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DETERMINANTS OF CREDIT RATIONING: A STUDY OF INFORMAL LENDERS AND FORMAL CREDIT GROUPS IN MADAGASCAR

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ABSTRACT

Previous research on the determinants of credit rationing exclusively focused on the behavior of formal lenders who contract directly with an individual borrower. Based on a household survey in Madagascar, this paper presents an analysis of credit rationing behavior by informal lenders and by members of community-based groups that allocate formal group loans among themselves. The results show that group members obtain and use locally available information about the applicant's creditworthiness in much the same way that informal lenders do. This paper therefore empirically confirms theoretical arguments made that community-based groups have an information advantage over distant formal bank agents.

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1. INTRODUCTION

This paper presents an empirical analysis of the determinants of credit rationing by lenders. The theoretical argument why rationing of credit occurs is well established. If lenders raise interest rates, they will attract riskier projects and obtain more risky loan portfolios with adverse effects on their expected risk-adjusted returns. Therefore, the interest rate cannot equate demand and supply in credit markets (Stiglitz and Weiss 1981).

At a given interest rate, lenders may refuse to give credit to some applicants, while rationing or fully agreeing to the loan amount demanded by other applicants. Because of information asymmetry between lender and borrower, rationing of credit demand becomes necessary for lenders.

Lenders frequently demand collateral in order to assess the borrower's creditworthiness and to increase the risk-adjusted return on the loan. In past research, collateral requirements have been identified as a major determinant of the lender's decision to ration loan demand (Binswanger, McIntire, and Udry 1989). The majority of formal lenders in developed and developing countries require physical collateral such as land. This lending policy is regressive for tenants, wage laborers, smallholders, and small-scale rural enterprises. It has serious implications for growth and equity objectives of development policy.

Informal lenders, on the other hand, often use collateral substitutes. Third party guarantees, tied contracts, and threat of loss of future access to credit are common devices in informal contracts (Adams and Fitchett 1992; Binswanger, McIntire, and Udry 1989). The efficient use of collateral substitutes depends on the ability of the lender to obtain information about the creditworthiness of the borrower at low cost.

Lending through groups is the institutional arrangement most discussed in recent years (Adams and Ladman 1979; Adams and Vogel 1979; Bhatt 1988; Bratton 1986; Braverman and Guasch 1986; Desai 1983; Huppi and Feder 1990). Apart from some successful group-lending schemes such as the Grameen Bank (Hossain 1988; Yaron 1992), the performance of group lending, which is most often only measured by its repayment rate, has been mixed. The most important feature of lending through groups is joint liability. It implies that all group members are sanctioned if any one member of the group does not repay his or her loan. The group obtains a loan from a financial intermediary, and the allocation of the group's loan amount among the members is decided by the group members themselves. The form of sanctions taken to penalize defaulting groups vary greatly in practice, but most often comprise the threat of loss of future access to formal credit. Each group member may therefore have an incentive to ensure that other members do not default, and will seek information to judge upon the peers' creditworthiness.

The core of this paper consists of an empirical analysis of credit rationing that shows that group lending can economize on the fact that group members have better information about the applicant's creditworthiness and efforts than the bank's agent (Stiglitz 1990). The formal sector in Madagascar, which overwhelmingly lends through groups, rations the loan

demands in a similar way as informal lenders. The results therefore confirm the presumption that groups can efficiently obtain and utilize locally available information. The paper identifies the leverage ratio of a household as the most important determinant for loan rationing, both for informal lenders and for groups. On the other hand, physical collateral only plays a minor role in credit rationing, although it is sometimes used in groups to compel repayment.

The paper is structured in the following order. Section 2 describes major characteristics of the segmented rural credit markets in Madagascar. Section 3 outlines the econometric framework, and discusses the variables. Section 4 presents and interprets the results, based on a cross-section of 651 adult individuals in 189 households. The results are summarized in the final section.

2. SEGMENTATION OF RURAL FINANCIAL MARKETS IN MADAGASCAR

The rural financial market is composed of various distinct subsectors: a formal segment and various segments of an informal market. In rural Madagascar, formal lenders comprise credit and savings schemes of nongovernmental organizations, governmental extension services in cooperation with the Agricultural Development Bank, and parastatal or private agribusiness firms. Formal lenders are institutions regulated by the government and the Central Bank whereas informal lenders are operating beyond the regulatory framework of the financial system. The informal sector is highly heterogeneous with respect to the type of relationship between borrower and lender, such as social cohesion or the existence of an interlinked transaction. When social cohesion is taken as a stratifying criteria

(Robison and Schmid 1988), informal lenders can be grouped into two segments. The first segment are relatives, friends, and, to a lesser extent, informal self-help groups that provide the bulk of short-term informal credit in Madagascar. All other informal lenders have a more socially distant relationship with their borrowers, and frequently provide credit linked with transactions in commodity or labor markets.[1]

These three segments of the rural financial market provide credit services that differ from each other with respect to many product characteristics, such as average duration and amount of loan, its use, and the interest rates and transaction costs. Economists have long recognized the uniqueness of credit contracts in rural financial markets.[2] This characteristic implies limited substitutability of loans from different market segments and limited competition between the segments. However, as reviewed by Kochar (1991), empirical analysis frequently assumes that the formal sector is the cheapest source of credit and that it rations the loan demand, whereas the informal sector does not ration the loan demand and satisfies any spillover demand at varying interest rates.[3] This assumption is neither in concordance with the Stigler-Weiss theoretical argument for credit rationing nor with the empirical evidence that informal lenders also ration credit demands, as it will be shown in Section 4 of this paper.

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[1] For an application of this typology differentiated by the degree of social cohesion, see Zeller et al. (1991).

[2] See the literature cited in Yadav, Otsuka, and David (1992).

[3] For example, Clive, Srinivasan, and Udry (1988).

The reason for market segmentation appears to not be the sticky formal market interest rate but the unique characteristics of the different credit services provided by the various segments that inhibit the substitution of credit by switching from the formal to the informal segment and vice versa. In the following, some of the major loan characteristics between formal and informal loans are compared: loan amount obtained and use of loan, duration of loan, and interest rate charged.

The data is based on an extensive survey of 189 randomly selected households in three agro-ecological regions of Madagascar during 1992. The household survey covers assets, production, income, consumption, credit transactions, and nutritional status of preschoolers and their mothers. The surveys were administered during three rounds in order to capture seasonal interlinkages between savings, gift and credit transactions and household investment, production, consumption, and nutrition. All adult household members older than 13 years of age were asked in each of three rounds about their credit transactions. Such adults numbered 651. The three rounds cover a total recall period of almost two years. All interviews were held with confidentiality: other persons and household members were asked to not be present during the interview.

In addition, 148 groups were randomly selected. The president of the group and five randomly selected members were asked about the structure, conduct, and performance of their groups.

BORROWING BEHAVIOR AND SOURCES OF LOANS

During October 1990 and September 1992, 182 out of 189 households borrowed from the informal sector at least once. Formal loans were obtained by 131 households. Borrowing from both sectors was rather frequent: 120 households borrowed from both sectors. On the other hand, only 62 households borrowed exclusively from informal lenders, whereas four wealthy households borrowed only from the formal sector.

The formal sector in Madagascar mostly lends through groups: 77 percent of the household sample loans are lent through groups which then on-lend to their members. In 3 of the 14 existing group-based lending programs in the survey areas, the members cannot allocate the group loan among themselves although they all are sanctioned if one of them defaults. These three programs are specialized agricultural credit programs for wheat, barley, and tobacco. Here, the loan amount is a function of the acreage planted for the specific crop. These loans account for less than 15 percent of the total loan amount lent through groups.

Direct lending to individuals occurs in 23 percent of formal loans. The agricultural bank has largely withdrawn from lending to individuals in recent years because of low repayment rates. Commercial banks never really played any role in the rural sector. In fact, the bulk of the sample loans lent to individuals comes from a private rice mill that disburses mostly cash credit for rice farmers. The total credit is given to the president of the village or another trusted individual who then distributes the credit among the villagers. Repayment of loans have to be made by delivering paddy to the village agent. The interest rate is implicit: the rice mill fixes the rice price in advance for the harvest season. The price was about 20 percent lower than the actual market price at the peak harvest season, implying an

annual interest rate of roughly 40 percent for a loan period of six months. Most of the borrowers therefore only delivered the quantity necessary to repay the loan and marketed the rest elsewhere. In the second survey year, the rice mill experienced considerable repayment problems, and eventually ceded its credit program. This credit scheme is similar to the early governmental credit program in the 1970s, which lent credit via village heads. However, repayment rates were very low, and the program failed. Without physical or social collateral, repayment cannot be enforced.

LOAN AMOUNT AND USE

The use of loans by households is reported in Table 1. The source of credit is differentiated into informal and formal sectors. The majority of borrowers reported that the loan was used for production purposes. On average, 78 percent of the amount of formal loans is spent on farm implements, livestock, inputs for crop production, and off-farm enterprises. The informal sector, though, frequently serves

Table 1—Use of formal and informal credit

Category of Credit Use	Informal (n = 1,355) Mean Share of Amount Used For...of Total Amount Borrowed	Informal (n = 1,355) Aggregated Average Amount Used For ...	Formal (n = 245) Mean share of Amount Used For...of Total Amount Borrowed	Formal (n = 245) Aggregated Average Amount Used For ...
	(percent)	($)	(percent)	($)
1. Food	52.2	3.2	11.1	5.0
2. Health	5.5	0.3	1.3	0.3
3. Social events	4.3	1.1	0.5	1.0
4. School expenses	0.5	0.1	0.0	0.1
5. Farm implements and livestock	3.9	1.1	17.4	11.8
6. Farm inputs	11.3	1.2	57.4	31.7
7. Inputs for handicrafts, petty trade	7.9	3.5	3.5	2.4
8. Reimbursement of other loans	1.2	0.2	3.3	3.5
9. Other uses	13.2	1.3	5.5	3.9
Aggregate	100.0	11.9	100.0	59.6

consumption needs. Here, the mean share spent on food, health, social events, and schooling is 64 percent.

The average amounts of informal and formal loans are US$11.9 and US$59.6, respectively.[4] The importance of informal sector loans, however, is larger than what this simple comparison of loan sizes may suggest. In the entire recall period, 1,355 informal credits and 245 formal credits were obtained by the survey households.[5] The share of informal loans in total lending volume not adjusted for maturity is 52.4 percent. As shown in Table 2, the average loan duration in the informal sector is only 65 days in comparison with 226 days for formal loans. Thus, the amount of capital provided per time period by the formal sector is much larger than the capital from the informal sector.

Informal lenders play a crucial role in providing credit at a duration of less than three months. Out of 1,214 informal loans, 759 loans are predominantly used for consumption purposes. These short-term loans are lent by friends and relatives, the local shopkeeper, or the landlord. The loans are often given at short notice. They frequently cover unforeseen

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[4] Average per capita income obtained through the household survey amounts to US$175.

[5] The number of informal loans is systematically underreported because 15 percent of the informal loan transactions are repeated in short and quite regular time intervals. We found permanent relationships between borrowers and their neighbors, shopkeepers, and landlords, where weekly, biweekly, or monthly transactions took place. Since it is impossible for a respondent to recall all those tiny loans, the recall period for high-frequency loans was adjusted to the usual period of repayment of such loans. The number of informal loans needs, therefore, to be increased by extrapolation of the number of "high-frequency loans."

income shocks and help to smooth consumption. In Madagascar, predominantly poor households and women apply for this type of loan.

This short-term credit line is not at all serviced by formal lenders in Madagascar.[6] Hence, there is little competition or spill-over effect between formal and informal sectors in this market segment. This limited substitutability of formal and informal sector is further reinforced if formal programs only lend in-kind. For example, all agribusiness credit programs lend agricultural inputs for specific farm enterprises. Limited substitutability of formal and informal loans and therefore limited competition is seen as an important determinant for the high divergence of interest rates in rural financial markets.

REPAYMENT RATES WITH RESPECT TO TYPE OF LENDER AND USE OF LOAN

Table 2 shows the repayment rates by sector. Repayment rates at the due date were 78 percent and 80 percent in the informal and formal sector, respectively. With an average delay of about 30 days, 93 percent and 94 percent of loans were fully

[6] Except for the CIDR program, a French nongovernmental organization, which encourages group members to deposit savings in a group fund. These funds are then on-lent with an interest margin of about 10 percent to other members at a real interest rate of about 35 percent. The loans are short-term, paid in cash, and the group members do not discriminate against loans used for consumption. Interest rates for savings deposits and internal loans were set by the group members themselves. Since these loans basically provide the same credit service as those of informal lenders, they can compete with informal lenders, except for relatives and friends, who charge about 100 percent for the poorest one-third of the sample households. (See Chao-Beroff [1992] for a description of program design and rationale.)

Table 2—Loan amount, duration, and repayment by sector and type of credit[a]

	Informal (n=1,214) Credit for			Formal (n=139)		
	Consumption (n = 759)	Production (n = 283)	Other Uses (n = 172)	Consumption (n = 11)	Production (n = 120)	Other Uses (n = 8)
Loan amount in $[b]	6.8	26.1	6.1	39.5	52.2	25.1
Average loan duration (in days)	51	76	32	153	209	155
Percentage of loans fully paid in time	77.7	78.1	80.2	90.9	79.2	100
Percentage of loans fully paid but late	16.7	11.8	9.9	0.0	15.0	0.0
If paid late: average number of days in arrears	32	31	12	...	30	0
Repayment rate (including late payments)	94.4	89.9	90.1	90.9	94.2	100
Share of loans by sector (in percent)	62.5	23.3	14.2	7.9	86.3	5.8

Notes: Descriptives apply to loans which were due before last survey round ended (n = 1,388).

[a] Credit was categorized as consumption loan if sum of uses for categories 1, 2, 3, and 4 (see Table 1) implies highest share of all three categories. For production credit, categories 5, 6, and 7 apply. For loans for other uses, categories 8 and 9 apply. Thirty-five out of 1,388 credits are mixed loans, and not included in table.

[b] Franc Malgache valued at FMG 1,850 per US$.

repaid in the informal and formal sectors, respectively. This repayment performance is quite satisfying.

Does the repayment rate differ subject to the type of loan use? In order to investigate this question, Table 2 categorizes the loans into three groups: credit for consumption, production, and for other uses (including reimbursement of other outstanding loans). Some 62.5 percent of the informal loans were mostly used for consumption, whereas only 7.9 percent of the formal loans were predominantly used for consumption. Table 2 shows that repayment rates of consumption loans compared to production loans do not differ by a large extent. An often articulated presumption against use of credit for consumption is that consumption does not yield income and thus cannot secure the repayment of the loan. In poor households, however, where the main production factor is labor, expenditures for food, medicine, clothing, education, and housing are critical in maintaining and increasing the household's income base. Furthermore, credit may sometimes also be a more cost-efficient mean of smoothing consumption than other traditionally employed measures.[7]

[7] See Alderman and Paxson (1992) for a literature review on consumption smoothing measures employed by households.

CONDITIONS ENFORCED BY THE LENDER

To obtain a loan, borrowers must usually and necessarily comply with some loan conditions. Table 3 shows the lenders' conditions, as reported by borrowers. There are marked differences between informal and formal sector loans.

In 36 percent of the formal loans, the pledge of physical collateral is required, whereas informal lenders rarely use it. It has to be noted that the formal financial institutions do not externally stipulate collateral requirements for the group as a whole or for individual members of a group. The only exception is the paddy bank system, which provides seasonal inventory credit for farmers who store paddy. A group under this program stores paddy for about five months in a communal building. Each member receives a cash loan, which is about 75 percent of the value of the quantity stored. The stored paddy serves as collateral.

When accounting for this forced collateral in the paddy bank scheme, only 30 percent, instead of 36 percent, of collateral requirements of total formal loans are set by members themselves. In case of loan default by an individual member, several actions can be taken by the group (Table 4). Based on a survey of 148 randomly selected groups who received 226 group loans, 61 percent of the late payments were made by the members in arrear. In 9 percent of the cases, the other members paid for the debt of their peer without seizing the collateral. Payment by other members usually only occurs if the defaulting member simply is not able to repay the loan and had experienced income or consumption shocks. The group sold collateral only in

Table 3—Loan conditions by sector (relative frequency in percent)

Conditions	Informal (n = 1,375)	Formal (n = 245)
Collateral required	0.9	35.9
Credit disbursed with witness	5.2	39.6
Must work for lender without receiving wages	2.2	0.0
Must sell to lender (part) of harvest	1.5	14.7
Must buy something from lender	2.3	5.3
If repaid late, interest will rise	2.0	16.3
If not paid, no more access to new credit	18.5	36.3
Must pay down payment	0.1	3.3
No conditions	21.4	0.4

Notes: Respondent could specify up to three conditions. Many of the conditions given by the respondent were categorized as being different from the ones listed in the table.

Table 4—Actions when associations are defaulting on their loans

Action	Percent
Who made the late payments[a] (n = 44)	
Members in arrear	61.4
The other members	9.1
The members sold collateral of the defaulting member	2.3
Other forms of repayment	27.3
Consequences for defaulting group members[b] (n = 46)	
Forced to leave association	5.9
Not able to attain credit in following year	33.3
Made to pay fee for paying late	11.8
Other	49.0

[a] Of the 48 group loans that were partially or fully repaid after the due date, four credit transactions have missing information on who paid. The total number of group loans in the sample is 228.

[b] Out of 50 credits with late or no payments, information on the consequences is missing for four cases.

2 percent of the cases. The threat of sale of collateral or social sanctions by the peers is often sufficient to compel repayment.

Other forms of repayment, which account for 27 percent of the cases, include payments through the insurance scheme of KOBAMA, a credit program for wheat farmers. In specialized agricultural credit programs that focus on a single enterprise, insurance services and policies to reschedule loans in times of crop failure appear to be important for developing a sustainable long-term relationship between agribusinesses and farmers. The risk of crop failure is best shared between the firm and the farmer. However, incentives and penalties for circumventing "free-rider problems" and moral hazard must be set appropriately in such schemes.

The group itself, the extension agent, or both together take further follow-up actions for defaulting members. About 6 percent of the late payers were forced to leave the association. One-third will not be able to obtain any credit for the following year, while the other members in the group will still be able to borrow. Some programs stipulate late payment fees, an efficient device to compel timely reimbursement. Other consequences for defaulting members account for 49 percent. These mostly include unsettled disputes between defaulting members and the group as a whole, where a decision on further action is not yet reached.

Two-thirds of the formal loans in Madagascar, however, do not require any collateral, but carry other conditions (Table 3). Formal loans are more frequently disbursed in the presence of a witness than informal loans, in order to be able to compel repayment through social networks. The threat of disclosing future access in case of default is used in about 20

percent of the informal loans and in 36 percent of the formal loans. The coupling of the sale of products with credit transactions is observed for about 15 percent of the formal loans: these constitute loans from milk, rice, wheat, barley, and tobacco processing firms that couple the repayment of the loan with the marketing of the output. Groups of these credit programs can often only obtain credit in the form of fertilizer, which explains why about 5 percent of the borrowers reported that they are required to buy something from the lender.

Table 3 shows that interlinked transactions also exist in the informal market. Shopkeepers increase sales by providing credit for food, farm inputs, and household necessities. Collectors disburse credit in advance to secure the marketing of the crop, mostly through middlemen residing in the village, who then on-lend to individual farmers. Many land-rich households secure access to hired labor in the peak labor season by transacting in advance in the credit market. The laborer obtains a credit but, in exchange, makes a commitment to work for the lender for a certain period. He or she earns either a prespecified wage equal or lower than the market wage or no wage at all. Two percent of the informal loans carried the condition to provide an unpaid labor service to the lender. Implicit interest rates can sometimes be very high in interlinked contracts.

However, 21 percent of the informal loans do not carry any conditions, and may probably be viewed, in case of loan default, as a gift from the lender to the borrower. Presumably, the only condition is that the borrower may also provide a gift or a loan in the future when the current lender will be in need. It appears that the respondent may not have wanted to articulate this condition always, even if it were true. These unconditional loans mostly carry no interest rate. The economics of understanding these loan transactions are

more of the nature of a reciprocal gift economy than a pure credit market (Coate and Ravallion 1993).

PARTICIPATION OF THE POOR IN INFORMAL AND FORMAL CREDIT MARKETS

The survey shows that most of the sample households borrow. The most frequent lenders are friends and relatives. They provide the bulk of short-term credit, either in cash or in kind, normally for a couple of days, but, in some cases, for up to several months. Most of these loans are interest free. They are predominantly used for consumption, such as food, health, and education expenditures.

Larger informal loans, or loans for a longer duration, frequently carry positive interest rates even if the lenders are friends and relatives. Other informal lenders basically provide the same financial service, but at higher interest rates. Larger loans, for example, above US$50, which is the mean size of a formal loan, are rarely lent by informal lenders. The formal sector's mean share in total amount of credit lent for more than one month duration ranges from 41.6 percent to 54.3 percent to 72.9 percent for the lower, medium, and upper tercile of households grouped by wealth (see Table 5, last three rows), respectively. The high share of formal credit is explained by the fact that the 10 villages for the household-level questionnaires were randomly selected among the villages that have formal credit programs.

Table 5—Interest and repayment rates, differentiated by tercile of household wealth, by type of lender and by duration of loan

Wealth Tercile

Type of Lender

Formal | Friends and Relatives | Other Informal | All

Lender

54.3	16.6	36.3	97.4	84.2	100											
72.9	41.6	16.1	17.2	72.6	51.0	93.2	96.2	79.5	84.6	100	100	142	59	41		
20.8	6.5	92.4	84.0	10.7												
15.8	23.8	37.6	15.4	8.0	10.1	84.0	91.7	85.8	70.7	80.8	84.4	15.3	13.8	22.5	274	383
36.3	30.5	23.2	13.5	83.3	90.5	68.4	79.3	32.8	26.5	458	168	119	200			
42.9	12.8	93.8	87.5	13.4												
19.5	53.7	6.7	26.2	42.4	13.3	16.0	86.8	91.2	69.8	80.7	14.8	30.5				
69.8	103.6	92.8	85.7	A	41.1	31	67	59								
12.8	46.5	7.8	81.6	91.3	63.7	69.6	30.4	60.0								
9.4	24.1	22.1	92.3	83.8	21.7	14										
17.4	36.6	10.7	12.0	86.7	92.0	72.5	80.8	A	40.5	21.8	23	25				
2.8	7.6	4.7	100.0	100.0	100.0	509	447	558								
B																
A																
B																
B																

Note: A = [illegible]

Average annual interest rates and the average repayment rates are differentiated in Table 5 by tercile of wealth of borrowing household, by type of lender, and by duration of loan. The interest rates comprise the imputed cost for interlinked credit contracts. They are weighted averages of annual nominal interest rates of all loans in a particular cluster. Each interest rate for a particular credit transaction was weighted by the share of the particular loan amount over total amount obtained in the respective cluster. Several interesting patterns emerge from the survey data:

- The poorer and medium wealth tercile pay higher interest rates than richer households. Mean interest rates to be paid by the poorest one-third of households to other informal lenders is, on average, 103.6 percent, 30.5 percent to friends and relatives, and 17.2 percent to formal lenders.
- The observed informal interest differentials between rich and poor borrowers could be explained by differences in the risk of loan default, in the lender's transaction costs per unit of money lent, and in monopoly profits. Poor households have a better record of debt repayment than richer households, irrespective of type of lender.[8]
- The formal credit and savings programs account for a considerable share of total amount borrowed to rural households. The poorer one-third of households obtains 41.6 percent of its total credit amount from formal programs, whereas the wealthy households obtain 72.9 percent of credit from formal lenders.

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[8] Data on lender's and borrower's transaction costs have been enumerated. The analysis of the hypothesis concerning monopoly profits is subject of future work.

All households, irrespective of their wealth, obtain a considerable portion of their total credit amount from formal sources. The repayment rates of over 80 percent at due date, and over 90 percent, including late payments with an average delay of about 30 days, are satisfactory. The high repayment rates point out that group-based rural financial intermediation can successfully work in Madagascar. The formal programs should seek to raise the share in lending to poorer households in view of the outstanding repayment performance of this group. Any existing entry barriers for poor households, such as the minimum amount of paddy to be stored in the paddy bank system, or the amount of up-front membership fees found in some of the programs, should be carefully examined. In addition, financial intermediation for the poor should include financial services other than the currently dominant seasonal loan. It should seek to increase the share of medium-term loans for investment. The formal sector may also provide short-term loans between one and three months, although such loans may have to carry higher interest rates in order to cover the increase in unit transaction costs. Short-term loans are highly demanded by the poor and by women in particular. The provision of short-term cash loans with small loan amounts is therefore seen as an effective measure to enable self-targeting of credit to the poor. The wealthy households have only little demand for such loans.

3. ECONOMETRIC FRAMEWORK FOR ANALYZING DETERMINANTS OF LOAN RATIONING

Participation in borrowing is a function of the household's or individual's demand for credit and its (his or her) access to a market. What can be observed as the outcome of this process is the amount borrowed and the occurrence of loan rationing. To analyze the determinants of this outcome, demand and supply factors need to be separated. When conceptualized as a sequential decision process, the household or its member decides at stage 1 whether to apply for credit. At stage 2, the lender decides whether to give the applicant all the credit he or she asked for, or partially reduce the credit amount, or to fully reject his or her demand.

The decision to apply depends on whether the household member has a demand for credit. Out of 651 adult members (older than 13 years), only 196 did not apply at all for credit from the informal sector during the total recall period of almost two years. These nonborrowers are mostly young household members who still reside with their parents, or members of wealthy households. Of the 455 members who were older than 17 years,[9] 346 members or 76 percent of all adult individuals did not apply for credit from formal lenders. Most often, only the head of the household and, to a lesser degree, the spouse, applied for formal credit. In rural Madagascar, it is usually the husband who is expected to interact with formal lenders and outsiders. The formal lenders do not discriminate against the participation of women, although some also appear to do little to encourage women's

[9] Formal lenders usually require that an individual be 18 years or older. The survey therefore did not ask "adult" members below 18 years related to their perceived access to formal lenders.

participation. However, the analysis of the data collected on intrahousehold sharing of credit reveals that the specific use of large, normally formal loans are jointly decided by head and spouse together.

If an individual actually applies for credit, it is at the discretion of the lender to fully approve the loan demand, or to partially ration it or to even completely reject it. Each adult household member was therefore questioned how much and what he or she asked to borrow, and whether the lender approved or rationed the application. Credit applicants who were rationed by their lender fall in the group of supply-constrained individuals.[10]

Some individuals may apply for loans, but experience complete rejections. If such individuals did not make any successful loan applications during the recall period, they are categorized as nonborrowers, even though they articulated a loan demand. Each adult household member over 14 years was therefore questioned whether he or she experienced any complete rejections of credit applications during the recall period and who the potential lender was. Several loan applications were completely rejected by informal lenders, and several applications for membership in a formal group were also rejected. Individuals who experienced such rejections are also categorized as being rationed in the informal or formal market.

Other individuals may want to obtain credit but do not apply, since they perceive no chance of receiving any credit, and therefore, they find it not even worth trying. Each

[10] The design of the questionnaire was based on research by Feder et al. (1990). To my knowledge, this study first enumerated the occurrence of loan rationing through household surveys in developing countries. Most of the literature on credit constraints is based on data that lack information on loan rationing (see Jappelli, 1990).

nonborrower was therefore asked the reason for not applying for credit. Most of the answers were lack of demand for credit. Also, all nonborrowers perceived a chance to have access to some informal credit if they would need some.[11] As far as access to formal credit was concerned, 52 nonborrowers out of a total of 455 respondents revealed that they were either rejected as a formal member of a credit association or did not apply for membership because they perceived of having no chance of being accepted. These 52 individuals are therefore considered supply-constrained in the formal sector, although they never did apply for formal credit.

In summary, household members can be categorized into four groups:

- applicants and nonapplicants, and, in addition,
- supply-constrained or not supply-constrained.

For informal and formal credit, respectively, Tables 6 and 7 group all adult household members into four corresponding columns. The tables report the means of individual and household characteristics that are expected to have some influence on the decision to apply for credit or on the decision of the lender to ration a loan demand.

[11] The recall period of the survey coincided with two fairly normal years so that supply constraints in the informal sector were not severe. In years of natural catastrophes, where credit demand is high but supply is low, some households may not be able to borrow.

Table 6—Formal market participation—Means of explanatory variables differentiated by application and credit rationing

Credit Rationing in **Formal** Sector	Individual Has Not Applied: Not Constrained (n = 294)	Individual Has Not Applied: Constrained (n = 52)	Individual Has Applied: Not Constrained (n = 53)	Individual Has Applied: Constrained (n = 56)	Mean[a] (n = 455)
Individual characteristics					
He/she is head of household (HCHIEFD)	0.22	0.35	0.79	0.82	0.36
Age in years (AGE)	34.5	33.3	41.3	40.0	35.4
Sex (Dummy = 1 if male) (Male)	0.42	0.56	0.85	0.86	0.53
Number of sick days in recall period (JOURMAL)	25.2	15.0	25.1	33.5	23.1
Number of years of formal education (YRSEDUC)	3.0	3.4	3.6	4.5	3.2
Member has his/her ancestral burial place in the region (DISTRZ2)	0.10	0.02	0.08	0.09	0.08
Earns some wage labor income (SALARYD)	0.24	0.35	0.25	0.16	0.25
Value of rice land owned by individual (TRCLDVI1)	187	75	1,010	975	322
Value of upland owned by individual (TUPLDVI1)	223	367	856	655	319
Monetary saving of individual (CTVSAVI1)	0.3	0.7	5.3	2.3	1.1
Member has social responsibility in village (RESPD)	0.10	0.08	0.55	0.48	0.17
Household characteristics					
Size of household (HHSIZE)	6.64	6.54	7.26	5.71	6.73
Dependency ratio (DEPRATIO)	0.39	0.40	0.42	0.38	0.39
Head of household was sick (HHSICKD)	0.14	0.15	0.19	0.37	0.18
Death/second burial event (FAMDECD)	0.52	0.40	0.34	0.52	0.49
Circumcision, marriage (CIRCOD)	0.51	0.54	0.62	0.45	0.51
Other family events (AUTD)	0.12	0.10	0.08	0.12	0.12
Positive family event (POSEVENT)	0.50	0.54	0.50	0.46	0.50
Average outstanding formal debt (DEBT.FOR)	29.2	48.7	76.9	75.2	41.5
Average outstanding informal debt (DEBT.INF)	17.5	21.7	14.5	28.7	18.4
Value of rice land owned by household (TRCLDVH1)	883	1,137	1,510	1,169	1,073
Value of upland owned by household (TUPLDH1)	959	963	1,162	960	1,015
Value of total assets (TASSETH1)	2,832	3,587	4,383	3,342	3,306
Average outstanding formal debt divided by last year's income proxy (LEVFORM)	0.03	0.06	0.09	0.09	0.05
Average outstanding informal debt divided by last year's income proxy (LEVINFO)	0.03	0.05	0.02	0.03	0.03

[a] All household members who are 18 years or older. Adulthood is prerequisite for membership in formal credit and savings associations.

Table 7—Informal market participation—Means of explanatory variables differentiated by application and credit rationing

Credit Rationing in **Informal** Sector	Individual Has Not Applied		Individual Has Applied		Mean[a]
	Not Constrained (n = 196)	Constrained (n = 0)	Not Constrained (n = 348)	Constrained (n = 107)	(n = 651)
Individual characteristics					
He/she is head of household (HCHIEFD)	0.16		0.30	0.52	0.29
Age in years (AGE)	30.9		31.2	34.2	31.6
Sex (Dummy = 1 if male) (Male)	0.48		0.55	0.60	0.54
Number of sick days (JOURMAL)	19.2		18.9	26.6	20.2
Number of years of formal education (YRSEDUC)	2.7		3.1	3.9	3.1
Member has his/her ancestral burial place in the region (DISTRZ2)	0.04		0.11	0.07	0.08
Earns some wage labor income (SALARYD)	0.16		0.25	0.29	0.23
Value of rice land owned by individual (TRCLDVI1)	326		199	344	261
Value of upland owned by individual (TUPLDVI1)	292		221	323	259
Monetary saving of individual (CTVSAVI1)	0.6		1.5	0.8	1.1
Member has social responsibility in village (RESPD)	0.10		0.13	0.22	0.14
Household characteristics					
Size of household (HHSIZE)	7.61		6.98	5.87	6.99
Dependency ratio (DEPRATIO)	0.35		0.41	0.43	0.39
Head of household was sick (HHSICKD)	0.08		0.15	0.24	0.14
Death/second burial event (FAMDECD)	0.52		0.49	0.47	0.50
Circumcision, marriage (CIRCOD)	0.53		0.48	0.59	0.52
Other family events (AUTD)	0.13		0.11	0.13	0.12
Positive social event (POSEVENT)	0.52		0.47	0.57	0.50
Average outstanding formal debt (DEBT.FOR)	52.3		39.7	41.5	43.7
Average outstanding informal debt (DEBT.INF)	17.3		16.2	25.1	18.0
Value of rice land owned by household (TRCLDVH1)	1,466		942	710	1,059
Value of upland owned by household (TUPLDH1)	1,174		1,072	817	1,059
Value of total assets (TASSETH1)	4,357		3,207	2,326	3,403
Average outstanding formal debt divided by last year's income proxy (LEVFORM)	0.06		0.04	0.05	0.05
Average outstanding informal debt divided by last year's income proxy (LEVINFO)	0.02		0.03	0.05	0.03

* All household members who are 14 years or older.

Univariate probit models are used to estimate the determinants of the two dependent variables: APPLY (0 = not apply, 1 = apply) and SUPPMAX (0 = member was not rationed in her loan demand, 1 = was rationed).

The following equation is used for estimating the probability of applying for a loan:

$$\text{Prob (APPLY)} = F\ (I, H, E), \qquad (1)$$

where (expected sign of relationship in brackets) I = vector of individual characteristics of applicant affecting credit demand (age[+], sex[?], education[+], sick days[+], being a wage laborer [+], being head of household [+], having social responsibility in community [+]); H = vector of household's endowment in human capital that affects credit demand (education [+], dependency ratio [?]); and E = vector of household events that are expected to positively affect credit demand (migration or death of a family member, bad harvest, positive but costly social events such as marriage and circumcision).

The second-stage model, which estimates the probability that an individual's loan demand is rationed by a lender, has the following equation:

$$\text{Prob(SUPPMAX)} = F\ (I, W, E, L), \qquad (2)$$

where I = vector of individual characteristics affecting lender's decision (like equation (1), but, in addition, individually owned collateral); W = vector of household characteristics affecting lender's decision (value of household assets not owned by individual at beginning of recall period [+], value of assets like livestock and monetary savings that can be easily liquidated in order to repay a loan [+]); E = like stage 1 (signs arbitrary, for formal lenders probably negative); and L = vector of repayment ability variables (outstanding debt of

household [-], or ratio of outstanding debt over last year's income as a proxy for income earning capacity [-]).

The model is estimated separately for the formal and informal sectors. The separate treatment of the market segments serves to identify similarities and differences between the sectors concerning the determinants for credit application and loan rationing. In order to correct for selection bias in modelling the sequential decision process of the borrower in the first stage and the lender in the second stage, the Mill's ratio from the first stage PROBIT model is included as an additional regressor in the second stage PROBIT.

4. MODEL RESULTS

The results of the PROBIT models are first shown for the participation of households in informal and then in formal markets.

CREDIT RATIONING BY INFORMAL LENDERS

The regression results concerning the decision to apply for informal credit are listed in Table 8. The probability of applying for informal credit significantly increases (at least at the 10 percent level)

- with higher age of applicant (AGE), but at a decreasing rate (AGESQ).
- with the number of years of schooling (YRSEDUC). Increased human capital augments ceteris paribus returns on capital and therefore credit demand.

Table 8—Determinants of application for informal credit by individual adult household members (probit estimate)

Explanatory Variable	Parameter	t-Value	Mean of Variable
AGE	0.070356	3.231***	35.8
AGESQ	-0.00090	-3.842***	1,526.40
SEX	-0.16768	-0.938	0.54
YRSEDUC	0.074602	2.517**	3.33
SALARYD	0.33490	1.977*	0.24
DEPRATIO	0.53036	1.494	0.40
FAMDECD	0.00559	0.041	0.49
CIRCOZD	-0.11812	-0.855	0.52
AUTD	-0.10250	-0.476	0.11
HHCHIEFD	0.94046	4.140***	0.41
RESPD	-0.071751	-0.336	0.195
JOURMAL	0.00205	1.699*	25.1
DISTRZ2	0.83861	2.615*	0.083

N^a = 455

Chi-squared = 18.41

Percent predicted correctly = 75.6

Definition of variables:

Members 18 years or older.

- if the individual is deriving part of his income from wage labor (SALARYWD). Being a wage laborer is a crude indicator for poverty. This result shows that the poor significantly rely on short-term credit with a mean duration of only two months.
- if the individual is the head of household (HHCHIEFD). The head of household is culturally expected to go to most lenders, especially concerning important household loans.
- with the number of sick days of household members during the recall period, implying need for credit for medicaments and paying care (JOURMAL).
- if the burial place (*Tanindrazana*) of the individual's ancestral family is in the region of his or her current domicile (DISTRZ2). Having the ancestor's burial place in the region of the individual's families implies stronger social ties in the community and nearby and therefore an increased participation rate in the informal credit network of friends and relatives.

Gender of the individual appears to not affect the application process for informal credit (SEX). Furthermore, social events in the households over the recall period were not significant determinants of loan application (FAMDECD, CIRCOD, AUTD). As can be seen from Table 3, the use of informal loans for financing social events is fairly low.

The determinants of being supply-constrained by the informal market are shown in Table 9. The probability of being constrained by an informal lender significantly increases

Table 9—Determinants of being credit-constrained: Informal sector (probit estimate)

Explanatory Variable	Parameter	t-Value	Mean of Variable
AGE	0.081537	2.615**	35.8
AGESQ	-0.00094	-2.653**	1,526.4
SEX	-0.12383	-0.596	0.54
YRSEDUC	0.085538	2.999**	3.33
HHSICKD	0.12953	0.743	0.78
TASSETH	-0.002147	-2.504**	117.0
POSEVENT	0.12325	0.848	0.56
HHCHIEFD	0.39488	1.694*	0.41
RESPD	0.088388	0.454	0.20
DISTRZ2	-0.36145	-1.333	0.08
LEVINFO	1.6854	2.185*	0.03
MILINI	0.12448	1.139	0.017
LEVFORM	-0.22656	-0.316	0.050

$N^* = 455$
Chi-squared = 51.21
Percent Predicted Correctly = 78.24

- with higher age of applicant, but at a decreasing rate. Most of the borrowers—irrespective of choice of sector—are of medium age. Younger and older household members borrow relatively little.
- with the number of years of schooling. Two effects may explain this counterintuitive result. First, lenders may not value the number of years of schooling as a strong indicator for the ability to repay a loan. Second, applicants with a higher level of schooling may demand larger loan amounts than less-educated individuals. Since lenders may not value their education or perceive higher default risk as the loan amount rises, they ration these loan demands more frequently.
- if the individual is the head of household. As the head of household asks for more important credits than other household members (higher loan amount sums and longer duration), he is also likely to be more frequently rationed than other household members.

As expected, higher total household wealth significantly increases the probability that the lender disburses the credit as demanded.[12] In addition, the ratio of average outstanding informal debt during the recall period and household income (LEVINFO)[13] also significantly

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[12] If household wealth is differentiated into rice land, upland, livestock, consumption, and production durables, the value of livestock and upland are significant determinants. Livestock and also, to a lesser degree, upland can be sold, whereas sales of rice land are only socially accepted when the buyer is part of the extended family.

[13] The average level of outstanding annualized debt is defined as the mean of outstanding debt at four points in time: at the end of the agricultural year 1990/91, and at the time of each of the three rounds. Medium-term loans—with a duration over a year—were annualized, and only the installments to be paid in the following 12 months were counted.

affects the lender's decision: the higher the leverage, the higher the probability of being constrained. However, the leverage of debt to formal lenders does not seem to affect the decision of the informal lender (LEVFORM): the parameter is negative and not significant.

In summary, the lender's decision to approve a loan request is based on the wealth of the applicant's household, which is an indicator for repayment ability. In addition, indebtedness in the informal sector affects the decision of the informal lender in deciding to ration the loan amount, but outstanding debt in the formal sector does not influence this decision. **Do informal lenders expect to be repaid first?**

CREDIT RATIONING BY MEMBERS OF FORMAL GROUPS

Tables 10 and 11, respectively, list the probit estimation results for application of credit from and rationing by formal lenders.

Below, the differences in the determinants of application in the informal market versus the formal market are highlighted. When comparing the determinants of applying for a loan in the informal (Table 8) with the formal sector (Table 10), the following conclusions can be drawn:

Table 10—Determinants of application for formal credit by individual adult household members (probit estimate)

Explanatory Variable	Parameter	t-Value	Mean of Variable
AGE	0.048107	1.626*	36.1
AGESQ	-0.00048	-1.559	1,546.3
SEX	0.60643	2.628**	0.53
YRSEDUC	0.10516	3.204***	3.36
SALARYD	-0.21735	-1.095	0.25
DEPRATIO	-0.44259	-1.104	0.40
FAMDECD	-0.25464	-1.572	0.49
CIRCOZD	0.14272	0.864	0.51
AUTD	-0.05578	-0.207	0.11
HHCHIEFD	0.69257	2.817**	0.42
RESPD	0.84347	4.483***	0.20
JOURMAL	0.00170	1.171	25.1
DISTRZ2	0.13622	0.479	0.08

N[a] = 427

Chi-squared = 140.80

Percent predicted correctly = 81.97

Definition of variables:

Members 18 years or older

Dummy Dep. Dist. Dep. Ratio (Dep. Ratio = 0)

Table 11—Determinants of being credit-constrained: Formal sector (probit estimate)

Explanatory Variable	Parameter	t-Value	Mean of Variable
AGE	0.039	1.435	36.1
AGESQ	-0.00042	-1.410	1,546.3
SEX	0.457	2.204**	0.53
YRSEDUC	0.0694	2.369**	3.36
SALARYD	-0.094	-0.533	0.25
JOURMAL	-0.000162	-0.115	25.1
TRCLDVI1	-0.0000074	-0.125	359.1
TUPLDVI1	-0.00000063	-0.087	378.0
CTVSAVI1	-0.011	-0.973	1.2
DEPRATIO	-0.197	-0.520	0.40
FAMDECD	-0.134	-0.925	0.50
CIRCOZD	-0.07331	-0.487	0.51
AUTO	0.12	0.526	0.11
HHCHIEFD	0.191	0.808	0.42
RESPD	0.159	0.794	0.196
DISTRZ2	-0.338	-1.141	0.082
MILINF	0.56817	5.123***	-0.000004
LEVINFO	1.84	1.964*	0.08
LEVFORM	1.00200	1.463	0.05

N = 427
Chi-squared = 74.51
Percent Predicted Correctly = 76.58

- being a male significantly increases the probability of applying in the formal sector, but not in the informal sector. In male-headed households, most of the formal credits are taken out by the head of the household. Few women of male-headed households are members in formal credit groups, and 17 out of the 189 sample households are female-headed.
- earning income as a salaried worker, which is a crude indicator of poverty, increases the probability of applying for informal credit, but is not significant for the likelihood of formal application. This result implies that wage-earning individuals, who, in general, belong to the poorer segment of the rural population, turn to the informal credit market. The result further indicates that financial services offered by formal lenders do not respond to the financial needs of the poor (loan disbursal when needed, small amounts, low unit transaction costs).
- the number of sick days of the household member (JOURMAL) does not affect the demand for formal credit, but does so significantly for informal credit. Again, the argument can be made that the formal market does not offer timely disbursement of short-term consumption loans, and that applicants therefore turn to the informal market.
- stronger ties of the individual's clan with the community and region, indicated by the close distance from the village to the clan's ancestral burial place (DISTRZ2), does not affect the application in the formal sector, but is significant for application in the informal sector. This result suggests that informal credit exchange networks are relatively more important among families living for longer periods in the region.

Do the determinants of the lender's decision vary between sectors? A comparison of Table 9 (informal case) with Table 11 (formal case) provides an answer to this question:

- being a man significantly increases the probability of being constrained in the formal market, but this is not so in the informal market. However, as shown in Table 10, it also raises the probability of applying for formal credit. Because men usually ask for larger loan amounts than women and because the lender may perceive a higher risk of default with rising loan amounts, lenders therefore more frequently ration male borrowers.
- the possession of rice land or upland by the individual member does not affect the formal lender's decision to ration the loan. Land is not a good collateral in Malagasy society. Only 0.9 percent of informal loans report the use of physical collateral, but 36 percent of the formal loans involve some type of physical collateral, which is then mostly animals, land, or paddy stored in locked communal bins. In only 2 percent of loan defaults, groups sold collateral of the member in arrears. However, the possession of land is an indicator for future income potential and, therefore, also of the ability for repayment. Regression results, not reported here, show that, as in the informal case, total assets owned by the household, of which land constitutes a large share, are significant determinants of the formal lender's decision in satisfying the demand of the borrower.
- the level of average outstanding **informal** debt divided by income does significantly affect the formal lender's decision. The level of average outstanding **formal** debt has the expected positive sign, but is only significant at the 15 percent level.

If willingness to repay a loan would not vary between informal and formal sectors, one would expect that both the formal and informal outstanding debt would matter for the lender's decision to ration the loan. As previously shown, informal lenders seem not to care about outstanding formal debt when rationing a loan. Most of the formal credit schemes are based on groups with mandatory group liability, which screen and ration the credit demand of their peers. It is interesting to note that—like for informal lenders—the group members care first about informal average outstanding debt, which they can rather easily observe through listening to gossip in the village. When reviewing the repayment capacity and default risk of a loan applicant, both informal lenders and the members of the formal credit groups appear to give more weight to indebtedness of the informal rather than the formal sector. Informal borrower-lender relationships may often be based on long-established social ties or business relationships. Honoring these relationships by vulnerable households becomes crucial since they do not want to lose access to the informal credit and insurance system. In terms of crises, it can therefore be expected that informal loans get repaid first. This result is important for the sustainability of formal group-based programs in "bad" years. The schemes should therefore be prepared to reschedule loans when severe covariate shocks inhibit their clients to pay off their debt. On the other hand, they also should strictly reinforce repayment of loans if the group as a whole did not experience any devastating income shocks.

Strict enforcement of repayment of debt is a crucial condition to incite group members to consider outstanding formal debt as a lending criteria. It appears that the sample groups that have existed on average for only two years cannot be expected to have already achieved

the same trusted borrower-lender relationship than long-established informal social and business relationships have. Establishing trustful, endurable, and long-term relationships between the formal program and their clients will take its time.

5. CONCLUSIONS

This paper presents an analysis of the determinants of loan rationing by informal lenders and by members of community-based groups that obtain credit from formal lenders. The results show that formal groups obtain and use information about the creditworthiness of the credit applicant in a similar way than informal lenders do.

Land as a criteria for loan rationing neither plays a role for informal lenders nor for members of the groups. Informal lenders and group members can obtain information about the wealth, indebtedness, and income potential of the loan applicant. Both lenders ration loan demands in view of total household wealth and the leverage of the household, which is defined as the ratio of outstanding debt over income. Thus, the results confirm the theoretical argument that community-based groups have an information advantage over distant formal bank agents. Like informal lenders, the group members have access to information that is only available to insiders of the borrower's community. The use of the leverage ratio as a significant determinant of loan rationing is less regressive than the use of land as collateral that has been identified as the overriding determinant for access to formal credit contracted directly between the bank and the individual borrower.

The substitution of physical for social collateral through group liability can therefore contribute to increased participation of the poor in credit markets. However, the results also

show that formal group members and informal lenders similarly consider wealth and leverage ratio as criteria for rationing. Thus, inequalities in frequency of loan rationing between the poorer and the richer households not only exist in the group-based credit schemes, but also in informal credit markets. The leverage ratio is seen as a valid banking criteria for loan rationing. To the extent that poorer households may tend to have higher levrage ratios, it has to be concluded that credit for the poor has also its limits.

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