600.2)
HH size	418.9	948.9	472.7	858.3	775.1	290.7
	(393.9)	(691.8)	(318.5)	(774.5)	(723.6)	(527.7)
Children	-1102.9	-79.24	-1149.6	-7420.8	-305.4	-8521.2
	(3389.7)	(4918.6)	(2686.4)	(7743.5)	(3425.6)	(8110.8)
Migrant	-1267.1	3572.7	2664.3	-5319.7*	-3906.2	1114.1
	(1327.2)	(2954.7)	(2246.9)	(2871.1)	(3023.9)	(1046.3)
Ga-Adangbe	-297.7	-602.0	-206.1	4732.0	3727.6	932.2
	(1307.1)	(2956.2)	(4541.8)	(4354.1)	(3334.0)	(3136.9)
Ewe	-566.1	-2464.8	2651.5	1509.3	-214.8	2095.4
	(2271.8)	(4805.8)	(1976.1)	(3965.6)	(4134.2)	(5094.4)
Other language	1352.9	-5199.3	373.7	8145.9	2357.9	4735.8
	(2456.7)	(4439.5)	(2980.5)	(5018.9)	(4009.7)	(3590.1)
Dominant language	-937.9	113.3	-3318.6	-5084.0	-5.13	-3401.2
	(1423.7)	(2929.5)	(2234.8)	(3605.1)	(2726.0)	(2978.5)
Years resident	856.8	2366.9	5018.1**	-458.3	-283.5	1322.0
	(1175.0)	(2406.6)	(1966.7)	(2398.9)	(1643.2)	(1458.5)
# changes residence	1953.1*	3469.5**	1627.4**	2109.4	1263.1*	1345.9
	(994.5)	(1359.7)	(762.6)	(1512.0)	(691.6)	(1217.7)
Income	1945.6**	3291.5**	2637.4	5592.2**	3842.4**	1588.6
	(739.0)	(1493.3)	(1642.3)	(1814.4)	(1401.4)	(1368.7)
Value of crop lost	71.8	382.6	179.1	-9.50	664.8**	-596.8
	(257.6)	(450.5)	(206.4)	(617.9)	(323.4)	(553.6)
Semi-urban	-1756.5	-5473.6	-1773.9	-545.8	-3110.7	4396.9
	(2082.1)	(4045.1)	(2320.5)	(4844.5)	(3377.6)	(3442.8)
Distance from bank	-146.6**	-361.6**	-369.6*	-310.6**	-262.3**	23.5
	(68.4)	(142.0)	(196.8)	(131.5)	(117.7)	(69.6)
Amount lent/remitted last year	.147**	.187**	.082**	.226**	.205**	.026
	(.06)	(.085)	(.034)	(.092)	(.085)	(.076)
No. obs.	587	587	182	248	205	205
Pseudo Rsq	.16	.02	.06	.24	.23	.23

Notes: * denotes significance at the 10 percent level, ** at the 5 percent level. Sample includes households interviewed both in 1987/88 and in 1988/89. Standard errors in cols. 1,2,4, 5 and 6 are corrected for heteroskedasticity and clustering of the residuals at the village level. Standard errors in col. 3 are bootstrapped. Controls include a dummy for Muslim religion.

(a) Dependent variable in cols. 1-3 is amount borrowed by household from all sources (including 0 for households that did not borrow). Dependent variable in col. 4 is amount of all loans taken by household

(conditional on borrowing positive amounts); in col. 5 is amount of all loans taken from relatives and private non-moneylenders (conditional on being positive); in col. 6 is the difference between loans taken from all sources and loans taken from relatives and from private non-moneylenders.

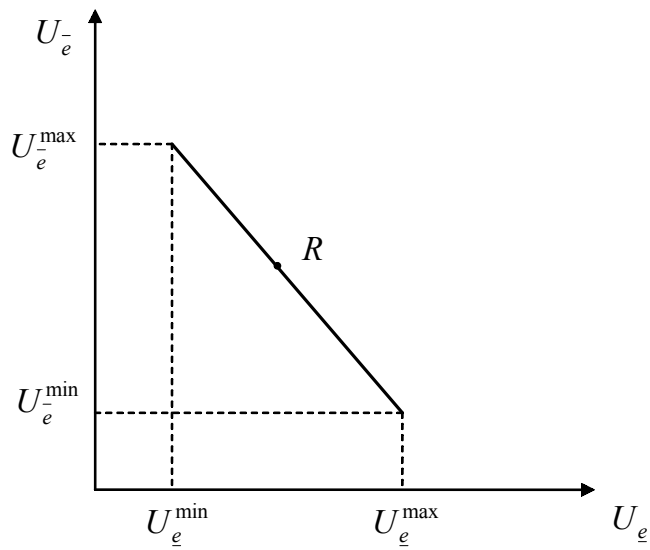

Figure 1: Pareto Frontier