Non-Exclusive Competition and the Debt Structure of Small Firms

April 16, 2012

Claire Célérier[1]

Abstract

This paper analyzes the equilibrium debt structure of small firms when competition between lenders is non exclusive. Lenders simultaneously offer loan contracts, the borrower can accept more than one of them, and the set of contracts that is accepted is not observed. Two categories of lenders compete: banks that monitor their borrowers, and uninformed lenders. The monitoring technology alleviates the moral hazard problem but induces a fixed cost. I find that the equilibrium debt structure of small firms depends on their initial wealth: poorly-capitalized ones are only offered expensive loans by uninformed lenders. Richer ones can be financed at a lower price by banks. The fraction of the loan offered by the lead bank, the interest rate that is charged, and the sum of lenders' profits decrease with the borrower's initial wealth.

[1]Banque de France, DGEI-DMS-SAMIC - Toulouse School of Economics. Email: claire.celerier@gmail.com

1 Introduction

Understanding the financial choices of small firms is key in corporate finance. However, the literature has mostly focused on firms that are already well established. In the U.S., entrepreneurs are increasingly relying on credit cards to finance their businesses. The National Small Business Association reports that in December 2009, 49 percent of small business owners were using credit cards to finance their firms. Petersen and Rajan (1994), based on data from the Small Business Survey, show that firms first use relatively cheap sources of financing when available, and then resort to more expensive informal credits. The objective of this paper is to address the following question: Why do small firms largely rely on expensive informal finance such that credit cards or trade loans? This paper starts from the assumption that there is a fixed cost to be monitored by traditional banks. Consequently, small firms are financed through informal loans. But informal lenders may lack of information on the borrowing patterns of these small firms: they cannot observe the set of contracts accepted by the borrower and ensure that there is no multiple contracting. In the presence of moral hazard, this problem of non exclusivity can lead to inefficiencies and rents.

There is ample evidence that non exclusivity is prevalent in credit markets. Consumers and small firms typically hold several credit cards and are often given incentives to open new accounts. More generally, exclusivity clauses are rare in debt contracts, and information sharing does not exist for small firms in most countries. This paper presents an incentive model of non exclusive competition in which the strategic interactions between lenders affect the borrower's financing choices. Non exclusivity refers to the borrower's ability to accept more than one loan offer without lenders observing the set of contracts that is accepted.

Non exclusive competition combined with moral hazard can generate externalities. Consider that a borrower's unobservable effort can impact the return to a loan and that the cost of this effort is increasing with the loan amount. In this case, any lender must consider other lenders' offers as they can mitigate the borrower's incentive to exert effort. This restricts quantities offered and so, the Bertrand competition mechanism does not work. For example, if the borrower is better off taking twice the first best loan amount and shirking rather than investing the first best amount and exerting effort, competition between two lenders cannot generate the first best level of investment.

In this model, two categories of lenders compete: monitoring and non monitoring ones. The monitoring technology alleviates the moral hazard problem, but induces a fixed cost: the minimum investment required in branch network, human capital, and relationship building. For simplicity, the variable cost of monitoring is normalized to 0. Non monitoring lenders consist mainly in credit card issuers/informal lenders. Monitoring ones are traditional banks. One of the contributions of the paper is to explain financing choices under non exclusive competition between bank loans and uninformed finance.

Monitoring has two opposite effects on borrowers' surplus. On the one hand, it reduces incentives to shirk and hence increases debt capacity. On the other hand, it is costly, which lowers borrowers' payoff in case of success. Since the cost of monitoring is fixed, access to monitored finance depends on the borrower's self-financing capacity. I find that as the latter increases, the use of traditional bank loans increases whereas interest rates decrease.

When competition is non-exclusive, in the presence of moral hazard, equilibria with positive profits for active lenders arise Parlour and Rajan (2001). To alleviate the moral hazard problem, borrowers can either invest some of their own capital or turn to financial intermediaries. As in Hölmstrom and Tirole (1997) monitoring is a partial substitute for self-financing, and it increases borrower's debt capacity. However, departing from Hölmstrom and Tirole (1997), in this model monitoring affects the competitive game between lenders. With monitoring, the distribution of surplus varies in favor of borrowers and lenders' profits decrease.

Monitoring also affects the borrower's debt structure. By assumption, monitoring decreases a borrower's incentives to shirk in any of his loan relationships. Hence, his project can be financed first, by a traditional bank then, by uninformed lenders. However, to ensure that the borrower takes the loan with monitoring, the bank loan should be large enough, so that the borrower surplus is higher taking this contract and paying the fixed monitoring cost than accepting only non monitoring contracts. In other words, given that the set of loans accepted by the borrower is not observable, the monitoring lender is forced to retain a larger share of the loan when the borrowers require more intense due diligence to be sure that he is not going to free ride on the monitoring lender's offer. This has the following key empirical implication: the lead bank finances a larger portion of the project when moral hazard increases.

This paper is related to two disjoint bodies of literature. The first one analyzes the consequences of non exclusive relationships under moral hazard. This literature has been pioneered by Bizer and DeMarzo (1992) and Kahn and Mookherjee (1998). They consider that agents take their contractual decisions sequentially. More recently, Parlour and Rajan (2001), Martimort and Stole (2002) and Attar et al. (2011) have focused on models of competition in which intermediaries post their offers simultaneously. The second one focuses on the role of lenders as delegated monitors. This literature uses the term monitoring with three different meanings. Ex ante, monitoring can refer to lenders' activity of screening out "bad" loan applicants (see for instance Broecker (1990)). During the realization of a project, it may consist in preventing the borrower's opportunistic behavior (see, for instance, Hölmstrom and Tirole (1997)). Ex post, monitoring refers to lenders' activity of auditing borrowers who failed to meet contractual obligations (see, for instance, Diamond (1984)). As in Hölmstrom and Tirole (1997), I assume that monitoring reduces borrower's benefit of shirking.

This paper extends from Hölmstrom and Tirole (1997) in two directions. First, it models the financing choices of small firms. Whereas in Hölmstrom and Tirole (1997) poorly capitalized firms have no access to the credit market, in this paper the latter can have access to "uninformed loans". This result is in line with Robb and Robinson (2009) who find that small firms in the U.S. have a large access to external finance. Second, in this model monitoring and non monitoring lenders compete and competition is non exclusive, which implies new results in terms of the cost of borrowing, the debt structure, and latent contracts.

The next section develops the basic model. The case of exclusivity is described in Section 3. Section 4 analyzes the equilibrium of the model under non exclusive competition. Empirical implications are presented in Section 5. Finally, Section 6 concludes.

2 The Basic Model

The model has two types of agents: borrowers and lenders. Both are risk neutral and borrowers are protected by limited liability. There are three periods. At time 1 lenders offer simultaneously loan contracts. At time 2, each borrower chooses a subset of offered contracts and makes an investment decision. At time 3, cash flows are realized and payments are made. The analysis focuses on subgame-perfect equilibria in which lenders play pure strategies.

2.1 Borrowers

Each borrower can invest in a project of variable size I that yields a verifiable return of either $G(I)$ in case of success or 0 in case of failure. The function $G : R_+ \to R_+$ is increasing and strictly concave in I, and satisfies the Inada conditions.

The probability of success of the project is affected by an unobservable effort of the borrower e, $e = \{H, L\}$. Let p_e denote the probability of success depending on the level of effort. I assume that $p_H = p > 0$ and p_L is normalized to 0.

When a borrower chooses $e = L$, he enjoys a private benefit BI. This private benefit implies an opportunity cost of providing effort. I make the following assumption

Assumption 1 *The investment project has a positive net present value if and only if the borrower selects* $e = H$*:*

$$pG(I) - I > 0 > BI - I$$

There is a continuum of borrowers with initial wealth A. If $A < I$ the borrower needs to borrow at least $I - A$. A is observable to all lenders.

A contract has the following structure: (i) because of the borrower's limited liability, neither lenders nor the borrower are paid if the investment fails; (ii) if the project succeeds, the borrower pays $R > 0$ to lenders; (iii) if the project succeeds, the borrower receives $G(I) - R$. Therefore, a borrower's expected utility is:

$$U_A(I, R, e) = \begin{cases} p(G(I) - R) - A & \text{if } e = H \\ BI - A & \text{if } e = L \end{cases}$$

2.2 Lenders

There are two types of lenders: uninformed lenders and intermediaries. Uninformed lenders include financial institutions offering unmonitored personnel loans or credit card firms. They are considered as uninformed since they do no monitor borrowers. Intermediaries are endowed with a monitoring technology that alleviates the moral hazard problem.

Both types of lenders compete with each other by simultaneously offering loan contracts denoted C_u for uninformed lenders, and C_m for intermediaries, where

$$C_i = (L_i, R_i) \in R^2$$

where L_i is the loan amount and R_i is the promised repayment.

2.2.1 Uninformed Lenders

An uninformed lender i's expected utility is:

$$V_u(L_i, R_i, e) = \left\{ \begin{array}{cc} pR_i - L_i & \text{if } e = H \\ -L_i & \text{if } e = L \end{array} \right\}$$

2.2.2 Intermediaries

Intermediaries offer contracts with monitoring. The function of monitoring is to reduce the borrower's opportunity cost of being diligent from BI to bI. This monitoring technology involves a fixed cost c, and a variable cost that is normalized to 0.

Given that monitoring does not increase the probability of success, for a given loan amount, the borrower will always prefer not to be monitored and receive a private benefit B rather than b. Hence, monitoring must allow more capital to be raised. Therefore, the monitoring technology is coupled with a loan contract and intermediaries always invest in the project.

An intermediary i's expected utility is:

$$V_m\left(L_i, R_i, e\right) = \left\{ \begin{array}{cc} pR_i - L_i - c & \text{if } e = H \\ -L_i - c & \text{if } e = L \end{array} \right\}$$

3 The Case of Exclusivity

This section describes the impact of monitoring in the standard framework of exclusive competition.

3.1 Uninformed Finance

This section analyzes the possibility of financing a project without monitoring. First, suppose that there is no moral hazard problem, i.e. $B = 0$. In this case, the borrower is offered the contract $C^* = (L^*; R^*)$ such that $L^* = I^* - A$ and $R^* = \frac{I^* - A}{p}$ where I^* is the first best level of investment. I^* maximizes the total surplus from production, implying $I^* = \arg\max_I\{pG\left(I\right) - I\}$. The first order condition is

$$pG'\left(I^*\right) = 1$$

Now consider that the borrower receives a private benefit $B > 0$ from shirking and let $\widehat{I^u}$ denote the level of investment. $\widehat{I^u}$ maximizes the borrower's surplus, subject to the incentive compatibility constraint

$$p(G(I) - R) \geq BI$$

Hence, the borrower must be paid at least $\frac{BI}{p}$ in case of success. A necessary and sufficient condition for the lender to earn non-negative profits is

$$pR - I + A \geq 0$$

The lender's participation constraint is binding. Therefore, the borrower exerts effort if and only if

$$p(G(I) - \frac{I - A}{p}) \geq BI$$

Defining

$$A_u^* = I^* - p\left(G(I^*) - \frac{BI^*}{p}\right)$$

implies that only borrowers with $A \geq A_u^*$ can achieve the first best level. I make the following assumption

Assumption 2

$$A_u^* > 0$$

Assumption 2 is satisfied if B is large enough, i.e. $BI^* > pG(I^*) - I^*$. It simply states that any borrower cannot achieve the first best level of investment without some amount of self finance.

Let $\overline{I_A^u}$ be the investment level that uniquely satisfies

$$p\left(G(\overline{I_A^u}) - \frac{B\overline{I_A^u}}{p}\right) - \overline{I_A^u} + A = 0$$

Borrowers with $A < A_u^*$ invest $\overline{I_A^u}$. Hence, the second best level of investment is

$$\widehat{I_A^u} = Min\left[\overline{I_A^u}, I^*\right]$$

and the repayment is

$$\widehat{R_A^u} = \frac{\widehat{I_A^u} - A}{p}$$

Proposition 1 *In the standard case of exclusivity, the investment level is the second best level of investment* $I = \widehat{I_A^u}$ *such that*

- *Borrowers with* $A \geq A_u^*$ *invest* $\widehat{I_A^u} = I^*$
- *Borrowers with* $A < A_u^*$ *invest* $\widehat{I_A^u} = \overline{I_A^u}$
- *Uninformed lenders earn zero profit whereas the borrower's surplus is maximized subject to the incentive compatibility constraint*

3.2 Monitoring

Monitoring reduces the benefit from shirking from BI to bI at a fixed cost c, and so can allow more external capital to be raised. The borrower's incentive constraint with monitoring becomes

$$G(I) - R \geq \frac{bI}{p}$$

And the participation constraint of a single intermediary is

$$pR \geq I - A + c$$

Defining A_m^*, with $0 < A_m^* < A_u^*$, such that

$$A_m^* = I^* - p\left(G(I^*) - \frac{bI^*}{p}\right) + c$$

We make the following assumption

Assumption 3

$$bI^* + c < BI^*$$

Assumption 3 simply implies that $A_m^* < A_u^*$. Only borrowers with $A \geq A_m^*$ can achieve the first best level of investment with monitoring.

Defining $\overline{I_A^m}$ the level of investment satisfying

$$p\left(G(\overline{I_A^m}) - \frac{b\overline{I_A^m}}{p}\right) - \overline{I_A^m} + A - c = 0$$

$\overline{I_A^m}$ exists if A high enough. Indeed, a minimum level of wealth $\underline{A_m}$ is required to convince intermediaries to finance the project

$$\underline{A_m} = \min\{A | \exists I \geq 0 \text{ s.t. } A = bI + c + I - pG(I)\}$$

I make the following assumption

Assumption 4

$$A_m \geq 0$$

Assumption 3 states that any project cannot be financed by intermediaries without a minimum amount of own capital. It is satisfied if for any $I \geq 0$

$$pG(I) - I < bI + c$$

Let $\widehat{I_A^m}$ denote the second best level of investment with monitoring. It verifies

$$\widehat{I_A^m} = Min\left[\overline{I_A^m}, I^*\right]$$

At the second best, repayment is

$$\widehat{R_A^m} = \frac{\overline{I_A^m} - A + c}{p}$$

Proposition 2 *In the standard case of exclusivity, when one lender monitors, the investment level is* $\widehat{I_A^m}$ *such that*

- *Borrowers with* $A \geq A_m^*$ *invest* $\widehat{I_A^m} = I^*$
- *Borrowers with* $\underline{A_m} \leq A \leq A_m^*$ *invest* $\widehat{I_A^m} = \overline{I_A^m}$
- *Borrowers with* $A < \underline{A_m}$ *cannot be financed by intermediaries, implying* $\widehat{I_A^m} = 0$

3.3 Debt Structure

Monitoring is socially valuable only if the surplus generated from alleviating the moral hazard problem is higher than the monitoring cost c. Let $S(A)$ define the monitoring surplus

$$S(A) = \underbrace{pG(\widehat{I_A^m}) - \widehat{I_A^m} - c}_{\text{Production surplus with monitoring}} - \underbrace{\left(pG(\widehat{I_A^u}) - \widehat{I_A^u}\right)}_{\text{Production surplus without monitoring}}$$

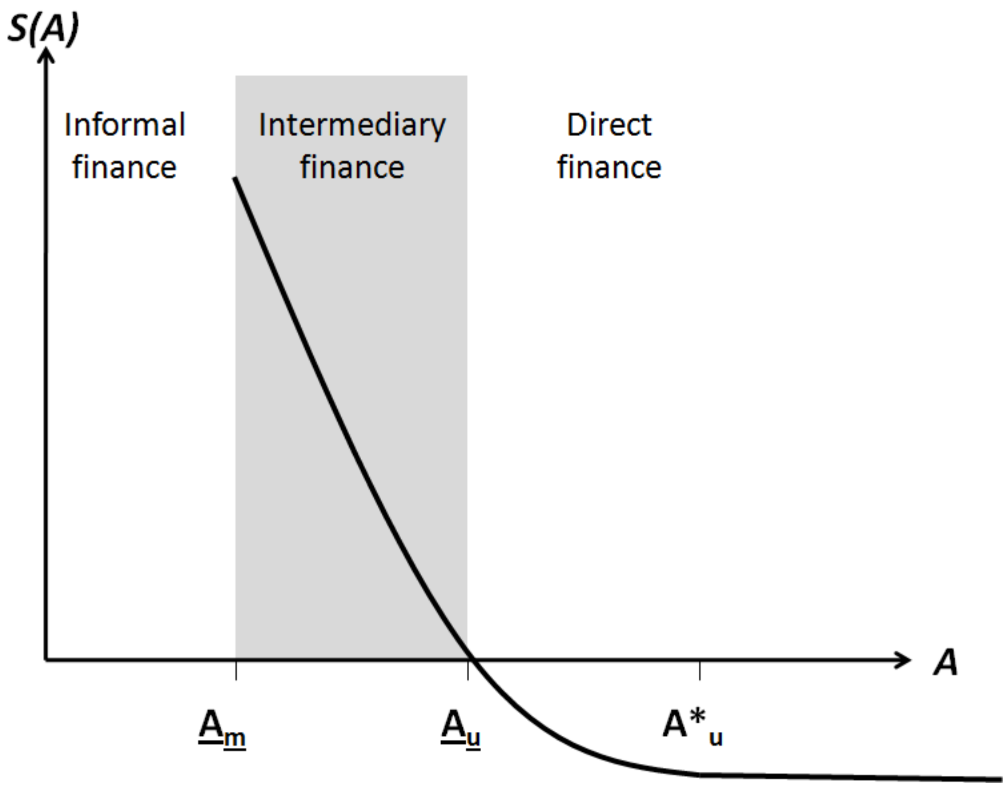
G concavity implies that the monitoring surplus $S(A)$ is decreasing in A in the interval $[\underline{A_m}; A_u^*]$. In addition, $S(\underline{A_m}) > 0$ and $S(A_u^*) < 0$. As a result, there exists a unique $\underline{A_u}$, with $\underline{A_m} \leq \underline{A_u} \leq A_u^*$ such that

$$S(\underline{A_u}) = 0$$

Figure 1 describes this threshold value $\underline{A_u}$.

Figure 1

Threshold value $\underline{A_u}$



This leads to the following proposition

Proposition 3 *In the standard case of exclusivity, borrowers fall into three categories*

1. *Borrowers with* $A \geq \underline{A_u}$ *invest without the help of monitoring. If* $A \geq A_u^*$, *they achieve the first best level of investment without monitoring.*

2. *Borrowers with* $\underline{A_m} \leq A \leq \underline{A_u}$ *invest with the help of monitoring. If* $A \geq A_m^*$ *they achieve the first best level of investment with monitoring.*

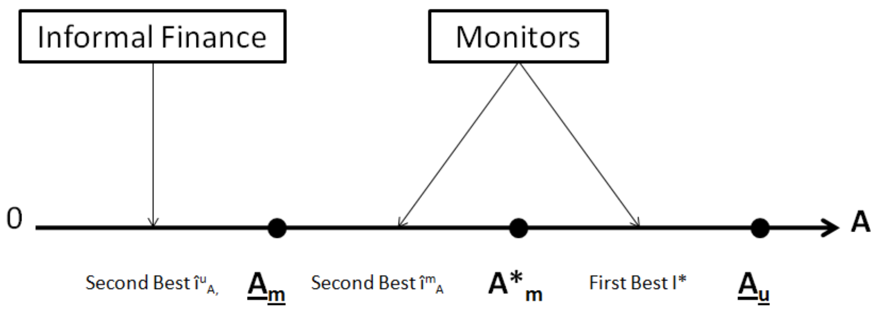
3. *Poorly-capitalized borrowers, with* $A \leq \underline{A_m}$, *cannot invest with the help of monitoring since they cannot convince intermediaries to finance the project. They achieve the second best level of investment without monitoring.*

Proof. Let demonstrate first that $S(A)$ is a decreasing function of A. If $A \geq A_u^*$, the first best can be financed by uninformed lenders, and so $S(A) = -c$. If $A_m^* \leq A < A_u^*$, the competitive allocation with monitoring is the first best level of investment, whereas the competitive allocation without monitoring is constrained and is increasing in A. Therefore, $S(A)$ is decreasing in A. If $\underline{A_m} \leq A \leq A_m^*$, the first best cannot be financed neither with nor without monitoring. $B > b$ implies that $\widehat{I_A^u}$ increases at a higher rate than $\widehat{I_A^m}$. In addition, due to G concavity, if $\widehat{I_A^m} - \widehat{I_A^u}$ decreases, the difference in net present value decreases even more. And so $S(A)$ is decreasing in the interval $[\underline{A_m}; A_u^*]$. In addition, $S(\underline{A_m}) > 0$ and $S(A_u^*) = -c < 0$. As a result, there exists a unique $\underline{A_u}$, with $\underline{A_m} \leq \underline{A_u} \leq A_u^*$ such that $S(A) = 0$ ■

Figure 2 summarizes the results. Compared to Hölmstrom and Tirole (1997) in this model any firm can be financed with external funds. However, only a fraction of them can have access to intermediate finance.

Figure 2

Firm Debt Structure - Exclusive Competition



4 Non Exclusive Competition

This section describes the competitive game when competition is non exclusive.

4.1 The Competitive Game

The competitive game unfolds as follows. At time 1, lenders compete by offering non-exclusive loan contracts. At time 2, each borrower can simultaneously accept more than one offer. Let $C^{\mathcal{O}} = (L^{\mathcal{O}}, R^{\mathcal{O}})$ denote the set of all contracts offered and $C^{\mathcal{A}} = (L^{\mathcal{A}}, R^{\mathcal{A}})$ the set of all contracts accepted. The size of the investment for a borrower with initial wealth A is

$$I = L^{\mathcal{A}} + A$$

A lender is *active* if his contract is accepted, *latent* if not.

In equilibrium, lenders offer profit maximizing contracts given the moral hazard problem and the strategy of other lenders. In turn, the consumer accepts an optimal set of contracts and decides to exert effort or not.

In this model, moral hazard is *severe*; the borrower's surplus in case of low effort is strictly increasing in I. This has the important implication that if the borrower decides to exert low effort, the strategy of accepting all offered contracts is optimal. Hence, he ultimately chooses between two options:

- To accept a subset of offered contracts and exert high effort ($L^{\mathcal{A}} \leq L^{\mathcal{O}}$), or
- To accept all contracts and exert low effort ($L^{\mathcal{A}} = L^{\mathcal{O}}$)

Assumption 1 implies that in any equilibrium, the borrower exerts high effort. Hence, under non exclusive competition, the borrower's incentive compatibility constraint is

$$p(G(L^{\mathcal{A}} + A) - R^{\mathcal{A}}) \geq B(L^{\mathcal{O}} + A)$$

In addition, since the total surplus from production is decreasing if $I > I^*$, the level of investment is at most I^*.

Finally, note that monitoring reduces the borrower's opportunity cost of being diligent from BI to bI for *all* his loan relationships. Therefore, the fixed cost of monitoring implies that only one lender monitors.

Lemma 1 *Under non exclusive competition, any equilibrium has the following properties*

1. *The aggregate contract accepted $L^{\mathcal{A}}$ verifies $L^{\mathcal{A}} \leq I^* - A$ where I^* is the first best level of investment.*

2. The borrower's incentive compatibility constraint without monitoring is

$$p(G(L^{\mathcal{A}} + A) - R^{\mathcal{A}}) \geq B(L^{\mathcal{O}} + A)$$

3. There is at most one active lender that monitors

Proof. By contradiction, assume that $L^{\mathcal{A}} \geq I^* - A$. Hence, the level of investment I verifies $I \geq I^*$. If $I > I^*$, the total surplus from production $pG(I) - I$ is strictly decreasing. Consequently, reducing the size of the investment results in an increase in the surplus. So, the aggregate contract accepted is at most $L^{\mathcal{A}} = I^* - A$, where I^* is the first best level of investment. ■

4.2 Poorly Capitalized Borrowers

This section characterizes equilibria in which borrowers are financed only through non monitoring loans. It concerns poorly-capitalized borrowers, with $A < \underline{A_m}$, for which the cost of the monitoring technology is too high (Proposition 2). Since $\underline{A_m} < A_u^*$, the incentive compatibility constraint is binding, and the aggregate amount offered $L^{\mathcal{O}}$ is at most the second best $\widehat{I_A^u} - A$. Indeed, if $I \geq \widehat{I_A^u}$ the borrower will be better off taking all contracts and shirking.

Furthermore, in any equilibrium allocation with poorly capitalized borrowers i) there is no *latent* contracts, ii) the incentive compatibility constraint is binding and iii) lenders get positive profits.

Consider first the set of offered contracts $L^{\mathcal{O}}$. A *latent* lender, whose offer is not taken, can reduce the offered loan amount and the repayment so that the borrower accepts his offer. The incentive to shirk is decreasing with the aggregate loan amount, and so the borrower behaves. Since $I \leq \widehat{I_A^u}$, the production surplus is increasing in I, and this deviation is profitable.

Second, suppose by contradiction that the incentive constraint is not binding. Any active lender has an incentive to deviate: he can increase the total loan amount and keep the borrower's surplus constant until the incentive constraint is binding. Since the borrower is indifferent he will accept the offered contract, and behave. In addition, since $I < I^*$ the total surplus from production is increasing in I, and so the deviation is profitable. A direct implication concerns the repayment amount $R^{\mathcal{A}}$, which verifies

$$R^{\mathcal{A}} = G\left(L^{\mathcal{A}} + A\right) - \frac{B}{p}(L^{\mathcal{A}} + A)$$

Finally, suppose that there exists an equilibrium allocation in which lenders get zero profit. In such an allocation $I = \widehat{I_A^u}$ since the incentive compatibility constraint is binding. If $I = \widehat{I_A^u}$, any decrease in the level of investment has a lower impact on the total surplus from production than on the agency cost. Indeed, $G'(I_A^u) - \frac{1}{p} < \frac{B}{p}$. Therefore, any equiproportional decrease in the level of investment and the borrower's payoff will increase profits without inducing default and so, an *active* lender has always an incentive to deviate.

With poorly capitalized borrowers, if moral hazard is severe enough and if a lender is offering that maximizes its profits, the *monopolist* contract, no inactive lender can compete without inducing shirking: the borrower will be better off accepting both contracts and shirking. Since the incumbent lender maximizes its profit, he has no incentive to deviate. Therefore, an equilibrium can emerge with a unique active lender offering a *monopolist* contract.

Proposition 4 *If the borrower is poorly-capitalized, i.e. if $A < \underline{A_m}$, in any equilibrium*

1. *The total amount of debt offered is at most the second best level of investment $\widehat{I_A^u}$*
2. *There is no monitoring*
3. *There is no zero profit equilibrium. A credit allocation maximizing lenders' profits can even emerge in equilibrium*
4. *There is either a unique active lender, or N symmetric active lenders*

Proof. See in Appendix ■

4.3 Intermediate Borrowers

Intermediate borrowers, with $\underline{Am} < A < \overline{A_m}$, can invest with the help of monitoring, but cannot achieve the competitive allocation with monitoring. Two equilibria can emerge: a monopoly allocation with monitoring and a limit pricing equilibrium, in which the offered loan amount is the first best whereas lenders get positive profits that are limited by the presence of competing latent contracts.

4.3.1 Monopoly Allocation with monitoring

If the initial wealth of the borrower is high enough, i.e. if $A > \underline{A_m}$ then the borrower can be financed with monitoring. However, if $\underline{A_m} < A < A_m^*$ the aggregate amount offered $L^{\mathcal{O}}$ is at most the second best $\widehat{I_A^m} - A$. Indeed, since if $I = \widehat{I_A^m}$ the incentive compatibility constraint is binding, if $I \geq \widehat{I_A^m}$ the borrower is better off taking all contracts and shirking.

Lemma 2 *The total amount of debt offered $L^{\mathcal{O}}$ to intermediate borrowers, with $\underline{A_m} < A < A^*_m$, is at most the second best level of investment $\widehat{I^m_A} - A$.*

Therefore, the offered loan amount is constrained to be lower than the first best level, and so in any equilibrium allocation i) there is no *latent* contracts, ii) the incentive compatibility constraint is binding and iii) lenders get positive profits iv) an allocation maximizing lenders' profit can emerge in equilibrium.

Proposition 5 *If the borrower is intermediately-capitalized and $\underline{A_m} < A < A^*_m$ an equilibrium can emerge with the following properties*

1. *The investment level is rationed and equal to the amount a single monopolist would offer*
2. *The borrower is monitored*
3. *There is a unique active lender*
4. *The credit allocation maximizes the lender's profit subject to the borrower's incentive compatibility constraint*

Proof. See Appendix. ■

4.3.2 Limit Pricing Equilibrium with Monitoring

Let consider borrowers with $A > A^*_m$. In that case, the offered loan amount is $L \geq I^*$. Indeed, assume by contradiction that there is an equilibrium such that $L^{\mathcal{O}} < I^*$. In this case, there is no latent contracts, because a latent lender could always decrease the total loan amount and interest rates such that his contract is accepted. Indeed, the surplus from production will decrease at a lower rate than the benefit from shirking, and so it will no induce shirking. In addition, the incentive compatibility constraint is binding. If not, an active lender has always an incentive to deviate by increasing the total loan amount and keeping the borrower's surplus constant until the incentive constraint is binding. I show that an active lender has always an incentive to deviate and so this allocation cannot be considered as an equilibrium. This leads to the following proposition

Let $\overline{A_m}$ denote the wealth threshold above which two intermediaries can compete offering the first best with monitoring without inducing shirking. Each lender observe A, and offers the contract $(I^* - A; \frac{I^*-A}{p})$. If the borrower takes only one contract and behaves, his payoff is

$$pG(I^*) - I^* - c$$

In contrast, the borrower can choose to take both contracts and shirk. His payoff becomes:

$$b(2I^* - A) - A$$

Hence, the borrower behaves if and only if

$$pG(I^*) - I^* - c \geq b(2I^* - A) - A$$

$\overline{A_m}$ verifies

$$\overline{A_m} = \frac{1}{1+b}\left(2bI^* - pG(I^*) + I^* + c\right)$$

Therefore, if $A_m^* < A < \overline{A_m}$, two intermediaries cannot compete offering first best contracts without inducing shirking.

If $A_m^* < A < \overline{A_m}$ a limit pricing equilibrium can emerge. In this equilibrium an active lender offers the first best level of investment, and a latent lender offers a zero-profit contract such that the incentive compatibility constraint is binding. The interest rate charged by the active lender is such that the borrower is indifferent between accepting its contract, or the contract from the uninformed lender. The active lender cannot deviate by increasing rents without his offer being rejected in favor of the inactive lender's one, the inactive lender cannot increase or decrease the loan amount without inducing shirking and, finally, any contract offered by a third uninformed lender would induce shirking.

Proposition 6 *If the borrower is intermediately-capitalized with $A_m^* < A < \overline{A_m}$, an equilibrium can emerge with the following properties*

1. *The investment amount is the first best I^**
2. *The borrower is monitored*
3. *Profits are positive*
4. *There is a unique active lender and a latent contract is offered by an uninformed lender*

Proof. See Appendix. ■

4.4 Well-Capitalized Borrowers

Borrowers with $\overline{A_m} < A < \overline{A_u}$ can have access to the competitive allocation with monitoring. Indeed, by definition, $\overline{A_m}$ is high enough to relax the constraint on quantities in the competition game: two lenders can compete offering the first best level of investment without inducing shirking.

Let α denote the fraction of the investment financed by the lead monitoring lender. Uninformed lenders offer contracts knowing that the borrower is going to be monitored. However, since the borrower's benefit from shirking is higher without monitoring, the latter has an incentive to take all contracts from uninformed lenders and shirk. Consequently, the fraction of the loan offered by the lead bank satisfies

$$pG(I) - I - c + A \geq bI(1-\alpha)$$

$$\alpha \geq 1 - \frac{1}{bI}(pG(I) - I - c + A)$$

When A increases α decreases.

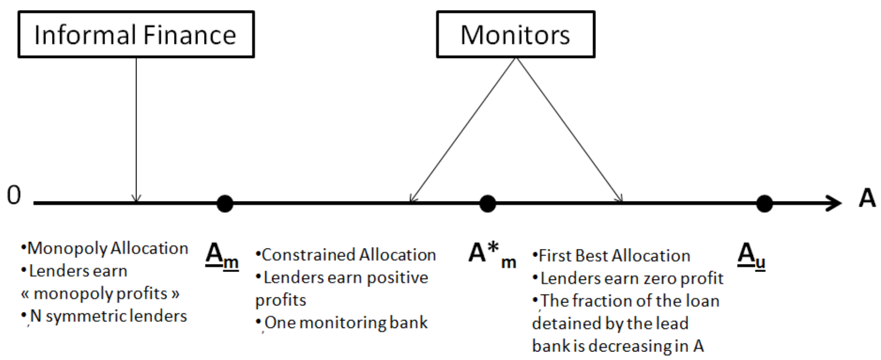
Proposition 7 *If the borrower is well-capitalized, with* $\overline{A_m} < A < \overline{A_u}$, *there is a unique equilibrium such that*

1. *The investment level is the first best* I^*
2. *The borrower is monitored*
3. *Lenders earn zero profits*
4. *There may be multiple active lenders and the fraction of the loan offered by the lead one is decreasing in the borrowers' initial wealth*

Proof. See Appendix. ■

Figure 3

Firm Debt Structure - Non Exclusive Competition



5 Empirical Implications

The model makes the following empirical predictions on the debt structure of small businesses.

Sources of borrowing

Proposition 4 predicts that poorly-capitalized borrowers will have access to external finance, but not to monitoring. They can be financed by "informal lenders": credit cards, family or trade loans. Proposition 5, 6 and 7 imply that intermediately and well-capitalized borrowers can be financed with traditional bank loans.

Cost of Capital

Proposition 4 and 5 predict that small firms are charged non competitive interest rates. Lenders' rents decrease with the financing capacity of the borrower. Proposition 7, on the contrary, predict that well-capitalized firms can have access to zero-profit loans.

Multiple contracting

Proposition 4 predicts that multiple symmetric contracting emerge with poorly-capitalized borrowers. Proposition 5 and 6 imply that intermediately-capitalized borrowers are financed mainly by a unique monitoring bank. Concerning well-capitalized borrowers, Proposition 7 states that the fraction of the loan amount retained by the lead bank is decreasing with the firm financing capacity.

6 Data

The objective is to test the empirical implications of our model with the National Survey of Small Business Finance Data. This survey collects information on small businesses in the United States by interview. The information collected includes the use of financial services among which credit cards. The survey is available for the years 1987, 1993, 1998 and 2003.

References

Attar, A., E. Campioni, and G. Piaser (2006). Multiple Lending and Constrained Efficiency in the Credit Market. *Working Paper*.

Attar, A., C. Casamatta, A. Chassagnon, and J. Decamps (2011). Multiple Lenders, Strategic Default and the role of Debt Covenants. *Working Paper, Toulouse School of Economics*.

Attar, A., T. Mariotti, and F. Salanié (2011). Nonexclusive Competition in the Market for Lemons. *Econometrica 79*, 1869–1918.

Ausubel, L. (1991). The Failure of Competition in the Credit Card Market. *The American Economic Review 81*(1), 50–81.

Berger, A. and F. Udell (1995). Relationship Lending and Lines of Credit in Small Firm Finance. *The Journal of Business 68*(3), 351–381.

Bisin, A. and D. Guaitoli (2004). Moral Hazard and Nonexclusive Contracts. *The Rand Journal of Economics 35*(2), 306–328.

Bizer, D. and P. DeMarzo (1992). Sequential Banking. *The Journal of Political Economy 100*(1), 41–61.

Broecker, T. (1990). Credit-Worthiness Tests and Interbank Competition. *Econometrica 58*(2), 429–452.

Diamond, D. (1984). Financial Intermediation and Delegated Monitoring. *The Review of Economic Studies 51*(3), 393–414.

Diamond, D. (1991). Monitoring and Reputation: The Choice between Bank Loans and Directly Placed Debt. *The Journal of Political Economy 99*(4), 689–721.

Dick, A. and A. Lehnert (Forthcoming). Personal Bankrupcy and Credit Market Competition. *Journal of Finance*.

Freixas, X. and J. Rochet (2008). *Microeconomics of Banking*. MIT Press.

Hölmstrom, B. and J. Tirole (1997). Financial Intermediation, Loanable Funds, and the Real Sector. *The Quarterly Journal of Economics 112*(3), 663–691.

Kahn, C. and D. Mookherjee (1998). Competition and incentives with non exclusive contracts. *The Rand Journal of Economics 29*(3), 443–465.

Martimort, D. and L. Stole (2002). The Revelation and Delegation Principles in Common Agency Games. *Econometrica 70*(4), 1659–1673.

Parlour, C. and U. Rajan (2001). Competition in Loan Contracts. *The American Economic Review 91*(5), 1311–1328.

Petersen, M. and R. Rajan (1994). The Benefits of Lending Relationships: Evidence from Small Business Data. *The Journal of Finance 49*(1), 3–37.

A Proofs

A.1 Proof of Proposition 4

If the borrower is poorly capitalized, i.e. if $A < \underline{A_m}$, in any equilibrium

1. $L^{\mathcal{O}} \leq \widehat{I^u_A}$

By definition, $A < \underline{A_m} \Rightarrow A < A^*_m$ and Assumption 3 implies that $A^*_m < A^*_u$. Consequently, $\widehat{I^u_A} = \overline{I^u_A}$.

2. There is no monitoring

By definition of $\underline{A_m}$, $A < \underline{A_m}$ implies that for any $I \geq 0$

$$A < bI + c + I - pG(I)$$

and so, a contract with monitoring cannot be offered without inducing shirking.

3.a. There is no zero profit equilibrium

By contradiction, assume that there exists a zero profit equilibrium. I show that an active lender, unique or not, has always an incentive to deviate, which contradicts the assumption.

First, consider any lender i offering $L > 0$. If there is no other active lender $j \neq i$ offering $L' > 0$, lender i will offer the monopolist contract (L^u_M, R^u_M) and hence deviate. A unique active lender has always an incentive to deviate

Suppose now that in addition to lender i offering $L > 0$ there exists at least one other active lender $j \neq i$ offering (L', R'), with $L' > 0$.

As by assumption we are in a zero profit equilibrium, it must be the case that $R' = \frac{L'}{p}$. Since $I^{\mathcal{O}} \leq \widehat{I^u_A}$, this implies

$$L + L' \leq I^u_A - A$$

$$\Rightarrow L' + A < I^u_A$$

This implies:

$$B(L' + A) < pG\left(L' + A\right) - L'$$

Introducing $I' = L' + A$, we have:

$$BI' - A < pG\left(I'\right) - I'$$

Since $pG(I') - I'$ is increasing on the interval $[0; I^*]$, there exists $\epsilon > 0$ such that:

$$\begin{cases} pG(I') - I' & < & pG(I'+\epsilon) - (I'+\epsilon) \\ B(I'+\epsilon) - A & < & pG(I'+\epsilon) - (I'+\epsilon) \end{cases}$$

Therefore, there exists $\delta > 0$, such that:

$$pG(I'+\epsilon) - (I'+\epsilon+\delta) > \max\left[B(I'+\epsilon) - A; pG(I') - I'\right]$$

Thus, the contract $\left(\epsilon, \frac{\epsilon+\delta}{p}\right)$ is a profitable deviation for lender i, which contradicts the premise that there exists a zero-profit equilibrium.

3b. An allocation maximizing lenders' profits can emerge as an equilibrium

Suppose now that a lender offers the monopolist contract $C_M^u = (I_M^u, R_M^u)$ without monitoring. This allocation maximizes the lender's profit when the incentive compatibility constraint is binding, an so a unique active lender offering this allocation has no incentive to deviate. I_M^u verifies

$$I_M^u = \arg\max_I \{G(I) - \frac{BI}{p} - I + A\}$$

which implies $G'(I_M^u) = \frac{1+B}{p}$, and $R_M^u = G(I_M^u) - \frac{BI_M^u}{p}$. An inactive lender has two options.

First, the inactive lender can offer a contract (L', R') accepted in conjunction with the monopolist one. The borrower's incentive constraint becomes

$$G(I_M^u + L') - R_M^u - R' \geq \frac{B(I_M^u + L')}{p}$$

Introducing $R_M^u = G(I_M^u) - \frac{BI_M^u}{p}$, the no default condition becomes

$$G(I_M^u + L') - G(I_M^u) - R' \geq \frac{L'B}{p}$$

Using G concavity and introducing $G'(I_M^u) = \frac{1+B}{p}$

$$L'\frac{1+B}{p} - R' \geq \frac{L'B}{p}$$

which implies

$$R' < \frac{L'}{p}$$

However, the necessary condition for this deviation to be profitable is $R' \geq \frac{L'}{p}$. Therefore, this deviation cannot be profitable without inducing shirking.

Second, the deviating lender can offer a contract (L', R') that is preferred to the monopolist one. The borrower's incentive constraint is

$$p\left(G(L'+A) - R'\right) \geq B(L' + I^u_M)$$

And the deviating lender's profit π'

$$\pi' = pR' - L' \tag{1}$$

Profits are maximum when the incentive constraint is binding, implying

$$R' = \frac{1}{p}\left[pG(L') - B(L' + I^u_M)\right] \tag{2}$$

Introducing (2) and differentiating (1), the FOC is

$$G'(L'+A) = \frac{1+B}{p}$$

This implies $L' + A = I^u_M$. This deviation neither is profitable if and only if

$$pG(I^u_M) - B(2I^u_M - A) - I^u_M - A \geq 0$$

Therefore, if moral hazard is severe enough, this deviation neither is profitable.

4. There is either a unique active lender, or N symmetric lenders

First, at any equilibrium allocation, the borrower's surplus is such that the incentive compatibility constraint is binding. Suppose by contradiction that it is not the case:

$$R^{\mathcal{A}} < G\left(L^{\mathcal{A}} + A\right) - \frac{B}{p}(L^{\mathcal{O}} + A)$$

I show that any active lender has a profitable deviation. Let $C_i = (L_i, R_i)$ be the equilibrium offer of an active lender i, and suppose he deviates offering the contract $C'_i = \left(L_i + \epsilon, R_i + \frac{\epsilon}{p} + \epsilon^2\right)$ for some strictly positive number ϵ. I define $C^{\mathcal{A}}_{-i} = (L^{\mathcal{A}}_{-i}; R^{\mathcal{A}}_{-i})$ the aggregate contract accepted by the borrower in equilibrium excluding contract C_i, $C^{\mathcal{A}}_{-i} = \sum_{j \neq i} C^{\mathcal{A}}_j$. For ϵ small enough:

$$p\left[G\left(L^{\mathcal{A}}_{-i} + L_i + A + \epsilon\right) - \left(R^{\mathcal{A}}_{-i} + R_i + \frac{\epsilon}{p} + \epsilon^2\right)\right] \geq p\left[G\left(L^{\mathcal{A}}_{-i} + L_i + A\right) - R_i - R^{\mathcal{A}}_{-i}\right]$$

Therefore, since the net present value is increasing in ϵ for $I + \epsilon < I^*$, the borrower has an incentive to accept contract C'_i. Let $\bar{L} = L^{\mathcal{O}} - L^{\mathcal{A}}$ denote the aggregate loan amount offered by *latent* lenders. Following this deviation, the borrower strictly prefers $e = h$ if and only if:

$$p\left[G\left(L^{\mathcal{A}} + A + \epsilon\right) - \left(R^{\mathcal{A}} + \frac{\epsilon}{p} + \epsilon^2\right)\right] > B\left(L^{\mathcal{A}} + A + \epsilon + \bar{L}\right)$$

$$G\left(L^{\mathcal{A}}+A+\epsilon\right) > \frac{B}{p}\left(L^{\mathcal{A}}+A+\epsilon+\bar{L}\right)+\left(R^{\mathcal{A}}+\frac{\epsilon}{p}+\epsilon^{2}\right) \tag{3}$$

The function G's concavity implies:

$$G\left(L^{\mathcal{A}}+A+\epsilon\right)-G'\left(L^{\mathcal{A}}+A+\epsilon\right)\epsilon \;>\; G\left(L^{\mathcal{A}}+A\right)$$

Hence, condition (3) is true if $\exists\epsilon>0$ such that

$$G\left(L^{\mathcal{A}}+A\right)+G'\left(L^{\mathcal{A}}+A+\epsilon\right)\epsilon > \frac{B}{p}\left(L^{\mathcal{A}}+A+\epsilon+\bar{L}\right)+\left(R^{\mathcal{A}}+\frac{\epsilon}{p}+\epsilon^{2}\right)$$

$$G\left(L^{\mathcal{A}}+A\right)-\frac{B}{p}\left(L^{\mathcal{A}}+A+\bar{L}\right)-R^{\mathcal{A}} > -G'\left(L^{\mathcal{A}}+A+\epsilon\right)\epsilon+\frac{B\epsilon}{p}+\left(\frac{\epsilon}{p}+\epsilon^{2}\right) \tag{4}$$

I define δ such that:

$$\delta = G\left(L^{\mathcal{A}}+A\right)-\frac{B}{p}\left(L^{\mathcal{A}}+A+\bar{L}\right)-R^{\mathcal{A}} > 0$$

By definition, $\delta>0$. Then, condition (4) holds if $\exists\epsilon$ small enough such that

$$\delta > \left[-G'\left(L^{\mathcal{A}}+A+\epsilon\right)+\left(\frac{B+1}{p}+\epsilon\right)\right]\epsilon$$

Hence, the offer C_i' is accepted and the borrower exerts effort. In addition, the deviation is profitable. Indeed:

$$p\left(R_i+\frac{\epsilon}{p}+\epsilon^{2}\right)-\left(L_i+\epsilon\right)=pR_i-L_i+p\epsilon^{2}>pR_i-L_i$$

Second, at any equilibrium allocation, I show that there is no *latent* contract. By contradiction, let consider a lender i whose offer (L_i,R_i) is not taken. It implies that:

$$p\left(G(L^{\mathcal{A}}+A)-R^{\mathcal{A}}\right)\geq p\left(G(L^{\mathcal{A}}+A+L_i)-R^{\mathcal{A}}-R_i\right)$$

Suppose that i deviates offering the contract $(\epsilon;\frac{\epsilon}{p}+\epsilon^2)$, with $\epsilon<L_i$. As $\epsilon<L_i$, we have:

$$p\left(G(L^{\mathcal{A}}+A+\epsilon)-R^{\mathcal{A}}-\frac{\epsilon}{p}-\epsilon^{2}\right)>B(L^{\mathcal{O}}+A-L_i+\epsilon)$$

As a result the borrower will accept the contract and exert effort. Therefore, this is a profitable deviation for lender i.

Third, at any positive profit equilibrium, excluding monopoly profit ones, the borrower must be indifferent between accepting N or $N-1$ contracts whatever the contract that is not taken

Let consider a positive profit equilibrium with a unique lender $\Rightarrow$ monopoly allocation.

Let consider a positive profit equilibrium with N active lenders offering contracts $C_i = (L_i, R_i)$ for $i = 1....N$. The borrower's surplus is the one at which the incentive compatibility constraint is binding and there is no *latent* contracts. The borrower's surplus is higher than at the monopoly profit allocation if and only if:

$$L^{\mathcal{A}} + A > I_M^u$$

For this allocation to be an equilibrium, no lender should have an incentive to deviate. We show that a lender has no incentive to deviate only if the borrower is indifferent between taking N or $N-1$ contracts, whatever the deviating one.

Let consider that lender i offers the contract $C_i' = (L_i - \epsilon, R_i - \frac{\epsilon - \epsilon^2}{p})$. We show that this is a profitable deviation **(a)**, that except if the borrower is indifferent between taking N or $N-1$ contracts, whatever the deviating one, he is going to accept the contract **(b)**, without shirking **(c)**.

(a). This is a profitable deviation for lender i if the borrower takes the contract and exerts high effort. Indeed, let π_i and π_i' be respectively lender i's profit when the contracts i and $i^{'}$ are accepted without shirking. We have:

$$\pi_i\prime = p\left[R_i - \epsilon\frac{1-\epsilon}{p}\right] - I_i + \epsilon$$

$$\pi_i\prime = \pi_i + \epsilon^2$$

So the contract i' is a profitable deviation for lender i if the borrower accepts it and behaves.

(b). Now we show under which conditions the borrower accept the contract. Let denote as $C_{-i}^{\mathcal{A}} = (L_{-i}^{\mathcal{A}}; R_{-i}^{\mathcal{A}})$ the aggregate contract that is accepted exclusing the contract C_i. We consider three cases covering all possibilities.

First, let assume that we have:

$$pG\left(L_{-i}^{\mathcal{A}} + A\right) - pR_{-i}^{\mathcal{A}} > pG\left(L^{\mathcal{A}} + A\right) - pR^{\mathcal{A}}$$

In this case, the borrower would never have taken contract i at equilibrium, which contradicts the first assumption.

Second, let assume that we have:

$$pG\left(L_{-i}^{\mathcal{A}} + A\right) - pR_{-i}^{\mathcal{A}} < pG\left(L^{\mathcal{A}} + A\right) - pR^{\mathcal{A}}$$

In this case, there exists ϵ small enough such that:

$$pG\left(L_{-i}^{\mathcal{A}} + A\right) - pR_{-i}^{\mathcal{A}} \leq pG\left(L^{\mathcal{A}} + A - \epsilon\right) - pR^{\mathcal{A}} + \epsilon - \epsilon^2$$

As a result, the borrower is better off accepting the deviating contract.

Third, let assume that we have:

$$pG\left(L_{-i}^{\mathcal{A}} + A\right) - pR_{-i}^{\mathcal{A}} = pG\left(L^{\mathcal{A}} + A\right) - pR^{\mathcal{A}}$$

In this case only we cannot find an ϵ small enough such that the borrower is going to take the offer.

(c). Second, we show that if the borrower accepts the deviating contract he behaves. If it were an equilibirum for the borrower to accept $C_{\mathcal{A}}$, then from Proposition 3.2., we know that:

$$pG\left(I^{\mathcal{A}}\right) - pR^{\mathcal{A}} = B\left(I_i + \sum_{j\in N|\{i\}} I_j\right)$$

Let $C'_{\mathcal{A}} = (I^{\mathcal{A}\prime}, R^{\mathcal{A}\prime})$ be the aggregte offer after the deviation. We know that $I^{\mathcal{A}} > I^m$, as a result, for ϵ small enough, we also have $I^{\mathcal{A}\prime} > I^m$. As on the interval $[I^m; I^*]$, the function $pG(I) - I - BI$ is strictly decreasing, we can write that:

$$pG\left(I^{\mathcal{A}} - \epsilon\right) - pR^{\mathcal{A}} + \epsilon > B\left(I_i + \sum_{j\in N|\{i\}} I_j - \epsilon\right)$$

As a result, for ϵ small enough, we have:

$$pG\left(I^{\mathcal{A}\prime}\right) - pR^{\mathcal{A}\prime} > B\left(I'_i + \sum_{j\in N|\{i\}} I_j\right)$$

Hence, the contract (I'_i, R'_i) is accepted and the borrower exerts high effort.

As a result, lender i has an incentive to deviate and the allocation such that $I^{\mathcal{A}} > I^m$ is not an equilibrium.

A.2 Proof of Proposition 5

Same demonstration as in proposition 4, except that due to the monitoring technology, there is no symmetric equilibrium since only one lender monitors. Therefore, the unique equilibrium is the monopolist one.

A.3 Proof of Proposition 6

Let define the function F such that $F(L) = p(G(L+A)) - L - b(L+I^*)$. By definition, for any $A < \overline{A_m} - pc$, $(I^* - A) < 0$. There exists A_l such that $F(I_M^m - A) = 0$. I show that for any A, $A_l < A < \overline{A_m}$, there exists an equilibrium in which lender i

offers the contract $(I^* - A; \frac{I^*-A-c}{p} + \lambda)$ that is taken, lender j offers the contract $(L'; \frac{L'-A}{p})$ that is not taken where L' and λ verify:

$$F(L') = 0 \tag{5}$$

$$\lambda = p(G(I^*)) - I^* + A - c - pG(L' + A) - L' \tag{6}$$

No deviation for the latent lender.

Suppose that lender j decreases the loan amount. The borrower's payoff from accepting contract j is strictly less than $pG(L' + A) - L'$, which can be obtained by accepting and repaying contract i alone. Hence, contract j is not accepted. Suppose now that j increases the loan amount he offers. Since $L' > I_M^m$ the benefit from shirking increases at a higher rate than the production surplus. Hence, the borrower will accept both contract and shirk. Consequently, there is no profitable deviation for lender j.

No deviation for the active lender.

Lender i can not increase or decrease the loan amount without his contract being rejected, since the surplus is maximized at I^*. In addition, he cannot increase interest rates since the borrower's surplus must be at least the one he gets accepting contract j.

No deviation for any inactive lender.

Any contract that would be preferred must offer a payoff of at least $pG(L') - L'$ to the borrower; However, in this case, the borrower will be better off taking the three contracts and shirking.

A.4 Proof of Proposition 7

Consider lender i offering the following contract $(I^* - A, \frac{I^*-A+c}{p})$ with monitoring.

No deviation for any latent lender.

An inactive lender cannot offer a contract that will be strictly preferred to the one offered by lender i, since it maximizes the borrower payoff.

No deviation for the active lender.

Suppose that lender i deviates offering a contract $\left(I^* - A, \frac{I^*-A}{p} + \epsilon, 1\right)$. Then, another lender can offer the following contract with monitoring to compete $\left(I^* - A, \frac{I^*-A}{p} + \frac{\epsilon}{2}, 1\right)$. This contract will be strictly preferred by the borrower without inducing shirking, since $2BI^* < pG(I^*) - I^* + A$. Therefor, lender's i deviation is not profitable.