The Performance of Village Intermediaries in Rural Credit Delivery under Changing Penalty Regimes: Evidence from Senegal

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This article concerns the use of village intermediaries to mitigate asymmetric information problems in rural credit delivery. We consider an example from Senegal and examine the intermediaries' screening of loan applicants. The results show that, when the intermediaries expected to incur a substantial penalty in the event of borrower default, they engaged in appropriate screening, allocating credit to borrowers likely to repay their loans. When the default penalty was lowered, however, the intermediaries engaged in opportunistic screening, emphasising political affiliation and consanguinity in their lending decisions. These results reveal both the potential efficacy of village intermediaries in allocating credit and their extreme sensitivy to penalty regimes.

I. INTRODUCTION

A key constraint to agrarian development in many low-income countries is the near absence of formal credit sources for the rural poor. Lender–borrower information asymmetries represent an important obstacle to the

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emergence of such sources: formal lenders know little about the characteristics and actions of rural borrowers and the resulting problems of adverse selection and moral hazard often undermine rural lending. Recently, widespread interest has developed in lending arrangements that make use of local informational advantages to mitigate these problems. Group-based lending schemes have received the bulk of the attention, largely as a result of the success of the Grameen Bank in Bangladesh [*Hossain, 1988*].[1] Theoretical work suggests that group lending can make effective use of local information and improve the performance of credit markets [*Besley and Coate, 1995; Arnott and Stiglitz, 1991; Stiglitz, 1990*]. Optimism about the potential of group lending to provide sustainable financial services to the rural poor has led to the introduction of group-lending schemes in a variety of developing country contexts [e.g., *Wenner, 1995; Wydick, 1995*].

Group lending is only one approach to making use of local information in rural lending, however. Another promising approach that has received considerably less attention is the use of village intermediaries. By contracting with a member of a rural community to serve as an intermediary in the allocation and recovery of loans, a lender can make use of the community member's comparative advantage in screening loan applicants, monitoring loan use and enforcing loan repayment. In a rigorous theoretical treatment of village intermediaries, Fuentes [*1996*] asserts that a lender can specify a compensation scheme – rewards for repaid loans and penalties for loan defaults – that will induce the intermediary to engage in an appropriate level of screening and enforcement. Chaves and Gonzalez-Vega [*1996*] cite examples from Indonesia confirming that village intermediaries can be effectively used in rural credit delivery.

In this article, we examine the performance of the village intermediaries of the *sections villageoises* in Senegal. The *sections* were created in 1983 to replace state-controlled co-operatives and serve as the primary avenue through which formal agricultural credit is delivered to peanut producers in Senegal's Peanut Basin. In each *section* a village intermediary is responsible for allocating credit among *section* members. Our analysis focuses on the screening behaviour of these intermediaries. We analyse the intermediaries' lending decisions to determine if they engage in appropriate screening of loan applicants, that is, do they allocate credit to 'good' borrowers who are likely to repay their loans.[2] In addition we ask the question, How sensitive is the screening behaviour of the *section* intermediaries to changes in the compensation scheme?

We devote the first section of the article to developing a framework for addressing the screening questions posed above. In section II, we provide a brief history of the formal agricultural credit market in the Peanut Basin and describe the origin, structure and functioning of the *sections villageoises*.

We attempt to identify the competing objectives of an intermediary in order to illuminate the mechanism through which the compensation scheme affects his[3] lending behaviour. In section III we discuss the events that led to a fall in the penalty a *section* intermediary could expect to incur in the event of borrower default. In section IV we formalise our model of intermediary objectives and changing penalty regimes. The model permits formal representation of an intermediary's allocation rule – the criteria he uses for determining how much credit he will allocate to an individual with a given set of characteristics – and how this rule changes in response to changes in the default penalty. We define appropriate screening in relation to the allocation rule: the intermediary is engaged in appropriate screening if the criteria entering the allocation rule are borrower characteristics likely to contribute to loan repayment. The model illustrates how these repayment characteristics figure less prominently in the allocation rule when the default penalty falls.

In the third part of the article we apply the framework we have developed to analysing the credit allocation decisions of the *section* intermediaries. In section V we describe the setting in which our data were collected and examine the patterns of credit allocation in periods of high and low default penalty. In section IV we econometrically recover the implicit allocation rules that the *section* intermediaries used in these two periods. The results reveal that the intermediaries engaged in appropriate screening in the high-penalty period, but that they screened on the basis of characteristics unrelated to the likelihood of loan repayment when the default penalty fell. In section VII we examine the efficiency implications of the change in allocation rules that resulted from the fall in the default penalty. We conclude in section eight with a discussion of the results and their policy relevance.

II. AGRICULTURAL CREDIT IN THE PEANUT BASIN OF SENEGAL AND THE ROLE OF THE INTERMEDIARY IN THE *SECTION VILLAGEOISE*

Peanuts are the most important cash crop in Senegal and peanut seed credit is the most important form of formal credit in Senegal's Peanut Basin. Peanuts are a particularly credit-intensive crop: seed is expensive and only about ten peanuts are yielded for each seed planted. This results in an input cost for seeds alone of about US$70 per hectare. For comparison, millet, the most important food crop in the Peanut Basin, requires only about US$2.50 per hectare in seed costs. In addition, on-farm storage of peanut seeds is difficult, storage losses can be quite high and stored seeds are susceptible to the development of toxic fungi. Hence, peanut production requires

substantial outlays at planting time and most farmers actively seek out credit to produce peanuts.

Prior to financial market reform in Senegal, a parastatal institution allocated peanut seed credit on a tax-roll basis – each household was allocated a fixed amount of seed credit for each adult household member on government tax rolls. Borrowers were charged a flat, in-kind interest of 25 per cent that was deducted from the value of their harvest at commercialisation (the parastatal was the only legitimate purchaser of peanuts). In theory, delinquent borrowers were denied future loans but, in practice, the government tolerated low repayment rates as it periodically reduced or eliminated the amount owed, particularly in response to poor harvests or when elections approached. Borrowers learned to expect the periodic debt annulments, repayment rates were low, and the resulting outstanding debts became a crippling burden on state finances. By late 1980 the unpaid debt for agricultural inputs exceeded US$100 million [*Tuck, 1987*], approximately one quarter of the total value added in agriculture.

Fundamental reforms in Senegal's agricultural policies were introduced in the early 1980s. Two key objective of these reforms were the disengagement of the state from agricultural markets and the 'responsabilisation' of the private sector and the producers themselves for the organisation of agricultural production, including input provision and output marketing. New structures, the *sections villageoises*, were created to replace the existing co-operatives, with the aim of creating new, more efficient co-operatives, less under state tutelage, that would eventually evolve into largely autonomous private enterprises [*Gaye, 1990*]. The *sections* play a particularly important role in the provision of peanut seed credit, serving as the main channel through which formal credit is supplied to peanut producers [*Gaye, 1987*].

A *section* has two components, the general membership and the governing board. The active general membership typically comprises around 50 individuals from a village or a village quarter, and is primarily made up of male household heads, although dependent males and women can, in principle, be members. The members of a *section* elect a governing board, including a president, a secretary and a treasurer. The president functions as the village intermediary, and has primary responsibility for determining how much peanut seed credit to allocate to each member of the *section* in each year. The intermediary receives no explicit rewards for on-time loan repayment. If any member of the *section* defaults on his loan the entire *section* receives no further credit until the outstanding loan is repaid. Rather than forego future loans, the members of a *section* generally pool their resources to repay the defaulting member's loan. The intermediary's share of the burden is determined by the other members of the *section*. If the

intermediary's decision to lend to the defaulting member is seen as irresponsible, that is, if the loan was made to someone who was widely known to be a bad credit risk, the members of the *section* will hold the intermediary responsible for a disproportionate share of the loan.

At the surface, it would seem that an individual would be foolish to accept the role of intermediary – there is no reward for good repayment performance of credit recipients and there is the possibility of substantial penalties in the case of borrower default. Nevertheless, the position of intermediary is seen as desirable and is actively pursued. We suggest that the reason for this lies in unmeasured benefits that accrue to the intermediary. These benefits can be understood in the context of the economic and social organisation of rural communities. Rather than engaging in single-stranded, impersonal and immediate market transactions, an individual typically transacts with selected members of his or her community in multi-stranded, personalistic, inter-temporal interactions. Exchanges in the economic, political or social sphere at a given date become inter-temporal obligations that are compensated at a future date with exchanges in the same or another sphere.[4] For example, one individual may provide his son's labour service on another's fields today and be compensated in the future by a 'gift' of a share of the harvest, support of his position in community political affairs, or assistance in finding a suitable spouse for his child. These arrangements resemble the 'prestation' systems first described by Marcel Mauss [*1954*]. At any given time, an individual has a stock of such obligations owed to him that he has accumulated through past exchanges with members of his community.

The intermediary of a *section villageoise* is particularly well placed to increase the stock of obligations owed to him. Formal agricultural credit is a rationed commodity and thus the granting of a loan generates an obligation owed to the intermediary by the loan recipient. To increase his stock of obligations, the intermediary would like to screen prospective borrowers on the basis of their 'obligation characteristics', that is, he would like to grant loans to individuals who will give the highest obligation returns. For example, a loan granted to a person influential in village politics is likely to have higher returns than one granted to someone whose opinions are not valued. Similarly, granting a loan to a relative may yield higher returns given the repeated-game nature of family interactions. In this way, influence and relatedness would be examples of obligation characteristics.

The intermediary is constrained in his pursuit of obligation objectives, however, by the penalty he will incur in the event of borrower default. To avoid penalties, the intermediary should screen prospective borrowers on the basis of their 'repayment characteristics', that is, the characteristics that reflect the likelihood a borrower will repay his[5] loan. These could include

his productive capacity and farming habits (his ability to repay from returns to the seed loan), his liquid assets and non-agricultural income sources (his ability to repay the loan with other resources), and his reputation (his willingness to repay given that he can repay).

The intermediary's problem then becomes choosing a balance between screening for obligation returns and screening for the likelihood of repayment. From the perspective of the lending institution, it is only when he emphasises the latter of these two that he is engaging in appropriate screening.

III. THE 1993 PARLIAMENTARY ELECTIONS AND THE FALL IN THE EXPECTED PENALTY FOR DEFAULT

Events leading up to the 1993 parliamentary elections in Senegal add an additional dimension to this story and permit the analysis of the sensitivity of the intermediary's screening to his expected penalty for borrower default. While the state was nominally disengaged from the agricultural credit market since the mid-1980s, as the elections approached President Abdou Diouf announced a number of measures 'to improve the circumstances of the country's rural inhabitants', among which was state underwriting of peanut seed credit for the 1993/94 agricultural season [*Le Soleil, 26 March 1993: 3*]. With the long history of state-sponsored debt annulments, there was a general impression that this represented an announcement that the *sections* would not be held fully responsible for the repayment of seed loans. This anticipation of partial or total state debt forgiveness can be interpreted as a reduced expected penalty for borrower default, both at the level of the *section* and at the level of the intermediary. If the stylised representation of the intermediary's objectives developed in the previous section is accurate, this fall in the expected penalty should have resulted in a change in the balance in the intermediary's screening towards less emphasis on screening for the likelihood of repayment and more emphasis on screening for obligation returns. In the following section we formalise the above discussion in a simple model of the impact of changes in the default penalty on the decision-making of intermediaries.

IV. VILLAGE INTERMEDIARIES, THE ALLOCATION RULE AND THE ROLE OF THE PENALTY FOR BORROWER DEFAULT

A lender uses a village intermediary to allocate credit among potential borrowers. The intermediary must choose the quantity of capital, $K \geq 0$, he will grant to each member of his village. A given borrower may or may not repay his loan. The probability that he will repay is a function of repayment characteristics, z^r ,

$$\rho = \rho(z^r)$$

where

$$0 \leq \rho \leq 1; \rho_{z^r} > 0$$

Information flows freely in the lending environment and the intermediary as well as all the other member of the village know the values of the z^r variables for all potential borrowers.[6]

In the event that a borrower defaults, the village is responsible for the outstanding loan. Part of the debt may be forgiven, however. From the perspective of the intermediary the percentage of an outstanding loan that will be forgiven, α, is exogenous. As a member of the village, the intermediary must carry a share of the remaining burden. If the intermediary lent to a borrower known to be a bad risk, that is, an individual with low values of the z^r variables, the intermediary's behaviour will be seen as irresponsible by the other members of the village and his share will increase. We can thus represent the penalty, P, that the intermediary will pay in the event a borrower defaults as a function of the amount lent, K, the level of debt forgiveness, a, and the values for the repayment characteristics of the borrower, z^r :

$$P = h(\alpha, z^r)K,$$

where

$$h_\alpha < 0, h_{z^r} < 0,$$

that is, the share of the defaulted loan amount for which the intermediary is held responsible decreases with increasing debt forgiveness and increasing values for the repayment characteristics of the borrower. In addition, we assume

$$\frac{\partial}{\partial \alpha}\left(\frac{h_{z^r}}{h}\right) > 0,$$

meaning that the percentage increase in penalty the village imposes for irresponsible lending decreases as the level of debt forgiveness increases.

The intermediary is the primary source of formal credit and formal credit is a rationed commodity. Thus, when the intermediary grants a loan to an individual he can expect to receive compensation from that individual. This compensation may be in the economic, political or social spheres and takes the form of an obligation owed to the intermediary by the credit recipient. The intermediary increases the stock of these obligations owed to him through selective granting of loans. The obligation returns to lending vary across borrowers and are a function of characteristics of the borrower, z^o, and the amount of the loan. We define the change in a intermediary's stock

of obligations, o, associated with granting a loan to a borrower as:

$$o = o(z^o, K).$$

We assume that this function takes the form

$$o = o(z^o, K) = f(z^o)g(K)$$

where

$$f_{z^o} > 0; g_K > 0; g_{KK} < 0.$$

The intermediary gets utility from income and obligations owed to him. For simplicity, we choose the obligation function to map z^o and K into income units. The intermediary's maximisation problem of deciding on how much credit to grant for given levels of z^r and z^o is:

$$\max_K U = E(Y) + o,$$

subject to

$$E(Y) = -(1-\rho(z^r))h(\alpha, z^r)K,$$

$$o = f(z^o)g(K), \text{ and}$$

$$K \geq 0.$$

His problem is thus

$$\max_K L = -(1-\rho(z^r))h(\alpha, z^r)K + f(z^o)g(K) + \mu K.$$

The solution to this problem is described by the Kuhn-Tucker conditions:

$$K[-(1-\rho(z^r))h(\alpha, z^r) + f(z^o)g_K(K) + \mu] = 0, \text{ and} \quad (1)$$

$$\mu \geq 0, K \geq 0. \quad (2)$$

For an interior solution, m=0 and (1) can be rewritten

$$f(z^o)g_K(K) = (1-\rho(z^r))h(\alpha, z^r), \quad (3)$$

expressing the trade-off faced by the intermediary: the intermediary grants a borrower credit up to the point where the marginal obligation gains equal the marginal penalty incurred in the event of default times the probability of default. We can now define the intermediary's allocation rule across penalty regimes and across borrowers with different levels of repayment and obligation variables, $K^* = K^*(\alpha, z^r, z^o)$, as

$$K^* = G\left[\frac{(1-\rho(z^r))h(\alpha, z^r)}{f(z^o)}\right], \quad (4)$$

where $G(\cdot) = g_k^{-1}(\cdot)$. Differentiating this expression with respect to z^r and z^o yields

$$\frac{\partial K^*}{\partial z^r} = G' \cdot \frac{-\rho_{z^r} h + (1-\rho) h_{z^r}}{f}, \text{ and}$$

$$\frac{\partial K^*}{\partial z^o} = -G' \cdot \frac{(1-\rho) h f_{z^o}}{f^2}.$$

The relative importance of repayment and obligation characteristics in the determination of the loan size, K, is then described by

$$\frac{\partial K^* / \partial z^r}{\partial K^* / \partial z^o} = \left[\frac{\rho_{z^r}}{(1-\rho)} - \frac{h_{z^r}}{h} \right] \frac{f}{f_{z^o}}.$$

This ratio can be shown to be a decreasing function of the level of debt forgiveness, *a*:

$$\frac{d}{d\alpha} \left(\frac{\partial K^* / \partial z^r}{\partial K^* / \partial z^o} \right) = -\frac{f}{f_{z^o}} \frac{\partial^2 \log h}{\partial \alpha \partial z^r} < 0, \tag{5}$$

meaning that, when the level of debt forgiveness increases, the intermediary will put relatively less weight on the repayment variables and relatively more weight on the obligation variables in his credit allocation decisions.

This result becomes more clear in graphical representation. For a given level of debt forgiveness we can represent the allocation rule $K^* = K^*(\alpha, z^r, z^o)$ as credit isoquants in (z^r, z^o) space. We take a linear approximation of the rule,

$$K^*(\alpha, z^r, z^o) = \gamma(\alpha) + \beta_r(\alpha) z^r + \beta_o(\alpha) z^o,$$

and restrict our attention to a single isoquant $K = \bar{K}$, the slope of which is

$$-\frac{\beta_r}{\beta_o} = -\frac{\partial K / \partial z^r}{\partial K / \partial z^o}.$$

We now consider the impact of a decrease in the expected penalty for default (an increase in the level of debt forgiveness, α) by comparing the allocation rule in the high-penalty (low α) period,

$$K^h(\alpha^h, z^r, z^o) = \gamma^h + \beta_r^h z^r + \beta_o^h z^o,$$

with the allocation rule in the low-penalty (high α) period,

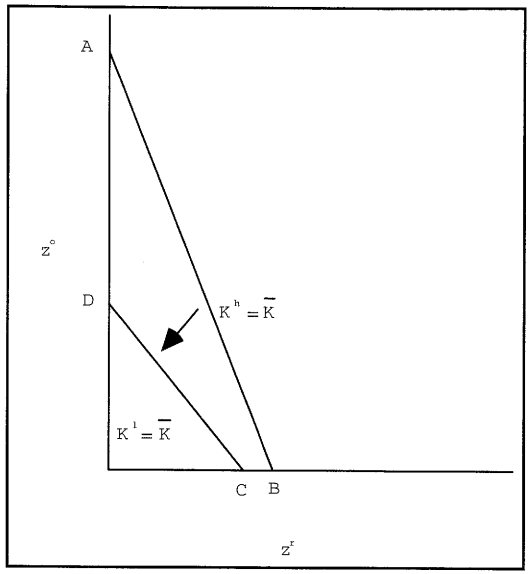
$$K^l(\alpha^l, z^r, z^o) = \gamma^l + \beta_r^l z^r + \beta_o^l z^o.$$

Result (5) above says that a decrease in the expected penalty for borrower default (an increase in a) causes a rotation of the $K = \bar{K}$ isoquant as show in Figure 1.

The isoquant becomes less steeply sloped ($\frac{\beta^h_r}{\beta^h_o} > \frac{\beta^l_r}{\beta^l_o}$) meaning the intermediary places a lower relative value on z^r in terms of z^o (equivalently,

FIGURE 1

THE IMPACT OF AN DECREASE IN THE EXPECTED PENALTY FOR BORROWER DEFAULT.



a higher relative value of z^r in terms of z^o). If $\bar{K} = 0$, borrowers with (z^r, z^o) characteristics in the ABCD area gain access to credit.

The preceding analysis provides the framework for addressing the screening questions we posed in the first section of this article. The two questions were: (1) do the *section villageoises* intermediaries engage in appropriate screening, that is, do they allocate credit to good borrowers likely to repay their loans? and (2) how sensitive is the screening behaviour of the intermediaries to changes in the compensation scheme? In terms of our framework, appropriate screening would be represented by very steeply sloped credit isoquants (controlling for differences in units of measurement). Ideally, only repayment characteristics would enter into the allocation rule ($\beta_r > 0$, $\beta_o = 0$) and the isoquants would be vertical ($\frac{\beta_r}{\beta_o} \to \infty$). The question of the sensitivity of screening to changes in the compensation scheme was considered more directly in the model. When the penalty falls, we expect the intermediary to place less emphasis on screening for the likelihood of repayment relative to screening for obligation returns, resulting in less steeply sloped isoquants $(\frac{\beta^h_r}{\beta^h_o} > \frac{\beta^l_r}{\beta^l_o})$. The limiting case would be screening only for the likelihood of repayment in the high-penalty

period ($\beta^h_r > 0$, $\beta^h_o = 0$, vertical isoquants) and screening only for obligation returns in the low-penalty period ($\beta^l_r > 0$, $\beta^l_o = 0$, horizontal isoquants). In the next sections we apply this framework to data collected on the lending decisions of *sections* intermediaries.

V. SETTING AND DATA

The empirical analysis draws on data from a survey of the heads of 95 farming households we conducted in the Peanut Basin of Senegal in 1992–94. These households were a sub-sample of households surveyed in 1989–91 as part of a study undertaken by the International Food Policy Research Institute (IFPRI) and the *Institut Sénégalais de Recherches Agricoles* (ISRA).[7] The sub-sample consists of the three IFPRI/ISRA survey zones – Niakhar, Passy and Dioli – that were located in the Peanut Basin. While the IFPRI/ISRA study collected data on all household members, our study concerned only the activities of the household heads, as only household heads were active *section* members.

The study area lies in western Senegal. Annual rainfall ranges from 500–1000 mm and a rainfed rotation of millet and peanuts is the predominate cropping system. The use of animal traction is widespread due to a liberal credit programme for purchasing draft animals and equipment that existed prior to 1980.

As Table 1 shows, the households in the sample are poor – mean annual income per adult equivalent is approximately US$150.[8] Income varies markedly across households with the poorest households earning less than one-tenth of what the highest income households earn. Wide disparities in wealth, as measured by livestock wealth, are also found, with herd values ranging from US$35 to US$8000.

All households in the sample engage in agricultural production, but productivity varies widely as a result of a number of factors including (1) differences in farming experience and ability of the household head, (2) rainfall and soil quality, (3) control of (or access to) directly productive resources, particularly animal traction, labour and land, and (4) access to indirectly productive resources, most importantly credit in the form of peanut seeds and fertiliser. Labour markets are active, making it possible to supplement the household work force with non-household labour, although transactions costs in labour hiring can be substantial. Land markets are very restricted due to the formal prohibition of land transactions instituted in the 1960 Law of National Domain. Land 'borrowing' and 'lending' is relatively common, however.

Credit markets are very active and nearly all households indicated that they regularly participate as borrowers and/or lenders. The credit market

TABLE 1
SUMMARY DATA FOR THE HOUSEHOLDS STUDIED (n=95)

	Sample Mean	Standard Deviation	Minimum	Maximum
Household Characteristics				
1. Household Size in Adult Equivalents	9.9	6.7	2.5	52.6
2. Net Income per Adult Equivalent ($US)				
Total	152.7	76.9	38.3	434.0
Crop and Livestock	87.0	54.8	4.4	239.6
3. Cultivated Hectares per Household	8.1	6.5	0.1	39.1
Characteristics of Household Heads				
4. Age	50.5	11.7	27.0	75.0
5. Years as Household Head	21.6	12.8	1.0	50.0
6. Years of Formal Education	0.5	1.7	0.0	
7. Value of Livetsock ($US)	869.0	1158.1	34.5	8008.6
8. Non-agricultural income of Household Head ($US)	335.3	505.4	0.0	2206.9
Peanut Seeds Used in *1993/94 Agricultural Season (Kgs)* by *Source**				
9. Section Villageoise	50.7	53.2	0	250
10. Stocks	75.1	135.7	0	825
11. Other	21.2	68.6	0	500
12. Total	146.9	171.9	0	875

* The value of peanut seed loans can be calculated using the conversion $US 0.8/kilogram seeds.

Source: 1,4–11, survey data; 2–3, IFPRI/ISRA survey data.

follows a common pattern of segmentation – the sources for consumption loans are informal while those for production loans are formal. The sources for informal consumption loans include friends, neighbors, relatives and merchants. Loan terms vary widely with nominal interest charges ranging from 0 per cent to 100 per cent on loans of one day to one year in duration.[9] In addition, rotating savings and credit associations (*tontines*) are common as are itinerant merchants (*bichek foukou*) who sell consumer goods, particularly housewares, on credit.

Formal production credit from the *section villageoise* has been described in some detail above. It is worth noting here the importance of credit coming through the *sections* as revealed in Table 1: more than a third of the peanut seed used by the survey households was allocated through the *sections*. This is particularly significant when it is recognised that, on average, peanuts are responsible for approximately 50 per cent of their net revenue from agriculture.

The results of the survey indicate that nearly all household heads sought

production or consumption credit during the survey: 39 respondents sought both formal peanut seed production credit and informal consumption credit for cereals, 44 sought only formal production credit, seven sought only consumption credit, and only five sought neither formal production credit nor informal consumption credit.

The survey covered two agricultural seasons representing two different penalty regimes for the intermediaries. The first, 1992/93, was a 'normal' year and represents the high-penalty period. The second, 1993/94 was the election year and represents the low-penalty period. In the remainder of the analysis, attention is restricted to the 67 household heads that lived in villages in which the *sections villageoises* functioned in both 1992/93 and 1993/94. Examination of patterns in *section villageoise* credit for 1992/93, and 1993/94 shows marked changes in both the demand for and supply of *section* credit. In 1992/93, 54 per cent of the sample sought *section villageoise* peanut seed loans, 86 per cent of those seeking credit received it, and 81 per cent of those receiving credit obtained the full amount they requested.[10] In 1993/94, the election year, 93 per cent of respondents sought credit, probably as a result of expectations that the loans would not have to be repaid, 81 per cent of those seeking credit received it, and 66 per cent of those receiving credit obtained the full amount they requested. Overall, the number of individuals receiving credit increased from 31 in 1992/93 to 50 in 1993/94.

Table 2 presents recipients and non-recipients of *section* credit in cross-tabular form. If the intermediaries' allocation rules remained the same in the two years we would expect to find all observations on the diagonal from the upper left corner to the lower right corner, that is, those who did not receive credit in 1992/93 did not receive credit in 1993/94 and those who received credit in 1992/93 received credit in 1993/94. While 60 per cent of the sample falls on this diagonal, a substantial number of respondents changed status between the two periods: 34 per cent of the sample moved from non-recipient to recipient status and six per cent of the sample moved from recipient to non-recipient status. Table 3 presents the quantities of credit

TABLE 2

CHANGES IN SECTION VILLAGEOISE CREDIT ALLOCATION, 1992/93 – 1993/94.

	Didn't Receive Credit in 1993/94	Did Receive Credit in 1993/94	Total
Didn't Receive Credit in 1992/93	13	23	36
Did Receive Credit in 1992/93	4	27	31
Total	17	5	67

Source: Survey data.

allocated as further evidence of a change in the pattern of allocation between the two periods. When taken across the whole sample, the mean amount of credit received per household head increased by 64 per cent. This increase was largely achieved by increasing the number of recipients as the mean amount received among those who were allocated credit remained essentially unchanged.

TABLE 3

CHANGES IN MEAN AMOUNTS OF PEANUT SEED CREDIT (KGS) RECEIVED BY HOUSEHOLD HEADS FROM THE SECTIONS VILLAGEOISES, 1992/93–1993/94

	Production Year		Percent
	1992/93	1993/94	Change
All Household Heads	35.1	57.4	+63.7%
Those Receiving Credit	75.8	76.9	+1.5%
Total	2350	3847	

Source: Survey data.

These results suggest that the intermediaries did, in fact, change their allocation rules in response to the change in the default penalty. In the next section we econometrically analyse the lending decisions of the intermediaries to identify the characteristics for which they were screening in each period.

VI. ECONOMETRIC APPROACH AND RESULTS

The aim of our econometric analysis is to recover the implicit allocation rules used by the intermediaries in the high- and low-penalty periods. We have no direct observations on the penalty. Rather, we have observations on the lending decisions of intermediaries in high-penalty (low α, normal) and low-penalty (high α, election) periods. From the observed behaviour we can estimate the underlying allocation rules.

Our data consist of observations at one point in time for the characteristics of each individual in the sample, and observations at two points in time (the high- and low-penalty periods) for the amount of credit allocated to them. We pool the observations for the two periods and estimate the model

$$K_{it} = \gamma + y_t\phi + z_i'\beta + y_t z_i'\delta + e_{it}$$

where

K_{it} is the amount of credit individual i receives in year t;

y_t is a dummy variable for the year:

$y_t = 0$ for t=high-penalty year and $y_t = 1$ for t=low-penalty year;

z_i is a vector of individual i's characteristics thought to enter into the intermediary's allocation rule;
γ and ϕ are scalar parameters,
β and δ are vectors of parameters and
e_{it} is a household-year specific error term.

We estimate the model using a Tobit procedure to correct for the censoring of the borrowing data at zero.

With this formulation, the intermediary's allocation rule is represented by the vector of parameters $\beta^h = \beta$ in the high-penalty period and $\beta^l = \beta + \delta$ in the low-penalty period. Partitioning β^h and β^l into the parameters associated with repayment and obligation characteristics, the high-penalty allocation rule is represented by the parameters β^h_r, β^h_o and the low-penalty allocation rule is represented by the parameters β^l_r, β^l_o.

Thirteen variables are included in the regression analysis. They are grouped into three categories: repayment characteristics, repayment/obligation characteristics, and obligation characteristics. The rationale for the choice of each variable is given below. Descriptive statistics on the variables are presented in Table 4.

Repayment Characteristics

The likelihood that an individual will repay a loan is a function of his ability to repay the loan and the likelihood that he *will* repay the loan given that he *can* repay. His ability to repay the loan is determined by (1) the returns to the use to which the loan was put and (2) his ability to repay using other resources. In the case of peanut seed credit, the returns to the loan are determined by the productivity of peanut cultivation on the individual's farm. Returns should be higher if the individual has greater access to the factors of production, such as labour (both human and animal) and land.

We use four variables to represent the likely returns to a peanut seed loan on an individual's farm: the individual's evaluation of whether or not he has sufficient land, the household male work force between the ages of 15 and 25 present in the rainy season, the number of draft animals, and the average physical product of peanut seeds. The average physical product of peanut seeds, expressed as kilograms of production per kilogram of seeds, is taken from the results of the IFPRI/ISRA survey of these same households and is intended to capture both observable and unobservable factors contributing to the productivity of peanut cultivation. The measure is taken from the 1989/90 agricultural season and can be considered exogenous to the present analysis.

The ability of an individual to repay his loan in the event of poor returns from peanut production is largely determined by his non-agricultural

TABLE 4

VARIABLES USED IN ECONOMETRIC ANALYSIS (n=67)

	Sample Mean	Standard Deviation	Minimum	Maximum
Repayment Characteristics				
Land Sufficiency (% Yes)	57%	–	–	–
No. of Males, Aged 15–25 Present in the Rainy Season	1.6	1.8	0	12
Number of Draft Animals	2.3	1.6	0	7
Average Physical Product of Peanut Seeds (kgs production/kgs of seed)	12.1	4.5	1.1	21.3
"Honesty" (% deviation from enumerator mean)	-0.4	17.2	-43.9	19.7
Obligation Characteristics				
Relative of Intermediary (% Yes)	61%	–	–	–
Member of Ruling Party (% Yes)	61%	–	–	–
Family's Residence in Village (Above Village Median – % Yes)	61%	–	–	–
Repayment/Obligation Characteristics				
Non-Agricultural Income (FCFA)	108,230	167,435	06	40,000
Value of Livestock Holdings (FCFA)	255,760	330,483	10,000	2322,500
Years as Household Head	22.8	12.7	1	50
SONACOS Employment (% Yes)	4%	–	–	–
Member of the Board of the Section Villageoise (% Yes)	15%	–	–	–

Notes: 1) 1992–94 exchange rate 250 FCFA/$US.
2) The identical percentages for the three obligation variables only reflects coincidence – none of the variables is a linear combination of the other two.

income and his possession of liquid assets. Several measures of non-agricultural income and wealth are available, but all have some aspects that might make their inclusion as obligation characteristics equally reasonable. They are consequently discussed under 'Repayment/Obligation Characteristics'.

The likelihood that an individual *will* repay a loan given that he *can* repay will be reflected in reputation characteristics. Accurate loan histories are very difficult to obtain in this setting and we opted for a number of subjective measures. The reputation measures collected were 'honesty', 'work habits', and 'borrowing habits'. After extended discussions on the intended meaning of these measures, the enumerators conducted confidential interviews with village leaders in each of the survey villages to elicit evaluations of the sample household heads with respect to each measure. The enumerators then turned these evaluations into numerical

scores from 1 to 4 for each category. The variables used are corrected for differences in enumerator mean scores. Here, we use the 'honesty' variable as the measure best representing the characteristic of interest.

Repayment/Obligation Characteristics

A number of characteristics that should be important in determining an individual's ability to repay a loan might also be included among the obligation characteristics. We consider three general variables that fall into this category: non-agricultural income, the value of livestock holdings and the number of years as household head. In the event of a poor peanut harvest, individuals with substantial non-agricultural income will be better able to repay their seed loan. However, it is also likely that individuals with the highest levels of non-agricultural income will be among the wealthier individuals in the community, perhaps making the obligation returns to lending to them particularly high. Similarly, livestock are not only a source of liquidity from which a loan could be repaid, but also a very significant measure of wealth and status in a community. In a somewhat different vein, farming experience is thought to be an important determinant of agricultural productivity and one might expect the returns from a seed loan to be influenced by the numbers of years an individual has acted as household head, that is, the number of years during which he has had full responsibility for household farming operations. However, it is also the case that positions of influence within these communities are generally held by long-established household heads making this a candidate for a obligation variable as well.

Two other, site-specific characteristics belong in the repayment/obligation category. First, three individuals in the sample have substantial positions at the *Société Nationale de Commercialisation des Oléagineux du Sénégal* (SONACOS) warehouse. Since the distribution, collection, cleaning, grading, weighing, and sale of peanut seeds and peanut production is undertaken at these warehouses, it is clear that an intermediary would have a substantial interest in cultivating the favor of these individuals. This would suggest inclusion as an obligation variable. However, it also true that the proximity of the SONACOS employees to these activities would make their loan default particularly visible and might result in the use of professional as well as social pressure to encourage them to repay their loans. This would suggest categorisation as a repayment variable. Rather than drop these three from the sample, we include a SONACOS dummy variable. Similarly, ten individuals in the sample were on the board of the *section villageoise*. Since these individuals are at least nominally in charge of the peanut seed credit programme it is likely both that additional social and economic pressure could be brought to bear on them to ensure that they

repay their loans in the high-penalty year, and that they would have privileged access to the intermediary in the low-penalty year. We correct for these effects through the inclusion of a dummy variable for membership on the board of the *section villageoise*.

Obligation Characteristics

Identification of appropriate obligation variables is complicated by the fact that neither the stock of obligations nor the obligation returns to allocating loans are observable and are instead indirectly inferred. Many of the characteristics that contribute to high obligation returns are likely to be site specific and depend on local dimensions of the social, cultural, and political environment. In addition, as was discussed above, some of the more promising general candidates for obligation variables (for example, wealth) also qualify as repayment characteristics. Within this restricted context, we propose three obligation characteristics: being a relative of the intermediary, being active in the governing party, and being a long-term resident of the village.

Consanguine relationships are central to the organisation of Senegalese society and tremendous weight is placed on fulfilling obligations to family members. The repeated-game nature of interactions with relatives and the social pressure that can be brought to bear on errant family members make it likely that, *ceteris paribus*, the obligation returns from loaning to relatives will be higher than the returns from loaning to non-relatives. To represent this hypothesis, we use a dummy variable for being a relative of the intermediary.

Political life in Senegal extends significantly to the level of rural communities. In the long-standing patron–client relationship between the state and the peasantry, the governing *Parti Socialiste* (PS) has rewarded loyal rural party members with political largesse in a variety of forms. Loaning to active PS party members should thus have relatively high expected obligation returns, especially in a parliamentary election year. We represent this with a dummy variable for PS membership.

Finally, in the area in which the study was undertaken, special status in village politics is accorded to individuals who are descendants of the village founders. Since data for this specific characteristic are not available, we use the number of years of one's family's residence in the village as a proxy. However, as the age of the sample villages varies greatly, we calculate the sample median residence for each village, categorise individuals as old or new residents relative to this median, and represent this by a dummy variable.

Regression Results

In Table 5, we present the results of the Tobit estimation of the high-penalty and low-penalty allocation rules. Three of the five repayment characteristics

TABIE 5

INTERMEDIARY'S ALLOCATION RULE: RESULTS OF TOBIT REGRESSIONS
ENDOGENONS VARIABLE: KILOGNIMS OF PEANUT SEED CREDIT RECEIVED
n=134 Observations (67 households*2 yesrs)

	Period			
	High-Penalty		Low-Penalty	
Variable Description	Estimated Coefficient ($\beta^h = \beta$)	Significance Level* (P-Value)	Estimated Coefficient ($\beta^l = \beta + \delta$)	Significance level** P-Value)
Year Dummy (1=election year)			90.3	0.104
Repayment Characteristics				
Land Sufficiency (1-Yes)	35.2	0.042	14.38	0.341
No. of Males, Aged 15–25 Present in the Rainy Season	8.21	0.080	2.41	0.581
Number ofDraft Animals	1.01	0.897	2.03	0.085
Average Physical Product of Peanut Seeds (kgs production/kgs of seed)	5.75	0.007	0.20	0.915
"Honesty"	0.0039	0.994	0.22	0.649
Repaymen/Obligation Characteristics				
Non-Agricultural Income	-0.00002	0.741	0.00001	0.804
Value of Livestock Holdings (FCFA)	-0.00005	0.354	0.000009	0.722
Years as Household Head	0.0915	0.908	-1.03	0.136
SONACOS Employment (1=Yes)	154.2	<0.001	140.65	<0.001
Member of the Board of the Section Villageoise (1=Yes)	52.4	0.038	43.71	0.049
Obligation Characteristics				
Relative of Intermediary (1=Yes)	-6.53	0.660	28.77	0.063
Member of Ruling Party (l=Yes)	11.06	0.577	37.18	0.032
Fantily's Residence in Village (1=Above Village Median)	-11.32	0.498	-20.10	0.190
Constant	-98.0	0.024		
F-test of Joint Significance (P-Value) o:				
Repayment Variables (5, 107 d.f.)		0.009		0.266
Obligation Variables (3, 107 d.f.)		0.809		0.045
Log-Likelihood Function	-472.7			
Chi-Squared Statistic Significance of Regression (27 d.f.)	91.300			
Significance Level (P-Value)	<.0001			
Pseudo R-Squared	0.088			

* Asymptotic t-test of $\beta = 0$.
** F-test of $\beta + \delta = 0$.
The p value is the exact significance of committing a Type I error.

Source: Survey data.

enter positively and significantly in the high-penalty allocation rule. Two – land sufficiency and the average physical product of peanut seeds – are significant at the $P \leq 5$ per cent level, while one – the male labour force – is significant at the $P \leq 10$ per cent level. Somewhat surprisingly, only two of the repayment/obligation variables – SONACOS employment and being a member of the *section* board – are significant. None of the obligation characteristics significantly enters the high-penalty rule. Focusing our attention on the two unambiguous categories, F-tests of joint significance (presented at the bottom of Table 5) give results consistent with appropriate screening: the repayment characteristics are jointly highly significant while the obligation characteristics are not significant ($\beta_r > 0$, $\beta_o = 0$). This represents the vertical credit isoquants described in section IV. The results further suggest that the intermediaries screened on the basis of the productive capacity of potential borrowers, rather than on their ability to repay the loan from other sources or from their wealth reserves.

The results in the low-penalty period look quite different. Two of the three obligation characteristics – being a relative of the intermediary and being a member of the ruling party – enter the low-penalty allocation rule positively and significantly. The three repayment variables that were significant in the high-penalty rule are no longer significant. However, one repayment variable – the number of draft animals – does enter significantly. The two site-specific repayment/obligation characteristics again enter significantly. It thus appears that the intermediaries changed their screening behaviour dramatically when the default penalty fell. The F-tests of joint significance reveal that this was indeed the case: the obligation characteristics are now jointly significant while the repayment characteristics are jointly not significant ($\beta_o > 0$, $\beta_r = 0$). This represents the limiting case described at the end of section IV: the credit isoquants went from vertical in the high-penalty period to horizontal in the low-penalty period.

These results suggest that the intermediaries were highly sensitive to changes in their perceived default penalty. In the normal year, when the penalty was high, it appears that borrowers were chosen on the basis of their productive capacity. In the election year, when the penalty was low, repayment considerations apparently no longer played an important role in the lending decisions of the intermediaries, and credit was allocated to those individuals likely to give high obligation returns. It seems likely that these changes had substantial consequences. In the next section we thus examine how the change in screening behaviour affected the expected efficiency of credit allocation and the resulting likelihood that borrowers would be able to repay their loans.

VII. EFFICIENCY CONSEQUENCES OF THE CHANGES IN ALLOCATION RULE

Peanut seed credit is most efficiently allocated when it is delivered to those individuals who produce the most peanuts from the available seed. We use the 1989/90 measure of the average physical product of peanut seeds to represent the amount of peanuts each individual would produce from a given amount of seeds. In Table 6, we present the mean values for the average physical product of peanut seeds for recipients and non-recipients of credit in 1992/93 and 1993/94. A t-test of means indicates that the recipient group had significantly higher productivity farms than the non-recipient group in the high-penalty year, but that there was no significant difference between recipient and non-recipient groups in the low-penalty year.

TABLE 6

AVERAGE PHYSICAL PRODUCT OF PEANUT SEEDS (KGS PRODUCTION PER KG SEEDS) FOR RECIPIENTS AND NON-RECIPIENTS OF SECTION VILLAGEOISE SEED CREDIT, 1992/93 AND 1993/94

Production Year		Average Physical Product of Seeds Recipients	Non-Recipients	Significance of Difference* (P-Value)
1992/93	Mean	13.56	10.88	0.01
	Standard Error	3.97	4.54	
1993/94	Mean	12.08	12.24	0.92
	Standard Error	3.86	6.03	

* T-test of difference of means.Source: Survey data.

We can approximate the expected productivity of the observed credit allocation in each year by

$$Q_t = \frac{\sum_i q_i K_{it}}{\sum_i K_{it}},$$

where K_{it} is the amount of credit individual i received in year t and qi is the average physical product of peanut seeds for individual i. The resulting measure, Q_t, is a weighted average of individual productivities, where the weights are each individual's share of the total credit allocated in each period. The results, presented in Table 7, show that expected productivity expressed as kilograms production per kilogram seed, fell substantially, from 13.74 to 12.22, a decline of more than 11 per cent.

The selection of individuals with lower productivity farms meant that

the loan recipients be would less likely to be *able* to repay their loans. In addition, since there was a general expectation that the state would tolerate a higher level of default in 1993/94, they would probably be less *willing* to repay. Both factors are likely to have contributed to an increase in the default rate for 1993/94 and a substantial burden of defaulted loans.

TABLE 7

EXPECTED PRODUCTIVITY OF THE OBSERVED CREDIT ALLOCATION, 1992/93 AND 1993/94

Production Year	Expected Production*	Total Seeds Distributed (kgs seed)	Expected Productivity (kgs production/ kgs seed)
1992/93	32287	2350	13.74
1993/94	46997	3847	12.22

* Sum over the sample of (productivity of seeds * quantity of seeds received).
Source: Survey data.

VIII. DISCUSSION OF RESULTS AND CONCLUSIONS

The results of this analysis have important implications for credit market policy in developing countries. The absence of viable financial services for agricultural producers severely constrains agrarian development, particularly in sub-Saharan Africa, and lender–borrower information asymmetries severely constrain agricultural credit market development. The example of the *sections villageoises* suggests that, given appropriate incentives, village intermediaries can effectively mitigate the asymmetric information problem between a formal lender and rural borrowers. When the intermediaries of the *sections* expected to face a substantial penalty for borrower default, they allocated credit to 'good' borrowers, that is, those who would make the most productive use of the credit resources and who would be most able to repay their loans. If this outcome can be replicated, in the *sections* themselves and in other contexts, the use of village intermediaries would represent a promising approach to financial intermediation that serves the needs of both rural producers and formal lenders.

These results also suggest the need to proceed with extreme caution, however, for when the intermediaries perceived a change in their incentives they dramatically changed their lending behaviour, allocating limited credit resources to individuals less likely to repay their loans. One such 'off' year could compromise the viability of most credit programmes. Extreme care

will be required when structuring the incentives of village intermediaries, and this should include recognition of competing objectives that could affect intermediary behaviour. It is only when the intermediaries see it in their own best interests to make 'good' lending decisions that their actions will contribute to the emergence of sustainable rural credit markets.

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NOTES

1. A recent analysis of the Grameen Bank calls into question the importance of the group-lending structure (specifically, joint liability) in the Bank's success, however [*Jain, 1996*].
2. We emphasise the likelihood of repayment in our definition of appropriate screening to focus on the sustainability of the lending arrangement. Alternative definitions of screening behaviour, that is, 'appropriate' are, of course, possible. For example, if lending were to be targetted to specific groups to achieve redistributive goals, the appropriateness of the intermediariy's screening behaviour might be evaluated according to the wealth or income levels of credit recipients.
3. In the study area, all the intermediaries of the *sections* are men.
4. Fafchamps [*1992*] describes similar, informal reciprocal arrangements for mutual insurance schemes in rural communities.
5. All but one of the prospective borrowers in the sample were men.
6. This assumption is consistent with the findings of Zeller [*1994*] and Udry [*1990*].
7. The sampling and household-level survey methods used in the IFPRI/ISRA study are detailed in Kelly and Reardon [*1989*] and Fall, Kelly and Reardon [*1989*]. In each survey village, sample households were selected at random from the pool of all agricultural households after 'uncooperative and very atypical households' were removed.
8. These data are for 1988–89, however, a year in which the harvest was poor. In 1989–90, the harvest was better and the mean figures are $166.4 for total net income and $119 for crop and livestock income. We use the 1988–89 figures in the table because the disaggregated figures (for calculating the standard deviation) were not available for 1989–90.
9. While 96 per cent of the sample is Moslem and Islamic law prohibits charging fixed interest on loans, it appears that this is largely ignored.
10. This is consistent with non-negligible transactions costs in seeking out loans – rational borrowers internalise the intermediary's allocation rule to avoid costly unsuccessful attempts at borrowing. A number of normal years in succession presumably gave potential borrowers a fairly clear picture of this allocation rule.

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