Intermediation and Equilibrium Allocation of Investment Capital: Implications for Economic Development

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Working Paper No. 290
August 1991

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Working Paper No. 290

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The existence of interest rate differentials, rate of return differentials, and credit rationing are often believed to be serious impediments to the efficient allocation of investment capital. Moreover, interference with the efficient allocation of investment funds itself has adverse consequences for capital formation and economic development. The growth of financial intermediation is often asserted to be a force towards reducing interest-rate/rate-of-return differentials and credit rationing, and thus towards promoting efficient investment and economic development.

The objective of this paper is to develop a model in which these assertions can be investigated. We consider the equilibrium allocation of investment capital in an environment with risk-neutral agents, and with both adverse selection and costly state verification. Potential investors and investment projects inhabit different locations, and the cost of verifying a project's return depends on its location. Specifically, intra-location monitoring is less costly than inter-location monitoring. Under stated conditions, the presence of costly state verification implies that in equilibrium borrowers and lenders will employ debt contracts.[1] And with debt contracts in use, adverse selection implies that credit rationing must be observed.[2] The cost differential between inter- and intra-location monitoring implies an incentive for the intermediation of interlocation funds flows. Thus this environment contains all necessary ingredients for investigating assertions about intermediation and the allocation of investment capital.

Following Williamson (1986, 1987), we assume that project owners announce contract terms subjective to incentive constraints and the constraint of delivering at least a certain market determined (expected) return to investors. In addition, we assume that there is an upward sloping supply curve of investment capital in each location, and that the composition of the population with respect to borrowers and lenders differs across locations. We then consider three different "market structures:" (i) locational autarky, (ii) unintermediated inter-location funds flows, and (iii) intermediated inter-location funds flows. In the first, there is no role for intermediation under our assumptions, and cross-location differences in interest rates and credit rationing will be observed. This results in an inefficiency that can be reduced, but not eliminated, by unintermediated inter-location funds flows. This is because the different costs of within-location versus inter-location monitoring permit some rate of return differentials and differential credit rationing to persist across locations. However, these can be completely eliminated by intermediaries who lend to agents in their own location and borrow from a large number of agents in "the other" location. In doing so they service (conduct monitoring of) loans as required. Complete diversification permits them to pay a certain return to depositors, eliminating the need for inter-location monitoring. In equilibrium, inter-location interest rate and rate of return differentials are arbitraged away.

These results bear on a number of issues in economic growth and development. For instance, it is often argued that in the absence of well-developed and fully integrated intermediation, rate of return and interest rate differentials are observed, but that they can be reduced or eliminated by appropriate intermediation (see, for example, Davis 1965, Cameron 1967, McKinnon 1973, and Shaw 1973). Our model economy displays exactly these features. It also indicates why limitations on the ability of intermediaries to operate in multiple locations will inhibit inter-location funds flows, even in the presence of significant expected return differentials. This provides a potential answer to the question, posed by Lucas (1990) for instance, of why international investments are not primarily done in underdeveloped economies (which presumably offer high rates of return).

Another common argument (see, e.g., McKinnon 1973 and Shaw 1973) is that, in developing countries, information/transactions costs inhibit the efficient allocation of investment capital and financial intermediation. This, in turn, reduces investment and causes extensive credit rationing. Improvements in the technology for acquiring information are alleged to improve intermediation, reduce credit rationing, and increase investment. Such a scenario is investigated here, and our results are essentially consistent with these assertions.

The remainder of the paper proceeds as follows. Section I defines the environment and presents conditions under which equilibrium loan contracts will be debt contracts with truthful revelation of borrower types. Section II describes a general equilibrium when loan markets are locationally autarkic, and intermediation is unnecessary. These two sections essentially reproduce results from Boyd and Smith (1991), which was devoted to showing when debt contracts would be used in environments with adverse selection and costly state verification. In order to make this paper self-contained those results are described here, but proofs, discussions of assumptions, etc. are omitted. Section III examines direct (unintermediated) inter-location lending, demonstrating that interest-rate/rate-of-return differentials will persist, as will differential credit rationing across locations. This result is used to explain some historical observations from the U.S., which are discussed by Davis (1965). Section IV considers intermediated inter-location lending, and shows that differences across locations in interest rates, rates of return, and credit rationing will be eliminated. It also shows that improvements in information technology can increase intermediation and reduce credit rationing. Section V relates our analysis to some of the other theoretical intermediation literature, discusses possible extensions, and concludes.

I. The Model

A. Environment

This section describes a simple environment in which an adverse selection problem and multiple locations are introduced into Williamson's (1987) model of credit markets. Throughout the notation is kept as close to Williamson's as possible. Also, our objective is to produce conditions under which, as in Williamson (1987), debt contracts emerge in equilibrium. Several somewhat restrictive assumptions are made to permit this to occur in a relatively simple way. A more detailed discussion of various assumptions appears in Boyd and Smith (1991).

We consider a model with two locations, indexed by $j = 1, 2$. Each location has an equal measure of agents, divided into three groups. A fraction α_j of the population in location j belongs to the first group, called "lenders," while $1 - \alpha_j$ belongs to the other two groups, called "borrowers." In addition borrowers consist of two types; a high average return type (type g) and a low average return type (type b). Borrower type is indexed by $i = g, b$. A fraction θ_j of borrowers are of type b in location j.

All borrowers are risk neutral and each is endowed with an indivisible project that requires one unit of the investment good to operate. If funded, it generates a random return $\tilde{w}$ after one period. Realizations of $\tilde{w}$, denoted w, among borrowers of type i are independent and identically distributed. For type g borrowers project returns have the probability distribution G, with associated density function g. Similarly for type b borrowers project returns have the probability distribution F, with the associated density function f. f and g are assumed to be differentiable, and to have the common support $[0,\bar{w}]$. Throughout we assume that the functions f and g are common knowledge, and that $f(w) > 0$ and $g(w) > 0 \ \forall \ w \in [0,\bar{w}]$.

The following assumptions are imposed. First $G > F$ in the sense of first order stochastic dominance, i.e., $F(w) \geq G(w) \ \forall \ w$, with strict inequality for some w. Second, there exists a value $w^* \in (0,\bar{w})$ such that

$$\text{(a.1)} \qquad f(w) = g(w) \ \forall \ w \geq w^*.$$

Of course then $F(w) = G(w) \ \forall \ w \geq w^*$. Assumption (a.1) requires that return distributions differ only for "low" values of w.

It is also assumed that a borrower's type is private information, ex ante, and that the realization w for any project is observed costlessly only by the project owner. This realization can be observed by any other agent in the same location at a cost (in effort) of $\gamma > 0$. Observing the realization w for an agent in a different location requires $\tilde{\gamma} > \gamma$ units of effort. We assume that, $\forall\, w \in [0,\bar{w}]$,

$$\text{(a.2)} \qquad \begin{aligned} &f(w) + \tilde{\gamma} f'(w) > 0, \\ &g(w) + \tilde{\gamma} g'(w) > 0. \end{aligned}$$

Finally, we assume that borrowers are endowed with none of the investment good, and that they care only about second period consumption (c). Lenders are endowed with one unit of the investment good, and second period effort. If second period effort of e is expended in monitoring, lenders' utility is given by c − e.

If borrowers do not operate their projects they engage in an outside alternative which yields a payoff of R_i to type i borrowers. It will be useful to impose the following assumption on the values R_i. Define

$$\hat{w}_g = \int_0^{\bar{w}} wg(w)dw; \quad \hat{w}_b = \int_0^{\bar{w}} wf(w)dw$$

and let I(w) be the indicator function

$$I(w) = \begin{Bmatrix} 1 & \text{if } f(w) \geq g(w) \\ 0 & \text{otherwise} \end{Bmatrix}.$$

Then we assume that

$$\text{(a.3)} \qquad \hat{w}_g - R_g < \hat{w}_b - R_b - \int_0^{w^*} w\,[\,f(w) - g(w)]\,I(w)dw.$$

As discussed by Boyd-Smith (1991), (a.3) implies that the expected utility of borrowers of all types declines with increases in expected monitoring costs (ceteris paribus). Note that (a.3) also implies that $R_g > R_b$.

Lastly, lender k in each location is assumed to have some opportunity cost of investment, t_k.[3] The distribution of opportunity costs in the lender population is denoted by H, where $H(t) = \int_{\underline{t}}^{t} h(s)ds$, with $h(s) > 0$; $s \geq \underline{t}$. Finally, we assume that $w^* \leq \underline{t}$. Thus return distributions across different borrower types vary only over returns that are low relative to the expected return required to elicit any funds.

B. Optimal Contracts

Following Williamson (1987), it is assumed that borrowers offer contractual loan terms to lenders, taking the contracts offered by all other borrowers as given. Then loan contract offers must yield a prospective lender at least the market expected return, r, given the inferences that a lender draws about a borrower's type. Throughout we focus on separating equilibria, in which type g and b borrowers offer distinct contractual terms. Having derived conditions under which such equilibria exist, we will comment on the possibility of pooling equilibria.

A loan contract specifies the following set of objects: (i) a probability that credit will be received by a type i borrower, p_i, so that credit is granted stochastically even if a lender is available; (ii) a set of return realizations, $A_i \subset [0,\bar{w}]$, for which monitoring of a type i borrower (costly verification of the state) occurs, and of course a set $B_i = [0,\bar{w}] - A_i$ of realizations for which monitoring does not occur (note that we abstract from stochastic monitoring); (iii) a noncontingent loan repayment (interest rate) x_i if $w \in B_i$; (iv) a repayment schedule $R_i(w)$; $w \in A$. As is implicit in this description we focus only on contracts that induce truthful revelation by the borrower.[4]

Feasibility requires that $0 \le x_i \le w$, $w \in B_i$; $0 \le R_i(w) \le w$, $w \in A_i$, and $R_i(w) \le x$ $\forall\, w \in A_i$.

1. Type b Borrowers

If self-selection of borrower types occurs, then we conjecture (and verify subsequently) that type b borrowers are not constrained by any incentive conditions that require type g borrowers not to want to mimic type b contract announcements. Then type b borrowers choose p_b, A_b, B_b, x_b, and $R_b(w)$ to maximize

$$p_b \left\{ \int_{A_b} [w - R_b(w)]\, f(w)dw + \int_{B_b} (w - x_b)\, f(w)dw \right\} + (1-p_b)R_b$$

subject to

$$(1) \qquad \int_{A_b} [R_b(w) - \gamma]\, f(w)dw + x \int_{B_b} f(w)dw \ge r$$

and $0 \le R_b(w) \le w$, $w \in A_b$; $R_b(w) \le x$, $w \in A_b$.[5]

Assuming that r is sufficiently low that type b borrowers are not driven out of the credit market altogether (see below), this problem is identical to that considered by Gale and Hellwig (1985) or Williamson (1987). Thus $p_b = 1$, and the other contractual terms are those of so-called standard debt contracts; i.e., $A_b = [0, x_b)$, $R_b(w) = w \;\forall\, w \in [0, x_b)$, and x_b satisfies

$$(2) \qquad \int_0^{x_b} wf(w)dw + x_b[1 - F(x_b)] - \gamma F(x_b) = r.$$

If (2) has more than one solution, then apparently the smallest solution to (2) maximizes the expected utility of a type b borrower. Denote the (smallest) solution to (2) by $x_b = \phi(r)$, and note that

$\phi'(r) = 1/[1 - F(x_b) - \gamma f(x_b)] > 0$. Finally, for future reference, we define the function $\pi_b(x)$ by

$$\pi_b(x) = \int_x^{\bar{w}} wf(w)dw - x[1 - F(x)],$$

so that $\pi_b(x)$ is the expected payoff to a borrower who offers a debt contract paying the interest rate x. Note that $\pi_b'(x) < 0$, and that the solution to the type b borrowers' problem sets $p_b = 1$ iff $\pi_b[\phi(r)] \geq R_b$.

2. Type g Borrowers

An optimal contract for type g borrowers is now derived under the assumption that self-selection occurs. Conditions implying that this is an equilibrium are then stated.

Consider the following problem for type g borrowers: to maximize

$$p_g \left\{ \int_{A_g} [w - R_g(w)]g(w)dw + \int_{B_g} (w - x_g)g(w)dw \right\} + (1-p_g)R_g$$

subject to

$$\text{(3)} \qquad \int_{A_g} [R_g(w) - \gamma]g(w)dw + x_g \int_{B_g} g(w)dw \geq r$$

$$\text{(4)} \qquad p_g \left\{ \int_{A_g} [w - R_g(w)]f(w)dw + \int_{B_g} (w - x_g)f(w)dw \right\} + (1-p_g)R_b \leq \pi_b[\phi(r)],$$

$0 \leq R_g(w) \leq w$, and $R_g(w) \leq x \; \forall \; w \in A_g$. Note that even if a lender is available credit may not be received (if $p_g < 1$); however, if credit is received the lender must obtain an expected return of at least r. Equation (4) asserts that the utility a type b agent can obtain by announcing a type g contract does not exceed that obtained by announcing the type b contract derived previously.

We may immediately observe that (4) must be binding in equilibrium. If this were not the case then the solution to the type g borrowers' problem would set $p_g = 1$ and be a standard debt contract (if r is not too high). But then

$$(5) \qquad \int_0^{x_g} wg(w)dw + x_g[1 - G(x_g)] - \gamma G(x_g) = r$$

would hold, implying $x_g < x_b$. This, of course, would result in a violation of (4). Thus adverse selection must affect the solution to the type g problem. Also, for future reference, denote the (smallest) value of x_g satisfying (5) by $x_g = \psi(r)$. Then $\psi'(r) = 1/[1 - G(x_g) - \gamma g(x_g)] > 0$.

We now state conditions sufficient for the solution to the problem of type g borrowers to be a debt contract with credit rationing.

Proposition 1. Define $\epsilon(r) \equiv \hat{w}_g - R_g - r$ and $\delta(r) \equiv \hat{w}_b - R_b - r - \int_0^{w^*} wI(w)[f(w) - g(w)]dw$. Suppose that the following conditions hold:

$$(6) \qquad \delta(r) - \epsilon(r) \geq \epsilon(r) - \gamma G[\psi(r)]$$

$$(7) \qquad \gamma g(w) \geq 1 - G(w) - \gamma g(w) \qquad \forall\, w \geq \psi(r)$$

$$(8a) \qquad g(w) \geq f(w) - g(w) \;\forall\, w$$

$$(8b) \qquad f(w) \geq g(w) - f(w) \;\forall\, w.$$

Then the optimal contract for type g borrowers sets $A_g = [0,x_g)$, $R_g(w) = w \;\forall\, w \in A_g$, $x_g = \psi(r)$, and $p_g = \{\pi_b[\phi(r)] - R_b\}/\{\pi_b[\psi(r)] - R_b\} < 1$ [since $\phi(r) > \psi(r)$].

Proposition 1 is proved in Boyd-Smith (1991). Note that $\delta(r) - \epsilon(r)$ is independent of r, so (6) holds if r is sufficiently large. Also, $\psi(r) > r$, so (7) holds (for instance) if $2\gamma g(w) \geq 1 - G(w) \;\forall\, w \geq \underline{t}$. We henceforth proceed under the assumption that a debt contract is optimal for type g agents among the class of separating contracts. We now state conditions implying that a separating (sequential Nash) equilibrium exists with respect to contract announcements.

C. Existence of a Separating Equilibrium

Clearly the incentives of borrowers to deviate from the contracts derived above depend critically on the inferences that lenders draw as a result of a deviation. We assume that lenders believe that any borrower announcing a debt contract with $x = \phi(r)$ is a type b borrower with probability one, and any borrower announcing a contract that is maximal for type g borrowers (among the set of contracts satisfying (3) and (4)) is a type g borrower with probability one. We further suppose that any other announcements cause lenders to believe that the agent announcing the contract is a type b borrower with probability one. The latter specification guarantees that type b borrowers have no incentive to deviate from the candidate separating equilibrium contracts derived above.[6] Under this specification of lender beliefs we now show that

Proposition 2. Suppose (7) and (8) hold. Then the best deviation from the candidate separating equilibrium for a type g borrower is a debt contract with $x = \phi(r)$. Or, in other words, the best deviation for a type g borrower is to mimic type b borrowers.

Proposition 2 is proved in Boyd-Smith (1991). (7) and (8) are henceforth assumed to hold.

Define the function $\pi_g(x)$ by

$$\pi_g(x) = \int_x^{\bar{w}} wg(w)dw - x[1 - G(x)].$$

Then $\pi_g(x)$ is the expected utility of a type g borrower (conditional on receiving credit) under a debt contract specifying the interest rate x. Proposition 2 implies that type g borrowers have no incentive to deviate from the candidate separating equilibrium iff

(9) $\quad p_g\pi_g(x_g) + (1-p_g)R_g \geq \pi_g(x_b).$

The determination of equilibrium contracts (under the assumption that debt contracts are observed) is depicted in Figure 1. In the figure type i borrowers have indifference curves described by loci of the form $p\pi_i(x) + (1-p)R_i = k$. For $x \geq \psi(r) > r \geq \underline{t} \geq w^*$, $\pi_g(x) = \pi_b(x)$. For all such x, the slope of a type b indifference curve in this space is given by

$$\frac{dp}{dx} = \frac{p[1 - F(x)]}{\pi_b(x) - R_b} = \frac{p[1 - G(x)]}{\pi_b(x) - R_b}$$

while the slope of a type g indifference curve is given by

$$\frac{dp}{dx} = \frac{p[1 - G(x)]}{\pi_g(x) - R_g} = \frac{p[1 - G(x)]}{\pi_b(x) - R_g}.$$

Thus type g indifference curves through any point (x,p) (with $x \geq \psi(r)$) are more steeply sloped than type b indifference curves through the same point (as shown).

In equilibrium, (x_b,p_b) is chosen to maximize $p\pi_b(x) + (1-p)R_b$ subject to $x \geq \phi(r)$ and $p \in [0,1]$. If $\pi_b[\phi(r)] > R_b$, the solution sets $p_b = 1$ and $x_b = \phi(r)$. Similarly, the candidate separating equilibrium values (p_g,x_g) must lie on or below the type b indifference curve through $(\phi(r),1)$, and on or to the right of $x = \psi(r)$. As shown, the solution sets $x_g = \psi(r)$ and $p_g = [\pi_b(x_b) - R_b]/[\pi_b(x_g) - R_b]$. Apparently this (x_g,p_g) pair is preferred to $(\phi(r),1)$ by type g agents. Hence, by Proposition 2, type g agents have no incentive to deviate in any separating equilibrium, and a separating equilibrium exists.[7]

When (6), (7), and (8) hold, both borrower types announce debt contracts. These have the feature that type g borrowers voluntarily experience credit rationing. Since the rationing of credit to relatively high quality borrowers may appear counterintuitive, some discussion is warranted. In this environment, there are no observable ex ante differences between borrowers of different types.

Our result is therefore more correctly stated as follows: among borrowers who are *observationally indistinguishable* (ex ante), high quality borrowers will experience credit rationing. This result parallels standard results in adverse selection settings (e.g., Rothschild and Stiglitz 1976, Azariadis and Smith 1990, or Smith and Stutzer 1989) that "good risks" experience rationing, among agents with the same observable characteristics.

Stated in this way, our result sets the stage for a confirmation of some common assertions in the development literature. There it is often argued that there are agents with high quality investment projects who are denied funds, while agents with lower quality projects receive full funding. (See McKinnon 1973, p. 8 for such an argument.) The development of intermediation is argued to ameliorate (although not necessarily eliminate) some of this rationing of relatively high quality projects. Our analysis offers an explanation for why rationing impacts on high quality projects. Moreover, the next three sections show that the development of intermediation will tend to increase the allocation of funds to high quality (rationed) borrowers.

II. General Equilibrium: Locational Autarky

A. Existence

In this section we describe the determination of equilibrium rates of return, r, under the assumption that each location is autarkic, with no interlocation funds flows. Interlocation funds flows are analyzed in Sections III and IV. We consider only the situation in which loan supply is potentially adequate to meet all possible loan demand. In particular, if optimal loan contracts for all borrower types are debt contracts (the situation considered here), then x_g and x_b are determined by (2) and (5) for any r. But then there is an interest rate, $\tilde{x}$, (which under our assumptions is the same for all borrower types), such that $\psi^{-1}(\tilde{x}) \geq \psi^{-1}(x)$ and $\phi^{-1}(\tilde{x}) \geq \phi^{-1}(x)\ \forall\ x$.[8] We assume that

(a.4) $\alpha_j H[\phi^{-1}(\tilde{x})] \geq (1-\alpha_j); \quad j = 1, 2.$

Thus the kind of credit rationing discussed by Williamson (1986, 1987) cannot be observed. Modifications of the analysis that are required if (a.4) fails are discussed in Boyd-Smith (1991). Finally, since our focus in this section is on autarkic loan markets, for the remainder of the section locational subscripts are omitted.

In equilibrium, $x_b = \phi(r)$, $x_g = \psi(r)$, $p_b = 1$, and

$$p_g = \frac{\pi_b[\phi(r)] - R_b}{\pi_b[\psi(r)] - R_b}. \tag{10}$$

In addition, loan supply must equal loan demand, so that

$$\alpha H(r) = (1-\alpha)[\theta + (1-\theta)p_g] \tag{11}$$

if borrowers of both types are active in the credit market. This occurs iff $\pi_b[\phi(r)] \geq R_b$ and $\pi_g[\psi(r)] \geq R_g$. We henceforth restrict attention to equilibria with this property, as otherwise adverse selection is uninteresting.

Equations (10) and (11) constitute two equilibrium conditions jointly determining r and p_g. These conditions are depicted by the solid loci in Figure 2. Since $H' > 0$, (11) defines an upward sloping locus in the figure which intersects the horizontal axis at $(H^{-1}[\theta(1-\alpha)/\alpha],0)$. Equation (10) intersects the horizontal axis at the value $\bar{r}$, defined by $\pi_b[\phi(\bar{r})] \equiv R_b$. Also, the locus defined by (10) has slope

$$\left.\frac{dp_g}{dr}\right|_{10} = \frac{p_g\pi_b'[\phi(r)]\phi'(r)}{\pi_b[\phi(r)] - R_b} - \frac{p_g\pi_b'[\psi(r)]\psi'(r)}{\pi_b[\psi(r)] - R_b}, \tag{12}$$

which is of ambiguous sign. However, sensible results on interlocation funds flows in Sections III and IV will depend on (10) being downward sloping for values of r and p_g that can simultaneously satisfy (10) and (11). We therefore restrict attention to the case where

(13) $$\left.\frac{dp_g}{dr}\right|_{10} < 0 \quad \forall\, r \in [\underline{r},\bar{r}].$$

It is demonstrated in Boyd-Smith (1991) that (13) holds if

(a.5) $$\frac{1 - G(x)}{\pi_b(x) - R_b} + \frac{g(x) + \gamma g'(x)}{1 - G(x) - \gamma g(x)} > \frac{g(x)}{1 - G(x)}$$

$\forall\, x \in [\underline{r},\bar{r}]$. (a.5) is henceforth assumed to hold,[9] in which case the locus defined by (10) is downward sloping as shown.

So long as $H^{-1}[\theta(1-\alpha)/\alpha] < \bar{r}$ and (a.5) hold, then, an equilibrium exists and there is a unique value of r that equilibrates the loan market. We now investigate some properties of this equilibrium.

B. Comparative Statics

We use Figure 2 to demonstrate some comparative static properties of the equilibrium. First, increases in α shift (11) to (11′), as indicated by the dashed line in the figure. Such parameter changes do not affect (10), and hence reduce the equilibrium expected return. Furthermore such changes raise p_g, and hence reduce the extent of credit rationing. The same qualitative effects occur if θ is reduced.

In order to consider the consequences of varying γ, it is useful to write from (2) that $x_b = \phi(r;\gamma)$ and from (5) that $x_g = \psi(r;\gamma)$. Then (10) is more explicitly written as

(14) $$p_g = \frac{\pi_b[\phi(r;\gamma)] - R_b}{\pi_b[\psi(r;\gamma)] - R_b}.$$

It is straightforward to verify that reductions in γ shift (10) to the right if (10) is downward sloping (i.e., if (a.5) holds). Then reductions in γ shift (10) to (10′), while leaving (11) unaffected. Thus reductions in monitoring costs raise equilibrium values of r and p_g, and hence reduce credit rationing. The analysis therefore bears out arguments that reductions in costs of acquiring information will tend to reduce credit rationing and stimulate investment.

III. Equilibrium with Unintermediated, Interlocation Funds Flows

We now consider the possibility that lenders make loans in locations other than their own, and hence reintroduce locational subscripts. In particular, suppose that $\alpha_1 \geq \alpha_2$ and $\theta_1 \leq \theta_2$, with at least one of these inequalities strict. Then the analysis of the previous section indicates that, under locational autarky, $r_2^* > r_1^*$ will hold, where r_j^* is the (locationally autarkic) equilibrium expected rate of return to lenders. Thus there is, at least potentially, an incentive for funds to flow from location 1 to location 2. Such an incentive exists either because there is a greater potential supply of investment capital in location 1 (if $\alpha_1 > \alpha_2$) or because effective loan demand is greater in location 2 (if $\theta_1 < \theta_2$), or both.

This section investigates equilibria when individual borrowers in location 1 can lend directly to individual lenders in location 2, as before under the assumption that loan supply is adequate to meet loan demand. One might view the absence of intermediated interlocation lending as stemming from legal restrictions, an interpretation which is pursued further below.

A. Equilibrium

It is now necessary to complicate both the notation and the notion of an equilibrium. Let r_j denote the (market) expected return to a lender in location j who lends in his own location, and r_{jk} the expected return of a lender in location j who lends to a borrower in location k $\neq$ j. Similarly, let x_{bj} (x_{gj}) denote the interest rate offered (as part of an optimal debt contract) by type b (g) borrowers in location j. p_{bj} (p_{gj}) is similarly the probability of receiving credit in location j. All other terms of the loan contract are as previously.

In an equilibrium with interlocation funds flows, location 1 lenders lend in both locations. In order for them to be willing to do so, $r_1 = r_{12}$ must hold. If location 2 lenders lend in location 2 but not in location 1 (as will be the case in equilibrium), $r_2 \geq r_{21}$ must be satisfied. Similarly, all borrowers must prefer the source of funds they obtain to all other possible sources, as otherwise an interest rate paid to some group of lenders would be bid up. Thus the usages x_{bj} and x_{gj} are unambiguous.

Location 1 lenders who lend in location 2 face a monitoring cost of $\tilde{\gamma} > \gamma$. An important ingredient in the analysis is the interest rate that a type b(g) borrower in location 2 must pay to yield an expected return of r_{12} to a location 1 lender. Let $\phi(r_{12};\tilde{\gamma})$ denote the (smallest) solution to

$$(15) \qquad \int_0^x wf(w)dw + x[1 - F(x)] - \tilde{\gamma}F(x) = r_{12}.$$

Thus $\phi(r_{12};\tilde{\gamma})$ is the interest rate a type b borrower in location 2 must pay to yield a return of r_{12} to a location 1 lender. Similarly, let $\psi(r_{12};\tilde{\gamma})$ denote the (smallest) solution to

$$(16) \qquad \int_0^x wg(w)dw + x[1 - G(x)] - \tilde{\gamma}G(x) = r_{12},$$

so that $\psi(r_{12};\tilde{\gamma})$ is the interest rate a type g borrower in location 2 must pay to yield a return of r_{12} to a location 1 lender.

A location 2 lender lending to a type b borrower in location 2 at the interest rate x_{b2} obtains an expected return $q_b(x_{b2};\gamma)$ given by

$$(17) \qquad q_b(x_{b2};\gamma) \equiv \int_0^{x_{b2}} wf(w)dw + x_{b2}[1 - F(x_{b2})] - \gamma F(x_{b2}).$$

The same lender lending to a type g borrower in location 2 at the interest rate x_{g2} receives the expected return $q_g(x_{g2};\gamma)$, with

$$(18) \qquad q_g(x_{g2};\gamma) \equiv \int_0^{x_{g2}} wg(w)dw + x_{g2}[1 - G(x_{g2})] - \gamma G(x_{g2}).$$

If type b (g) borrowers in location 2 were paying the interest rate $x_{b2} = \phi(r_{12};\tilde{\gamma})[x_{g2} = \psi(r_{12};\tilde{\gamma})]$, then location 2 lenders would prefer lending to type b (g) borrowers iff $q_b[\phi(r_{12};\tilde{\gamma});\gamma] \geq (\leq)\ q_g[\psi(r_{12};\tilde{\gamma});\gamma]$. It will be convenient to not have the direction of preference in this case depend on r_{12}. Therefore, we now state a sufficient condition for $q_g[\psi(r_{12};\tilde{\gamma});\gamma] \geq q_b[\phi(r_{12};\tilde{\gamma});\gamma]$ to hold $\forall\ r_{12} \geq \underline{t}$. It will be apparent how the analysis would be modified if the reverse inequality always held.

Define $\tilde{x}(\gamma)$ implicitly by $1 - F[\tilde{x}(\gamma)] - \gamma f[\tilde{x}(\gamma)] \equiv 0$. Then $x_{ij} \leq \tilde{x}(\tilde{\gamma})\ \forall$ i, j, since $\tilde{x}(\tilde{\gamma})$ is the interest rate that maximizes the expected return of location 1 lenders (independent of borrower type). We now state

<u>Proposition 3</u>. Suppose that

$$(19) \qquad \hat{w}_g - \hat{w}_b \geq \gamma\{F[\tilde{x}(\tilde{\gamma})] - F(w^*)\}.$$

Then $q_g[\psi(r_{12};\tilde{\gamma});\gamma] \geq q_b[\phi(r_{12};\tilde{\gamma});\gamma]\ \forall\ r_{12} \geq \underline{t}$.

Proposition 3 is proved in the Appendix. Equation (19) is assumed to hold for the remainder of the analysis. It asserts that within location monitoring costs are not too large.

Assuming the supply of funds is adequate to meet the effective demand, there are four possibilities as regards an equilibrium with unintermediated interlocation lending. We now consider each case in turn.

<u>Case 1</u>. In this case location 1 lenders lend to both type b and g borrowers in location 2. Location 2 lenders lend only to type g borrowers in their own location. Then location 1 lenders must receive an expected return of r_1, so that $x_{b2} = \phi(r_1;\tilde{\gamma})$ and $x_{g2} = \psi(r_1;\tilde{\gamma})$, while $x_{b1} = \phi(r_1;\gamma)$ and $x_{g1} = \psi(r_1;\gamma)$.

Furthermore, the arguments of Section I imply that $p_{b1} = p_{b2} = 1$ will hold, as will

(20) $$p_{g1} = \{\pi_b[\phi(r_1;\gamma)] - R_b\}/\{\pi_b[\psi(r_1;\gamma)] - R_b\} \equiv p(r_1;\gamma)$$

and

(21) $$p_{g2} = \{\pi_b[\phi(r_1;\tilde{\gamma})] - R_b\}/\{\pi_b[\psi(r_1;\tilde{\gamma})] - R_b\} \equiv p(r_1;\gamma),$$

where $r_{12} = r_1$ has been used in (20). As in Section II.B, $p(r;\tilde{\gamma}) < p(r;\gamma) \; \forall \, r$ if (10) is downward sloping, as we assume.

To verify that location 2 lenders prefer lending to type g rather than type b borrowers in location 2, we note that this follows from Proposition 3. To verify that location 2 lenders do not wish to lend in location 1 ($r_2 \geq r_{21}$), we observe that $q_g[\psi(r_1;\tilde{\gamma});\gamma] > q_g[\psi(r_1;\gamma);\tilde{\gamma}] = r_{12}$.

For this situation to constitute an equilibrium, two additional conditions must be satisfied: loan supply and loan demand are equal, and location 2 type g borrowers absorb at least as many funds as are supplied by location 2 lenders. To state the first of these conditions, we define

(22) $$z(r_1) \equiv \alpha_1 H(r_1) - (1-\alpha_1)[\theta_1 + (1-\theta_1)p(r_1;\gamma)].$$

Then $z(r_1)$ is the excess supply of funds in location 1. For loan supply across locations to equal total loan demand,

(23) $$z(r_1) + \alpha_2 H\{q_g[\psi(r_1;\tilde{\gamma});\gamma]\} = (1-\alpha_2)[\theta_2 + (1-\theta_2)p(r_1;\tilde{\gamma})],$$

must hold. If there is a value r_1 satisfying (23) and $z(r_1) \geq (1-\alpha_2)\theta_2$, then type g borrowers in location 2 absorb at least as many funds as are supplied by location 2 lenders, and a case 1 equilibrium obtains.

As we observed previously, in such an equilibrium $p(r_1;\gamma) > p(r_1;\tilde{\gamma})$, so differential credit rationing across locations will be observed. So will cross-location interest rate differentials, since $x_{b1} = \phi(r_1;\gamma) < \phi(r_1;\tilde{\gamma}) = x_{b2}$ and $x_{g1} = \psi(r_1;\gamma) < \psi(r_1;\tilde{\gamma}) = x_{g2}$. Finally, location 2 lenders obtain a higher expected return than location 1 lenders, since $r_1 = q_g[\psi(r_1;\tilde{\gamma});\tilde{\gamma}] < q_g[\psi(r_1;\tilde{\gamma});\gamma] = r_2$.

<u>Case 2</u>. In this case location 1 lenders lend only to type b borrowers in location 2, while location 2 lenders lend to both type b and g borrowers. In order for them to be willing to do so $q_b(x_{b2};\gamma) = q_g(x_{g2};\gamma)$ must hold. In order for location 1 lenders to be willing to lend to type b borrowers in location 2, $x_{b2} = \phi(r_1;\tilde{\gamma})$ must also hold. Therefore,

(24) $$q_g(x_{g2};\gamma) = q_b[\phi(r_1;\tilde{\gamma});\gamma].$$

Note that, from (24) and from Proposition 3, $x_{g2} \leq \psi(r_1;\tilde{\gamma})$.

Location 1 lenders are content with this arrangement, since $x_{g2} < \psi(r_1;\tilde{\gamma})$. We then need to argue that location 2 type g borrowers are content, in the sense that they have no incentive to attempt to borrow from location 1 lenders. To see that this is the case, note that for a type g borrower paying the interest rate x_{g2},

(25) $$p_{g2} = \{\pi_b[\phi(r_1;\tilde{\gamma})] - R_b\}/\{\pi_b(x_{g2}) - R_b\}.$$

This borrower therefore obtains an expected utility level of $p_{g2}\pi_g(x_{g2}) + (1-p_{g2})R_g$.

If the same borrower were to borrow from a location 1 lender, he would have to offer the interest rate $\psi(r_1;\tilde{\gamma})$, and his expected utility would be $p(r_1;\tilde{\gamma})\pi_g[\psi(r_1;\tilde{\gamma})] + [1 - p(r_1;\tilde{\gamma})]R_g$. Thus type g borrowers are content to borrow in location 2 iff $p_{g2}[\pi_g(x_{g2}) - R_g] \geq p(r_1;\tilde{\gamma})\{\pi_g[\psi(r_1;\tilde{\gamma})] - R_g\}$. Using (20) and (25), this condition is equivalent to

(26) $$[\pi_g(x_{g2}) - R_g]/[\pi_b(x_{g2}) - R_b] \geq \{\pi_g[\psi(r_1;\tilde{\gamma})] - R_g\}/\{\pi_b[\psi(r_1;\tilde{\gamma})] - R_b\}.$$

But (26) follows from $\psi(r_1;\tilde{\gamma}) \geq x_{g2} > \underline{t}$, $R_g > R_b$, and $\pi_g' < 0$. Thus no agents have an incentive to deviate from their stated strategies.

As before, a case 2 equilibrium obtains if type b borrowers in location 2 absorb all interlocation funds flows, so that $z(r_1) \leq \theta_2(1-\alpha_2)$, and if loan supply equals loan demand. The latter condition requires that

(27) $$z(r_1) + \alpha_2 H\{q_b[\phi(r_1;\tilde{\gamma});\gamma]\} = (1-\alpha_2)[\theta_2 + (1-\theta_2)p_{g2}],$$

with p_{g2} given by (25), and x_{g2} given by (24).

It is easily verified that $p_{g2} < p(r_1;\tilde{\gamma}) < p(r_1;\gamma)$ holds, so that in a case 2 equilibrium differential credit rationing is observed. So are expected return differentials, since $r_2 = q_b[\phi(r_1;\tilde{\gamma});\gamma] > q_b[\phi(r_1;\tilde{\gamma});\tilde{\gamma}] = r_1$. Also, interest rate differentials will persist across locations. For type b agents this follows from $x_{b1} = \phi(r_1;\gamma) < \phi(r_1;\tilde{\gamma}) = x_{b2}$. For type g agents we have $q_g(x_{g2};\gamma) = q_b[\phi(r_1;\tilde{\gamma});\gamma] > q_b[\phi(r_1;\tilde{\gamma});\tilde{\gamma}] = r_1 = q_g[\psi(r_1;\gamma);\gamma]$. Thus $x_{g2} > \psi(r_1;\gamma) = x_{g1}$ is satisfied.

Case 3. Suppose that a value r_1 satisfying (27) and $q_g[\psi(r_1;\tilde{\gamma});\gamma] = q_b[\phi(r_1;\tilde{\gamma});\gamma]$ exists. Then there is an equilibrium with unintermediated lending where all lenders are indifferent between lending to type b and g borrowers in location 2. If such an equilibrium exists, earlier arguments can be repeated to establish that interest rate and rate of return differentials will exist across locations, as will differential credit rationing.

Case 4. It is possible that no interlocation funds flows occur when interlocation lending is unintermediated. For example, if $r_1^* \geq \max\{q_g[\bar{x}(\tilde{\gamma});\tilde{\gamma}], q_b[\bar{x}(\tilde{\gamma});\tilde{\gamma}]\}$, there are no interest rates that location 2 borrowers can pay location 1 lenders in order to induce funds to flow. In this event, which will occur if $\tilde{\gamma}$ is sufficiently large, locational autarky will persist. In this event, interest rate, rate of return, and credit rationing differentials between locations will obviously exist.

Summary

An equilibrium with unintermediated interlocation lending will display cross-location interest rate and expected return differentials, and differential credit rationing. Also, the occurrence of any interlocation funds flows requires that interlocation interest rate differentials be sufficiently large. We now use these observations to interpret some features of U.S. banking history.

B. Some Evidence

During the 19th and early 20th centuries, significant regional interest rate differentials were observed in the U.S. (Davis 1965, James 1978). This was a period where the importance of interstate branching prohibitions and unit banking laws has been well documented. Moreover, according to Davis (1965, p. 356), during this period "most of the savings accrued in the developed areas (that is, in the Northeast), but the demand for capital moved steadily toward the South and West." Thus the kind of model just described appears relevant.

Moreover, the model of the previous section accords well with observations of this period. As indicated by Davis (p. 358), an "interest differential of 2 percent" was required to induce capital to migrate. Moreover, there were persistent regional return differentials (even with losses deducted). This led Davis (p. 358, footnote 7) to argue that such differentials could not be explained by differences in risk (or other obvious factors) associated with borrower characteristics in different regions.

The model of Section A is entirely consistent with these observations, however. Interest rates are highest in location 2, whether funds flow between locations or not. Moreover, $r_2 > r_1$, so average returns in location 2 (to location 2 lenders) exceed those in location 1, even though these average returns deduct losses. (This return differential would appear even larger if monitoring costs were included.) This is despite the fact that the borrower pool in location 2 has no higher intrinsic default risk than the borrower pool in location 1 if $\theta_1 = \theta_2$. Thus our model readily accounts for this aspect of historical U.S. experience.

In general, historians (e.g., Cameron 1967) and development economists (e.g., McKinnon 1973) have argued that an incompletely integrated financial system results in return differentials and an accordingly inefficient allocation of investment capital. The model of the previous sections displays these features. The inefficient allocation of capital manifests itself in the fact that credit rationing will be more severe in location 2 (if (10) is downward sloping). We now describe a complete integration of the financial system via intermediation.

IV. Equilibrium with Intermediated Interlocation Funds Flows

Intermediaries operating in both locations are essential to the elimination of locational return differentials. Moreover, there exists an incentive for them to form, which we now describe.

Suppose that some agent in location 2 (the intermediary) contracts with a set of lenders (having positive measure) in location 1 to deliver one unit of funds each in exchange for the certain return r. Simultaneously, the intermediary offers funds to individual borrowers in location 2 exactly as individual lenders in location 2 do; i.e., by accepting offered contracts. The intermediary conducts the monitoring of these loans as necessary, so that loans from location 1 lenders to location 2 borrowers can be monitored at a cost of γ rather than $\tilde{\gamma}$. Finally, since the intermediary lends to a large number of borrowers, it is feasible to pay a certain return to location 1 lenders,[10] who can simply be viewed as depositors.[11]

If the equilibrium of Section III is in force then there is an arbitrage profit to be made by doing this, since funds can be obtained for a return of r_1 and lent for an expected return of r_2. An absence of arbitrage profits requires that $r_1 = r_2$. Moreover, clearly all interlocation lending will have to be intermediated, so that $x_{bi} = \phi(r;\gamma)$ and $x_{gi} = \psi(r;\gamma)$; $i = 1, 2$. Thus intermediation eliminates interlocation rate of return and interest rate differentials. Also, since intermediaries pay certain returns to location 1 depositors, no interlocation monitoring occurs in equilibrium.

In this situation, an equilibrium exists under the assumptions of Section III, and is characterized by (common) values p_g and r satisfying (10) and

$$\alpha' H(r) = (1-\alpha')[\theta' + (1-\theta')p_g], \tag{11'}$$

where $\alpha' \equiv (\alpha_1 + \alpha_2)/2$, and where $\theta' = [(1-\alpha_1)\theta_1 + (1-\alpha_2)\theta_2]/(2-\alpha_1-\alpha_2)$. Clearly the comparative static results of Section II also continue to hold.

We might note that within-location lending can be intermediated as well as interlocation lending, although there is no obvious advantage (or disadvantage) to it. However, a lower bound on (and perhaps a natural measure of) the extent of intermediation is the net flow of funds from location 1 to location 2, which is $\alpha_1 H(r) - (1-\alpha_1)[\theta_1 + (1-\theta_1)p_g]$.

It is often argued that improvements in the technology for acquiring information will increase the extent of intermediation. Here such improvements can be represented by reductions in γ, say from γ_1 to $\gamma_2 < \gamma_1$. As shown in Section II, if (10) is downward sloping, reductions in γ raise the equilibrium return from r_1 to r_2, and also raise p_g from p_1 to p_2. Moreover,

$$\alpha'[H(r_2) - H(r_1)] = (1-\alpha')(1-\theta')(p_2 - p_1).$$

The change in intermediated (interlocation) lending is given by

$$\alpha_1[H(r_2) - H(r_1)] - (1-\alpha_1)(1-\theta_1)(p_2 - p_1),$$

which is positive if

$$\alpha_1/(1-\alpha_1) > [\alpha'/(1-\alpha')][(1-\theta_1)/(1-\theta')]. \tag{28}$$

When (28) holds improvements in information technologies will result in increased intermediation, as well as reductions in credit rationing, as often argued in the literature on intermediation and economic development.[12]

V. Conclusions

A model has been developed in which problems of both adverse selection and costly state verification complicate the allocation of investment capital. Comparative advantages in monitoring lead to the existence of intermediated lending in equilibrium. Intermediation prevents the existence of rate of return and interest rate differentials, as well as differential credit rationing. However, all of these could be observed if inter-location lending was not intermediated. Finally, it was seen that improvements in the information technology (reductions in γ) reduce credit rationing and potentially increase intermediation. This supports assertions in the development literature that higher costs of information acquisition in less-developed economies can result in more extensive credit rationing and reduced investment and intermediation.

The role played by financial intermediaries in our analysis is similar in spirit to, but different from that in some of the other theoretical literature on financial intermediation; in particular Diamond (1984), Boyd and Prescott (1986), and Williamson (1986). In that literature, intermediaries in part avoid redundant monitoring costs, and there are increasing returns to scale in intermediation. This implies that all lending is intermediated, and that no borrower would ever obtain funds from more than one source. These are clearly counter-factual implications. In our model there are no potential redundancies in monitoring; rather intermediation arises simply due to locational comparative advantages in monitoring. Thus there are no scale economies associated with intermediation, and all lending need not be intermediated. Moreover, in contrast to the situation in Diamond (1984), Boyd-Prescott (1986), or Williamson (1986), in the absence of intermediation rate of return and interest rate differentials are observed. Finally, of the literature just mentioned, only Williamson (1986) considers the possibility of credit rationing. However, his credit rationing arises only when it is impossible to elicit additional savings. Since the development of intermediation is often argued to elicit increased savings (Cameron 1967, McKinnon 1973), the type of credit rationing we consider seems more closely related to discussions in the development literature.

Finally, we comment on some possible extensions of the analysis. One would be to consider investment projects which are large relative to the endowment of any individual, as in Diamond (1984), Boyd-Prescott (1986), and Williamson (1986). In this situation intermediaries could help avoid redundant monitoring, as well as efficiently allocate investments across different locations. Thus they would perform multiple functions, rather than just the one we have focused on. Another extension would be to allow for some location specific randomness in intermediary offered returns. (This could occur, for instance, if intermediaries were of finite size.) The results of Krasa and Villamil (1990) suggest that our analysis would continue to be valid in this case. A final natural extension would be to consider various kinds of government interventions in financial markets. This would be of interest since such interventions are observed in virtually all economies, and are often rationalized by the presence of credit rationing and informational frictions of the kind we have considered.

Appendix:

Proof of Proposition 3

From the definition of q_b and π_b we have

$$q_b(x;\gamma) + \pi_b(x) = \hat{w}_b - \gamma F(x) \tag{A.1}$$

$\forall$ x, while similarly

$$q_g(y;\gamma) + \pi_g(y) = \hat{w}_g - \gamma G(y). \tag{A.2}$$

If x, y $\geq$ w*, then $\pi_g(y) = \pi_b(y)$ and $G(y) = F(y)$. Thus from (A.1) and (A.2),

$$\begin{aligned} q_g(y;\gamma) - q_b(x;\gamma) &= \hat{w}_g - \hat{w}_b - [\pi_b(y) - \pi_b(x)] - \gamma[F(y) - F(x)] \\ &= \hat{w}_g - \hat{w}_b - \int_x^y [\pi_b'(s) + \gamma f(s)]ds \\ &= \hat{w}_g - \hat{w}_b - \int_y^x [1 - F(s) - \gamma f(s)]ds. \end{aligned} \tag{A.3}$$

Further, since x, y $\geq$ w*, f(s) = g(s) and F(s) = G(s). Then (7) and (A.3) imply that

$$\begin{aligned} q_g(y;\gamma) - q_b(x;\gamma) &\geq \hat{w}_g - \hat{w}_b - \gamma \int_y^x f(s)ds \\ &= \hat{w}_g - \hat{w}_b - \gamma F(x) + \gamma F(y). \end{aligned} \tag{A.4}$$

Now set $y = \psi(r_{12};\tilde{\gamma})$ and $x = \phi(r_{12};\tilde{\gamma})$. From (A.4) we have

$$\begin{aligned} q_g[\psi(r_{12};\tilde{\gamma});\gamma] - q_b[\phi(r_{12};\tilde{\gamma});\gamma] &\geq \hat{w}_g - \hat{w}_b - \gamma F[\phi(r_1;\tilde{\gamma})] + \gamma F[\psi(r_1;\tilde{\gamma})] \\ &\geq \hat{w}_g - \hat{w}_b - \gamma F[\tilde{x}(\tilde{\gamma})] + \gamma F(w^*) > 0, \end{aligned}$$

where the latter equality follows from (23).

Footnotes

[1]As in Gale and Hellwig (1985), Williamson (1986, 1987), or Boyd and Smith (1991).

[2]As in Stiglitz and Weiss (1981).

[3]We can assume that lenders vary according to their opportunity costs of investment or, alternatively, that lender k has the utility function $c_1 + (c_2 - e)/t_k$, where c_h is period h consumption, $h = 1, 2$.

[4]If $w \in B$ but the borrower announces $w \in A$, we may assume that $R(w) = w$.

[5]At this point we should formally be agnostic on the locations of the lender and borrower, so either γ or $\tilde{\gamma}$ could appear in (1). For the remainder of this section we will only concern ourselves with the case where all monitoring is intralocation monitoring. However this is not important for our results. In Section III we discuss the possibility of interlocation monitoring.

[6]This leaves open the question of whether other specifications of lender beliefs would support other (pooling or semi-separating) equilibria. While this is clearly possible, such specifications seem unlikely to survive the refinements suggested by Cho and Kreps (1987). Also, we note that our specifications of lender beliefs reduce the question of equilibrium determination essentially to that considered by Rothschild and Stiglitz (1976).

[7]Note that this argument does not rely on the separating equilibrium contract for type g agents being a debt contract.

[8]$\tilde{x}$ is defined by $1 - F(\tilde{x}) - \gamma f(\tilde{x}) = 0$. Since $\tilde{x} > \underline{t} \geq w^*$ must hold for any funds to be offered by lenders, $G(\tilde{x}) = F(\tilde{x})$ and $g(\tilde{x}) = f(\tilde{x})$, so $\tilde{x}$ also satisfies $1 - G(\tilde{x}) - \gamma g(\tilde{x}) = 0$.

[9]A sufficient condition for (a.5) to hold $\forall\, x \leq \bar{r}$ is that $g'(x)[1 - G(x)] \geq -g(x)^2 \;\forall\, x \in [\underline{t}, \bar{r}]$.

[10]For a justification of our appeals to the law of large numbers see Uhlig (1987).

[11]Parenthetically, since intermediaries are members of the ordinary lender population, they have the same beliefs as all other agents about what a deviation from the separating contract announcements implies about a borrower's type. Thus the analysis of contract offers does not need to be modified because of the presence of intermediaries.

[12]When (28) fails, interlocation lending falls with reductions in monitoring costs. However, total credit extension (summed over locations) increases. If all (rather than just interlocation) lending were intermediated, intermediation would always increase with reductions in monitoring costs. All loans would be intermediated if there were some source of increasing returns to intermediation, as in Diamond (1984), Boyd and Prescott (1986), or Williamson (1986). (This point is discussed further in Section V.) Therefore, we feel that not too much should be made of the possibility that reductions in monitoring costs reduce intermediation if (28) fails.

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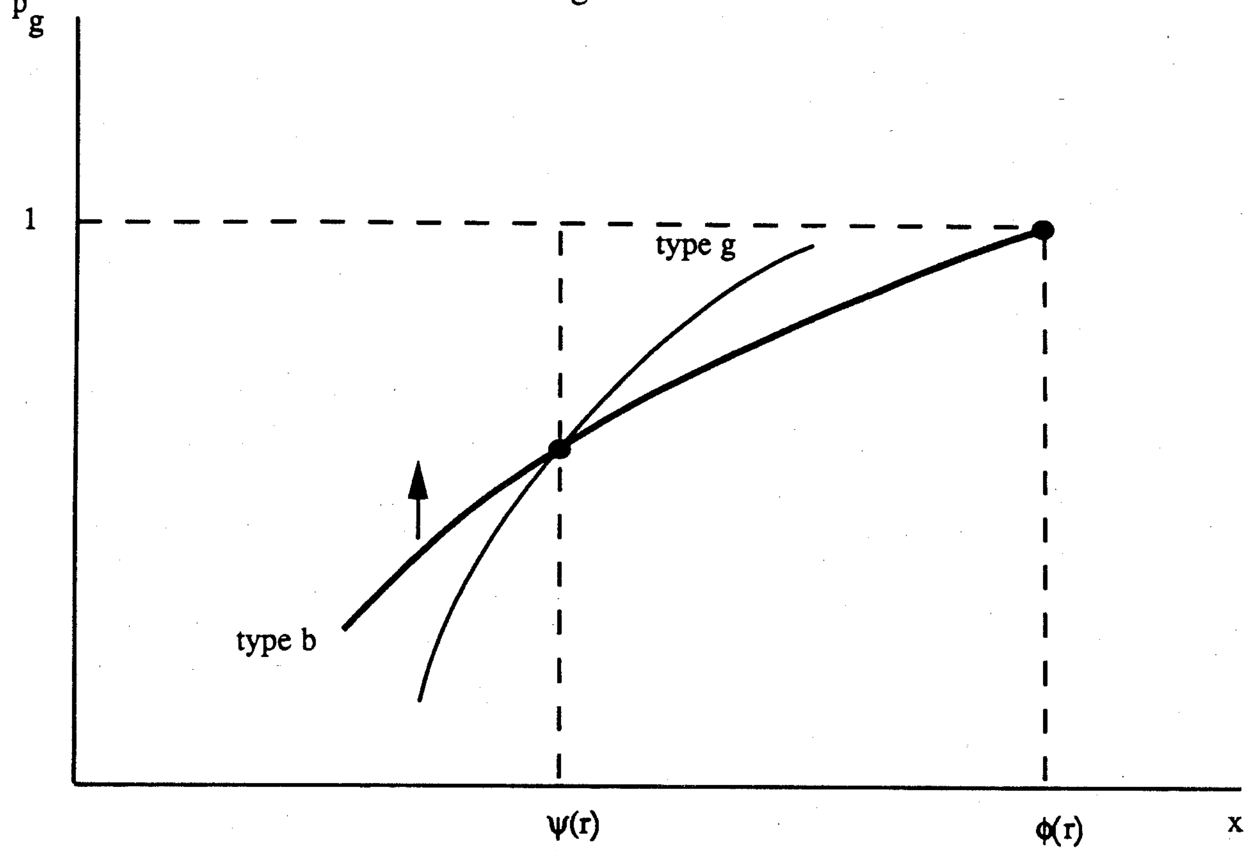
Figure 1



Utility increases in the direction shown.

Figure 2