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A THEORY OF IMPERFECT COMPETITION IN RURAL CREDIT MARKETS IN DEVELOPING COUNTRIES: TOWARDS A THEORY OF SEGMENTED CREDIT MARKETS

June, 1993

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Working Paper No. 58

This publication was made possible through support provided by the U.S. Agency for International Development, under Cooperative Agreement No. DHR-0015-A-00-0031-00.

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A THEORY OF IMPERFECT COMPETITION

IN RURAL CREDIT MARKETS IN DEVELOPING COUNTRIES:

Towards A Theory of Segmented Credit Markets

Preliminary draft, last revised June 1993

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Abstract. We set out a stylized representation of a rural credit market in a developing country in which the enforcement and screening technology is very limited: Banks can lend only to large farmers on the basis of land collateral, and small farmers can borrow only from moneylender-traders who market their output. We show that an expansion of bank credit has an ambiguous effect on the interest rate that moneylenders charge. The model thus provides a framework that can explain the failure of the expansion of rural banking in Asian developing countries to produce the anticipated dramatic reduction in small farmers' cost of borrowing.

Acknowledgements. Earlier drafts of this paper benefitted from comments by Tim Besley, Tim Guinnane, Anjini Kochar, Jenny Lanjouw, Peter Lanjouw, Ron McKinnon, Nicholas Stern, Chris Udry, and the participants in seminars at the London School of Economics, INSEAD, [illegible] University of Maryland, Princeton University, West Virginia University, and Yale University. Hoff's work was supported by the project on Institutional Reform and the Informal Sector (IRIS) at the University of Maryland; Stiglitz' work was supported by the Institute for Policy Reform (IPR).

"...[it is a] nearly universal fact that the poorest strata of the peasantry in many underdeveloped countries rely heavily, if not exclusively, on private moneylenders and not on sources of institutional finance. Indeed, financial institutions like banks and credit cooperatives typically do not consider them creditworthy, but paradoxically enough, private moneylenders do consider them creditworthy for advancing loans." (Amit Bhaduri, "Moneylenders," in The New Palgrave, 1987)

The prevailing models of credit markets generally assume that the information asymmetries and enforcement costs between a given buyer and lender are the same for all lenders. For example, in Stiglitz and Weiss (1981, 1983), lenders were homogeneous, borrowers were heterogeneous but, in the absence of some screening mechanism, observationally the same to the lender; the analytical problem was to design an indirect mechanism to screen out the riskiest borrowers and the riskiest projects. But in small, local markets some lenders have the ability to obtain virtually complete information about the creditworthiness of a prospective borrower, and thus they do not rely on indirect screening mechanisms at all, as emphasized particularly in studies of rural credit markets in developing countries (see the discussions in Siamwalla et al. 1990, esp. pp. 288-290, Bell 1990, esp. pp. 312, 323, and Udry 1990). While a national bank that deals on an impersonal basis with loan applicants may have very incomplete information about their creditworthiness, a local bank who has a longstanding relationship with a firm, or a trader-moneylender who has marketed a farmer's crop for many seasons, may have nearly complete information.

A second limitation in the applicability of prevailing models of credit markets is that they abstract from the problem of enforcement.[1] That abstraction is appropriate when the objective is to model an impersonal lending market in an economy with low-cost mechanisms of third-party enforcement available to all lenders. But in many developing countries, or in the case of loans in very

[1]For example, in Stiglitz and Weiss (1981), private information held by borrowers regarding the choice of project to be undertaken created an agency problem for lenders, but enforcement of claims contingent on public information did not.

small amounts, resort to formal law enforcement may provide a doubtful remedy. Lenders may therefore devise alternatives to formal law enforcement, and there are large differences among lenders in their ability to do so. Local or informal credit markets are often embedded in a social and economic context that facilitates enforcement of debt. A lender with strong social ties to a borrower may be able to rely on social pressure. A trader-lender who markets a farmer's crop may be in a good position to ensure repayment by collecting it at the threshing floor. Less benignly, an informal lender may be able to prevent wilful default by the threat of violence.

But such enforcement measures are not generally available to national banking institutions. In developing countries, formal lenders' limited enforcement and screening technologies help explain the fact that most formal lending is to large farmers who offer land as collateral.[2]

The differences among lenders in the ability to sort good borrowers from bad and to enforce repayment explain the persistence in many economies of credit markets that are segmented, with some borrowers having access only to a local credit market rather than to the lower cost national market; or some borrowers having access only to a moneylender, rather than to the lower cost local bank. This paper constucts a simple economic model of a credit market that is segmented between a formal and an informal sector. In the formal sector, institutional lenders provide intermediation between borrowers and depositors or the government and have very limited means of screening borrowers and

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[2]For example, for each of four Thai provinces, the percentage of formal loans backed by land collateral or by a group guarantee (a form of lending used by banks that we discuss in section III), ranged from 68 to 100 percent; whereas the comparable statistics on the percentage of informal loans backed by land collateral ranged from 5 to 14 percent (Feder et al., 1988), table 11, p. 54, reproduced in Oncham, 1992, table 3, p. 109. Econometric tests suggests that land titles are a binding constraint on borrowing and on investment in agriculture (Feder et al., 1988). In South India, a major form of agricultural lending is so-called "jewel loans," short-term credit given against the physical security of gold held in the branch safe. In his survey of 30 branches of banks in Tamil Nadu state, Wiggins (1992, p. 51) found that the median share of each bank's agricultural loans that were backed by jewels was 83 percent of its loan advances. [I have to check this paper and clarify this statement. Also I need to add a fn. from Claudio on the fact that many of these transactions costs are shifted to borrowers, and may make their effective interest rate from the formal sector very high.]

enforcing loans. In the informal sector, private individuals provide credit largely out of their own equity and have a richer set of monitoring and enforcement technologies. We use the model to address the question, Will an expansion of institutional credit expand borrowing opportunities to those who rely on the informal creidt sector?

This question is especially important in developing countries. The informal credit market represents in many developing countries half of the total credit market;[3] the gap between formal and informal rates is very large; and advancement of credit has been a major strategy of agricultural development and aid to the small farmer. In India and Thailand, for exmaple, government has succeeded in generating a massive expansion of formal credit in rural areas (Bell 1990, Siamwalla 1990). But government, facing the same (or higher) costs of information and enforcement as commercial banks, has by and large not succeeded in lending directly to the small farmer.[4] Although it is difficult to gather reliable data on interest rates charged by moneylenders, the evidence that exists is that the hoped-for dramatic reduction in the interest rates of rural moneylenders has not occurred. In Thailand, where the rural credit system has been subject to exceptionally intense study, there is evidence that the interest rates that moneylenders charge have been stable despite the massive injection of funds into the rural sector. In Thailand, larger, wealthier farmers generally have access to some funds at 12 percent, while others, with simlar or lower default rates, pay annual interest rates of 70

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[3]Estimates of the share of informal credit in total sources of credit to agricultural households in 11 low-income countries range from 30 percent to over 80 percent (Germidis 1990, Table 1).

[[I'm looking for measures of the size of the informal credit market. One very indirect measure is that (as reported in a talk by Larry Summers) 30 percent of households in the U.S. do not have a bank account.]

[4]Lipton and Toye (1989, Ch. 5) examined World Bank projects involving rural credit in India and found that the majority excluded farmers with less than 2.5 or sometim 5 acres, or tenants, or both. By this means, several major World Bank-assisted credit projects completed in the 1980s excluded more than half the farm households, although the credit was supposed to be for smallholders.

percent on six-month lonas (Siamwalla et al., 1990; Oncham 1992, p. 108 and citations therein).

This result is puzzling. Existing models of credit markets, whether they entail competitive market-clearing, rationing, or monopoly, predict that when the supply of credit is increased through provision of loans to any set of agents, there will be some *trickle-down* effect to other borrowers:[5] Creation of new sources of credit should increase the competitiveness of the credit market; and because those who obtain the credit from the new source would normally borrow less from their initial suppliers of credit, the reduction in demand would further tend to drive down interest rates. Thus, according to the standard models, even if the *direct* beneficiaries of government credit programs are large landowners, the eventual beneficiaries should include small farmers. In contrast, the central result of this paper is that an increase in formal credit has an *ambiguous* effect on the interest rates charged by informal moneylenders.

The credit market in developing countries appears to be a kind of *matching system*, where different prospective borrowers are sorted across different lenders according to the ability of a given lender to differentiate among borrowers and to enforce repayment by a given borrower. For example, only a farmer with land collateral (or in a group lending program) can be matched with a bank. A tenant can be matched with his landlord, where labor bonding provides collateral or where default on a loan is punishable by evicition from the land (see Esguerra and Mayer 1992 on the Philippines). Only an individual who markets his surplus through a trader can be matched with that trader-lender, where traders have the ability to collect directly from the borrower's farm at the time of harvest, and who through long-term relationships with the borrower have virtually complete knowledge of his productivity.[6]

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[5]The only exception is the case of perfectly discriminating monopoly.

[6]Our analysis thus complements that of Rey and Sengupta (1989, section 3) and provides an alternative to the theory of the interlinking of credit contracts in Braverman and Stiglitz (1981), which focuses on the use of interlinkage as a means of mitigating moral hazard. In a more complete model,

The trader-lender is the example of the informal lender that we model in this paper. The trader-lender plays a dominant role in informal credit markets in commercialized rural areas in various parts of Asia that have been subject to intensive filed studies--see Table 1 and Aleem (1990), and the discussion in section IV below. Characteristic of trader-lenders is that they screen a prospective borrower by requiring him to market their output exclusively through him. And while a loan is outstanding, the borrower is required to continue to use the trader-lender as his exclusive marketing agent. Thus there is an on-going screening process that "makes information on the size of the borrower's operations (and their changes) available to the creditor and to no one else.." (Siamwalla et al, p. 282). In contrast to indirect screeing mechaisms--via price-setting and collateral requirements as emphasized in Stiglitz and Weiss 1981, 1983 --the direct screening process creates relationship-specific capital between the borrower and lender that insulates the lender's market from competitors even when his charges exceed the marginal cost of lending. This relationship-specific capital is further enhanced by the fact that the borrower has imperfect information about his opportunities to borrow from other lenders, both because he may not know fully the terms they offer to a farmer of his "type," and because the outcome of any new screening process is uncertain.[7] Thus we will argue, following Aleem 1990, that the market structure of the informal credit sector is monopolistically competitive.

In the model, the ability to enforce loan contracts provides a return to becoming a trader that induces entry into that activity by those who have funds. The rents to those who have the ability to enforce credit contracts are dissipated through excessive entry. By the same token, an expansion of

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the two explanations would be complementary.

[7]As Salop (1976, p. 243) has emphasized, such an information asymmetry means that there are "effectively 'moving costs' of uncertainty from changing [suppliers]. If those costs are high enough, every firm can act like a complete monopolist over its segment of the market." In the market for trade-linked credit, changing moneylenders imposes the additional cost of undergoing a possibly year-long screening process during which the small farmer may be unable to obtain loans from either his current or former trader.

funds from banks, with the additional funds going to farmers who can offer titled land as collateral, may induce further entry by landowners into the trader-moneylending sector. The induced entry leads to higher excess capacity among trader-moneylenders and higher average costs, while search externalities among trader-lenders may lead to higher marginal costs of lending. Moreover, because funds from banks are, in general, rationed, the subsidy to moneylenders is infra-marginal; there is no direct pass-through of the lower borrowing rate faced by moneylenders to those to whom they lend. We show that rather than being passed on to the small farmer, the credit subsidy may be partly absorbed in the reduced efficiency of the informal moneylending-trading sector. Indeed, it is even possible that an expansion of formal credit to landowners *increases* the equilibrium interest rate charged by informal lenders. Hence, the general equilibrium effect of government credit intervention, as well as the direct effect, may fail to benefit the small farmer.

Informal rural credit markets in developing countries range along a continuum, with moneylenders exercising a greater or lesser amount of market power. The basic model presented in section I is intended to describe the monopolistic end of the spectrum where the only form of competition among informal lenders is entry competition. The more general model presented in section II is intended to describe the middle of the spectrum where the interest rate that an informal lender chooses depends on the interest rate charged by other moneylenders. We show that an expansion of formal credit is *more* likely to drive down informal interest rates when moneylenders engage in price competition. This accords with economic intuition: there is greater pass-through of subsidies in a more competitive than in a less competitive sector. To put it in a less formal way, the more usurious the moneylender appears, the less likely that he can be "put in his place" through the traditional policy instrument of expansion of institutional credit to the rural sector.[8]

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[8]The quotation is from a 1954 statement of the Reserve Bank of India's policy objectives in expanding institutional credit (Reserve Bank of India, All-India Rural Credit Survey, vol. 2, pp. 481-2, cited in Bell, 1990, p. 297.)

I. THE BASIC MODEL

1. Set-up of the model

This section explores the effect of the expansion of institutional credit in the rural sector assuming that:

(A.1) Credible promises of debt repayment can be made only between (a) institutional lenders and large farmers with land collateral and (b) trader-moneylenders and their clients.[9, 10]

(A.2) The only competition in the informal credit sector is entry competition, not price competition.

The economy consists of large landowners and small landowners. Large landowners are endowed with labor and liquid capital, K, as well as land. A large landowner allocates his liquid capital between on-farm investment, R, and lending. His output depends on his land, labor, and on-farm investment, but since we will hold his land and labor constant throughout, we can write his production function as F(R), with $F' > 0$ and $F'' \leq 0$.

Individuals trade part of their agricultural output for an importable consumption good, and the price ratio is set at one in world markets. Exchange entails a fixed cost: each trader must have one warehouse. A small landowner can borrow only from traders since, given (A.1), only traders can enforce the repayment of debt. Trader-moneylenders have the information to ensure that an individual borrows from at most one trader-moneylender in a given season.

A trader-moneylender's costs consist of three components: a fixed cost δ per period of the

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[9]This assumption is stronger than needed to obtain our results; we will show that our results will not change if there is lending between large farmers on the basis of land collateral.

[10]In this simplified model, we ignore the lending activity between landlords and their tenants. One could suppose that tenants work the land of absentee landlords (a pattern typical of South India), and that agency problems are sufficiently severe to give the trader-lender some economic advantage over the absentee landlord. The formal structure of the model of this section would be unchanged by introducing such tenants.

warehouse;[11] the cost of funds foregone from his own farm; and a non-pecuniary cost of effort to obtain information about the productivity of prospective borrowers and to enforce repayment. For simplicity, we assume that there are no marginal costs of storage/trading.[12]

An implication of this assumption and the assumption that traders engage in price competition is that they will charge nothing for the services of storage/trading. To see this, observe that large landowners who are not themselves traders are indifferent between the services of any two traders who charge the same price. A Bertrand Nash equilibrium will entail a zero charge for trading services since marginal costs are zero.[13] This, in turn, implies that all traders will be moneylenders since only in that way can they cover their fixed costs of trading and still compete with trader-lenders. (We already know that all moneylenders will be traders, since only in that way can they ensure repayment.)

We simplify the analysis by assuming that there are only two types of borrowers, "good" borrowers, who, with sufficient attention to repayment, will always repay their loans, and "bad" borrowers, who, with any reasonable level of expenditures on enforcement, still will not repay their loans (e.g., simply because their output is too small). We assume that, with adequate screening activities, a moneylender can sort out good from bad borrowers, and that it always pays moneylenders to incur not only those costs, but also the costs required to have debt contracts enforced.[14] Thus, in this simplified model, the probability of repayment is one. There are N trader-lenders, and Z good

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[11]The fixed cost may be viewed as including a rental charge for the warehouse if renting is possible, or one may suppose that there is a resale market so that a fixed rent can be imputed.

[12]All that our analysis really requires is that the average costs of trading/warehousing/storage within the relevant region are declining in the amount stored.

[13]In a more general model in which we explicitly modelled transportation costs involved in trading, the market for trading services as well as the informal credit market would be monopolistically competitive. The qualitative nature of our results do not depend sensitively on this simplification.

[14]In other words, so long as the probability of repayment is less than one, the marginal return to an increase in screening and enforcement activities exceeds the marginal costs.

borrowers. The N moneylenders divide the market symmetrically, each getting Z/N.[15] The model examined here abstracts from the dynamics of short-run adjustment.

The amount borrowed by each borrower is a function of the interest rate charged

(1) $$z = z(i),\ z' < 0,$$

At higher interest rates, small landowners borrow less.[16] The total amount lent by any moneylender is thus L, where

(2) $$L = z(i)\frac{Z}{N} \equiv z(i)\,m$$

and m is the number of borrowers per lender. Equation (2) defines the inverse demand function:

(3) $$i = i(L,N),$$

with

(4) $$-\frac{\partial \ln i}{\partial \ln L} = -\frac{\partial \ln i}{\partial \ln N} = \eta > 0$$

where $$\eta \equiv -\left(\frac{d \ln z(i)}{d \ln i}\right)^{-1}$$

The proportional price response to an increase in supply is the same whether the increase comes from

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[15]We will assume that the total number of borrowers, Z, is fixed. We could, alternatively, and perhaps more reasonably, assume that Z represents the total *potential* supply of good borrowers. The actual number to whom the moneylender lends is thus some number $Z^*/N \leq Z/N$. How this alters the trader-moneylender's maximization problem is described in a footnote below. We leave to future work how this alters the general equilibrium problem. Presumably at low levels of G, Z^* increases with an increase in G; at high levels, $Z^* = Z$ and so the analysis is as described above. [We'll ultimately need to link this discussion to the appendix.]

[16]We do not explicitly model the production or financial opportunities available to the small farmer. The function z(i) reflects the reduced-form solution to an optimization program where the small farmer may save and may undertake a variety of activities, both on and off the farm. The nature of his opportunities will affect the elasticity of z(i).

higher lending by each moneylender or from the entry of new lenders. The change will equal the inverse of the elasticity of each small landowner's demand curve, with absolute value denoted η. This result is a formal statement of assumption (A.2).

The nonpecuniary costs incurred by a moneylender in screening and enforcement depend on both the amount lent and the number of individuals to whom he lends. We thus postulate that these screening and enforcement costs are a function[17, 18]

$$C = C(L,N) \tag{5}$$

We assume that

$$C_L > 0, \quad C_{LL} > 0 \tag{6}$$

The borrower's incentive not to repay a loan and the proclivity to engage in risky activities both increase with the amount due (see, for instance, Stiglitz and Weiss, 1981). As more is lent, the marginal monitoring and enforcement costs will therefore tend to increase, and to do so at an increasing rate. These considerations also motivate the assumption that

$$C_{LN} > 0.$$

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[17]If the total number of small landholders who receive credit is endogenous, i.e., where $Z^* \leq Z$, then (3) would be $i = i(N,L,m)$ and (5) would be $C = C(N,L,m)$. The moneylender would simultaneously choose m and L to maximize profits. Given any optimal solution for L, the trader-moneylender would solve

$$\max_{\{m\}} \; i(L,N,m)L - C(L,N,m)$$

The solution yields $m = m(L,N)$. Substituting this into the functions for i and C yields

$$i = i(L,N,m(L,N)) \quad \text{and} \quad C = C(L,N,m(L,N)),$$

which are functions of L and N alone.

[18]It is reasonable also to suppose that screening and enforcement costs increase with the interest rate charged (see Eaton and Gersovitz [1981], Eaton, Gersovitz, and Stiglitz [1986], or Allen [1985]). Thus, we obtain $C = C(N,L,i)$, with $C_i > 0$. Nothing in the later analysis is affected by this generalization.

In the appendix, we present models of the monitoring and the search technology that have the property that $C_{LN} > 0$.

We do not need to fix the sign of C_N, but we will shortly use a stability argument to place bounds on its magnitude.

The trader-lender solves the following maximization problem

$$\underset{(L)}{Max} \left\{F(K - \delta - L + G) - C(L,N) + i(L,N)L - rG\right\}$$

where G is the amount of institutional lending to the large landowner, and r is the interest rate charged. Throughout the analysis, we assume that G is rationed. The trader-lender thus serves as a "retailer" of institutional funds to the small landowner, as illustrated in Figure 1.

In choosing the amount to lend, the moneylender compares the return he obtains on his farm to the return he obtains from lending, taking into account (a) the fact that to lend more he must reduce the interest rate charged, and (b) the effect on non-pecuniary screening and enforcement costs of lending more. His lending activity L is implicitly defined by the condition MC = MR, or

$$F' + C_L = i[1 - \eta] \tag{7}$$

The second-order condition requires

$$\Delta \equiv F'' - C_{LL} + 2\frac{\partial i}{\partial L} + L\frac{\partial^2 i}{\partial L^2} < 0. \tag{8}$$

We can now analyze the effect of an increase in institutional credit, G, on the interest rate moneylenders charge and the amount they lend. The two are closely linked. Using (2)

$$Zz'(i)\ \frac{di}{dG} = L\ \frac{dN}{dG} + N\ \frac{dL}{dG} \tag{9}$$

We will show that in the basic model, an increase in G always leads to an increase in the number of moneylenders, N. It is apparent from (9) that this effect tends to decrease i, as one might expect. On the other hand, it is possible that an increase in G leads each moneylender to lend *less*, so much less that interest rates actually increase, and the total amount lent (NL) actually falls. The reason for this perverse result is that entry induced by institutional lending raises each trader-lender's marginal cost of screening and enforcement (since $C_{LN} > 0$), raises his average fixed costs per borrower ($\delta N/Z$), and may also reduce the marginal revenue from lending ($i(L,N) + L\partial i/\partial L$). These effects may more than offset the reduction in trader-lenders' opportunity cost of funds, and the resulting contraction in L may more than offset the expansion in N. Before turning to the formal exercise, we provide a heuristic diagrammatic interpretation.

2. Diagrammatic Interpretation

Given a fixed number of trader-lenders, each will face a downward sloping demand curve for loans. The fixed costs of being a trader imply that his average cost curve is U-shaped, as depicted in Figure 2. Marginal costs of lending are increasing because (in this simplified version) to enforce contracts when borrowers have more debt outstanding and thus have more to gain by abrogating them, costs more.[19]

The free entry equilibrium is depicted as the tangency between the demand curve and the U-shaped average cost curve (a standard Chamberlinian equilibrium, where the demand curves drawn are those facing the trader-lender, not the industry). Increased government lending to large farmers reduces the marginal cost of lending (since with more funds and dimininishing returns to capital invested on the land, the opportunity cost of capital declines), so the average cost curve shifts down.

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[19]In practice, rather than confront these possibly steeply rising costs, lenders may attempt to recruit more "good" borrowers, but this too may face increasing marginal costs. In the basic model, this possibility is ignored.

At the initial number of trader-lenders, the activity now yields strictly positive profits, and so more large landowners become trader-lenders. With a smaller customer base facing each one, his demand curve shifts to the left. At the same time, the entry of new trader-lenders may shift the average cost curve. Normally, as we have already suggested, it would shift the average cost curve up, as the smaller number of borrowers for each moneylender means that the amount lent to each (for any given total lending activity) will increase; and with more lent, the monitoring and enforcement costs also increase.

As these shifts occur, eventually a zero-profit equilibrium is attained. It will normally entail each lender lending less, but whether interest rates are lower or higher--i.e., whether each borrower gets more or less funds--is ambiguous, as illustrated in Figure 3. An equilibrium is characterized by the conditions that

$$AC = i$$

and

$$\frac{dAC}{dL} = \frac{di}{dL},$$

which together impliy that in the equilibrium, the elasticity of the average cost curve equals the elasticity of the demand curve:

$$-\frac{d\ln AC}{d\ln L} = \eta$$

If at the initial interest rate, the elasticity of demand is unchanged by changes in N,[20] then the RHS of the equation above is, at the initial i, unchanged and what is at issue is only the effect on the elasticity of the AC curve. If the initial increase in N also leaves the elasticity of the AC curve

[20]Since L = z(i)Z/N, this is the case when the number of borrowers to whom a lender would wish to lend does not change as L changes.

unchanged, then the initial interest rate will still be an equilibrium point (Figure 3A). If the initial increase in N raises the elasticity of the AC curve, then the demand curve at the initial interest rate will cut the new AC curve from below (i.e., from the east), and lenders will perceive that they can increase profits by lowering the interest rate. The new equilibrium interest rate, labelled i_1 in Figure 3B, will therefore be less than the initial interest rate, i_0. If, on the other hand, an increase in N lowers the elasticity of the AC curve, then the demand curve at the initial interest rate will cut the new AC curve from above, and the interest rate will increase, as shown in Figure 3C.

To focus solely on the new elements introduced in this model -- the lender's overhead cost (δ) and screening/enforcement cost (C), let us abstract for the moment from the financial cost of lending by setting $F'(R) = 1$, which means that the time value of money is zero. Then the average costs of lending are just

$$\frac{\delta + C(L,N)}{L} + \rho(LN,G)$$

[Need to add discussion of ρ as the average shadow price of capital.]

It is easy to check that the elasticity of average costs with respect to L would be unchanged by new entry if screening and enforcement costs were fixed exogenously. With endogenous screening and enforcement costs, the elasticity may either increase or decrease, and hence the interest rate may either decrease or increase.[21]

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[21]A formal proof which is not based on the simplifying assumptions of this section will follow. In our heuristic interpretation, we only need to ascertain what happens to the elasticity of the AC curve, i.e.,

$$-\frac{d\ln AC}{d\ln L} = 1 - \frac{LC_L}{\delta + C}$$

We wish to know how this changes with N, where as N increases, we reduce L proportionately so as

3. Effect of an Increase in Formal Credit on the Number of Trader-Moneylenders

We now show formally that an increase in G, the amount made available through the rural credit program, induces entry into the trading-moneylending activity. Abstracting from problems of discreteness, the free entry condition into that activity implies that the returns to being a trader-moneylender (with the residual of one's capital being used in farming) equal the returns to remaining a pure farmer:

$$(10) \qquad V(N,G) \equiv \underset{\{L\}}{Max} \left\{ F(K - \delta - L + G) + i(L,N)L - C(L,N) - rG \right\} = F(K+ G) - rG$$

A stability argument yields the result that

$$(10a) \qquad \frac{\partial V}{\partial N} = L\frac{\partial i}{\partial N} - C_N < 0$$

For if not, then as N increased, the return to being a trader would increase, and the equilibrium would be unstable. That is, assume initially that we were in an equilibrium, with N* traders, with the return to being a trader equalling that to not being a trader (equation 10 holds), then if one more farmer should happen to become a trader, the return to being a trader would exceed that of not being a trader, and hence still more large landholders would be induced to become traders.

Applying the envelope theorem to the left-hand side of (10) yields

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to keep i unchanged along the demand curve. Thus,

$$\frac{-d\left(\frac{d\ln AC}{d\ln L}\right)}{d\ln N}\Bigg|_{LN=constant} = -\frac{L[NC_{LN} - LC_{LL} - C_L]}{\delta + C} + \frac{LC_L[NC_N - LC_L]}{[\delta + C]^2}$$

which may be either greater or less than zero.

$$\frac{dV}{dK} = F'(K - \delta - L + G) > F'(K + G).$$

The marginal product of capital is greater for a trader-lender than for a landholder specialized in farming and, thus, a marginal increase in credit availability increases the number of trader-lenders. Letting the subscript 1 refer to the pure farmer and the subscript 2 to the farmer-trader-moneylender, and implicitly differentiating (10) yields

$$\frac{dN}{dG} = \frac{F'_2 - F'_1}{C_N - L\frac{\partial i}{\partial N}} > 0, \tag{11}$$

as was to be shown.

Finally, one should consider the possibility of lending by large non-trader farmers to trader-farmers; that is, relaxing (A.1) above. Such lending would mitigate the need for additional expenditures on warehouses. But large farmers who lend to traders also need to enforce those loans, and so it is plausible that they will require collateral. Assuming that there is a limit on the amount of collateral that a trader-lender has, then once that limit is reached, any increase in institutional lending to large farmers, and thus any increase in the trader's mortgaging of his land, will crowd out intra-sectoral lending on a one-for-one basis and our results are strengthened. An increment in G will be offset by a reduction in lending from large farmers to farmer-trader-lenders, which in turn will tend to induce more large landowners to enter the trader-moneylending sector. Induced entry will be *larger* in this case than occurred in the absence of assumption (A.1) of no intra-large farm sector lending.

What drives the result that an increase in institutional lending induces entry into trading and

moneylending is thus *not* the restrictive assumption of no lending by large farmers to traders, nor the absence of investment opportunities other than informal lending, trading, and farming, but only the assumption that, at the margin, trader-moneylenders have lending or investment opportunities that dominate those of non-trader-lenders. This assumption implies that after government extends institutional credit to all large farmers, the marginal utility of money to a trader will exceed the marginal utility of money to a non-trader, so that (from equation (11)), entry into trading and moneylending will occur.

Using a Taylor series expansion of (11) we can approximate the proportionate increase in the number of traders:

$$\frac{d \ln N}{dG} \approx -F'' \frac{[\delta + L]}{C[\nu + \alpha\eta]} \tag{12}$$

where F"(R) is evaluated at the level of on-farm investment by the farmer-trader-moneylender; $\alpha \equiv iL/C$, the ratio of revenues from lending to screening/enforcement costs; and $\nu \equiv C_N N/C$, the elasticity of C with respect to N. In accord with intuition, the induced entry is greater (i) the more rapidly marginal returns to capital invested in farming diminish (the greater is -F″), (ii) the smaller the effect of entry on total screening and enforcement costs (the smaller is ν), and (iii) the greater the elasticity of demand for credit (the smaller is η).

4. Effect of an Increase in Formal Credit on the Volume of Informal Lending

We now totally differentiate the lender's first-order condition in (7) to obtain

$$\frac{dL}{dG} = \frac{-F'' + \left[-C_{LN} + \frac{\partial i}{\partial N} + L \frac{\partial^2 i}{\partial L \partial N}\right] \frac{dN}{dG}}{-\Delta} \tag{13}$$

Since $C_{LN} > 0$ and $\partial i/\partial N < 0$, it is apparent that the volume of loans made by a single moneylender could fall as a result of government lending.

To see whether *total* lending will fall (and so informal sector interest rates rise), we substitute (12) and (13) into (9) to obtain

$$(14)\quad sign\ \frac{d(NL)}{dG} = sign\ [-F''] \left\{1 + \left[\frac{\delta + L}{C[\upsilon - \alpha\eta]}\right]\left[-F''L + LC_{LL} - L^2\frac{\partial^2 i}{\partial L^2} - 2L\frac{\partial i}{\partial L} - NC_{LN} + N\frac{\partial i}{\partial N} + NL\frac{\partial^2 i}{\partial L \partial N}\right]\right\}$$

With diminishing returns to capital invested in farming, $-F'' > 0$. To simplify the remaining expression, note that the inverse of the borrower demand function,

$z(i) = LN/Z$, can be written as $i = \phi(LN)$. Then

$$\frac{\partial i}{\partial L} = N\phi', \qquad \frac{\partial i}{\partial N} = L\phi', \qquad \frac{\partial^2 i}{\partial L^2} = N^2\phi'', \qquad \frac{\partial^2 i}{\partial L \partial N} = \phi' + LN\phi''$$

so that

$$-L^2\frac{\partial^2 i}{\partial L^2} - 2L\frac{\partial i}{\partial L} + N\frac{\partial i}{\partial N} + NL\frac{\partial^2 i}{\partial L \partial N} = -L^2N^2\phi'' - 2LN\phi' + NL\phi' + NL\phi' + N^2L^2\phi'' = 0$$

Thus, the sum of the "i" terms is zero and

$$sign\ \frac{d(NL)}{dG} = sign\left\{1 + \frac{\delta + L}{C\ [\upsilon + \alpha\eta]}\ [-F''L + LC_{LL} - NC_{LN}]\right\}$$

Note that the stability condition (10a) ensures that $\upsilon + \alpha\eta > 0$. To sign the difference

$$LC_{LL} - NC_{LN}$$

we need to put more structure on the fucntion C(L,N), representing each lender's total screening, monitoring, and enforcement costs. A reasonable assumption is that these costs are increasing in the size of loan provided to each borrower (= LN/Z, which we can write as LN since Z is exogenous), and depend as well on the number of moneylenders:

$$C = c(LN)\,h(N), \qquad with\ c' > 0$$

We do not fix the sign of h'(N). Part (ii) of the appendix motivates the assumption that $h' > 0$. But an effect that would operate in the opposite direction occurs if moneylenders are geographically dispersed and if, as the number of moneylenders increases, each lends within a smaller neighborhood of which he has more intimate knowledge. Given this cost function,

$$LC_{LL} - NC_{LN} = -c'N[h + h'N]$$

and so

$$\frac{d(NL)}{dG} \begin{matrix} < \\ = \\ > \end{matrix} 0 \quad as \quad c'Nh\frac{\delta}{\delta+L} + h'N\left[c'N - \frac{c}{\delta+L}\right] \begin{matrix} > \\ = \\ < \end{matrix} \frac{L}{\delta+L}i\eta - F''L$$

or, in elasticity form,

$$\frac{d(NL)}{dG} \begin{matrix} < \\ = \\ > \end{matrix} 0 \quad as \quad \alpha[\beta + \gamma] \begin{matrix} > \\ = \\ < \end{matrix} [1 - \gamma]\beta - \frac{L^2}{C}\left[[1 - \gamma]\frac{\partial i}{\partial L} + F''\right]$$

where

$$\alpha \equiv \frac{d\ln c}{d\ln(NL)}, \qquad \beta \equiv \frac{d\ln h}{d\ln N}, \qquad \gamma \equiv \frac{\delta}{\delta+L}$$

The perverse result that an increase in formal credit G leads to *less* informal lending and *higher*

informal interest rates is thus more likely to occur if (a) the elasticity of screening/enforcement costs with respect to loan size is large (α is large); (b) the fixed costs δ of being a trader are large, (c) the increase in institutional credit has only a small effect on the trader-lender's shadow price of capital (- F″ is small), and if nonetheless (c) the induced entry into moneylending is large because the elasticity of each borrower's demand for credit is large (- $\partial i/\partial L$ is small).

[[The role of β is ambiguous; high β means less entry and thus less increase in loan size per borrower; but high β also means the the direct effect (h') of entry on the marginal costs of lending is large.]]

Finally, note that our central result that an expansion of institutional credit need not lower the interest rates charged by moneylenders is robust under some alternative specifications of the financial opportunities of trader-moneylenders.[22] Suppose that, in addition to lending and farming activities, a trader-lender can invest in outside production activities or outside financial assets. If these outside opportunities have decreasing returns to scale, then our qualitative results are unaffected.[23] If these outside opportunities (such as bank accounts) have constant marginal returns, then the effect is the same as if we fixed F′ in the lender's first-order condition (equation 7). By fixing F′, we fix his shadow price of capital, independent of G.[24]. From (14), it is apparent that d(LN)/dG = 0. Formal sector lending to large farmers will be reinvested in the constant marginal returns financial asset, and the government intervention through G will be equivalent to a lump sum wealth transfer of G[F′ - r] to large landowners.

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[22]These remarks were stimulated by comments and criticisms by Ronald McKinnon.

[23]Intuitively, the presence of alternative financial outlets for trader-lenders means that their shadow price of capital would be higher than it otherwise would be and (in effect) -F″ is smaller than it otherwise would be, so that dN/dG and dL/dG are smaller than they otherwise would be.

[24]In this case, F″(R) is in effect zero.

II. A MORE GENERAL MODEL

The model presented in section I had limited competition among lenders. In setting interest rates, lenders do not worry about losing customers to rivals. There is a certain realism about this assumption in small villages, but in larger villages, there is a potentially important competitive effect. With more firms competing, all of the relevant elasticities are altered. In particular, now a moneylender's abilty to recruit m good customers depends not only on the number of other moneylenders seeking out borrowers, but also on the interest rate they charge, in comparison with the interest rate he charges. We postulate that now

$$m = Z(i,i^*)/N \quad and \; Z_1 < 0, \; Z_2 > 0$$

where i* is the interest rate charged by others. Thus, the total amount of informal credit is

(15) $$LN = Z(i,i^*)z(i)$$

which defines the demand curve facing each moneylender, L(i,i*,N), with the properties

(16) $$\frac{\partial L}{\partial i} = \frac{Z_1 z + Z z'}{N} < 0$$

(17) $$\frac{\partial L}{\partial i^*} = \frac{Z_2 z}{N} > 0$$

(18) $$\frac{\partial L}{\partial N} = -\frac{L}{N}$$

This generalization of demand leaves the lender's first-order condition unchanged, but now he faces a more elastic demand curve than before (noting that $Z_1 < 0$).

In the subsequent comparative statics exercises in the symmetric equilibrium, let

$$i = i^* \equiv i^{**} \tag{19}$$

Demand in general equilibrium depends on

$$LN = Z(i^{**}, i^{**})\, z(i^{**}),$$

so

$$\frac{\partial i^{**}}{\partial N} = \frac{L}{[Z_1 + Z_2]z + Zz'} \tag{20}$$

and

$$\frac{\partial L}{\partial i^{**}} = \frac{[Z_1+Z_2]z + Zz'}{N} \tag{21}$$

The expressions in (20) and (21) are ambiguous in sign since $Z_1 + Z_2$ is ambiguous in sign. It is easy to check that this sum will be zero in the symmetric equilibrium if Z(i,i*) is homogenous of degree zero in its arguments,[25] i.e., if only relative interest rates matter, but in general we will wish to consider the case where the informal credit market is highly competitive, that is, where $Z_2 > Z_1$.

The major alteration from the basic model is that we can no longer use the envelope theorem

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[25]If Z(i,i*) is homogeneous of degree zero in its arguments,

$$Z(ki,ki^*) = Z(i,i^*) \quad \textit{for all } k$$

then

$$iZ_1 + i^*Z_2 = 0,$$

or at the symmetric equilibrium with i = i*,

$$Z_1 + Z_2 = 0,$$

in analyzing the effect of G on the free entry condition; thus, we can no longer solve sequentially, first for dN/dG and then for dL/dG. L is not chosen to maximize the representative moneylender's income, since he ignores the effect his behavior has on other moneylenders' actions. It is more convenient if we take as the control variable i rather than L, with i* of other moneylenders taken as given. Each lender's solves:

$$\hat{V}(i^*,N,G) \equiv \underset{i}{Max} \{F(K-\delta-L(i,i^*,N) + G) + iL(i,i^*,N) - C(L(i,i^*,N),N) - rG\}$$

The first-order condition is

$$L + \frac{\partial L}{\partial i}[i - F' - C_L] = 0 \tag{22}$$

Substituting (19) into (22), the identity

$$\Psi(i^{**},N,G) = 0 \tag{23}$$

results. Substituting (19) into the free entry condition,

$$\hat{V}(i^*,N,G) = F(K + G) - rG, \tag{24}$$

the identity

$$\Lambda(i^{**},N,G) = 0 \tag{25}$$

results.

The partial derivatives that we will need to solve for di**/dG and dN/dG are:

(26a) $$\Psi_G = -L_iF'' < 0$$

(26b) $$\Psi_i.. = L_i..[1 + L_iF'' - L_iC_{LL}] + L_i + L_{i,i}..[i-F'-C_L]$$

(26c) $$\Psi_N = L_N + L_{iN}[i-F'-C_L] + L_iL_N[F''-C_{LI}] - L_iC_{LN}$$

(27a) $$\Lambda_G = F_2 - F_1 > 0$$

(27b) $$\Lambda_i.. = \dot{V}_i.. = [L_i.. - L_i]\left[\frac{L}{-L_i}\right]$$

(27c) $$\Lambda_N = \dot{V}_N = L_N[i-F'-C_L] - C_N$$

The general equilibrium is characterized by

(28) $$\frac{di^{\bullet\bullet}}{dG} = \frac{-\Psi_G\Lambda_N + \Psi_N\Lambda_G}{J}$$

and

(29) $$\frac{dN}{dG} = \frac{-\Psi_i..\Lambda_G + \Psi_G\Lambda_i..}{J}$$

where J is the Jacobian,

$$J \equiv \Psi_i..\Lambda_N - \Psi_N\Lambda_i..$$

As in the preceding model, an increase in institutional lending, G, leads each trader-lender, in the absence of new entry, to lower his interest rate: $\Psi_G < 0$. But in this model, unlike the basic model, each lender's choice of an interest rate reduces the profitability to others of being a trader-lender. Thus we can show two results.

Proposition 1. If in the basic model, $di^{**}/dG > 0$, then in the general model $di^{**}/dG < 0$ provided that Z_2 is sufficiently large.

Proof. The basic model is a special case of the general model where $Z_2(i,i^*) = 0$. Hence (26) and (27) continue to hold, but now $\Psi_{i}.. < 0$ (from the second order condition with respect to i), and $\Lambda_{i}.. = 0$ (since the agent correctly perceives the demand curve he faces). Substitution of $\Lambda_{i}.. = 0$ into (28) yields

$$\frac{di^{**}}{dG} = \frac{-\Psi_G\Lambda_N + \Psi_N\Lambda_G}{\Psi_{i}..\Lambda_N} \qquad \text{(basic model)} \tag{28'}$$

Given (26a), (27a), and the stability condition for the basic model ($\Lambda_N < 0$), a necessary and sufficient condition for (28′) > 0 is that

$$\Psi_N >> 0,$$

so that the numerator of (28′) is positive. But the numerators in (28′) and (28) are the same. From (28), the "perverse" result, $di^{**}/dG > 0$, is avoided iff $J < 0$, which is more likely the larger is $\Lambda_{i}..$; i.e., the larger is

$$\frac{L_{i}.. - L_{l}}{-L_{i}} = \frac{Z_2 z}{-NL_{l}}$$

a rising function of Z_2, as was to be shown.

Proposition 2. It is possible that an increase in G will reduce the profitability of moneylending to such an extent that trader-moneylenders will exit: $dN/dG < 0$.

Proof. Consider again the case described in proposition 1, where $di^{**}/dG > 0$ if $Z_2(i,i^*) = 0$, but $di^{**}/dG < 0$ as $Z_2 \rightarrow \infty$. In that case, we showed that $J < 0$ in the general model. From (29), $dN/dG < 0$ if $-\psi_{i^{**}}\Lambda_G + \psi_G\Lambda_{i^{**}} > 0$. Using (26a), (27a), and (27b), it can be seen that this condition requires that $\psi_{i^{**}} << 0$; that is, that the lender's market power falls sufficiently quickly as i^{**} falls. (But note that in the basic model, an increase in G could never induce exit, for in the basic model $J > 0$, unambiguously).■

[Move III to a short section on extensions.]

III. GROUP LENDING

The message of the basic model was that providing funds to the rural sector, intermediated through large rural landowners, might be ineffective in helping the small farmer, since a part of the implied subsidy would be dissipated through excessive entry of trader-lenders, and of the rest that is not dissipated, it is possible that little or even none reaches the poorest cultivators.

This section considers an alternative way of trying to increase credit availability to small farmers. The central problems confronting institutional lenders were that it could not (at reasonable cost) screen bad from good borrowers, and it could not enforce debt contracts except through land collateral. By transferring these functions to groups of borrowers, who each suffer a penalty for contract nonperformance by any other member of the group, who can easily observe each other and exert pressure on each other to uphold the contract, banks in several developing countries have been able to successfully lend directly to those without land collateral (see Huppi and Feder, 1990). If a member of the group defaults, he is cheating the group, not a stranger or an impersonal organization;

the group suffers because of the resulting cut-off of credit. With relatively immobile populations, a group member's dependence on the good will of all the other members of the group may extend well beyond the fixed term of the group's collective borrowing activity. In this way, *social collateral* replaces material collateral.[26, 27]

We simplify by assuming that with peer monitoring, it now becomes possible for institutional lenders to lend to a fraction β of the small landowners directly. This removes the corresponding number of individuals from the pool of borrowers available to the trader-moneylenders. Thus, we now replace equation (2) with

$$(2') \qquad L = z(i)\frac{[1-\beta]Z}{N}$$

so that the inverse demand function is

$$(*) \qquad i = i(L,N,\beta).$$

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[26]But note that so long as the group has a long-term relationship with the bank, one does not need to invoke social sanctions as a mechanism for enforcement. In the groups formed to borrow from the Grameen Bank of Bangladesh, group members have sometimes obtained five individual loans in succession and then continued to participate in their group through joint ventures and Grameen Bank-organized flood and fire insurance, savings programs, and primary schools for their children. The repayment rate for groups borrowing from the Grameen Bank has been 93 percent over the first 15-year period of its life, although the bank does not bring legal charges for nonpayment of debt. *There is thus no reliance on the legal system for enforcement.* In cases where a member of a Grameen Bank borrowing group has financial difficulties, the group normally arrives at a private arrangement to pay the member's debt (Fuglesang and Chandler, esp. pp. 2, 56, 116).

[27]Feder et al. (1988) show how important these group guarantees can become. In each of four Thai provinces, of the total number of formal loans extended to farmers without land titles, the percentage that were backed by group guarantee ranged from 44 percent to 77 percent. In contrast, group guarantees were not used by informal lenders. For these informal lenders, evidently the information problems were less severe or there were ways of enforcing contracts other than through land collateral or group guarantees. (In more developed countries, co-signature may perform some of the same roles as group lending. It is not just that the co-signatories represent a fall-back in the event of a default; the fact that they are potentially at risk induces them to monitor the borrower, and hence reduces the risk that the borrower defaults.)

We wish to examine whether an expansion of the government's group lending program (an increase in β) will lower or raise interest rates that moneylenders charge. Differentiating (1') totally yields

$$(9') \qquad [1-\beta]Zz'\frac{di}{d\beta} = L\frac{dN}{d\beta} + N\frac{dL}{d\beta} + Zz(i) \ .$$

The free entry condition allows us to solve for $dN/d\beta$. In the obvious notation

$$(10') \qquad V(N,\beta) \equiv \underset{\{L\}}{Max}\left\{F(K-\delta-L+G) + i(L,N,\beta)L - C(N,L,\beta) - rG\right\} = F(K+G) - rG.$$

Now, again using the envelope theorem

$$(11') \qquad \frac{d\ln N}{d\beta} = \frac{L\frac{\partial i}{\partial \beta} - C_\beta}{C[v+\alpha\eta]} < 0 \ .$$

An increase in β (at fixed L and N) reduces the interest rate along the demand curve since average loan size has increased: $\partial i/\partial\beta < 0$. Moreover, the increase in average loan size will also, in general, increase the costs of screening and enforcement: $C_\beta > 0$.[28] On both accounts, expansion of the banks' group lending program reduces the profitability of moneylending and there is exit from the trader-moneylending activity: $dN/d\beta < 0$.

Moreover, using the inverse demand function (*) and differentiating the first order condition in (7),

[28]In a more general model, it may be more expensive to call out the remaining [1-β]Z "good" borrowers.

$$(13') \qquad \frac{dL}{d\beta} = \frac{\frac{\partial i}{\partial \beta} - C_{L\beta} + L\frac{\partial^2 i}{\partial L \partial \beta} + \left[-C_{LN} + \frac{\partial i}{\partial N} + L\frac{\partial^2 i}{\partial L \partial N}\right]\frac{dN}{d\beta}}{-\Delta}$$

Again, it is possible for the effect on lending to be of either sign: there is a direct negative effect, but the exit of moneylenders has a positive effect. Thus, the provision of credit directly to small farmers through peer monitoring groups benefits those who receive the credit directly, but it has indirect effects on the remainder of the rural credit market that may be hard to ascertain. In particular, it *is* likely to drive moneylenders out of business, and to the extent that that is one of the intentions, it is likely to be successful. But these trader-moneylenders are performing a useful economic function; unless they are totally replaced by direct government loans, the reduction in the number of trader-moneylenders *may* have an adverse effect on those who do not get loans through peer monitoring groups. Typically, each moneylender will contract his lending activity and there will be fewer moneylenders. But whether this supply response is smaller or larger than the reduced demand (because fewer borrowers will be seeking funds from the informal sector) is a complicated matter, which depends on properties of the screening and enforcement cost function $C(L,N,\beta)$, the demand function $z(i)$, and the production function $F(R)$.

IV. THE MODUS OPERANDI OF THE TRADER-MONEYLENDER

This section sets forth aspects of the *modus operandi* of trader-moneylenders that motivate the formal model above. Many aspects of moneylenders' operations can be interpreted as solutions to their common problems of screening potential borrowers, limiting their indebtedness to third parties, and enforcing repayment.

1. A trader who lends money to a client generally requires him to sell all his crops to, or

through the trader.[29] [30] This trade-credit linkage

> makes information on the size of the borrower's operations (and their changes) available to the creditor and to no one else. Trade-credit linkage thus closes the borrower's access to other [informal] lenders (Siamwalla et al., p. 282).

2. *Principal and interest are recovered at harvest time from the value of crops sold, and these loans are not secured by land collateral.* Moneylenders who make seasonal loans can assure repayment by visiting the debtor's farm at harvest time. For example, in Aurepalle, India,

> The large moneylenders have regular employees who visit clients to learn the harvest date. The moneylender will then go to the threshing floor himself or send his employee with a bullock out to recover the principal and interest at the threshing floor. (Walker and Ryan, p. 203)

It is consistent with this second mode of operation that Siamwalla et al. (p. 282) reports that traders do not provide credit to producers of cassava, which unlike other crops can be harvested at any time over a period of nearly a year.

In some towns with well-organized commodity markets, traders cooperate in enforcement. Bell reports that

> In Chittoor [India], for example, a commission agent who dealt in *gur* [a sugar product] told me that agents frequently know one another's clients. If a farmer attempted to sell through an agent other than the one with whom he normally dealt, the former would deduct principal and interest on the loan, basing his calculations on the usual rule-of-thumb relating the size of the loan to the quantity to be delivered, and hand over the said sum to the latter. Others doing field research in India have reported similar practices elsewhere in India. (Bell, p. 313)

It is in the interest of each trader-moneylender to perform that service for others, so that they do it for

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[29]This requirement is noted in studies of India, Thailand, Pakistan, and the Philippines, respectively, by Bell, p. 306; Siamwalla et al., p. 282; Aleem, p. 348; and Floro and Yotopoulos, p. 78.

[30]Arnott and Stiglitz [1989] have noted that such exclusivity relationships are a standard part of principal-agent relationships when they can be enforced. They emphasize the externality that one relationship has on the returns to other relationships. Within the credit market, exclusivity enhances the information that the lender has about the borrower, the likelihood that the borrower will choose a high-risk project, and the ability of the lender to enforce his contract.

him. For immobile populations of farmers, under this system it would be difficult for a farmer to find an outlet for his crops without also repaying his debt.[31]

3. Trader-moneylenders lend out of their own equity and are also "retailers" of government-subsidized funds. In his study of the detailed operations of 14 commercial moneylenders serving a rural area in Sind, Pakistan, Aleem found that

> on average approximately half of the funds used by the informal lender come from his own savings, 30 percent from institutional sources either directly or indirectly (from cotton mills, wholesalers, and so forth who have direct access to such funds), and the remainder from other informal lenders as well as from clients who use him as a safe deposit (at zero cost) for surplus cash. (p. 341)

On average, the moneylenders' marginal cost of funds was estimated to be 32 percent (Aleem, Table 6), much higher than the 12 percent interest rate charged by formal lenders. It appears therefore that *moneylenders' access to the formal market was rationed.* In Aleem's study, to expand their lending, moneylenders stated that they turned primarily to other moneylenders for funds (rather than to other large farmers), which is consistent with our assumption that traders do not serve as intermediaries for large farmers who are specialized in farming..[32]

Harris (1983) observed in Tamil Nadu, India that large farmers were very active as lenders and traders and obtained funds from the formal credit sector:

> among larger farmers, money is simultaneously lent and borrowed, with interest rates and relative risks juggled in an effort to make a profit. This is known as "rolling," and the English word is used...

Is this quotation helpful?

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[31]Moreover, transportation costs to market are often significant, so that the net return from selling one's crop to a more distant trader may be substantially less. Transportation costs thus provide an alternative rationale for the monopolistically competitive nature of credit markets based on information asymmetries emphasized here.

[32]Econometric investigations of the extent of formal sector rationing in India are undertaken in Bell, Udry, and Srinivasan, 1990 and Kochar, 1992.

4. Before lending to a farmer, a trader-moneylender seeks information that the farmer is productive and reliable. Aleem (p. 335) found that on average the screening process takes one year (two agricultural seasons) during which the potential borrower, by marketing his output exclusively through the trader-moneylender, demonstrates his productivity. On average, lenders then rejected more than 50 percent of the applicants screened. One measure of the success of that screening process is the very low incidence of bad debt (reported as less than 5 percent in Aleem, p. 336, although in other studies the default rate is higher).

5. A borrower's relation with a single trader-moneylender typically extends over many years. Siamwalla et al. (p. 279) reported that more than 72 percent of informal sector borrowers in a 14-village survey of Thailand had not attempted to borrow from other informal lenders during the past three years, and that of these 72 percent, the average period of contact involving credit transactions was almost seven years.[33]

An implication of 4. and 5. is that for those not rejected as borrowers, the screening process creates relationship-specific capital. Having successfully passed the lender's screening test, the farmer becomes eligible for both production and consumption credit at short notice. That relationship-specific capital makes any other trader-moneylender an imperfect substitute for the one on which a borrower currently relies.[34]

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[33]Long-term relationships also serve to mitigate moral hazard problems. If the failure to get timely repayment in one year reduces access to capital in later years, then the borrower has greater incentives to repay. This in turn implies that the borrower obtains more favorable borrowing terms in a longer-term rationship. See Stiglitz and Weiss (1983).

[34]While the fact that a particular individual is lending money to a particular borrower is likely to be public knowledge (and thus *some* of the information which the lender has gleaned is made public), the amount lent, the interest rate charged, and the efforts required to enforce collection are not likely to be public. An essential task of the lender in screening loan applicants is determining the amount to be lent; not only does an increase in loan size increase the probability that the borrower will not be able to repay the promised amount, it also increases enforcement problems--borrowers' incentives not

Of course, more evidence is needed before we can infer that lenders exercise monopoly power over their borrowers. Striking evidence can be found in Aleem's study (especially Table 8) of the operations of 14 commercial moneylenders serving a rural money market in Sind, Pakistan. His first finding was that mean marginal costs of lending as a fraction of the amount recovered were much less than the average interest rate reported by borrowers. His second finding was the total average costs of lenders, as a fraction of the amount recovered, were comparable to the average interest rate charged. [How high were these costs, counting warehouses. Add fn.] These findings suggest that the informal commercial lending market is characterized by monopolistic competition. Each lender faces a downward-sloping demand curve from borrowers tied to him, so that he can price at above marginal cost, but entry of new moneylenders keeps pure profits close to zero by driving the price down to the average cost.[35]

IV. CONCLUSIONS AND GENERALIZATIONS

The interrelations among the various parts of the rural credit market are even more complicated than we have characterized them. The selection activities of the formal lenders affect the

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to repay increase, as emphasized in the work of Eaton and Gersovitz (1981).

[35]An objection that can be raised against this argument is that, since in some areas, as discussed above, trader-lenders are able to collude to enforce contracts, why don't they also collude to fix prices and interest rates? Trader-moneylenders will not be able to collude to fix prices as long as there are any individuals in or near the village with sufficient capital to become trader-moneylenders. An attempt to fix prices (at a level above the zero-profit level) would induce entry, and an attempt to create an entry barrier by threatening nonenforcement of debts owed to new entrants would not be in the self-interest of the incumbents. If that threat were carried out, the new entrants would only more surely undermine the position of the incumbents by providing the incumbents' debtors a marketing outlet for their crops by which they could avoid repayment. Thus it is a Nash equilibrium for each trader-moneylender to enforce the debt of every other trader-moneylender, even that owed to new entrants. This game could be modelled either as a supergame or as a finite game under the kinds of imperfect information considered in Kreps, Milgrom, Roberts, and Wilson (1982).

quality mix available to the informal sector, and *vice versa*.[36] As we have noted earlier, the credit system can be viewed as solving a matching problem, putting together borrowers with those lenders who are most informed about the risk of that borrower and most able to enforce his contracts. In any matching-search model, there are externalities: with more lenders, it may be more costly to find an appropriate set of borrowers. To lend the same amount of money, with fewer borrowers, the amount lent per borrower must increase, thus increasing the monitoring and enforcement cost. The selection activities of each of the informal lenders affect the quality mix available to other informal lenders and, thus, the efforts they have to exert to obtain the desired quality mix. There are thus a variety of externality-like effects that arise in this market; and each moneylender is not likely to take into account these externality-like effects. The factors upon which this paper focuses are, however, sufficiently complex to suggest the range of possible consequences of increased formal sector lending.

Recent field studies of rural credit markets in developing countries shed light on the differences across lenders in their capacity to recover loans. Rural credit markets are fragmented[37] because of the absence of a low-cost and reliable legal structure and information transmission system. The consequence of fragmentation is that there are *great differences between the shadow price of capital for different borrowers*, and this has been used to justify government subsidies to the expansion of formal credit in rural areas. But we showed that if the cause of the fragmentation is the screening and enforcement problem, then relatively little or even none of the subsidies to institutional credit channelled to farmers with land collateral reaches the poorest cultivators.

We next addressed the question, How can a credit market that behaves badly because of screening and enforcement problems be moved toward a more efficient equilibrium? The answer is

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[36]Lanjouw, 1992, suggests that formal lenders skim off the lowest risk borrowers, and that this provides an explanation for the failure of informal interest rates in Palanpur to fall in response to the expansion of formal sector lending.

[37]The term is from McKinnon, 1973, p. 5.

not for government to drive the moneylender out of trading. That would shift the lending business to other informal moneylenders with even higher transaction costs. One answer that has been offered is for government to channel credit subsidies directly to trader-moneylenders in order to take advantage of their information capital and comparative advantage in enforcement. But the model of this paper would suggest that such intermediation is already occurring, and that its effects are not necessarily beneficial. It may result not only in partial dissipation of the subsidy through induced entry, but it may even increase informal interest rates.[38]

Instead, we would argue that the solution must lie in designing substitutes for the information and enforcement activities of trader-moneylenders, and in interventions in infrastructure that reduce the cost of those activities. In theory, financial agencies could enter the business of trading themselves. But that approach to the enforcement problem would likely fail if they did not have a monopoly on trade in the farmers' outputs,[39] and such a monopoly on trade and a reduction in competition would entail bad consequences of its own. One implication of case studies of rural credit markets is that the government sector needs a vibrant private sector to police it; when services of private moneylenders are not widely available, government lending may be highly corrupt.[40]

An alternative approach to the enforcement problem would be to expand government lending to self-formed groups of poor farmers. Those groups, through their reliance on *social collateral*, have a comparative advantage in solving the enforcement problem. ~~The study of the design of such peer monitoring programs is just beginning (see Huppi and Feder [1989], Stiglitz [1990], and Varian~~

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[38]An alternative critique of this policy is provided in Floro and Rey, 1992.

[39]The kind of cooperative enforcement among private traders that we discussed in section IV would presumably not extend to a government agency whose objective was to displace all of the private traders.

[40]A striking case is the systematic use in one financial institution in Palanpur, India, of phoney record-keeping to impose exorbitant charges on borrowers who lacked political connections and access to funds from other sources. See Lanjouw, 1992, table 8 (unnumbered chapter on credit).

~~[1990]).~~ The results of this paper call attention to the need for such institutional innovation. But our paper also raises questions about the full consequences of group lending programs when they are limited to only a part of the market: for the reduction in the profitability of moneylending may lead to less competition in the informal lending market; and while the exit out of the trader-lending market will reduce the dissipation of resources from excessive entry, the reduced competition may itself work to the disadvantage of those borrowers who are not part of group borrowing programs.

Appendix

This appendix presents two very simple models with the property that $NC_{LN} > LC_{LL}$. The first model focuses on moral hazard and the cost of monitoring a borrower's activities. The second model describes a screening process where search externalities among lenders cause each lender's marginal costs of search to go up as the number of lenders increases.

(i) Moral hazard model. Assume there are many risky activities indexed by j = 1, 2, 3..., and one safe activity, j = 0. With probability p^j, the *j*th risky activity is successful and yields a return of $R^j(z)$, where z is the amount lent to the borrower and $R^{j\prime} > 0$ and $R^{j\prime\prime} < 0$. If the activity is unsuccessful, it pays off zero. The return to undertaking a risky activity k is

$$\pi^k(i) \equiv \underset{z}{\text{Max}} \; p^k[R^k(z) - iz]$$

The return to undertaking the safe activity is

$$\pi^0(i) = \underset{z}{\text{Max}} \; \{R^0(z) - iz\}$$

Define

$$z^k(i) \equiv \arg\max \; p^k[R^k(z) - iz], \text{ so } dz^k/di < 0$$

and similarly for $z^0(i)$. Assume that when projects are ranked so that $p^{k+1} < p^k$, then

(1-A) $$z^{k+1} > z^k, \text{ and } p^{k+1}z^{k+1} > p^kz^k.$$

This means that projects that have a lower probability of success are more profitable at a higher scale, as illustrated in Figure 4, and that (since $d\pi^k/di = - p^kz^k$),

$$\frac{\partial\pi^{k+1}}{-\partial i} > \frac{\partial\pi^k}{-\partial i} > \frac{\partial\pi^0}{-\partial i} > 0$$

A decrease in the interest rate of course makes every project more profitable to the borrower. But the effect of an interest rate decline is larger with respect to projects with a lower probability of success

since these projects are operated at a larger scale according to (1-A). It follows that if

$\pi^k = \pi^{k+1}$ at $i = \hat{i}$, then $\pi^{k+1} > \pi^k$ at $i < \hat{i}$. In the absence of supervision, the lender undertakes the activity, denoted k*, that yields the highest return.

The lender can monitor the borrower and observe which activity he is undertaking, and assume that the (marginal and total) cost of ensuring that the borrower undertakes the safe activity is less than the (marginal and total) benefit, so that lenders always spend enough to ensure that the borrower does not undertake any risky activity. The lender chooses the degree of intensity of monitoring, λ, where λ is the probability that a borrower who is cheating will be discovered. If he is discovered, he is subjected to a punishment F (such as break-up of his relationship with the lender or the seizure of some of his personal property), and F enters additively into his utility. Cheating therefore yields the borrower a payoff $\pi^{k*}(i) - \lambda F$, while honoring the agreement yields π^0; the borrower will cheat whenever $\pi^{k*}(i) - \lambda F > \pi^0(i)$. Knowing this, lenders will choose a monitoring technology that satisfies $\lambda \geq [\pi^{k*}(i) - \pi^0(i)]/F$, so that his cost of monitoring is a rising function of $\pi^{k*}(i) - \pi^0(i)$, and thus a decreasing function of i.

In equilibrium, we will have

$$\frac{di}{dz^0} = \frac{di}{d\left(\frac{LN}{Z}\right)} < 0$$

so that an increase in N, holding L constant, lowers i, which thus increases the required level of monitoring. We have thus established for this model that the monitoring function depends only on the product, LN, and we write the function as $C = f(LN)$, where $f' > 0$. Then

$$C_{LN} = f' + f''LN \quad \text{and} \quad C_{LL} = f''N^2$$

so that

$$C_{LN}N - C_{LL}L = Nf' > 0,$$

as was to be shown. In addition, $C_{LN} > 0$ under the plausible condition that the elasticity of f' is greater than minus one.

(ii) Screening externalities (first draft). Consider now the lender's process of search for good borrowers. A common pool analogy is instructive: Lenders are looking for good borrowers; the more lenders there are searching for the limited supply of good borrowers, the greater effect each has to exert to find a good borrower. The assumption $C_{LN} > 0$ goes further; it means that the *marginal* as well as the *total* cost of lending increases as the number of lenders increases. A simple model with this property is one where there is duplicative search. Suppose that the number of small farmers is S, of whom Z are good borrowers. Then $g_1 = Z/S$ is the ratio of good borrowers to the total. Search proceeds as follows. In the first "round" lenders can sample k potential borrowers. It costs c to screen each small farmer, so that cost of screening k small farmers is kc. In the first round, the number of (good) borrowers selected by each moneylender is kg_1 at a cost per borrower of c/g_1. In the second round, the ratio of good prospective borrowers to total small farmers is

$$g_2 = \frac{Z - kNg_1}{S - kNg_1} < g_1$$

and the number of good prospective borrowers screened is kg_2 at a cost of c/g_2. (Assume that two "rounds" suffices to find all borrowers, which requires that $kN[g_1 + g_2] \geq Z$. -- [[But the fact that two rounds suffice on average doesn't mean that two rounds always suffices.) The marginal cost of lending the last rupee is C_L. The cost C_L is the cost of finding good customers in the second round. The cost of finding good customers in the second round is a function of the quality mix in the second round. And the quality mix in the second round is a function only of the number of screeners. Hence, $C_{LN} > 0$.

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Table 1

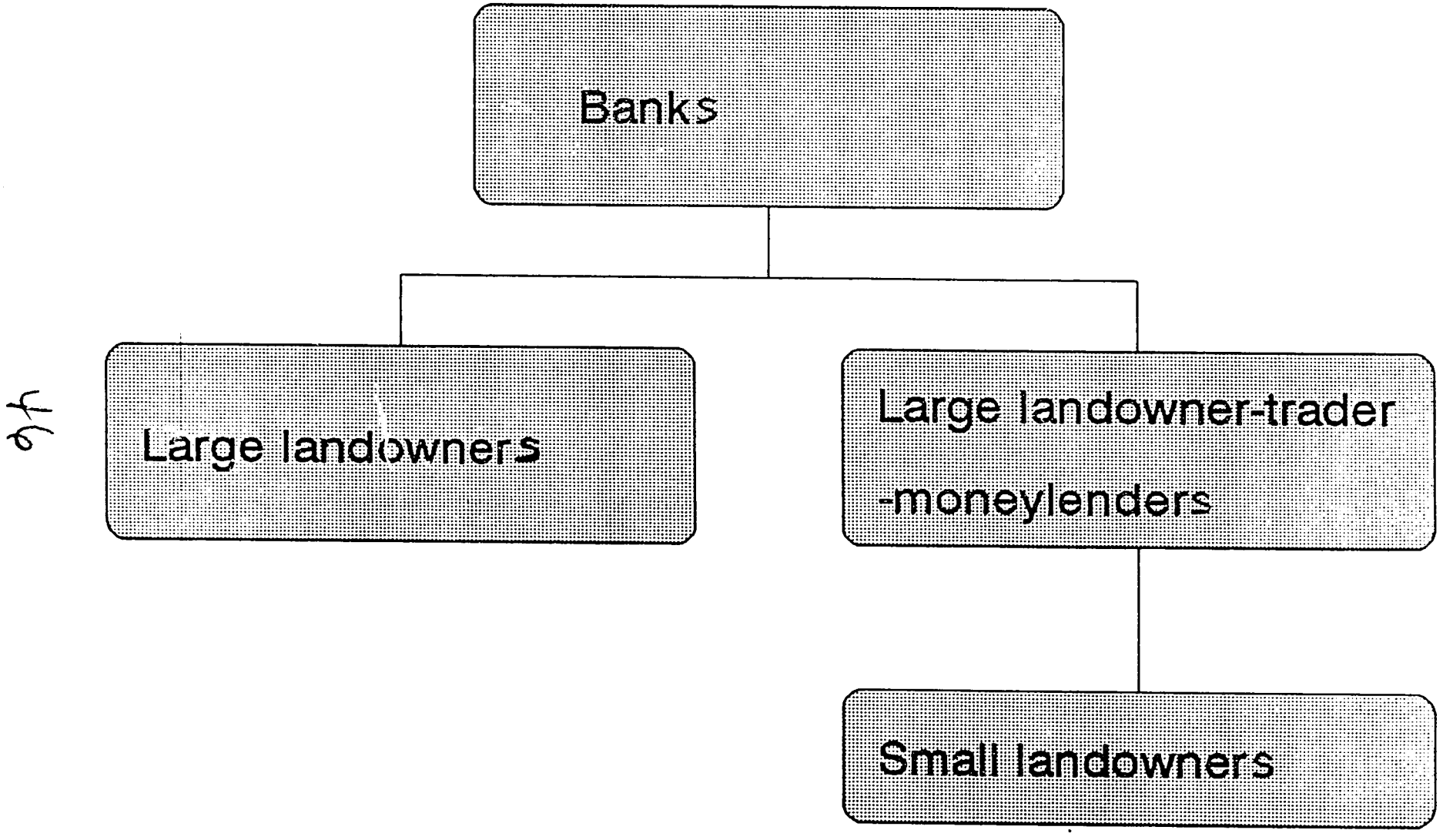
Credit Interlinked with Trade

1.	As a percentage of total informal credit to cultivating households, Punjab, India, 1980-81	62%
2.	As a percentage of total informal credit in developed rural areas, Philippines, 1984	47%
3.	As a percentage of credit supplied by nonresident lenders,	73%
	and as a percentage of total informal credit, in Nakhon Ratchasima province, Thailand, 1984-85	29%
4.	As a percentage of credit supplied by informal moneylenders, Munoz, Neueva Ecja, Philippines, 1992	51%

Sources:
1. Bell 1990, Table 6.
2. Floro and Yotopoulos 1991, Tables 5.1, 5.2, 3.12.
3. Siamwalla et al. 1990, Table 4. These figures are for all credit provided by traders and may thus overstate the amount of credit interlinked with trade.
4. Esguerra and Meyer 1992, derived from Table 2

Figure 1

Schema of a Formal and Informal Credit Market



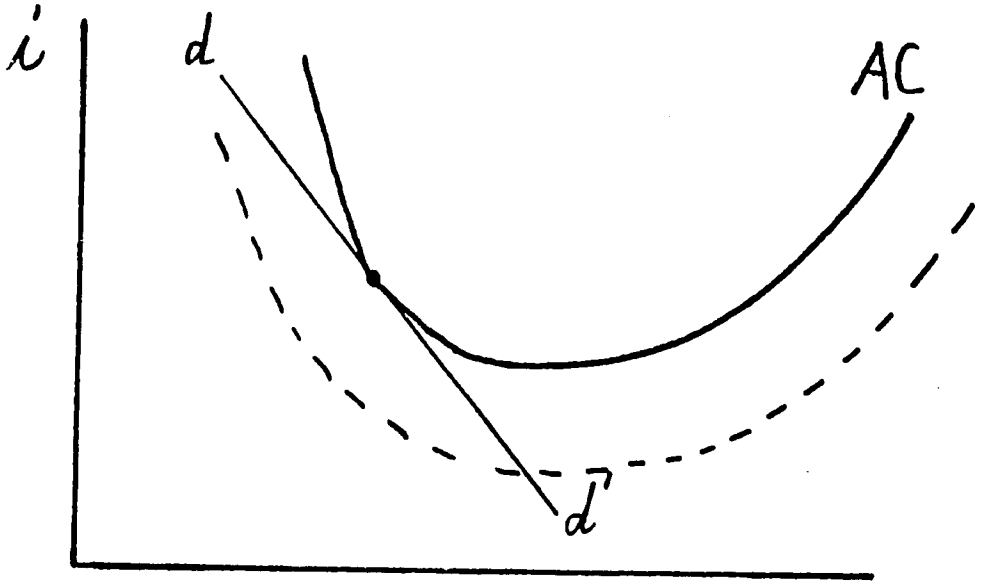


FIGURE 2

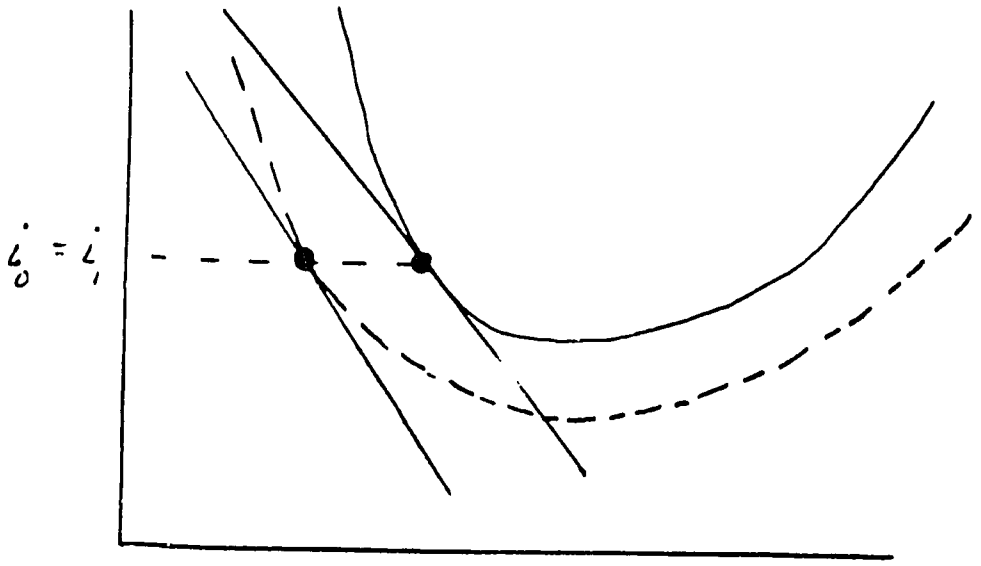


FIGURE 3A

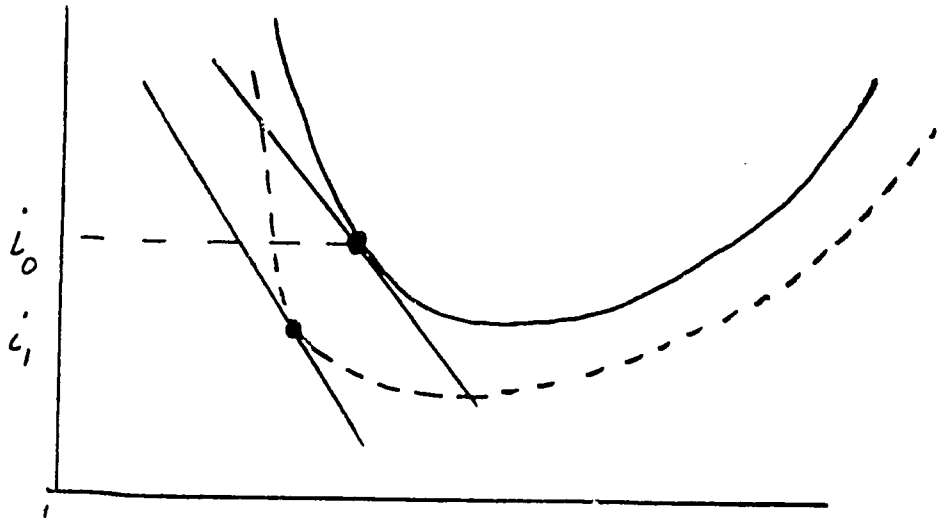


FIGURE 3B

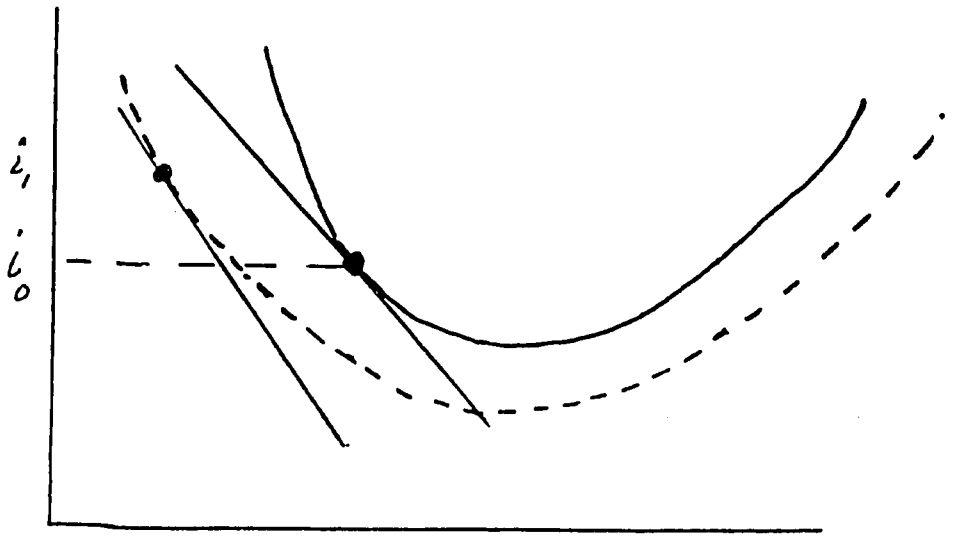


FIGURE 3C

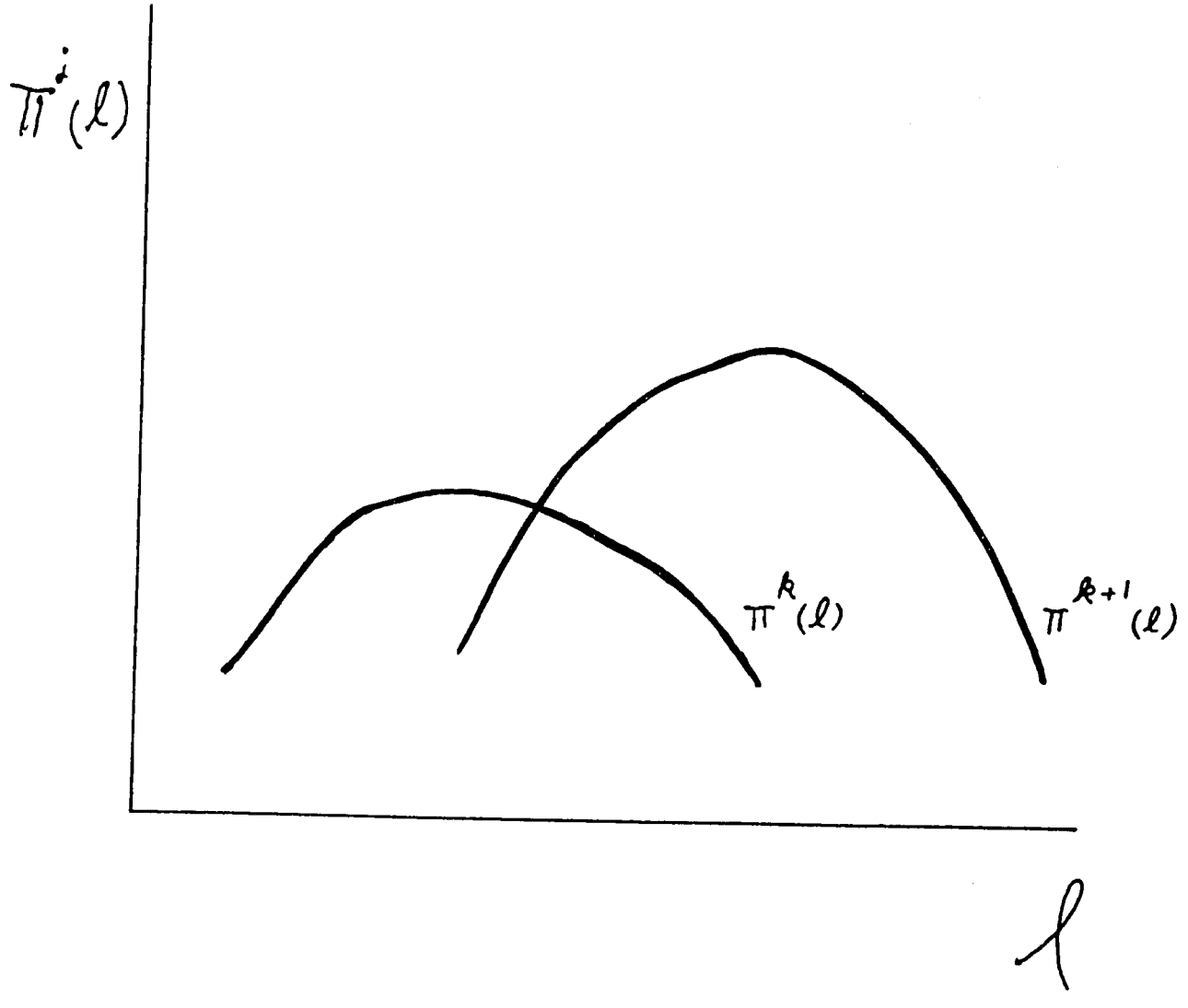


FIGURE 4