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**INSIDERS AND OUTSIDERS:
The Choice between Informed and Arm's-length Debt**

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ABSTRACT

While the benefits of bank financing are relatively well understood, the costs are not. This paper argues that while informed banks make flexible financial decisions which prevent a firm's projects from going awry, the cost of this credit is that banks have bargaining power over the firm's profits, once projects have begun. The firm's portfolio choice of borrowing source and the choice of priority for its debt claims attempt to optimally circumscribe the powers of banks.

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While the benefits of bank financing are relatively well understood, the costs are not. This paper argues that while informed banks make flexible financial decisions which prevent a firm's projects from going awry, the cost of this credit is that banks have bargaining power over the firm's profits, once projects have begun. The firm's portfolio choice of borrowing source and the choice of priority for its debt claims attempt to optimally circumscribe the powers of banks.

According to received theory, banks reduce the agency costs associated with lending to small and medium growth firms in various ways.¹ Yet in practice, many such firms diversify away from bank financing even if banks are willing to lend more.² Why do these firms forsake informed and seemingly more efficient sources of debt finance to borrow from less informed arms-length sources? While the benefits of bank financing are relatively well understood, the costs are not. This paper argues that while informed banks make flexible financial decisions which prevent a firm's projects from going awry, the cost of this credit is that banks have bargaining power over the firm's profits, once projects have begun. The firm's choice of borrowing sources and the choice of priority for its debt claims attempt to optimally circumscribe the powers of banks.

In this paper, I consider an owner-managed firm with a project idea. It has to make an externally financed investment in order to obtain a stochastic payoff. After making the investment, the owner exerts costly effort which affects the distribution of project returns. The state of the world, which is privately observable by the owner, is then realized. Depending on the state of the world, continuing the project (as opposed to liquidating it) may have positive or negative net present value (NPV). As the owner has a residual claim, and all financing is through external debt, she always wants to continue the project. I distinguish different sources of credit by their ability to acquire information about the debtor and their accessibility. A bank that lends to the firm for a project can obtain information about the firm in the course of lending which the firm cannot easily communicate to others.³ Further, bank debt is easily renegotiated, because the bank is a monolithic, readily accessible creditor. However, a typical arm's-length creditor like the bondholder receives only public information. It is hard to contact these dispersed holders and any renegotiation suffers from information and free-rider problems.

This paper makes a simple but fundamental point. An informed bank will be able to control the owner's decision such that the project is continued only if it has positive NPV. In the process of doing so, however, it adversely affects the owner's incentive to exert effort.

To see this, I consider two kinds of bank contracts. The short-term bank contract is one where the bank requires repayment of the loan after the state is realized. As the bank is also informed about the state, it can prevent the owner from continuing a negative NPV venture by demanding repayment. Unfortunately,

it can also demand repayment when continuing is efficient. If the owner has only the bank as a source of finance, she has to share some of the surplus from the project with the bank in order to persuade it to continue lending. As the owner no longer obtains all the surplus from the project, she exerts lower effort than optimal, thus reducing the project returns.

Alternatively, the bank can require repayment only when the project is completed. This is the long-term bank contract. The bank can no longer extract surplus from the firm. However, this contract creates a new problem. The bank cannot simply demand repayment when project continuation is inefficient, it now has to bribe the owner to stop the project. States where continuation has a negative NPV are now more attractive than before. The owner's incentive to exert effort to avoid these states is reduced. From the analysis of the above contracts, I derive implications for the choice of maturity of bank debt.

The third contract I consider is a long-term contract offered by an arm's-length investor. Unlike the banks, arm's-length lenders have no control over the owner's continuation decision. However, surplus is not reallocated after the state is realized. This contract may give the owner a higher incentive to exert effort than do either of the bank contracts. I conclude that the welfare effect of borrowing from a bank rather than arm's-length sources is ambiguous; the benefit of being bank controlled has to be weighed against the costs of distortions in the owner's incentives to exert effort.

While analyzing the short-term bank contract, I assume initially that the firm is locked in to the bank for some exogenous reason. This assumption does not merely help us present the main issues simply. It could characterize economies where the banking sector is not competitive, either because of bank collusion or because of government intervention (see Modigliani and Perotti (1990)). I relax this assumption by allowing uninformed, outside lenders to compete with the informed, inside bank to lend when the owner wants to continue the project.

Competition among potential financiers is a double-edged sword. On the one hand, the inside bank's ability to appropriate surplus is reduced, which improves the owner's incentives to exert effort. On the other hand, the bank's control over the project is also reduced because uninformed lenders may continue unprofitable projects. The firm chooses its optimal borrowing structure, with the aim of reducing the bank's ability to appropriate rents, without drastically reducing its ability to control. The two fundamental factors

within the firm's choice set in doing this are the levels of initial borrowing from the two different sources and the relative priority assigned to the respective claims. I thus obtain cross-sectional implications for a firm's choice of borrowing sources as well as the relative priority of its borrowing. I also show how public revelation of information affects this choice.

There are two main contributions of this paper. The first contribution is to emphasize a cost of bank finance that stems endogenously from the monitoring and control function the bank performs. The second contribution is to show how maturity, source choice, and priority affect both the benefits and the costs of bank debt. This is in contrast to much of the literature (Diamond (1991b) is an exception), which assumes the costs of bank debt to be exogenous and invariant to attributes of debt contracts like priority. My paper is similar to Grossman and Hart (1986) in that the ex post allocation of property rights determines ex ante incentives. I, however, endogenously obtain the division of these rights into the rights to surplus and the rights to control. Because both these rights are aspects of the bank's information-based implicit property rights, they tend to vary similarly with most factors. My model is also not the first to examine the choice between bank and arm's-length debt. In Diamond (1991a) firms build reputation by taking on costly bank monitored debt. Firms that acquire good reputations then move on to the arm's-length market to save on monitoring costs. The important difference in this paper is that the cost of bank debt is endogenous.

This paper is similar in parts to Sharpe (1990). However, there are important differences. Sharpe restricts his analysis to examining the costs of the inside bank's rents. My paper, in addition, explores the benefits of the inside bank's control. This difference in approach is important. For example, I show that changes in the allocation of priority, in general, do not alter the inside bank's rents. A focus on only rents could lead to the misleading conclusion that priority does not matter. However, changes in priority alter the inside bank's control and thus influence the owner's incentives to exert effort. My paper is also different in content. Sharpe examines the role of implicit contracts in reducing the bank's *incentives* to extract rents. My paper emphasizes the amount of borrowing from different sources and the allocation of priority as factors that alter the bank's *ability* to extract rents as well as its ability to control the firm. The rest of the paper is structured as follows. Section I describes the basic model. Section II analyzes the different contracts assuming that once a firm borrows from a bank, it is compelled to borrow only from it in the future. The

basic trade-off is demonstrated by comparing bank debt with arm's-length debt. In section III, the assumption of exogenous lock-in is relaxed. I show how the bank's ability to control and its ability to extract surplus emerge from its informational advantage over outside lenders. I examine the effect of multiple sourcing, priority, and interim public revelation of information on the efficacy of bank debt. Section IV examines extensions and Section V concludes.

I. The Model

A. The Project:

Consider an economy with a single owner-managed firm (henceforth the 'owner' or the 'firm'). The owner has a project idea. At the initial date 0, the owner has to invest a fixed amount I . She then expends personal effort β at a unit cost of 1. Effort increases the expected value of future returns in a way to be specified. The assets purchased at date 0 can be liquidated at date 1 for value L where $L \leq I$. At date 2, these assets depreciate to value zero.

There are two possible states at date 1. The state can be good, G , with probability q and bad, B , with probability $(1-q)$. At date 2, in the good state the project pays out X with probability 1. In the bad state it pays out X with probability p_B and zero with probability $(1-p_B)$. I assume that $X > I \geq L > p_B X$.

Private effort $\beta \in [0, \infty)$ along with an exogenous quality parameter $\theta \in [0, 1]$, affect the probability q of the good state's occurring. For a small firm, β is the physical or mental exertion by the management. For a large firm, β can be thought of as discretionary investment. The quality θ represents exogenous determinants of the likelihood of the project's being good.⁴ I assume $q = q(\beta, \theta)$, where q has the following properties

$$q_1(\beta, \theta) > 0, q_{11}(\beta, \theta) < 0, q_2(\beta, \theta) > 0, \quad (\text{A.1})$$

$$q_1(0, \theta) = 1/\epsilon, q_1(\infty, \theta) = 0, \quad (\text{A.2})$$

$$q_{12}(\beta, \theta) = 0, \quad (\text{A.3})$$

where the subscript k denotes the partial with respect to the k^{th} argument. I also use subscripts for the date but the difference will be clear from the context.

Assumption (A.1) states that the probability of the good state being realized is increasing and

concave in the effort of the owner and is increasing in the quality θ . Assumption (A.2) states that the marginal benefit of effort decreases to zero from a large number. Assumption (A.3) is a separability assumption.

In summary, if the owner invests at date 0;

Date 0	Date 1	Date 2
Investment I made. Effort β exerted after investment made.	State realized. Owner can continue project. If not, project is liquidated for value L	Project pays out X with probability 1 in the good state. In the bad state it pays X with probability p_B and zero with probability $(1-p_B)$. Assets are worthless.
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B. Financiers

This is a risk-neutral world and the riskless interest rate is 0. The owner has no money of her own. She must borrow to finance the project. There are two types of lenders in the *competitive* date 0 credit market;

i) Banks enter the market at each date to acquire information and make loans. If a bank makes a loan to a firm at date 0, it gains access to the internal records the firm maintains (and henceforth it will be referred to as the inside bank). During this period, the bank monitors the firm's books and the accounts the firm maintains with the bank. Much of the information obtained this way is 'soft' in nature. It cannot be credibly communicated to outsiders even if the firm wants to do so. Therefore, banks acquire information only by lending, which is consistent with the empirical evidence in Lummer and McConnell (1989). I assume, for simplicity, that the costs of monitoring are negligible.

ii) Arm's-length Investors lend at date 0 and return to collect repayments at date 2. Even if they lend, they do not examine the books. This may be because they have a high private cost of monitoring as compared to the banks or because the size of each investor's loan is small, resulting in a free-rider problem.

C. Information

Everyone knows quality θ at date 0. Once the project starts, the owner knows the effort exerted. She

also learns the state before deciding whether to continue the project at date 1. The inside bank learns the effort provided and the state at the same time as the owner. Arm's-length investors and outside banks observe only public signals, which are assumed uninformative unless otherwise specified.

D. Contracts

I assume that contracts cannot be made contingent on the liquidation decision, effort, or the state. Myers (1977) discusses in detail why it may not be possible to make contracts contingent on investment (or disinvestment). Effort and the state can be observed only by the owner and anybody privy to inside information, but not by the courts. The courts, however, can observe and verify the monetary transfers that the parties choose to record.

I allow only debt contracts, an assumption which may be justified by appealing to the costly state verification technology in Diamond (1991a) or Gale and Hellwig (1985). Without loss of generality, I consider only pure discount debt contracts, that is, contracts where the firm borrows an amount A_i at date i and is required to make a *single* repayment D_{ij} at date j . I call contracts over a single period ($j-i=1$) *short-term contracts* and those over two periods ($j-i=2$) *long-term contracts*. Any debt contract is a convex combination of short- and long-term contracts.

I do not allow for contracts where the required repayment, under any circumstance, is less than the amount borrowed, i.e., $D_{ij} < A_i$. These contracts are implausible and a minor change to the model would rule them out.⁵ As the credit markets are competitive at date 0, I assume that any ex post rents accruing to a lender are paid up front to the owner at date 0. In general, such rents would be given back to the firm by reducing its cost of doing business or as perks related to the project.

II. The Basic Trade-off

Henceforth the terms ex ante and ex post are with reference to the time the initial date 0 contract is agreed to. The following subscripts are used: L denotes long-term, S short-term, b denotes bank, and a arm's-length.

The borrower decides (i) what type of lender to approach and maturity to borrow; (ii) what effort level β to exert and, after contracting; (iii) whether to continue or liquidate after seeing the state at date 1. The lender decides (i) the contract terms offered at date 0 and, (ii) whether to renegotiate, cut off credit, continue with the old contract, or offer a new contract at date 1. The first-best solution is now characterized.

A. First-Best Solution

If financed, at date 1 the owner should continue in the good state and close the project down in the bad state. The expected surplus is $q(\mathbf{S}, \mathbf{Z})(X - I) - (1 - q(\mathbf{S}, \mathbf{Z}))(I - L) - \mathbf{S}$ at date 0. The first term is the surplus in the good state, the second is the depreciation losses in the bad, while the third is the cost of effort. The project should be financed only if the surplus is positive for some effort level. The effort β_{FB}^* , which maximizes this surplus, is obtained by solving the first-order condition (FOC)

Assumptions A.1 and A.2 ensure existence and uniqueness of the solution.

$$q_1(\mathbf{S}, \mathbf{Z}) = \frac{I}{X - I} \quad \text{for } \mathbf{S} = \mathbf{S}_{FB}^* \quad (1)$$

A contract that approaches first best should have the following two features: First, the owner should have an incentive to voluntarily liquidate the project in the bad state. Alternatively the lender should have the ability to coerce or persuade her to do so. Second, the owner should obtain all the surplus from the good state and face all the losses in the bad. As we see later, no rational contract simultaneously achieves both objectives. The resulting trade-off between project control and owner's incentives to exert effort is the main focus of the paper.

In what follows, I repeatedly use the following ideas: (a) given limited liability, the owner will never liquidate in the bad state unless refused credit or bribed and (b) the competitive date 0 market for credit and lender individual rationality together imply that loans are zero NPV projects. Hence all inefficiencies are ultimately borne by the owner.

I first analyze contracts with the arm's-length lender, then contracts with the bank. In order to present the issues as simply as possible, I initially assume the firm can write only one type of contract at a time. In addition, once the owner has borrowed from a bank, I assume it is locked in to that bank for all future borrowing. I relax both assumptions later.

B. Arm's-length Contract

By assumption, the arm's-length lender neither receives information nor can he act upon it. In this situation, the short-term contract is equivalent to the long-term contract and I consider only the latter. The owner borrows amount I at date 0 and promises to repay D_{02a} at date 2. As discussed before, the owner will always continue at date 1, even though it may be inefficient to do so. The lender is not present to influence

this decision. Given an arm's-length contract at date 0, the owner chooses her effort level by solving

Let β_a^* solve the corresponding F.O.C. Let the lender conjecture that ex post contract, the (unobservable) effort exerted by the owner will be β_a^c . The arm's-length investor lends provided he finds it individually rational,

and provided the contract is feasible, $X \geq D_{02a}$. In a Rational Expectations Equilibrium, the lender's conjecture must be correct so that

$$\beta_a^c = \beta_a^* \quad (4).$$

In a competitive credit market, (3) should be met with equality. So, if a feasible contract exists, the F.O.C obtained from (2), (3), and the equilibrium condition (4) taken together imply the optimal effort β_a^* is defined implicitly by

$$\beta_a^* = \frac{1}{\left(X - I - \frac{(1 - q(\beta_a^*, \mathbf{2})) (1 - p_B) I}{q(\beta_a^*, \mathbf{2}) + (1 - q(\beta_a^*, \mathbf{2})) p_B} \right) (1 - p_B)} \quad (5)$$

for $\beta = \beta_a^*$. The effort exerted is less than first best; $\beta_a^* < \beta_{FB}^*$. The rationale is simple. The owner continues in the bad state, forcing the rational lender to demand a higher face value than if the continuation decision were efficient. This reduces the surplus available to the owner in the good state. Also the residual value, $X - D_{02a}$, accruing to the owner with probability p_B increases the attractiveness of the bad state, further reducing effort. All inefficiency stems from the inability of the owner to commit to liquidate the project in the bad state.⁷

A solution β_a^* to (5) may not exist at low values of θ . Given the intrinsic poor quality of the project θ , the face value demanded could be so high as to depress the incentive to provide effort below the minimum required to satisfy the lender's individual rationality condition. In other words, the returns to the lender could decrease with increasing face value. Credit is then rationed because of poor incentives for effort.

C. Bank Contracts

C.1. Short-term Bank Contract

The owner borrows I at date 0. The bank observes the effort exerted and then the state. At date 1, in the bad state the project is liquidated and the bank recovers L . In the good state, the date 0 contract does not

oblige the bank to lend. It can use this discretion to hold up the owner and demand a share of the surplus in return for the funds needed to continue the project. Solving the bargaining game, the owner gets $\mu(X-L)$ while the lender gets $(1-\mu)(X-L)+L$, where $\mu \in [0,1]$ is the share of the unallocated surplus that the owner gets after bargaining. The currently exogenous μ will also be referred to as 'bargaining power'. Let q_{sb}^* denote the probability of reaching the good state with the induced effort. The FOC for the owner's effort decision at date 0 is

$$q_1(\mathbf{S}, \mathbf{2}) = \frac{1}{\mu(X-L)} \quad (6)$$

for $\beta = \beta_{sb}^*$, provided it is individually rational for the bank to lend:

This condition is merely that the bank make nonnegative profits from lending. If μ is high (≈ 1) the bank will not be able to recover the depreciation losses $(1-q_{sb}^*)(I-L)$. If μ is low (≈ 0), the owner, faced with poor incentives, will not exert much effort. Consequently, q_{sb}^* will be low, forcing down the term in square brackets. It will not be rational for the bank to lend in either case. As the bank rations credit when the firm's bargaining power is at extremes, arm's-length debt could be available to the firm when short-term bank debt is not. For intermediate values of μ , the bank will lend. But comparing (6) and (1), and using the monotonicity and concavity of q , there will be underprovision of effort compared to the first best.

The short-term bank contract requires repayment at date 1. This works well in the bad state, where the bank should cut off credit. In the good state where the bank should continue to lend, the contract has to be renegotiated with resulting distortions to the firm's incentives for effort. Note that the first best may be achievable if we constrain the bargaining sufficiently by means of an external nonrenegotiable mechanism. For example, a commitment to lend at a particular interest rate with the option for the bank to pull out achieves first best under some circumstances. But these mechanisms are somewhat special and will not be explored further (see note 8).⁸

C.2. Long-term Bank Contract

The bank lends I long-term to the firm, so that at date 1 the loan is renewed automatically and at date 2 the required repayment is D_{02b} . At date 1, in the good state, the optimal decision is to continue. As the surplus is fully allocated by the initial contract, there is no renegotiation. In the bad state, it is efficient to close down the project. As the bank cannot unilaterally do so the contract has to be renegotiated. The surplus (from taking the efficient decision) that they bargain over is $L - p_B X$. The owner gets $p_B(X - D_{02b}) + \mu(L - p_B X)$ while the lender gets $p_B D_{02b} + (1 - \mu)(L - p_B X)$ in the bad state. The first term in each expression is the amount allocated by the initial contract. We require that:

The left hand side of the equality is the face value demanded by the bank in order to break even. The inequality requires that the project return be enough to meet this in the good state. The face value demanded increases with the bargaining power of the owner for two reasons. First, the bank gets less of the surplus in the bad state. Second, it is easily shown that increasing the owner's share in the bad state reduces her

incentive to exert effort to avoid the state, thereby reducing q_{Lb}^* .

D. Choice between Contracts

The owner chooses between contracts on an ex ante basis. As the date 0 market for credit is competitive, all individually rational loans are zero NPV. Any ex post rents extracted by the bank are prepaid to the owner. These payments have no effect on her incentives to exert effort. Thus the owner's ex ante expected utility with bank financing is:

Note that the project continuation decision at date 1 is efficient, regardless of the maturity of bank debt. However, the maturity of bank debt affects the owner's incentives for effort and $q_{sb}^* \neq q_{Lb}^*$. The owner's ex ante contract expected utility with arm's-length financing is:

The first term in (9) and (10) is the expected surplus in the good state. The second term in (10) is the cost of inefficient continuation, while in (9) it is just the depreciation losses (as control is efficient). A bank loan is preferred if (9) > (10), so that

The choice between bank debt and arm's-length debt depends on whether the ex post continuation inefficiency with the latter outweighs the possible distortion to effort incentives with the former. If $q_a^* \leq q_b^*$, bank financing dominates arm's-length financing.

The interesting case is when $q_a^* > q_b^*$, that is, when the provision of effort with arm's-length financing is greater than that with bank financing. The first term in (11) is the ex ante benefit of bank control which is positive as $p_B X < L$; the second is the additional loss due to depreciation as the bad state is reached more often with bank debt; the third is the loss in surplus because of differential ex post effort distortion. If the ex ante cost of the relative underprovision of effort from the second and third term outweighs the benefit of control (the first term), bank finance can be less efficient than arm's-length finance.

For a given function $q(\cdot, \cdot)$, the exogenous bargaining power μ and project quality θ determine the choice of maturity and source. I briefly examine the effect of changing these parameters on loan choice.

D.1. Effect of Bargaining Power

As discussed earlier, the distortion in the owner's incentives on borrowing short term from the bank decreases as her bargaining power increases, so that $dq_{sb}^*/d\mu > 0$. The cost of arm's-length debt is, however, independent of μ . Consider a project for which arm's-length debt is preferred to short term bank debt for some

μ . Then

Lemma 1: *There is a $\hat{\mu}_S \in [0,1]$ such that arm's-length debt is preferred ex ante to short-term bank debt by any owner with bargaining power $\mu \leq \hat{\mu}_S$.*

The distortion to the owner's incentives on borrowing long-term from the bank *increases* as her bargaining power increases, so that $dq_{Lb}^*/d\mu < 0$. Consider a project for which arm's-length debt is preferred to long-term bank debt for some μ . It follows that

Lemma 2: *There is a $\hat{\mu}_L \in [0,1]$ such that arm's-length debt is preferred ex ante to long-term bank debt by any owner with bargaining power $\mu \geq \hat{\mu}_L$.*

It is easy to show that arm's-length debt is not always dominated by bank debt. For example, consider a choice between arm's-length and long-term bank debt. Assume that $q(0,\theta) = 0$ and $q(\epsilon,\theta)=1$, so that some small effort ϵ is necessary for the project to succeed with probability 1. Let $\mu=1$. Both types of lenders get back $p_B D_{02}$ in the bad state. However the owner, when borrowing from the bank, gets an additional $(L-p_B X)$ in the bad state compared to what she gets when borrowing at arm's-length. For a loan of the same face value, she has less of an incentive to exert effort when borrowing from the bank. Lender rationality then demands that $D_{02a} < D_{02b}$, which further reduces the owner's incentive to reach the good state when borrowing from the bank. In fact, if $p_B(X-D_{02b}) + (L-p_B X) > X - D_{02b} > 0$, she will exert no effort. Note that in this situation, she will still exert effort when borrowing at arm's-length. The bank will not lend long term while the firm may still obtain arm's-length loans.

Proposition 1: *(i) If $\hat{\mu}_S > \hat{\mu}_L$, the firm chooses short-term bank debt if $1 \geq \mu > \hat{\mu}_S$, arm's-length debt if $\hat{\mu}_S \geq \mu \geq \hat{\mu}_L$ and long-term bank debt if $\hat{\mu}_L > \mu \geq 0$. (ii) If $\hat{\mu}_L \geq \hat{\mu}_S$, then the firm never chooses arm's-length debt, borrows short term from the bank for $\mu \geq \hat{\mu}_{LS}$ and borrows long term if $\mu < \hat{\mu}_{LS}$, where $\hat{\mu}_{LS} \in (\hat{\mu}_S, \hat{\mu}_L)$.*

Proposition 1 suggests that the optimal maturity of bank borrowing is negatively related to μ , the share the owner obtains from bargaining. Maturity does not affect the bank's control but it alters the states in which bargaining takes place and hence the distortion to incentives. Another way to interpret this is that the postulated lock-in gives the bank property rights to the firm. With short term bank debt, the bank has

direct control rights, while with long-term bank debt, it acquires the right to control through bilateral bargaining, by giving up some right to the surplus. Because the surplus the bank acquires in different states depends on the maturity of the debt, maturity affects effort. The firm chooses maturity so as to give itself the best incentives for effort. Empirically, a firm should borrow long term from a bank when the latter has an exogenous source of power over the former. Examples of this power could include bank control over crucial suppliers and bank shareholdings in the firm.

D.2. Effect of Project Quality

The propositions I derive for the effect of project quality θ on the choice between either long term bank debt and short-term bank debt or arm's-length debt and short-term bank debt are similar. I state only one:

Proposition 2: There exists a project quality $\bar{\theta} \in [0,1]$ such that (i) short-term bank debt is preferred to arm's-length debt when $\theta \leq \bar{\theta}$ and (ii) arm's-length debt is preferred to short-term bank debt when $\theta > \bar{\theta}$.

Proof: See Appendix.

The intuition is simple: Conditional on the good state, the bank extracts the same amount, regardless of project quality. This depends crucially on the absence of interim date competition and the assumption that bargaining power is exogenous. In contrast, as the project quality improves, control becomes less important. The face value demanded by arm's-length lenders falls, improving incentives for effort. The owner's ex ante utility with either kind of financing is increasing in quality but increases at a faster rate with arm's-length financing, hence the proposition.

Firms with higher quality prefer arm's-length debt, a result similar to that of Diamond (1991a), who finds that firms with a higher reputation borrow from the arm's-length market. Here the finding is due to the fact that high quality firms find bank debt relatively more onerous and it holds even if monitoring costs are small.

E. How is Bargaining Power Determined?

So far I have assumed bargaining power μ to be exogenously given. This could be appropriate if lock-in between a firm and its initial bank is exogenous. For example, banks may agree not to poach each

other's clients. Such collusive practices may be reinforced by a government that wants to restrain 'destabilizing competition' in the banking sector (see Macrae(1990), Modigliani and Perotti (1990)). In such an economy, the firm and the bank are, ex post, in a *bilateral bargaining* situation between *two fully informed* parties. If we know their discount rates (a commonly accepted exogenous primitive) and the structure of the bargaining game, we can determine the share of the surplus the firm gets.

My assumption of exogenous lock-in is less tenable if banks do not collude and government intervention is minimal. The main difference between lenders, once the project has begun, is informational. I now show that the inside bank's informational advantage over outside lenders can endogenously lock the firm to it. In order to derive this, I now allow competition from outside un-informed lenders at the interim date 1. Obviously, interim competition reduces the inside bank's implicit property rights in the firm and hence its share of the rents. Unfortunately, its control rights are simultaneously reduced, for outside uninformed lenders may now interfere with the inside bank's closure decisions.

I then allow the firm to borrow from multiple sources at the same time. The firm structures its borrowing so as to maximize the bank's control while minimizing the consequent rents. The firm's choice variables in doing this are the relative amounts it borrows from the bank and the arm's-length lenders at date 0 and the relative priority of sources. I obtain implications for source choice and priority structure. Finally, I examine the effect of interim public signals.

For reasons of brevity, I now drop the long-term bank contract from consideration. Henceforth, 'bank contract' refers to the short-term bank contract.

III. Interim Competition and Multiple Sources

A. Bank Debt with Interim Competition

The bank lends amount I at date 0. At date 1, the owner has to roll over the repayment on the date-0 loan, D_{01} . Instead of being locked in to the initial bank at this point, the owner bargains for the best terms with all potential lenders (including the initial bank). I make two assumptions that simplify the algebra. First, $p_B = 0$. Second, assets do not depreciate over the first period, so that $L=I$.

As the first period loan is riskless, the date-1 repayment $D_{01} = I$. The amount to be borrowed by the owner at date 1, in order to continue the project, is $I_S = I$. At date 1, the owner asks both the inside bank and

a single outside bank (the number of outside banks is immaterial) to submit a sealed bid to the owner. The bid specifies the face value the lender demands at date 2 in return for the loan of I_S at date 1. The lowest bid is accepted. The solution to the bidding game determines the expected date 2 face value for the loan made at date 1.⁹ The equilibrium solution is

Proposition 3: (i) No equilibrium exists in pure strategies. (ii) There is an equilibrium in mixed strategies where: (a) the outside bank has a mixed strategy of bidding which is independent of the state. It will not bid at all with probability π_N . It makes zero expected profits. It makes positive expected profits conditional on the good state of

$$\frac{1-q}{q} I_S (1 - B_N) \quad (12)$$

where

$$B_N = \frac{(1-q)}{q} \frac{I_S}{(X - I_S)} \quad (13)^{10}$$

and q is the outside bank's conjectured probability of the good state. (b) The inside bank offers to lend only in the good state. If the outside bank bids with positive probability ($\pi_N < 1$), the inside bank makes a conditional expected profit of

$$\frac{(1-q) I_S}{q} \quad (14).$$

If the outside bank does not bid with positive probability, the inside bank captures all the project surplus.

Proof: See Appendix.

If the outside bank's strategy was pure and therefore predictable, the inside bank would charge a lower rate in the good state and not bid in the bad state, thus letting the outsider finance only bad projects. This is the problem of the Winner's Curse, which is why the outsider plays a mixed strategy. If the outside bank bids in the bad state, it gets to lend with certainty as the inside bank does not bid. The probability of this happening is $(1-q)(1-\pi_N)$ and the loss is I_S . The outsider recovers the loss by making a profit in the good state. Equation (12) is then obtained by conditioning on the good state.

The inside bank bids only in the good state where the loan is riskless. It charges a premium over the

full information rate, because its competition is uninformed. If the outside bank bids in the bad state, the owner will use part of the loaned amount to pay off the inside bank. If it does not, the project is shut down and the proceeds used to pay off the inside bank.

Proposition 3 supports what I assumed previously, as it implies that information asymmetry can lead to lock-in. First, no equilibrium exists in pure strategies and even allowing for noise, the outsider does not bid if its informational disadvantage is bad enough. In general, however, the firm is not locked in to the informed bank with probability 1. The inside bank's control and rental rights are changed, from the earlier analysis, in interesting ways.

In the earlier analysis, the informed bank exerted control directly by cutting off credit in the bad state. But now, if the inside bank refuses the bad project credit, it will be shut down only with probability π_N , as the uninformed outside bank may decide to lend. It follows that π_N is a measure of the control rights exercised by the inside bank. As $\pi_N \leq 1$, these (weakly) decrease compared to the earlier analysis. The inside bank extracts all the surplus when it is in a bilateral bargaining position. Such a position occurs now only if $\pi_N = 1$. As the bank is assumed to make take-it-or-leave-it offers here, it is appropriate to compare the level of rents it extracts now with those that would accrue if $\mu=0$ in the earlier analysis. Thus its ability to extract rent also (weakly) decreases.

Both the bank's rental and control rights depend on its implicit property rights or ex post monopoly power. Hence

Proposition 4: (i) Both the conditional expected rents extracted by the inside bank and the control exercised by it decrease in q and (ii) increase in I_S (the amount rolled over at date 1). (iii) The control exercised by the inside bank increases with a reduction in the available surplus $X-I_S$.

Proof: Follows directly by differentiating (13) and (14).

The implicit property rights of the inside bank arise because of (a) its *informational advantage*, which decreases in the outsider's estimate of the probability of success, q , and (b) the *value* of this advantage, which increases in the amount to be borrowed (or rolled over) at date 1, I_S .

A.1 Effect of Project Quality

The probability of the good state, q , depends on project quality θ , which in turn determines the inside bank's informational advantage (Proposition 4 (i)). Using Proposition 3, I can derive the share μ the firm gets as well as the control π_N exercised by the bank. The difference from the earlier analysis is that μ now depends on θ . As the analysis of a firm's choice between bank debt and arm's-length debt is similar to the one carried out earlier, I refer the reader to Rajan (1991a) for details. I present an example describing the firm's choice when its initial borrowing is entirely from the bank or from the arms-length market.

Example 1 Let $X=5$, $I=1$ and $q(\beta, \theta) = \theta - e^{-2\beta}$.

Place Figure 1, 2 and 3 about here.

As quality increases, the effort provided with bank debt approaches that with arm's-length debt (Figure 1). The control provided by the bank also decreases with quality (Figure 2). The costs and benefits of having an ex post informed lender are relatively minor for high-quality firms in a competitive, unrestricted economy. This makes firms with high-quality projects indifferent between bank debt and arm's-length debt (Figure 3). Transaction costs may entirely determine their choice of finance. This should be contrasted with our earlier analysis of an economy where lock in was exogenously mandated. In that economy, firms with high-quality projects found bank debt relatively more onerous.

The effects of having ex post informed lenders are significant for firms lower down on the quality spectrum. For medium-quality projects, the benefit of control outweighs the relative underprovision of effort, so bank debt dominates arm's-length debt. Arm's-length debt dominates for low quality firms, because both the marginal cost of the relative underprovision at low levels of effort and the magnitude of relative underprovision become significant.

B. Borrowing at Date 0 from Both the Bank and Arm's-length Lender

Proposition 4 (ii) shows that the firm can reduce the value of the inside bank's informational advantage over outsiders if the firm reduces the amount it has to roll over with the bank at date 1. It can do this by borrowing from both a bank and the arm's-length market at date 0. If bank debt is senior at date 2 to

arm's-length debt, I merely substitute the amount borrowed from the bank for I_S in (13) and (14) to obtain the inside bank's control and rents. The amount required to be borrowed short term, at date 1, is reduced. Outside banks are now more willing to lend the smaller amount at date 1, reducing the inside bank's rents but also its control. Note that arm's-length lenders also benefit as they get their share of the liquidation proceeds if the project is shut down at date 1. They free ride on the control provided by the inside bank (The proof of Proposition 5, in the Appendix, formally analyzes all this.).

The relative priority¹¹ of each claim on date-2 revenue, is an important determinant of rents and control.¹² My model clearly defines the optimal priority schedule.

B.1. Priority

Intuitively, it is clear that the lower the uncommitted date-2 surplus available to be allocated at date 1, the lower the uninformed outsider's willingness to bid. The control of the inside bank must increase (Proposition 4 (iii)). It may appear that the inside bank's ability to appropriate rents at date 1 should also be reduced if there is lower surplus to bargain over. It turns out that this is true only in the situation that the outsider does not bid at all ($\pi_N=1$). Otherwise, the reduction in outside competition completely counters the effect of the lower available surplus on inside bank rents. The size of the date-2 uncommitted surplus has no effect on rents when the outsider bids with positive probability.¹³

A firm with multiple date-0 lenders can commit surplus away from a subset of lenders by giving priority to the other lenders. If the arm's-length claim has priority over bank debt, the uncommitted date-2 revenue is reduced by the contracted face value D_{02a} . At the time of date 1 bargaining, the bargainers face an effective project revenue of $X-D_{02a}$, instead of X . So long as debt is risky, the uncommitted date-2 surplus is also *reduced*, by the amount of the default risk premium impounded in the face value D_{02a} . On the other hand, if the bank has priority, the size of the date-1 available surplus is *increased*, by the amount borrowed from arm's-length lenders at date 0.

Allocation of priority also affects the face value demanded by the arm's-length lender. If bank debt has priority, the arm's-length lender demands a higher face value as he can be dispossessed by the banks ex post.

Ascribing priority to the arm's-length claim improves efficiency as a result of the reduced

uncommitted surplus improving control, the reduced inside bank rents if $\pi_N=1$, and the lower rate demanded by the arm's-length lender. Therefore I state

Proposition 5: It is optimal for arm's-length debt contracted at date 0 to have a prior claim than bank debt over date-2 revenues.

Proof: See Appendix.

This result suggests that considerations of ex post bargaining are an important determinant of capital structure. If the only difference between arm's-length debt and arm's-length equity is priority, Proposition 5 suggests that debt is preferred even if there are no information asymmetries separating management and investors at date 0. In Figure 4, I plot the fraction of the loan that the owner optimally borrows from the bank at date 0, for the data in Example 1.

Place Figure 4 about here

For small and medium firms where the problem I discuss is important, arm's-length debt should be of higher priority than bank debt. In practice, there are two ways of effecting this. First, arm's-length debt could be collateralized with assets like land and buildings which are insensitive to the value of the firm.¹⁴ Bank debt, however, could be left unsecured.¹⁵ Second, arm's-length debt could be made senior to bank debt. This may be less effective than collateralization because bank debt, by virtue of its short maturity, can dispossess the arm's-length lender before the maturity of the arm's-length loan.

In his classic empirical study of 14 reorganizations, Dewing (1920) suggests that arm's-length lenders have priority over banks. He writes ". . . there are four classes of persons who are directly interested in the financial success of a large corporation. The first is that of the bondholders who have frequently a direct lien on the corporation's physical property . . . The second class is the holders of short time obligations and open accounts, - the banks and the merchandise creditors. These men have been more alert to the situation than the bondholders because they have been in closer touch with the business. Their claims to earnings are usually second to those of the bondholders. The third class...is the stockholders . . . the officers of the corporation . . . constitute the fourth class."

Leveraged buyouts in the United States seem a recent counterexample where banks hold a claim

senior to the public junk bonds. However, it can be argued that the true monitor in a buyout is the investment bank, which usually has an equity stake.

Diamond (1991b) obtains the opposite priority rule to what I obtain, because in his model the problem is one of excessive liquidation by the bank. If the bank has higher priority, it can dispossess the arm's-length creditor, giving the bank an incentive to avoid liquidation. In a sense, giving the bank priority makes the returns to arm's-length debt more sensitive to information. In his model, symmetrically informed competition prevents the bank from getting too much power. My assumption that the bank is an insider and better informed than other potential creditors is crucial to the difference in our results.

C. Interim Public Information

So far, I have assumed that there are no interim public signals to inform outsiders about the state. Now assume the firm has borrowed from a bank at date 0. Let a public signal \mathbf{W} about the state be seen at date 1, before the bidding takes place. If the firm is in the good state, let the public signal be w_G with probability Ω_G and w_B with probability $(1-\Omega_G)$. In the bad state, let it be w_G with probability $1-\Omega_B$ and w_B with probability Ω_B . I assume the signal is noisy but informative, so that $1 > \Omega_G > 1-\Omega_B > 0$. The outside bank now updates its prior conjecture q^* . If the signal is w_G , the posterior

if the signal is w_B ,

$$q_G^+ = \frac{q^* S_G}{q^* S_G + (1-q^*) S_B} \quad (15)$$

I now examine how interim information affects the firm's ex post incentives and its ex ante utility when financed with bank debt. In the limit of equal debt, perfect interim public information achieves the first best as, at date 1, all the creditors are perfectly informed. However, an informative but noisy interim signal can have very interesting effects. Contrary to intuition, the interim signal *may not* reduce the inside bank's ex post rents but may still improve the owner's incentives.

To see this, note that the owner gets nothing in the bad state. At date 0, she cares only about the expected excess cost of bank debt conditional on the good state. She maximizes

$$E_{w_G} \left[X - I - \frac{(1-q^+)I}{q} - \frac{(1-q^+)I(1-B_N^+)}{q} \right] \quad (17)$$

where E_{w_G} is the expectation in the good state over the values of the signal. The excess cost of bank debt is the term in square brackets in (17) and is direct from Proposition 3. The first term in square brackets is the rent extracted by the inside bank. The second term in square brackets is the amount recouped by outside banks in the good state, in compensation for inefficient lending in the bad state. Substituting (15) and (16)

in (17), the conditional expected excess cost then is

The inside bank's expected rent conditional on the good state, $E_{W|G} [(1-q^+)I/q^+]$, turns out to be $(1-q^*)I/q^+$. Surprisingly, this is exactly what it would be if there were no signal (keeping the market's conjectures about the effort level constant). The intuition is as follows. Conditional on seeing the good signal, outsiders bid more aggressively, and the inside bank's rents are lower than if there were no signal. However, conditional on seeing the (incorrect) bad signal, outsiders are less aggressive and the inside bank's rents are higher. The increase in rents is enough to compensate for any decrease, even allowing for the increased probability of the good signal in the good state.¹⁷

The second term in (18) which is the amount charged by outside banks is, however, lower as a result of the signal.¹⁸ The outside lenders now bid so as to make zero expected profits conditional on the signal. Conditional on seeing the bad signal, they bid less often than they would bid if they saw the good signal (and less often than if they had seen no signal). As the bad signal occurs more often in the bad state, on average they bid less in the bad state and $E_{W|B}[\pi_N^+] < \pi_N$. This implies that the amount they need to recoup in the good state so as to break even is lower with the signal than without.

In sum, for fixed conjectures, the interim signal has no effect on the inside bank's rents. However, the outside bank's continuation decision becomes more state contingent, which improves the inside bank's control. It follows that in equilibrium, the firm exerts more effort when there is an informative interim signal. Also, because the excess cost in (18) decreases with the accuracy of the signal, the effort exerted increases with the accuracy of the signal. We now examine the effect of the signal on the firm's ex ante utility.

The firm's ex ante utility is given by

As discussed above, the equilibrium q^* is higher in the presence of an informative signal because the firm exerts more effort. Also, the inside bank's control $E_{W|B}[\pi_N^+]$ is higher, keeping the outsider's conjecture of q^* fixed. However, it is not a priori obvious that both effects taken together imply that an informative interim public signal results in higher ex ante utility for the firm.¹⁹ But if the rate of change of ex ante utility with effort, β_{sb}^* , is nonnegative, for the range of β_{sb}^* induced by the interim signal, then

Proposition 6: The ex ante advantage to bank debt in the presence of outside potential lenders increases with the informativeness of an interim public signal.

The analysis above would argue that a firm should not match the maturity of its borrowing to the life of its assets but to the revelation of credible, accurate public information. For example, if the cost of information revelation increases when the firm is acting strategically in the product markets, the firm should borrow to match 'the maturity of its product market strategies'. In a similar vein, when a plant is being constructed, a substantial portion of the uncertainty is resolved when certain publicly visible output criteria are met. This could explain why such a project is financed initially with bank debt, which is then replaced by arm's-length debt.²⁰ The project gets the advantage of bank control at the important early stages. Public revelation of information reduces any attendant costs. Arm's-length debt replaces bank debt for subsequent stages where information is less easily revealed.

IV. Extensions

A. Relationships

I have, thus far, considered the firm to have only one project. This is the natural assumption if the size of the project is large compared to future opportunities. Typically, however, on successful completion of a project, firms have access to many new opportunities. In addition, success in a project usually leads to verifiable public information in the form of profits and demonstrable products.

In this situation, the inside bank has an incentive to 'behave' by reducing the rents it extracts during the project. It does this in the hope of getting a share of the attractive future lending opportunities. The low level of information asymmetries on completion of the project enable the firm to make the credible threat of denying these opportunities to the inside bank. Conversely, in an economy with only ex ante identical banks, a bank which 'behaves' gains reputation over other banks and is preferred as a future lender. It is easy to formalize a reputational equilibrium (see Rajan (1991a)), where such an implicit contract or 'relationship' is sustained between the bank and the firm. In a sense, the firm's share μ while bargaining within a relationship, is greater than its share in the context of a single project. Relationships thus improve the efficiency of short-term bank contracts.

Unfortunately, such relationships are less easily sustained in an economy which contains both arm's-length lenders and banks. The reason is simple. A relationship requires two-sided commitment. In a bank dominated economy, a bank that 'behaves' is confident that it has a superior reputation in the eyes of the firm

and will in fact be preferred to other banks for future projects. In an economy which also contains arm's-length lenders, however, reputation building by the inside bank may not be enough to ensure that it gets preference over arm's-length sources. Worse still, the factors that give the bank incentives to 'behave' may be the very factors that make a firm prefer arm's-length markets. For instance, consider the earlier situation of an economy with exogenously mandated lock-in. If convinced that good behavior would be rewarded, the inside bank has the greatest incentive to behave when the firm has high-quality future opportunities (which are most profitable to the bank). Yet, a firm with high-quality opportunities prefers to borrow from arm's-length markets for them (Proposition 2). The firm will not be able to commit to staying with the bank. The latter will then have little incentive to behave.

This suggests that the effectiveness of implicit contracts in reducing the cost of bank debt varies negatively with the liquidity of arms-length markets. Relationships may not be a sustainable way of reducing the cost of bank debt when alternative sources of finance are available.

B. Multiple Inside Banks

I have restricted the firm to borrowing from only one bank at date 0. Would borrowing at date 0 from multiple banks solve the problem I discuss? Under the assumptions that all these banks monitor closely and then compete a la Bertrand, the first best is achieved. If the decision to monitor is discretionary and not costless, the effectiveness of this solution is reduced, even under Bertrand competition.

If one of the banks has marginally easier access to the firm's books, it can preempt the others by investing the monitoring costs. As competition at date 1 is assumed Bertrand, the other banks have no incentive to invest in monitoring. Thus small monitoring costs coupled with unequal access may be enough to restore monopoly (see Rajan (1991b)).

Even if banks have equal access, it is possible to get overmonitoring (too many banks monitoring in an attempt to get the monopoly rents) or free-riding and too little control (see Rajan (1991a)). The recent experience of banks with debtors like Maxwell Corporation and Polly Peck suggests that the latter situation may be empirically more relevant.²¹ This is a fruitful area for future research.

C. Explicit Contracts and Mechanism Design

Would our problem be solved by designing mechanisms to implement explicit contracts?

Governments can legislate interest-rate ceilings. The ceiling limits ex post opportunism (at the cost of some credit rationing). Alternatively, a bank can offer loan commitment contracts that fix the interest rate it can charge while giving it the ability to withdraw the loan under extraordinary situations. In certain situations (see note 8) the loan commitment contract approaches first best.

Again these are not perfect fixes, for there are various methods other than through the interest rate that a bank can collect its rents. The bank can direct the choice of projects, levy compensating balances, or refuse to relax covenants when the credit rating improves. This is a general problem with using mechanism design to solve problems of ex post opportunism (Hart and Moore (1989)). Bargaining and transfers take place outside the mechanism, and efforts to 'game' the mechanism make it all the more inefficient. For example, Aoki (1989) suggests that the high ratio of cash to assets observed for Japanese firms incurring high debt stems from the banks' requiring firms to maintain 'compensating balances' with the banks, in order to get around the problem of interest-rate ceilings.

V. Conclusion

The main point of this paper has been that there is a fundamental trade-off between bank debt and arm's-length debt. The bank can monitor the firm and control its investment decisions. However, in the very process of doing this, it alters the division of surplus between itself and the firm. This distorts the firm's incentives. The firm may then prefer credit from arm's-length sources, which provide neither the benefits of bank debt nor the costs.

The bank's ability to control and its ability to influence the division of surplus are both linked, because they are aspects of the bank's implicit property rights. I showed how the bank's informational advantage over outside lenders could confer on it these property rights. I then discussed how borrowing from multiple sources and appropriately setting priority are ways of circumscribing the bank's ability to extract surplus without diminishing its control.

My analysis is not restricted to commercial banks. Many investment banks have the ability to acquire information and negotiate with the firms - the functions that characterize the entities I call 'banks'. As firms make repeated issues and some investment banks act as delegated monitors for a stable set of investors (see Bruck (1988)), my analysis of 'bank' finance would apply there too.²²

Finally, there has been some debate (see Meerscham (1991)) about the relative efficiency of a *relationship*-based banking system (where a firm is locked in to a relationship with one bank) compared to a transactions-based system (where many banks bid competitively for each transaction that a firm undertakes). My paper suggests that relationships and transactions reflect two extremes of the control-rent trade-off. Though there has been a movement away from relationships in the 1970s and 1980s in developed countries, our analysis suggests each system has its virtues and unidimensional comparisons are misleading. As a case in point, the deterioration in the credit rating of bank loan portfolios in the United States and Japan over this period may partly reflect the deterioration in control that accompanies the movement from a relationship-oriented system to a transactions-based competitive system. Without examining the accompanying effect on investment, statements on the efficiency implications of this phenomenon are inappropriate.

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Appendix

Proof of Proposition 2

I am done if I can show that the ex ante utilities are increasing in θ and the utility with arm's-length financing increases at a faster rate. Differentiating the ex ante utilities with respect to θ , I get

Implicitly differentiating the first order-conditions (4) and (5) and setting $\delta^2 q / \delta \theta \delta \beta = 0$

$$\frac{dU_{sb}}{d\theta} = X(1-I) \left(\frac{\partial q}{\partial \theta} \frac{S_{sb}}{S_a} + \frac{\partial q}{\partial \theta} \right) \quad (\text{A.1})$$

By direct comparison and knowing $\frac{\partial q}{\partial \theta} < L$, $\frac{dU_a}{d\theta} > dU_{sb}/d\theta$ Q.E.D.

$$\frac{dU_a}{d\theta} > 0 \quad \frac{dU_{sb}}{d\theta} = 0. \quad (\text{A.1})$$

Proof of Proposition 3

The proof extends and applies Engelbrecht-Wiggans, Milgrom and Weber (1983) and Hendricks and Porter (1988) to a general version of the model in the text.

The owner knows the random value \mathbf{V} of the project. \mathbf{V} takes values in \mathfrak{R} (set of real numbers) and has finite expectation. The two potential lenders are an informed inside lender (henceforth the insider) and an uninformed outside potential lender (outsider). The random variable \mathbf{Z} is the private information of the insider about the value of the project. Both the insider and the outsider know the joint distribution of (\mathbf{V}, \mathbf{Z}) .

Each lender submits a sealed bid r , which is the fraction of the project he will allow the owner to retain. The owner accepts the highest bid which exceeds her reservation bid r_o . If the bid r wins, the winner lends amount I at date 1 and in exchange gets $\mathbf{V}(1-r)$ at date 2.

The insider's problem, after observing $\mathbf{Z}=z$, is to choose r to maximize $\text{Probability}(\text{Bid } r \text{ wins}) (E[\mathbf{v} | \mathbf{z}=z] (1-r) - I)$. The insider's private information \mathbf{Z} enters his decision problem only through $\mathbf{H} = E[\mathbf{V} | \mathbf{Z}]$. I assume without loss of generality that the insider observes the real valued random variable \mathbf{H} rather than \mathbf{Z} . The insider after observing the private information can be characterized by his information-induced 'type' h .

The solution method requires a one-to-one mapping between the information-induced type of the insider and his equilibrium bid. As \mathbf{H} does not have a continuous distribution in the problem, I must 'smooth' out the types to obtain it. This is easily done by allowing the insider mixed strategies. The informed lender then randomizes, using a variable \mathbf{U} that is independent of (\mathbf{V}, \mathbf{Z}) . Without loss of generality \mathbf{U} has an

atomless distribution on $[0,1]$. A mixed strategy σ for the informed bidder is a function from $\mathbf{R} \times [0,1] \rightarrow [0,1]$ and $\sigma(\mathbf{h},\mathbf{u})$ is the bid when $\mathbf{H}=\mathbf{h}$ and $\mathbf{U}=\mathbf{u}$. I assume without loss of generality that σ is nondecreasing in \mathbf{u} for fixed values of \mathbf{h} .

I derive a continuous type \mathbf{t} from the joint distribution of \mathbf{h} and \mathbf{u} ; Let $\{(\mathbf{H},\mathbf{U}) < (\mathbf{h},\mathbf{u})\}$ denote the event $\{(\mathbf{H}<\mathbf{h}) \text{ or } (\mathbf{H}=\mathbf{h} \text{ and } \mathbf{U}<\mathbf{u})\}$. Let $\mathbf{T}(\mathbf{h},\mathbf{u})$ be the probability of that event and define $\mathbf{T} = \mathbf{T}(\mathbf{H},\mathbf{U})$. \mathbf{T} is the insider's distributional type and is uniformly distributed on $[0,1]$. Also note that $H(\mathbf{t})=\inf\{\mathbf{h}|\text{Prob}(\mathbf{H}\leq\mathbf{h})>\mathbf{t}\}$, $\mathbf{H} = H(\mathbf{T})$ a.s. This implies that \mathbf{T} carries all the information that \mathbf{H} does but has the advantage of being a continuous distribution.

To summarize, I started with information \mathbf{Z} , found the conditional \mathbf{H} , 'smoothed' it out with \mathbf{U} and thus obtained \mathbf{T} . The equilibrium strategy σ is now a function from the space of types $\mathbf{t} \in [0,1]$ to the space of bids $[0,1]$ and is assumed to be nondecreasing in \mathbf{t} .

The uninformed outsider gets no signal. His bidding strategy is described by a distribution G over $[0,1]$ representing his random choice of bids.²³ Finally I define σ^{-1} as the generalized inverse of σ , i.e. σ^{-1} is a function from the space of bids to the space of types.

Lemma A1: *The strategies (σ,G) are a Bayesian Nash equilibrium if the inside lender bids:*

$$\mathbf{F}(\mathbf{t}) = \frac{E[H(\mathbf{T}) | \mathbf{T} \leq \mathbf{t}] - I}{r} \quad \text{for } \mathbf{t} \geq \underline{\mathbf{t}}_o \tag{A.4}$$

where r_o is the reservation bid set by the owner (possibly zero),

$$\mathbf{F}(\mathbf{t}) = \underline{\mathbf{t}}_o \quad \text{for } \mathbf{t} < \underline{\mathbf{t}}_o \tag{A.1}$$

$$\underline{\mathbf{t}}_o \text{ is sup } \{\mathbf{t}: \{E[H(\mathbf{T})|\mathbf{T} \leq \mathbf{t}] - I\} / E[H(\mathbf{T})|\mathbf{T} \leq \mathbf{t}] = r_o\},$$

and $\underline{\mathbf{t}}$ is $\inf\{\mathbf{t}: H(\mathbf{t}) \geq I\}$.

The distribution of the uninformed bid is

$$\text{where } \bar{H} = E[H] \tag{A.1}$$

Proof: The equilibrium strategy is such that the expected payoff to each lender conditional on his information set is maximized given the strategy of the other lender. The proof consists of the following steps: (1) Show the equilibrium bids have identical support. (2) Use this to show the uninformed outsider makes zero profits in equilibrium. (3) Set the outsider's profit to zero to obtain the optimal bid for the informed. (4) Use the optimizing behavior of the informed to derive the bidding strategy for the uninformed.

I omit steps (1) and (2) which are identical to the argument in EMW (1983). The expected profits of the outsider conditional on winning with a bid r (where t is the corresponding informed type such that $\sigma(t)=r$) is $E[H(\mathbf{T})(1-r)-I|\mathbf{T} \leq t]$. Setting this equal to zero,

This expression holds when $t > t_0$ (where t_0 is the type 'corresponding' to a bid of r_0 as earlier defined).

$$r = \mathbf{F}(t) = \frac{E[H(\mathbf{T})|\mathbf{T} \leq t] - I}{E[H(\mathbf{T})|\mathbf{T} \leq t]} \quad (\text{A.10})$$
When $t_0 \geq t > \underline{t}$, the optimal bid for the informed is r_0 , as \underline{t} is the lowest information type at which the insider still makes profits by bidding r_0 . Below \underline{t} , the insider will not bid as any bid will result in certain losses.

The strategy of the outsider is chosen so as to induce the insider to bid according to σ . The insider after seeing t maximizes $G(r)[H(t)(1-r) - I]$ with respect to r where $r=\sigma(t)$. Differentiating with respect to r

where λ_1 is the Lagrangian multiplier for constraint $r \geq r_0$ and λ_2 is that for $r \leq \bar{r}$. Rearranging (when $\lambda_1 = \lambda_2 = 0$),

$$\frac{dG(r)}{dr} [H(t)(1-r) - I] - G(r)H(t) + \lambda_1 - \lambda_2 = 0, \quad (\text{A.1})$$

Also

$$\frac{G'(r)}{G(r)} = \frac{H(t) dr}{G(r)}, \quad (\text{A.1})$$

Substituting in (A.12) from (A.13) and (A.14),

$$dr = \mathbf{F}'(t) dt = \frac{I \left(\int_0^t H(s) ds \right)^{-1} H(t) dt}{\left(\int_0^t H(s) ds \right)^{-2}} dt . \quad (\text{A.1})$$

$$\frac{G'(r)}{G(r)} = \frac{\left(\int_0^t H(s) ds \right)^{-2}}{\int_0^t H(s) ds} \quad (\text{A.1})$$

Integrating between t and 1 (for $t > t_0$) and applying the boundary condition that $G(\sigma(1))=1$,

For any bid by the outsider corresponding to an informed type less than t_0 , the outsider expects losses. Hence $G(r_0)=G(\sigma(t_0))=G(0)$, i.e., the outsider does not bid with positive probability. The value $\pi_N = G(r_0)$ is the probability that the outsider does not bid. Q.E.D

Now consider the model in the text. In the good states (probability q) the project is worth X and in the bad (probability $1-q$) it is worth $p_B X$. The insider knows the value of the project exactly, so that $\mathbf{H} = X$ or $p_B X$; the outsider knows the distribution. Assume without loss of generality that \mathbf{U} is uniform on $[0,1]$.

$$t(h,u) = \text{prob} \{(\mathbf{H} < h) \text{ or } (\mathbf{H} = h \text{ and } \mathbf{U} < u)\},$$

$$t(h=p_B X, u) = u(1-q),$$

$$\text{and } t(h=X, u) = (1-q) + uq.$$

$$H(t) = p_B X \text{ for } t \leq 1-q$$

$$\text{and } H(t) = X \text{ for } t > 1-q.$$

Substituting values

$$G(\sigma(t_0)) = \frac{(1-q)I - p_B X (1-r_0) + uq}{(1-q)I - p_B X (1-r_0) + uq} \quad \text{for } t > t_0 \quad \text{(A.1)}$$

Equations (A.17) and (A.18) follow from the definition of $G(\sigma(t_0)) (= \pi_N)$ is obtained by substituting t_0 (the value of t at which the optimal bid of the insider is r_0) into $G(\sigma(t))$. Note that $\pi_N = 1$ when $q\{X(1-r_0) - I\} - (1-q)\{I - p_B X (1-r_0)\} \leq 0$, i.e., when the outsider cannot make profits in expectation even if he were the sole bidder (and not exposed to adverse selection). The outsider does not bid and the insider grabs all the rents up to r_0 .

Specializing the model further, I set $p_B X = 0$ and $r_0 = 0$ to get

Profit of the insider conditional on good state:

$$= (1-q)I/q \quad \text{when } \pi_N < 1$$

$$= X - I \quad \text{when } \pi_N = 1$$

$$\text{where } B_N = \min\left\{1, \frac{(1-q)I}{X-I}\right\}.$$

The profit to the outsider is zero on average. If $\pi_N < 1$, the outsider bids with positive probability whenever the project is bad. As the insider does not bid in these states, the outsider makes losses whenever she bids. The zero profit condition implies that these losses are equal in expectation to the profits she makes in the good state.

Loss to uninformed from bidding in bad state:

$$= (1-q)I(1-\pi_N) \quad \text{Q.E.D.}$$

Proof of Proposition 5

Assume fraction α of the total investment is financed through the bank and let arm's-length have lower priority than bank debt. The owner has an ex ante problem of choosing the fraction α and an ex post problem of deciding the effort level β . The ex post problem follows immediately, once I derive the expected date-2 face value demanded by the lenders. The expected face value demanded by the bank follows from Proposition 3. Substituting αI for I_s ,

$$I + \frac{(1 - \alpha_{aJ}^*)}{\alpha_{aJ}^*} I + \frac{(1 - \alpha_{aJ}^*)}{\alpha_{aJ}^*} (1 - B_{NJ}) I, \quad \text{(A.20)}$$

The control exerted by the bank enables the arm's-length lender to recover his money when the inefficient project is terminated at date 1. The face value demanded by the arm's-length lender can then be derived from his IR condition,

The value h is a complicated term, which I assume small.²⁴ As the effect of h is to increase the face value demanded by arm's-length debt, and $h=0$ when arm's-length debt has higher priority, relaxing the assumption only strengthens the argument for giving arm's-length debt priority.

Solving for D_{02a} from (A.22) and adding to (A.20), I get the total expected face value of debt at date 2, whence the ex post problem follows. Ex ante, the owner chooses α to maximize

Under regularity conditions which ensure a unique solution, I substitute the FOC for the ex post problem: $\max_{\alpha} U_{aj} = \alpha_{aj}^* (X - I) - (1 - \alpha_{aj}^*) I (1 - \mathbf{B}_{NJ}) - \mathbf{S}_{aj}^*$. (A.1)

The program (A.21), (A.23) and (A.24) is in the Standard Principal Agent framework and can be solved explicitly for α_{aj}^* and β_{aj}^* . $\frac{-I - \frac{\mathbf{B}_{NJ}}{I}}{\alpha_{aj}^*} - \frac{-I - \frac{\mathbf{B}_{NJ}}{I}}{\alpha_{aj}^*} \left(1 - \frac{\mathbf{B}_{NJ}}{I}\right) - 1 = 0$ for α . (A.1)

If arm's-length debt has priority, the net revenue of the project that the short-term lenders bid for at date 1 is $(X - D_{02a})$. I substitute this for X in Proposition 3. The control provided by short-term debt is now given by

When the outsider bids with positive probability ($\pi_N \neq 1$), priority affects only control π_N in Proposition 3, but not the rents of the inside bank, for reasons specified in the text. Obviously π_{NS} in (A.25) exceeds π_{NJ} in (A.21). The structure of the owner's problem remains the same. However the increased control reduces the compensatory rents demanded by the outside bank (from (A.20)), and improves effort (from (A.24)). For any value of α , $\beta_{as}^* > \beta_{aj}^*$. For any value of β , as π_{NS} is greater than π_{NJ} , a revealed preference argument establishes the superiority of giving arm's-length debt priority.

When the outsider does not bid at all, the priority of the arm's-length claim reduces the surplus available and hence the rents of the inside bank. The rest of the argument follows as above. Q.E.D.

ENDNOTES

1. The bank first screens prospective clients (Diamond (1991a)). Later, by threatening to cut off credit, it provides the firm with the incentives to take the right investments (Stiglitz and Weiss (1983)). As a result of the diminished adverse selection (through information) and the reduced moral hazard (through control of the firm's investment decisions), the bank has the capacity to provide cheap 'informed' funds as opposed to costly 'uninformed' or arm's-length funds (James (1987)). Finally, a positive loan renewal signal implies that other agents with fixed-payoff claims need not undertake a similar costly evaluation (Easterbrook (1984) and Fama (1985)).

2. For example, Anstaett, McCreary and Monahan (1988) document the case of Trans Leasing International Inc, a growth firm with a capitalization of \$60 million in 1987 and a projected investment of \$245 million over the subsequent five years. Trans Leasing restructured its borrowing by issuing notes and paying down bank borrowing. This met the firm's aims of "expand(ing) available debt capacity" and "diversify(ing) the company's sources of finance".

3. This information may be generated in real-time, during the process of lending. This includes information about the firm's prior projections, ability to meet prior targets, reliability and competence of personnel, etc. It is very hard for firms to present hard data on this to outside creditors. However, once a project is completed, there are 'hard' data like sales and profits which can be presented to outside creditors.

4. For example, a project to modify a successful car model for the new year has a high θ while the search for commercial superconductors is a low- θ project.

5. For example, in a world with fly-by-night operators (without projects) who are ex ante indistinguishable from the genuine firm, a lender offering such contracts would be swamped by the operators. These operators would pocket the difference between the amount borrowed and the required repayment. If the operators have some costs of dissimulation, any debt contract where $D_{ij} \geq A_i$ would cause them to self-select out. Rather than carry these operators through the model, we assume the contractual restriction.

6. If $L_0 < I_0$, no contract can achieve the first best solution. By limited liability, the owner does not face the full cost of the bad state. No contract can efficiently correct for this without ex-ante transfers to the lender (to

satisfy its rationality constraint). The owner's liquidity constraint rules out such transfers.

7. Equation (5) is a fixed point problem. The existence of a solution is not always assured and intuitively, for low-quality projects (low θ), no solution should exist. Assumptions A.1 and A.2 together with a single crossing condition would ensure that if a solution exists to (5), it is unique. In the example that I construct, a unique solution always exists for the range of project qualities that I examine. All the results hold even if there are multiple solutions (as in the Laffer curve theories of the LDC debt problem). I then define the solution to be the highest value of β , which implies that the face value is set at the lowest level compatible with lender individual rationality.

8. In the absence of a commitment by the bank to relend at date 1 and the commitment mechanisms in below, fixing the face value conditional on relending in the good state is vacuous, as it will always be renegotiated. When there is no commitment to relend, we can restrict ourselves without loss of generality to short-term contracts.

Commitment is possible through the appropriate design of governing mechanisms (see Aghion, Dewatripont, and Rey (1989); Macleod and Malcolmson (1989); or Hart and Moore (1988)). These mechanisms work by constraining the bargaining process and hence they suffer from limitations, as parties could always make unobservable offers (or threats made credible from) outside the process. The specific mechanisms described in the above papers will not work because (a) there is no obvious way in which the parties can specify a nonrenegotiable default option, (b) the owner is liquidity constrained and, (c) there is no last moment after which the gains from trade will disappear. Of course, if we make assumptions about the nature of the available mechanisms, the first-best contract can be achieved. For example, assume that the project is no longer available after a specific time at date 1. A contract which specifies bank control over the relending decision and fixes the date-2 terms for relending (at the minimum compatible with bank rationality) approaches the first best. The reason is that at the last instant, the owner can offer a contract to borrow at the above rate. The bank can do no better than accept. The owner cannot get a lower rate as the bank can assure itself of the rate in the initial contract and knows that it is in the interest of the owner to borrow (See Hart and Moore (1988) for details). Such a contract would be similar to lines of credit callable at the option of the

bank under 'materially adverse circumstances'.

9. I defend my choice of bargaining game, based on what I believe is common practice. For example, "what is being contemplated in 'obtaining competitive quotations' is an approach to a limited number of banks on an open basis. Each should be told that a competitive quotation is being taken from another bank, but not the name of the bank." - Donaldson and Donaldson (1982).

10. More precisely, $\pi_N = \text{Min} \left[1, \frac{1-q}{q} \frac{I_S}{X-I_S} \right]$.

11. A claim which has priority has effective legal precedence over the firm's revenues and assets. I distinguish priority from seniority, though in practice they are used interchangeably. The reason is that a claim which is collateralized with assets may be prior in the sense of this paper, though it may not be a senior claim.

12. As the loan in the first period is riskless, date-1 priority does not matter.

13. As an analogy, consider a miser with private knowledge about the size of her wealth. Let her have one favorite nephew who is informed about the size of the hoard and many uninformed relatives. If the miser publicly bequeaths a large amount to charity, the relatives lose much of their interest in her. The favorite nephew now has a *higher probability* of getting a *lower* bequest if he persists in his attentions. In our simple model, the expected size of his inheritance (rents) remains constant. But whether the miser gets any attention at all becomes more sensitive to the favorite nephew's decisions (control).

14. Typically, this takes the form of a mortgage bond or mortgage note. Of course, firms in the United States also issue unsecured debentures. It would be interesting to determine the relative importance of each type of bond in financing small and medium firms. Note that some countries prevent firms from issuing noncollateralized bonds. For example, before 1983, Japan prohibited these issues for all companies except Toyota and Matsushita Electricals.

15. Frank Lourenso, an executive vice president of Chemical Bank who is in charge of lending to small and medium-sized businesses, stated that most of Chemical's loans to businesses are unsecured (New York

Times, October 7, 1991). Even if bank debt is secured, it could be collateralized with assets like accounts receivables and inventories which are positively correlated with the value of the firm. In case of default, arm's-length debt secured on property would effectively have priority (under the implicit assumption that property values are independent of the value of the firm).

16. If the posterior $q^+ \leq I/X$, $\pi_N=1$ and the outside banks stop bidding. The firm and the inside bank are in a bilateral bargaining situation. Any decrease in the posterior, below the cutoff level I/X , has no effect on rents or control because they both reach their maximum value. We have not allowed for this in our analysis but it is easily incorporated.

17. Mathematically, the rents are decreasing in q^+ (Proposition 4 (i)). However, even though $E_{W|G}[q^+] > q^*$, rents do not decrease. This is because the rents are also convex in q^+ . From convexity, the increase in rents conditional on the bad signal balances both the decrease in rents conditional on the good signal and the increased probability of the good signal conditional on the good state.

18. This is easily seen. The term in square brackets in (18) is only equal to 1 when the signal is uninformative ($\Omega_G=(1-\Omega_B)$). It is easily shown that this increases from 1 as the determinants of the accuracy of the signal, Ω_G and Ω_B , increase.

19. Ex post, the owner makes the effort decision taking the outsider's a priori conjecture, q^* , as fixed. Even though there is underprovision of effort compared to the first best, it is not true that increased effort induced by the interim signal, always makes the firm better off ex ante. An increase in effort raises the outsider's a priori conjecture, q^* , which reduces the control of the inside bank, ceteris paribus. The reduction in control coupled with the cost of effort may outweigh any benefit from reaching the good state more often. This is clearly seen when $q^* \approx I/X$ and the interim signal is barely informative, $\Omega_G=(1-\Omega_B)+\epsilon$. The rate of change of ex ante utility with equilibrium effort, β_{sb}^* , is $-q_I I-1$ which is negative. In this case, the interim signal reduces ex ante utility, because it spurs the firm to costly effort which reduces control more than it increases surplus.

20. See Kelor Chemicals , Harvard Business School Case

21. See for example "Maxwell meltdown", The Economist, December 7, 1991.

22. Carosso (1970) and Dewing (1953) document the 'competitive bidding' controversy in the United States. Regulatory authorities observed that each firm was using the same investment bank(s) repeatedly for underwriting its issues. It was felt that the firms were being locked in and investment banks were exercising too much monopoly power over their clients. In response, the authorities required public utilities to put each issue up for competitive bidding by all potential underwriters. Carosso presents evidence from several studies that outside competition did not, in general, change the identity of the underwriters. This is consistent with the predictions of my model.

23. While I introduced mixed strategies for the informed for technical reasons, the mixed strategies for the outsider are a direct consequence of the assumption that the insider knows everything the outsider knows. If the outsider tries to play according to a pure and therefore predictable strategy, the insider will respond by bidding slightly higher if worthwhile and nothing if not. On average, the uninformed will lose, which cannot happen by individual rationality.

24. If D_{12} is the face value that the short-term lender who wins the bargaining game asks from the owner at date 1, then

$$h = \alpha_{aJ}^* \sum_{D_{12}} 1_{[X - D_{12} < D_{02}]} (D_{02} - (X - D_{12})) \text{Prob}(D_{12}) ;$$

It is hard to obtain h in closed form because it involves the distribution of the winning bid.