Financial Intermediaries as Facilitators of Reputation Formation in Credit Markets

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Abstract

This paper identifies a new role for financial intermediaries. The basic premise is that the smooth flow of information is obstructed when the number of lenders becomes too large. This erodes the value of a good credit history, which encourages default and may restrict lending. Financial intermediation gets 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 flow of information between lenders even when the number of indirect lenders (depositors) is very large. This restores borrowers' incentives for reputation formation and hence lenders' incentives to lend.

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1. Introduction

Why are financial intermediaries the main players in credit markets? Why don’t capital owners lend directly? Several important papers explain the role of financial intermediaries by identifying specific functions which intermediaries 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 credit markets may be unable to function without intermediaries even if depositers and intermediaries are identical in all respects.

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 can obstruct the flow of information in the market and thereby erode 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 anony-
mous. 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. This can restore the value of a good credit history to borrowers, and consequently, the willingness of capital owners to lend.

It is instructive to compare this approach to related information - based model of Diamond (1984). In Diamond’s model, intermediation can increase efficiency by reducing lenders’ monitoring costs. Here, by contrast, the role of intermediation is to eliminate the need for monitoring by motivating borrowers 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, the formation of firms by individual producers solves a moral hazard problem by increasing the value of a good reputation for themselves. By contrast, here the formation of intermediaries on the supply side of the credit market serves to facilitate reputation formation on the demand side of the market, by borrowers.

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. Borrowers have access to an investment technology which returns $G$ units of capital per unit of capital invested but own no capital of their own. $N$ new lenders are born at each period and live for two periods. At the beginning of her first period a lender is endowed with a unit of capital and is randomly matched with a borrower. The lender may either invest her capital on her own or lend it to the borrower with which she is matched; she may not lend to any other borrower and the borrower with which she is matched cannot borrow from any other lender at that period. A lender which invests on her own receives $r$ units at the end of the period, $G > r > 1$. If she lends her capital, we assume that, as a result of an unmodeled bargaining procedure, the surplus created by the borrower, $G - r$, is divided between the two parties such that the lender is repaid $r + \theta(G - r)$ and the borrower keeps $(1 - \theta)(G - r)$ where $0 < \theta < 1$.

At her second period a lender bequeathes the unit with which she was endowed to her offspring and consumes what is left ($r - 1$ or $r + \theta(G - r) - 1$). Since a specific lender and borrower do not interact more than once, reputational effects constitute the only intertemporal link in the model.

Before she decides whether or not to lend her capital, a lender obtains 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 (first period) 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 $\tau$, $j$ 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

\[^1\text{So } \theta G \text{ is the interest paid.}\]
\[ p(t, N) = \min\{1, j^t/N\}. \] 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 \( N \to \infty \).

To focus on reputational issues in the most direct way, I 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. 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 than 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 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 \( (1 - \theta)(G - r) \) per period and a discounted payoff of \( \frac{1 - \theta}{1 - \delta} (G - r) \) 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

\(^2\)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)
is optimal if and only if \( \frac{(1-\theta)(G-r)}{1-\delta} \geq G \), i.e., iff \( \delta \geq \delta^* = \frac{1-(1-\theta)(G-r)}{G} \). Thus, under complete information spreads instantaneously, a CE exists if \( \delta \geq \delta^* \).

Now let us return to our assumption that lenders are imperfectly informed - \( t^* > 1 \). Then, if lenders follow the above trigger strategy, a borrower who defaulted \( t \) periods ago (and hasn't defaulted since) obtains credit at the current period with probability \( 1-p(t, N) \). Thus a borrower who defaults once gets a payoff of:

\[
G + (1-p(1, N))\delta(1-\theta)(G-r) + (1-p(2, N))\delta^2(1-\theta)(G-r) + \ldots + (1-p(t^*-1, N))\delta^{t^*-1}(1-\theta)(G-r)
\]

(where \( p(t^*, N) = 1 \)). Thus, repayment is optimal only if:

\[
\frac{(1-\theta)(G-r)}{1-\delta} \geq G + (1-p(1, N))\delta(1-\theta)(G-r) + (1-p(2, N))\delta^2(1-\theta)(G-r) + \ldots + (1-p(t^*-1, N))\delta^{t^*-1}(1-\theta)(G-r)
\]

Since (for fixed \( j, t \) and \( \delta \)) \( p(t, N) \to 0 \) as \( N \to \infty \), corresponding to any \( \delta < 1 \) there exists \( N(\delta) \) such that for \( N > N(\delta) \), (1) does not obtain. Thus, if \( N \) is sufficiently large a CE does not exist. When the market is large, information does not spread quickly enough to motivate borrowers to maintain 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 - henceforth depositers - lend indirectly via financial intermediaries such that it is only possible for borrowers to obtain credit from an intermediary. Let's assume that now borrowers and intermediaries divide \( (1-\theta)(G-r) \) equally between themselves (and depositers receive \( r+\theta(G-r) \) from intermediaries). 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. Second, intermediaries must be motivated to repay depositers (i.e., banks must be motivated not to fail). We proceed 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 intermediaries 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, this rules out the possibility that individual borrowers and intermediaries can establish long term credit relationships. 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:

$$\frac{(1 - \theta)(G - r)/2}{1 - \delta} \geq G + (1 - p(1, I))\delta(1 - \theta)(G - r)/2 +$$

$$+ (1 - p(2, I))\delta^2(1 - \theta)(G - r)/2 + \ldots + (1 - p(t^* - 1, I))\delta^{t^*-1}(1 - \theta)(G - r)/2$$

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 $\tau$, then, since each depositer with intermediary $i$ lost money to it at period $\tau$, the probability that a young depositer at period $\tau + 1$ is informed of the default is just the probability of meeting a period $\tau$ depositer of intermediary $i$, which is

$$\pi(I, N, 1) = 1 - (1 - \frac{j}{N})^{N/I}.$$ More generally, the probability that a young depositer at period $\tau + t$ is informed about the default is

$$\pi(I, N, t) = 1 - (1 - \frac{j}{N})^{tN/I}.$$ Thus, if depositers play the trigger strategy, it is optimal for the intermediary not to default if:

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3The probability of not meeting a specific old lender is $\frac{1}{N}$. Since there are $N$ old lenders, the probability of not meeting any one of them is $(1 - \frac{j}{N})^N$. 

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\[
\frac{(1 - \theta)(G - r)/2}{1 - \delta} \geq G + (1 - \pi(I, N, 1))\delta \frac{(1 - \theta)(G - r)/2}{1 - \delta} + \ldots (3)
\]

\[+(1 - \pi(I, N, t^* - 1))\delta^{t^*-1} \frac{(1 - \theta)(G - r)/2}{1 - \delta}.
\]

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

\[
\frac{(1 - \theta)(G - r)/2}{1 - \delta} = G + e^{-j}\delta \frac{(1 - \theta)(G - r)/2}{1 - \delta} + \ldots + e^{-j^{t^*-1}}\delta^{t^*-1} \frac{(1 - \theta)(G - r)/2}{1 - \delta}.
\]

The rhs of the preceding equality is an upper bound on the payoff from default when \(I = 1\). Thus, for \(\delta \geq \delta^{**}\), there exists \(I(\delta)\) such that for \(I \leq I(\delta)\), it is optimal for the intermediary not to default. Hence we conclude:

A CE with intermediation exists for sufficiently large \(\delta < 1\) no matter how large the market is.

Financial intermediation, by separating the identity of indirect lenders from that of direct lenders, reduces the number of active lenders in the market. This accelerates the flow of information, enabling 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.

References

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