Financial Intermediaries as Facilitators of Reputation Formation in Credit Markets

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Abstract

This paper proposes a new explanation for the role of financial intermediaries. The basic premise is that the smooth and efficient function of credit markets requires that borrowers be provided with incentives and opportunities to build a reputation for creditworthiness. Absent such incentives and opportunities, borrowers may be insufficiently motivated to avoid default and lenders, in turn, will be unwilling to lend. When the number of lenders is small, it is natural and easy for them interact and exchange information. This leads to a transparency about credit histories which encourages reputation building by borrowers. By contrast, the presence of very large numbers of lenders restricts opportunities for the exhange of information between them, which diminishes the value of reputation building by borrowers. Financial intermediation gets around this difficulty by separating the identity of capital ownership from the identity of the actual lenders. Since each intermediary represents a very large number of capital owners, the number of direct lenders (the intermediaries) can be kept small enough to facilitate the smooth flow of information even when the number of indirect lenders (depositors) is very large. This restores the incentive of borrowers to establish good reputations.

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1. Introduction

Why are financial intermediaries the main players in credit markets? Why don't capital owners lend directly? Existing theories explain the role of financial intermediaries by identifying specific functions which intermediaries are able to perform better than their depositors, such as consumption smoothing (Diamond and Dybvig, (1983)) and reduced monitoring costs due to informational asymmetries (e.g., Diamond (1984), Ramakrishnan-Thakor (1984)).

This paper identifies a new role for financial intermediation. In contrast to existing theories which emphasize the superior abilities of intermediaries over their depositors, this paper argues that a regime of intermediary lending is able to nurture a more informationally efficient market structure than a direct lending regime. The argument is based on two premises. The first premise is that for credit markets to function smoothly and efficiently, it is essential to provide borrowers with incentives and opportunities to establish a reputation for creditworthiness. Absent such incentives and opportunities, borrowers may be insufficiently motivated to avoid default and lenders, in turn, will be unwilling to lend. The second premise is that a proliferation of the number of lenders exerts a negative externality on the flow of information in the market which erodes the value of reputation formation on the part of borrowers.

Specifically, in small credit markets, such as in a simple village economy, where everyone knows everyone else, lenders easily and naturally interact with one another and exchange information. This leads to a transparency about individual borrowers' credit histories which encourages virtuous behavior and discourages default. In particular, a borrower has a strong incentive to repay if it knows that opportunistic behavior vis a vis one lender is likely to be discovered by other potential lenders and cut off future credit from *all* lenders. By contrast, in large, densely populated and urbanized societies, the individual becomes largely anonymous. This severely curtails the opportunities for individual lenders to interact and exchange information, which in turn diminishes the value of a good credit history to borrowers, and makes default more attractive. Capital owners may then be unwilling to lend and market failure may result.

Financial intermediation can get around this difficulty by separating the identity of capital ownership from the identity of lenders. Since each intermediary represents a very large number of capital owners, the number of *direct* lenders (the intermediaries) can be kept small enough to facilitate the smooth transmission of information between them even when the number of *indirect* lenders (depositors) is very large. Thus, a switch from a direct lending regime to an intermediation regime can facilitate the flow of information between lending institutions sufficiently to restore the value of a good credit history to borrowers. By thus increasing the incentives for repayment on the demand side of the market, and consequently the willingness to lend on the supply side, intermediation enables credit markets to function more efficiently.

It is instructive to compare this approach to related information - based models, such as Diamond (1984). In Diamond's model, entrepreneur - borrowers are privately informed of the realized returns from their investment and, consequently, lenders must invest in costly monitoring technology to ensure repayment. Diamond shows that intermediation may then increase efficiency by reducing total monitoring costs in the market. In my model as well, intermediation alleviates frictions due to asymmetric information. But not by reducing lenders' monitoring costs. Indeed, here lenders do not actively monitor borrowers at all. Rather, the role of intermediation is to borrowers with sufficient incentive *to monitor themselves.* Borrowers behave virtuously in order to avoid tarnishing their reputations and jeopardizing future credit opportunities.

Gutman and Yecouel (2003) present a related argument for the role of firms in markets for experience goods. In their model, firms - which represent large numbers of individual producers - have more visible reputations than small, individual producers and hence may be motivated to provide high quality when individual producers would have insufficient incentives to do so. Interestingly, while in their model individual craftsmen establish firms to facilitate reputation formation *for themselves*, here intermediation by lenders facilitates reputation formation on the *opposite* side of the market, by borrowers.

The rest of the paper is organized as follows. To deliver the idea of the paper in the simplest possible way, the next section presents a basic model in which it is assumed that lenders cannot enforce repayment. In section 3 the model is modified and is shown to apply to more realistic environments.

2. The Model

There is an infinite number of discrete time periods. The market consists of two types of individuals, "lenders" and "borrowers". There are N infinitely lived borrowers. N new lenders are born at each period and live for two periods. A lender inherits a unit of capital at birth. At its first period she invests its unit. She can either either invest on her own, in which case she recieves r units at the end of the period, r>1, or lend out her capital to a borrower. Borrowers have access to a superiod investment technology which return G>r units per unit invested, but own no capital of their own. A lender . At the beginning of each period a lender is endowed with a unit of capital which she can either invest on her own or lend out as discussed below. If she invests on her own, she receives r units at the end of the period, $r > 1$. Borrowers have access to a superior investment technology which returns $G > r$ units per unit invested per period but own no capital of their own. A lender has the option of investing indirectly by lending her unit to a borrower. We assume that in that case, as a result of an unmodeled bargaining procedure, the borrower agrees to pay the lender $\theta(G-1)$ and keep (1-θ)$(G-1)$ where

$0 < \theta < 1$ and $\theta G > r$[1]. At her second period a lender bequeathes the "principal" - the unit with which she was endowed - to her offspring and consumes what is left ($r - 1$ or $\theta G - 1$).These assumption imply that a specific lender and borrower do not interact more than once. Hence reputational effects constitute the only intertemporal link in the model.

At the beginning of a period, a lender is randomly matched with a new borrower. She can either lend to that borrower or invest on her own; a lender cannot lend to any borrower other than the one with which he is randomly matched at that period and a borrower cannot obtain credit from any other lender at that period. Also, at the beginning of each period, before making lending and investment decisions, lenders obtain information about borrowers' credit histories from other lenders. Specifically, at her second period, a lender whose loan was not repaid informs $j > 1$ randomly selected young lenders of the identity of the defaulting borrower. At the following period each of those j lenders in turn pass on this information to j other randomly selected new young lenders and so on. Thus, if a borrower defaults at some period τ, j new lenders know of it at the following period, j^2 know it 2 periods hence, and j^t know about it t periods hence. Thus, since there are N lenders and since each borrower interacts with only one lender at each period, if a particular borrower defaults at some period, the probability that a young lender who is matched with that borrower t periods hence is informed of her default is $p(t, N) = \min\{1, j^t/N\}$. Let t^* be the number of periods it takes for all lenders in the market to learn that a particular borrower i has previously defaulted (i.e, $t^*$is the smallest integer such that $j^t \geq N$. Note that (for fixed $j$and t) $p(t, N) \to 0$ as $N \to \infty$.

In this section we assume that borrowers can "take the money and run". That is, lenders have no legal or other recourse to enforce repayment if a borrower wants to default (this somewhat unrealistic assumption is relaxed in the following

[1] So θG is the interest paid.

section). All borrowers are identical and opportunistic. Here opportunistic means that a borrower repays her loan only if the monetary payoff from repayment exceeds the payoff from default.

Since borrowers can achieve a higher return then lenders, the efficient outcome is that lenders lend their capital to borrowers rather than invest on their own. When is the market able to achieve this efficient outcome?

I restrict attention to stationary equilibria in which in which lenders' and borrowers' strategies do not depend on calendar time. There are then two possible (subgame perfect) equilibria for this game. In the inefficient *no - credit equilibrium*, (NCE), credit is never extended (lenders invest on their own). In the efficient *credit equilibrium* (CE), credit is extended to all borrowers.

Trivially, there always exists a NCE[2].

Under what conditions does a CE exist? Suppose for a moment that lenders are perfectly informed about borrowers' credit histories (that is, $t^* = 1$) and suppose that lenders use the following "trigger" strategy: At each period, lend

to any borrower except one who is known to have previously defaulted. Then a borrower who never defaults is able to borrow at every period, giving her a payoff of $(1-\theta)(G-1)$ per period and a discounted payoff of $\frac{(1-\theta)(G-1)}{1-\delta}$ where $\delta < 1$ is the discount factor. A borrower who defaults earns a discounted profit of G (since after defaulting it will not obtain any more loans). Hence repayment is optimal if and only if $\frac{(1-\theta)(G-1)}{1-\delta} \geq G$,i.e., iff $\delta \geq \delta^* = (1+\theta G-\theta)/G$. Thus, under complete information spreads instantaneouly, a CE exists for sufficiently large δ.

By contrast suppose there is imperfect monitoring, $t^* > 1$. Then, if lenders follow the trigger strategy, a borrower who defaulted t periods ago (and hasn't defaulted since) obtains credit at the current period with probability $1-p(t,N)$.

[2]In this equilibrium, a borrower's (out of equilibrium) strategy is to default whenever she receives a loan and the lenders' strategy is never to lend (whatever the borrower's history)

Thus a borrower who defaults once gets a payoff of: [3]: $G + (1 - p(1,N))\delta(1 - \theta)(G-1) + (1-p(2,N))\delta^2(1-\theta)(G-1) + ... + (1-p(t^*,N))\delta^{t^*}(1-\theta)(G-1)$. (where $p(t^*,N) = 1$). Thus, it is optimal for the borrower to repay the loan only if :

$$\frac{(1-\theta)(G-1)}{1-\delta} \geq G + (1-p(1,N))\delta(1-\theta)(G-1) + \\ (1-p(2,N))\delta^2(1-\theta)(G-1) + ... + (1-p(t^*,N))\delta^{t^*}(1-\theta)(G-1).... \tag{1}$$

Since (for fixed j, t and δ) $p(t,N) \to 0$ as $N \to \infty$, corresponding to any $\delta < 1$ there exists $N(\delta)$ such that for $N > N(\delta)$, $\frac{(1-\theta)G}{1-\delta} < G + (1-p(1,N))\delta(1-\theta)G + (1-p(2,N))\delta^2(1-\theta)G + ... + (1-p(t^*,N))\delta^{t^*}(1-\theta)G$. Thus, if N is sufficiently large a CE does not exist and the credit market fails. When information spreads only gradually and the market is large, borrowers do not have enough of an incentive to build up a reputation for creditworthiness. Absent this incentive, they prefer to default and lenders consequently prefer not to lend. The result is market failure.

2.1. Financial Intermediaries

The preceding result points to a role for financial intermediation to facilitate the existence of a CE. Suppose that instead of lending directly, capital owners - hencefoth *depositers* - lend *indirectly* via financial intermediaries such that it is only possible for borrowers to obtain credit from an intermediary. Let's continue to assume that a borrower agrees to pay interest of θG and let this be divided equally between a depositer and an intermediary (i.e., depositers receive $G(1-\theta/2)$ from intermediaries at the end of the period). As Diamond (1984) observes, under financial intermediation, there are two issues which must be addressed. First, just as under the direct lending regime, borrowers must be motivated not to default.

[3] This formulation applies if the borrower defaults only once.

Second, intermediaries must be motivated to repay depositers (i.e., banks must be motivated not to fail). We procede to show how our framework is able to resolve both these issues.

We continue to assume that depositers live two periods but have to assume that intermediatries are infinitely lived; otherwise they would never have an incentive to repay depositers. To preserve symmetry with the direct lending setup, in which a specific lender and borrower interact only once, we'll assume that at every period an borrower is randomly matched with a *new* intermediary (from whom it has not previously borrowed) and can not borrow from any other source at that period. In particular, the possibility that individual borrowers and intermediaries establish long term credit relationships is ruled out. Thus, as in the direct lending setup, reputational considerations constitute the only intertemporal link in the model.

Since now only intermediaries interact directly with borrowers, it is natural to suppose that intermediaries share information about defaulting borrowers only with other intermediaries while (old) depositers share information about defaulting intermediaries with (young) depositers. Specifically, an intermediary whose loan is not repaid informs j other intermediaries about the defaulting borrower at the following period, $j \geq 2$, who inform j other intermediaries at the following period and so on. Similarly, each old depositer informs j young depositers about defaulting intermediaries, who inform j young depositers at the following period and so on.

The preceding implies that under intermediation, the speed with which information disseminates, and hence the probability of detection, depends not on the size of the market, N, but on the number of intermediaries in the market, I. Specifically, the probability that an intermediary learns that a borrower defaulted t periods ago is now $p(t, I) = j^t/I$,which does not depend on N. Because each intermediary represents a large number of depositers, I may be kept small even if N is unboundedly large. Hence, if I is sufficiently small (i.e., the number of depositers per intermediary is large enough), $p(t, I)$ is large enough to discourage default even if N is very large. Specifically, if intermediaries follow the trigger strategy, it is optimal for borrowers not to default if:

$$\begin{aligned}&\frac{(1-\theta)(G-1)}{1-\delta} \geq G + (1-p(1,I))\delta(1-\theta)(G-1) + \\ &+(1-p(2,I))\delta^2(1-\theta)(G-1) + ... + (1-p(t^*,I))\delta^{t^*}(1-\theta)(G-1)....\end{aligned} \tag{2}$$

Since $t^* = 1$ if $I \leq 2$, the preceding inequality obtains if $\delta \geq \delta^*$.Thus for any $\delta \geq \delta^*$, there exists $I(\delta)$ such that if $I \leq I(\delta)$, it is optimal for borrowers not to default, regardless of how large N is.A similar logic applies with respect to intermediaries' incentive to repay depositers. Since each intermediary receives deposits from many different depositors, the probability that a young depositer learns about a defaulting intermediary also depends on the number of intermediaries in the market. Specifically, if there are I intermediaries and intermediary i defaults at period τ, then, since each depositer with intermediary i lost money to it at period τ, the probability that a young depositer at period $\tau+1$ is informed of the default is simply the probability that she meets an (second period) depositer of intermediary i, which is [4] $\pi(I, N, 1) = 1 - (1 - \frac{j}{N})^{N/I}$. More generally, the probability that a young depositer at period $\tau + t$ is informed about the default is $\pi(I, N, t) = 1 - (1 - \frac{j}{N})^{j^t N/I}$. Thus, if depositers play the trigger strategy, it is optimal for the intermediary not to default if:

$$\begin{aligned}\frac{\frac{\theta}{2}(G-1)}{1-\delta} &\geq G + (1-\pi(I,N,1))\delta\frac{\theta}{2}(G-1) + \pi(I,N,2))\delta^2\frac{\theta}{2}(G-1) + ... \\ &. + (1-\pi(I,N,t^*))\delta^{t^*}\frac{\theta}{2}(G-1).\end{aligned} \tag{3}$$

[4] The probability of not meeting a specific old lender is $\frac{j}{N}$. Since there are N old lenders, the probability of not meeting any one of them is $(1 - \frac{j}{N})^N$.

Observe that $\pi(I,N,t)$ is increasing in I and decreasing in N. Crucially, however, although $\pi(I,N,t)$ is decreasing in N, $\pi(I,N,t) \geq 1 - e^{-j^t/I}$ for any N, no matter how large. Thus, let δ^{**} solve:

$$\frac{\frac{\theta}{2}(G-1)}{1-\delta} = G + e^{-j}\delta\frac{\theta}{2}(G-1) + e^{-j^2}\delta^2\frac{\theta}{2}(G-1) + ... + e^{-j^{t^*}}\delta^{t^*}\frac{\theta}{2}(G-1). \quad (4)$$

The rhs of the preceding inequality is an upper bound on the payoff from default when $I = 1$. Thus, if $\delta^{**} < 1$ exists, then for $\delta \geq \delta^{**}$, there exists $I(\delta)$ such that for $I \leq I(\delta)$,it is optimal for the intermediary not to default. We also observe that $\delta^{**} < 1$ exists for sufficiently large j. Hence we conclude:

For sufficiently large j and sufficiently small I, a CE with intermediation exists for sufficiently large $\delta < 1$ *no matter how large the market is.*

By reducing the actual number of lenders in the market, and thereby accelerating the flow of information, financial intermediation can enable a viable credit market to exist when it otherwise could not.

It is instructive to compare this reasoning with that of Diamond (1984). In his model the resolution of informational asymmetries between borrowers and lenders require that lenders either engage in costly monitoring or that debt contracts impose inefficiently large non pecuniary penalties for default. Diamond shows that these costs are lower when loans are mediated through intermediaries than under direct lending. Here, as well, intermediation serves to alleviate the costs of asymmetric information. But it does so *not* by reducing monitoring costs. Indeed, in the CE default is an out of equilibrium event and lenders do not actively monitor borrowers' credit histories at all. Rather, if the probability of detection is sufficiently high, borrowers "monitor" themselves; it is in their interest not to default in order not to jeopardize future borrowing opportunities.

3. An Alternative Version

In this section the basic model of the preceding section is modified by relaxing the unrealistic assumption that lenders are unable to enforce repayment. Here we assume that a lender is able to legally enforce repayment whenever the borrower's investment generates any assets. Thus, a borrower defaults only if the return from its investment is insufficient for repayment. As in the previous section, we continue to assume that capital owners live for one period and borrowers are infinitely lived.

We use a modified version of Diamond (1989). There are two types of investment projects available to borrowers, *risky* and *safe.* The safe project returns $G > r$ with certainty. The risky project returns $B > G$ with probability π and 0 with probability $1 - \pi$, where:

Assumption 2 :
(i) $\pi B < r$
(ii) $\pi(B - r) > G - r$.

Part (i) of Assumption 2 implies that, since lenders can obtain r on their own, they are willing to lend only if borrowers are expected to invest in the safe project. And since the equilibrium expected interest rate cannot be less than r, part (ii) of Assumption 2 implies that a borrower's single period expected return from the risky project is greater than its single period return from the safe project. Hence a "myopic" borrower who is in the credit market for one period only (and so is unconcerned about any possible effects of project selection on future borrowing opportunities) would optimally invest in the risky project. Thus, in a one period world, credit would be unobtainable.

Therefore the only reason a borrower might invest in the safe project is if the type of project it selects affects its future borrowing opportunities. Since lenders can enforce repayment, a borrower defaults only if it invests in the risky project and realizes a return of zero.[5]

We assume that a lender learns with probability $p(t,N)$ if the borrower invested in the risky project t periods ago, where the properties of $p(t,N)$ are the same as in the basic model (in section 1).

Again, as in the previous section, a NC always exists; In that equilibrium, the lenders' strategy is not to lend and borrowers' strategy is to invest only in the risky project. If $p(t,N)$ and δ are large enough, there also exists a CE in which borrowers always invest in the safe project and the lenders' strategy is: lend if the borrower is not known to have ever invested in the risky project, do not lend otherwise. And, as in section 1, if N is large enough, $p(t,N)$ is too small for the CE to exist. In a large market, borrowers do not have enough of an incentive to invest in the safe project, which leads to credit market failure.

Again, financial intermediation comes to the rescue. By reducing the number of direct lenders, and hence increasing the probability of detection, financial intermediation can restore efficiency to credit markets by providing borrowers with the needed incentives.

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[5] The conflict of interest between lenders and borrowers could be resolved if loan contracts could be written to stipulate that the loan may only be invested in the safe project. Our formulation implicitly assumes that such contracts are infeasible. This will be the case if, for example, the project type, though observable to the lender, is not verifiable in court (but the borrower's realized assets are verifiable).

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