

How Do Firms Choose Their Lenders? An Empirical Investigation

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This article investigates which companies finance themselves through intermediaries and which borrow directly from arm's length investors. Our empirical results show that large companies with abundant cash and collateral tap credit markets directly; these markets cater to safe and profitable industries, and are most active when riskless rates or intermediary earnings are low. We show that determinants of lender selection sharpen during investment downturns and that there are substantial asymmetries in the way firms enter and exit capital markets. These results support a theoretical framework where intermediaries have better reorganizational skills but a higher opportunity cost of capital than bondholders.

Debt, the most common source of external funds for American corporations, is classified in many ways: short versus long term, secured versus unsecured, or publicly traded versus privately held. This article explores the relevance of this last distinction: Do firms borrow from arm's length investors or from intermediaries in a systematic way? We suspect that this is an important question, given how extensively these obligations are used: at the end of 1992, corporate commercial paper and publicly traded bonds stood at about \$1 trillion, while bank loans, private placements, and other intermediated debt represented more than \$2.4 trillion. Furthermore, Wright (1995) has shown that bank loans and private placements are highly procyclical while bond and commercial paper issues are quite countercyclical. Understanding how firms choose their lenders may unveil the mechanisms through which recessions and booms propagate and persist in the economy.

Despite the topic's appeal, there are very few studies that analyze how companies choose their lenders. This is no doubt related to the absence of corporate databases that classify debt into publicly traded or privately held. This limitation has forced scholars such as Mackie-

We would like to thank seminar participants at Berkeley, Canterbury, Otago, and Stanford Universities and at the Winter Finance Conference, Utah, and the SFS Corporate Finance meeting in Austin, Texas. We would especially like to thank Mitchell Petersen, Gary Gorton, Avanidhar Subrahmanyam, Mark Flannery, an anonymous referee, and Sheridan Titman for valuable comments. All errors are ours. Address correspondence to Miguel Cantillo, Walter Haas School of Business, University of California, Student Services Building S545, Berkeley, CA 94720-1900.

Mason (1990) and Calomiris, Himmelberg, and Wachtel (1994) to rely on proxies (e.g., whether a firm has a commercial paper or a bond rating) for their studies. The main difference between our analysis and these others is that our data consists not of proxies but of actual debt figures that span almost two decades. Indeed, we collected information about the way in which 291 firms issued different types of obligations between 1974 and 1992; we also used a wider panel of 5554 corporations that goes from 1985 to 1992. These data allow us to confirm previous results and to show that macroeconomic and historical conditions are important elements that affect how firms choose their lenders.

We also explore whether our empirical results reveal anything about the nature and functions of financial intermediaries. The role of intermediaries has been analyzed from two perspectives: one view, stressed in Rajan (1992) and here, sees banks as good reorganizers. This position has been justified theoretically by Bolton and Sharfstein (1996) and empirically by Gilson, Kose, and Lang (1990). The model we develop here assumes that intermediaries reorganize firms more efficiently than arm's length investors, but that these investors have a lower opportunity cost of capital than intermediaries. Hence different lenders dominate in different niches: a high quality company prefers to tap the credit markets directly since it is unlikely to default and only wants to bypass a costly middleman; a firm with poorer prospects, on the other hand, is more likely to need the intermediary's reorganization skills and for this reason borrows from banks. Our model predicts that large, profitable firms, with a high proportion of tangible assets, and high or stable cash flows borrow from arm's length investors; the reorganizational theory also tells us that companies are more likely to tap the credit markets directly when real interest rates or intermediary earnings are low. The other view of intermediaries sees them as good project screeners: this perspective has been articulated by Diamond (1991), Besanko and Kanatas (1993), and Holmstrom and Tirole (1997); in these models, ex ante incentive problems determine whether a firm is funded by intermediaries or by arm's length investors. If the company has minor incentive problems in choosing projects, it will avoid intermediaries, since the good they do by screening is outweighed by the fee they charge. On the other hand, a firm with serious misalignments goes to intermediaries because their screening services raise corporate value significantly.¹

The theories of banking just described are both distinct and alike: they both assume that intermediaries extract information more effi-

¹ These screeners are often thought of as venture capitalists, who are involved in the day-to-day affairs of their client firms. The analogy is also extended to banks and other debt intermediaries, although these investors usually avoid direct involvement with borrowers so as not to subordinate their loans [see Resnick and Weintraub (1980, ¶5.14, note 247)].

ciently than arm's length investors, which implies that companies with severe informational asymmetries borrow through banks. The two theories differ in their explanation of when intermediaries use their superior knowledge: those who see banks as reorganizers stress the ex post use of information to bargain more efficiently, while those who see banks as screeners emphasize the ex ante use of information to choose appropriate projects. It is important to note that these theories are neither mutually exclusive nor collectively exhaustive, that is, that it is possible that both are true or false. Our empirical analysis suggests that intermediaries are indeed at an informational advantage over arm's length investors, and that this advantage is best captured by a theory that sees banks as reorganizers rather than as project screeners. Although each theory of banking is undoubtedly relevant, we find that when their predictions are at odds, the reorganizational framework best explains how firms choose their lenders.

This article is organized as follows: Section 1 presents the theoretical model, its predictions, and an implementable procedure to test them. Section 2 describes our data and its origins. Section 3 begins by looking at how young and mature corporations choose their creditors; after that, it analyzes how firms select their lenders intertemporally, showing that macroeconomic conditions affect this choice powerfully, and that firms enter and exit the markets for publicly traded debt asymmetrically.

1. Theoretical Framework

Section 1.1 begins with a simple sketch of our framework. This is followed by a more detailed analysis of the underlying theory in Section 1.2, which also describes a procedure to test the theory econometrically, and which may be skipped by the more empirically minded readers.

1.1 Lender selection in a simple setting

Consider an economy populated by entrepreneurs, arm's length investors, and intermediaries; these parties write financial contracts at time $t = 0$.

Entrepreneurs are risk neutral and have a project with attributes $x = [v e z \mu \sigma r_f \phi]$, where v is the project's tangible assets; e is the fraction of the venture that is internally financed; z , μ , and σ are the project's size, profitability, and risk; r_f is the gross riskless rate; and ϕ is the intermediary's capital base. Entrepreneurs need to borrow one unit of capital to complete their project, and this investment yields a stochastic payoff s at time $t = 1$: s equals 1 in the bad state, which occurs with a probability $p(x)$ that depends on the project's attributes; s equals $\gamma > 1$ in the good state, which occurs with probability $1 - p(x)$.

Arm's length investors (bondholders), whose type is indicated by $\bar{\theta}$, are competitive and risk neutral. Bondholders rely solely on their own funds either to lend to entrepreneurs or to invest in safe securities that yield r_f , which is in effect their opportunity cost of capital.

Intermediaries (banks), whose type is indicated by $\underline{\theta}$, are competitive and risk neutral. By definition, intermediaries lend using a mixture of their own capital and other people's money. If banks decide not to lend, they can invest their capital in a riskless asset and also avoid intermediation costs. Indeed, Cantillo (1998) shows that frictions between banks and their depositors are expensive and raise intermediaries' opportunity cost of capital to $r_f + \pi(x)$, where the premium $\pi(x) > 0$ falls as banks become better capitalized.

Although outside investors can verify the entrepreneur's revenue, this is costly. In particular, bondholders' verification destroys a fraction $\delta(x) < 1$ of the firm's cash flows, where $\delta(x)$ varies according to the project's attributes; we also (temporarily) assume that banks incur infinitesimal verification costs. This is the costly state verification (CSV) framework introduced by Townsend (1979) and used later by Gale and Hellwig (1985), and which implies that the optimal contract between entrepreneurs and outside investors is debt. In a debt contract, the entrepreneur pays b (\underline{b} or \bar{b} depending on whether the lender is a bank or a bondholder) in the good state; in the bad state, the creditor seizes the entrepreneur's cash flows and incurs the verification costs. To maintain tractability, we rule out simultaneous bank and bond issues; although this is clearly an idealization, our data will confirm that this holds in almost 90% of the firm-year observations.

The expected economic profit function for arm's length investors and intermediaries is

$$U(x; \bar{\theta}, \bar{b}) = (1 - p)\bar{b} + p(1 - \delta) - r_f = 0 \Rightarrow \bar{b} = \frac{r_f - p(1 - \delta)}{1 - p}$$

$$U(x; \underline{\theta}, \underline{b}) = (1 - p)\underline{b} + p - r_f - \pi = 0 \Rightarrow \underline{b} = \frac{r_f + \pi - p}{1 - p}.$$

The entrepreneur's expected profit is $V(x; b) = (1 - p)(\gamma - b)$, or more explicitly,

$$V(x; \bar{b}) = (1 - p)\gamma + p(1 - \delta) - r_f$$

$$V(x; \underline{b}) = (1 - p)\gamma + p - r_f - \pi.$$

The entrepreneur's participation constraint is $V(x; b) \geq 0$, which we temporarily assume to hold. We define the entrepreneur's demand for publicly traded obligations as $h(x)$, which equals one if he borrows from arm's length investors and zero if he borrows from intermediaries. The

entrepreneur chooses the lender who charges the lowest rate; thus he compares the bondholder and bank offers by setting up the following decision function:

$$d(x) = V(\bar{b}) - V(\underline{b}) = \pi - p\delta \quad (1)$$

$$d(x) > 0 \Leftrightarrow \text{borrows from arm's length investors: } h(x) = 1$$

$$d(x) < 0 \Leftrightarrow \text{borrows from intermediaries: } h(x) = 0.$$

Equation (1) says that an entrepreneur borrows from bondholders if intermediation costs exceed the expected bankruptcy loss induced by bondholders, that is, if $\pi > p\delta$. A firm's choice of lenders depends on two factors:

1. Intermediation costs (π), whose cause is the friction between depositors and banks, and which raise intermediaries' opportunity cost of capital. Since $\pi(x)$ falls with improvements in bank cash flow ϕ , we have $d_{\phi}(x) < 0$.
2. Expected bankruptcy costs ($p\delta$): this factor can be separated into the probability of default $p(x)$ and the severity of the default $\delta(x)$:
 - (a) Probability of default: Section 1.2 shows that $p(x)$ falls when entrepreneurs have abundant internal funds, when industries are profitable or safe, and when riskless rates are low. Thus $d_{x_i}(x) > 0$ for $x_i = e, \mu$ and $d_{x_i}(x) < 0$ for $x_i = \sigma, r_f$.
 - (b) Severity of default: Section 1.2 shows that the loss function $\delta(x)$ is positively related to delays in private or court-administered workouts. Empirical work suggests that this delay is shorter for larger companies, and we argue that the same happens to firms with abundant tangible collateral, so $d_{x_i}(x) > 0$ for $x_i = z, v$.

Thus we predict that large companies with abundant cash or tangible collateral in safe or profitable industries are more likely to tap the credit markets directly. This likelihood also increases if we hold all other things constant and reduce risk-free rates or intermediary earnings. The results are restated more generally in Proposition 2.

1.2 Lender selection in a more general framework

This section derives the results (a) and (b) above. This involves endogenizing the probability of corporate failure and showing that it depends on prevailing interest rates, on a borrower's internal funds, and on the profitability and safety of the industry where it operates. This derivation also involves relating verification costs to delays in workouts; we argue that size and tangible assets partly determine the extent of these delays. This section is developed around two theorems: Proposition 1 shows

that high quality corporations tap arm's length investors for funds, while poor quality firms borrow through intermediaries. Proposition 2 develops a straightforward mechanism to assess econometrically a firm's choice of lenders.

We need to generalize the description of the project and its payoffs in order to endogenize the probability of bankruptcy. Since the project's size is z , and since the entrepreneur only has ze internal funds, he must borrow $z[1 - e]$ from outside investors. The project's expected payoff is $z\mu$; its actual payoff, $z\mu s \in [0, \infty)$, is realized at $t = 1$. The stochastic factor s has an expected value of one and a density function $f(s)$ satisfying the increasing hazard rate property.² Lender θ charges $D(x, \theta)$ to an entrepreneur with attributes x , and bankruptcy is triggered if the project's revenues fall below the face value of debt, that is, when $s < \frac{D}{z\mu} \equiv b$. In default, the entrepreneur is verified by his creditors and forced to pay as much as he can.

1.2.1 Bankruptcy costs and delays in workouts. Outside investors can verify the entrepreneur's revenues, but verification immobilizes funds to time $t = 1 + \Delta(\theta, x)$, where the delay depends on the project's attributes and the lender's type. Gilson, Kose, and Lang (1990) show that private and court-administered reorganizations are quite prolonged, taking on average 15 and 28 months to complete, respectively. These delays are costly if the investment generates substandard returns in the interim; the verification losses can be shown to be a fraction $\theta\delta(x) < 1$ of the firm's cash flows $z\mu s$.³ Franks and Torous (1994) and Tashjian, Lease, and McConnell (1996) show that loss rates (i.e., the fraction of the face value not recovered) in private, prepackaged, and formal reorganizations are 20%, 27%, and 49%. Hence intervention is not only costly but also varies considerably for different procedures. We assume that intermediaries reorganize projects more efficiently than arm's length investors, so $\underline{\theta} < \theta$; indeed, Gilson, Kose, and Lang find that companies who use bank debt are more likely to reorganize privately (i.e., faster and cheaper) than firms who use publicly traded debt.⁴ We

²The hazard rate is defined as $\rho(s) \equiv f(s)/[1 - F(s)]$. We assume the monotone hazard rate property (MHRP) for expositional purposes, since the (weaker) necessary assumption is that $s\rho(s)$ increases in s ; the MHRP is widely used in incentive contract models [see Fudenberg and Tirole (1991, chap. 7)]. In addition to the standard definition of increasing risk by Rothschild and Stiglitz (1970), we assume that the hazard rate increases for higher risk, so $\rho_x(s) > 0$.

³To show this, let us define $\pi(x, \theta)$ as the extra opportunity cost of capital for investor θ , where $\pi(x, \underline{\theta}) = 0$ and $\pi(x, \theta) > 0$; let us also specify $\Delta(\theta, x)$ as $-\ln(1 - \theta\delta(x))/k$ for some arbitrary k and $\theta\delta(x) < 1$. If interim returns are $\exp(-k)[r_f + \pi(x; \theta)]$, with $k > 0$, then the payoff at $t = 1 + \Delta(\theta, x)$ is $z\mu s [\exp(-k)[r_f + \pi(x; \theta)]]^{\Delta(\theta, x)}$, and its present value from the perspective of $t = 1$ is $z\mu s [\exp(-k)[r_f + \pi(x; \theta)]]^{\Delta(\theta, x)} / [r_f + \pi(x; \theta)]^{\Delta(\theta, x)} = z\mu s \exp[-k\Delta(\theta, x)] = [1 - \theta\delta(x)]z\mu s \leq z\mu s$.

⁴Brown, James, and Mooradian (1992) argue that arm's length investors are unlikely to reorganize privately because they suffer severe holdout and lemons problems which can only be overcome by court administered reorganizations.

also assume that intervention is shorter and relatively less damaging for larger projects ($\delta_z(x) < 0$) as Warner (1977) and Gilson, Kose, and Lang (1990) have documented; this implies that although reorganization costs may rise with size, *average* intervention expenses fall for larger projects. Finally, we assume that projects with more tangible assets v need shorter interventions, so $\delta_v(x) < 0$; the intuition for this is that since tangible assets have thicker secondary markets, their disposal takes less time.

1.2.2 Theoretical derivation of how firms choose their lenders. The entrepreneur and lender economic profits $V(x; b)$ and $U(x; \theta, b)$ are redefined in Equations (2) and (3). These functions are all scaled by size:

$$V(x; b) = \mu \int_b^\infty [s - b]f(s)ds - er_f = \mu \int_b^\infty [1 - F(s)]ds - er_f \quad (2)$$

$$U(x; \theta, b) = \mu b[1 - F(b)] + [1 - \theta\delta(x)] \int_0^b \mu sf(s)ds - [1 - e][r_f + \pi(x; \theta)], \quad (3)$$

where μb stands for the face value of debt and b for the point at which an entrepreneur defaults. We will now focus on b , and use it to define a lending equilibrium as:

Definition 1 (Lending Equilibrium). An equilibrium $b(x; \theta)$ is the lowest bankruptcy point where a lender breaks even and an entrepreneur makes positive profits: $b(x; \theta) = \min\{b': U(x; \theta, b') = 0 \text{ and } V(x; b') \geq 0\}$.

When there are many potential lenders, an entrepreneur selects the one who offers the lowest interest rate, or equivalently the lowest b . Let us define X as the domain of attributes and $S(\theta) \subseteq X$ as the subset of attributes where a lending equilibrium exists. Proposition 1 characterizes intermediary and bondholder lending equilibria $S(\underline{\theta})$ and $S(\bar{\theta})$.

Proposition 1. Define $S(\theta) \subseteq X$ as the set of attributes where a lending equilibrium exists:

- (i) If a firm can borrow, then “better” companies can also borrow; formally, if $(x_i, x_{-i}) \in S(\theta)$ then all $(x'_i, x_{-i}) \in S(\theta)$ where x'_i satisfies $(x'_i - x_i)U_{x_i} \geq 0$.
- (ii) If $\pi(x; \underline{\theta}) \leq [1 - \underline{\theta}]\delta(\underline{v}, \underline{z}) \int_0^{\hat{b}} sf(s; x) ds$ then an intermediary can lend wherever an arm’s length investor can; formally $S(\underline{\theta}) \subset S(\underline{\theta})$
- (iii) The sets of entrepreneurs who borrow from intermediaries and from arm’s length investors are well defined since bond yields are more

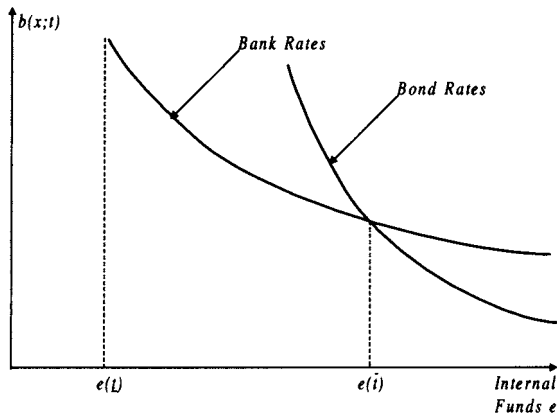


Figure 1
Single crossing property for lender rates

This figure shows the rates $b(x; \theta)$ charged by arm's length investors and intermediaries to firms with cash flow e .

sensitive to changes in attributes than bank rates; formally, equilibrium rates $b(x; \theta)$ satisfy the single crossing property, $\text{sgn}\left(\frac{d^2b}{dx_i d\theta}\right) = \text{sgn}(b_{x_i}) = \text{sgn}(-U_{x_i})$.

Figure 1 illustrates the proposition's results; it plots the rates charged by banks and bondholders to entrepreneurs with internal funds e . Proposition 1(i) demonstrates that if a company with funds e' is not rationed, then all firms $e > e'$ are not rationed either. Proposition 1(ii) ensures that banks can lend wherever bondholders can; Cantillo (1998) arrives at this result with an endogenously generated premium $\pi(x)$. Proposition 1(iii) says that banks and bondholders charge less to cash rich corporations *and* that bondholders cut their rates faster than banks. This single crossing property neatly separates bank and bond financed companies in two well-defined sets. For instance, cash rich corporations tap the bond market directly because they rarely default and need little verification; in these circumstances bondholders offer a better rate than intermediaries, since all that matters is who has the lowest cost of capital. Companies with moderate resources, on the other hand, cannot afford to switch away from banks, since eliminating these middlemen induces more damaging verification at the hand of bondholders.

1.2.3 An Implementable Solution. To exploit our theoretical results, we construct a decision function $d(x)$, defined in Equations (4) and (5), that computes bondholders' payoff were they to match the competitive rate \underline{b} charged by banks. $d(x_0) > 0$ means that for a firm with attributes

x_0 , bondholders are making a profit where banks are just breaking even. Since bondholders can underprice banks in this situation, it is clear that such firm x_0 prefers to tap the bondmarket. Proposition 2 shows that under some regularity conditions, the demand for securities $h(x)$ is closely related to the decision function $d(x)$.

$$\begin{aligned}
 d(x) &\equiv \frac{U(x; \bar{\theta}, \underline{b})}{1 - e} \\
 &= \pi(x; \underline{\theta}) - \frac{[\bar{\theta} - \underline{\theta}] \mu \delta(x) \int_0^{\underline{b}} \mu s f(s) ds}{1 - e} \quad \forall x \in S(\underline{\theta}) \quad (4)
 \end{aligned}$$

$$\begin{aligned}
 U(x; \underline{\theta}, \underline{b}) &= \mu \underline{b} [1 - F(\underline{b})] + [1 - \underline{\theta} \delta(x)] \int_0^{\underline{b}} \mu s f(s) ds \\
 &\quad - (1 - e) [r_f + \pi(x; \underline{\theta})] \equiv 0 \quad (5)
 \end{aligned}$$

Proposition 2. Assume $U_b(x; \bar{\theta}, \underline{b}) > 0$ for $x \in S(\bar{\theta})$. In that case, the firm borrows through intermediaries ($h(x) = 0$) iff the decision function is negative ($d(x) < 0$), and the company borrows from arm's length investors ($h(x) = 1$) iff the decision function is positive ($d(x) > 0$) for all attributes where a bank equilibrium exists ($x \in S(\underline{\theta})$). In addition, $d_{x_i}(x) > 0$ for $x_i = z, v, e, \mu$ and $d_{x_i}(x) < 0$ for $x_i = \sigma, r_f, \phi$.

Figure 2 illustrates the proposition's results, that is, that large corporations with a high proportion of tangible assets, high cash flow, or

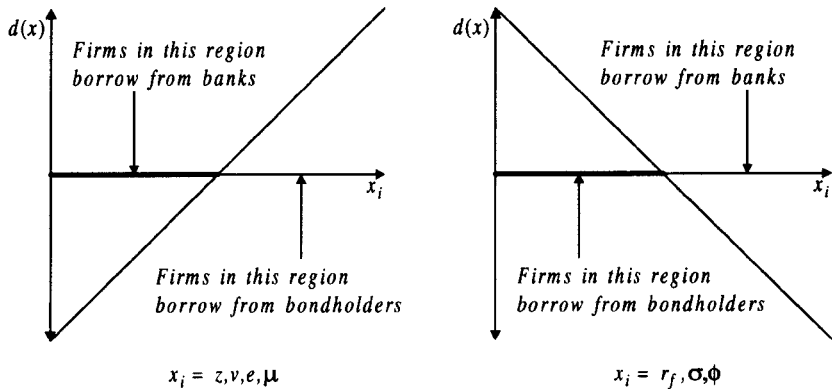


Figure 2
Decision variable $d(x)$ as a function of firm attributes

This figure shows the economic profit to arm's length investors were they to match the competitive rates charged by banks. $d(x_0) > 0$ implies that arm's length investors can underprice intermediaries when lending to a firm with attributes x_0 .

profitability borrow directly from arm's length investors since $d_{x_i}(x) > 0$ for $x_i = z, v, e, \mu$. In contrast, firms with risky projects or operating in an environment with high real interest rates and high intermediary earnings borrow from intermediaries, since $d_{x_i}(x) < 0$ for $x_i = \sigma, r_f, \phi$. Section 3 examines whether our theoretical framework can explain the actual choices made by companies. Before, however, we need to describe the nature and origins of our data.

2. Data Description

We will work with two datasets obtained from Compustat, Moody's manuals, and Compact Disclosure. There is a balanced panel of 291 corporations with uninterrupted annual data from 1974 to 1992, which we call the older set. This set contains extensive time and cross-sectional data not available elsewhere, and is composed of mature firms. The second set is an unbalanced panel of 5554 companies with at least 1 year of data between 1985 and 1992; although the newer dataset is not as rich as the older, it serves as a control, that is, as a way to examine if there are important behavioral differences between young and mature firms.

2.1 Selection of the older set

This set contains 291 companies with continuous information from 1974 to 1992, or 5529 firm-year observations. To select these corporations we excluded firms in agriculture, public utilities, transportation, financial services, and industries with SIC codes 8000 or higher—which includes government, legal, health, and educational services; this left 5775 companies. We then required that firms have uninterrupted data from 1974 to 1992 on basic balance sheet items (sales, earnings, liabilities, etc.); this reduced the sample to 576 firms, and filtered out young corporations. The third step was to exclude firms with significant merger or acquisition activities, which we defined as a change of 25% or more in the company's gross physical capital stock for reasons other than physical investment or retirements. Thus we excluded corporations when $|K_t - K_{t-1} - I_t + R_t| > 0.25K_{t-1}$, where K_t is the gross book value of physical capital, I_t is physical investment, and R_t denotes retirements. This left 320 firms, less 29 that were not in Moody's manuals, for a total of 291 companies. The following variables were obtained only for this set:

Publicly traded and privately held debt outstanding, was obtained from Moody's manuals. Moody's itemizes, rates, and discusses every public obligation issued by a firm. We coded as publicly traded debt those issues that Moody's itemized and where it made clear that it was not a private placement, an industrial revenue bond, a capitalized lease, or

commercial paper. We added to this any international issue of publicly traded bonds, which are normally listed in Moody's *other debt* section. We classified as privately held all remaining items, with the exception of commercial paper, industrial revenue bonds, and capitalized leases. These last items were excluded from our measures of long-term debt because they are either short term (e.g., commercial paper) or their nature—whether they are publicly traded or privately held—is unclear. The *ratio* of relative bond usage is $m_{it} = D_{it}^{\theta} / (D_{it}^{\theta} + D_{it}^{\theta})$, where D_{it}^{θ} and D_{it}^{θ} are the publicly traded and privately held long-term debt outstanding; a firm is completely bond financed when the ratio is one. *Age* is the difference between 1992 and the company's earliest recorded establishment date in Moody's historical summary.

We also obtained variables indicative of a firm's corporate governance for this set, to appraise the importance of alternative theories of banking. The *family control dummy* takes a value of 1 if the company is controlled by a family; we constructed this variable by looking at the 1974 and 1992 board of directors in Moody's manuals. We defined a firm as family controlled if there were two or more members of the 1992 board with the same last name, or if the 1974 and 1992 board each had a member with the same last name, but different first name. The *concentration of large shareholders* was obtained from Compact Disclosure and proxy statements for 1994; it aggregates the stakes held by large equityholders (i.e., shareholders owning more than 5% of the firm's class A stock). The *concentration of institutional investors* was obtained from Compact Disclosure and proxy statements for 1994; it computes the concentration of class A shares held by institutional investors.

2.2 Selection of the newer set

We retrieved all corporations listed in Compustat between 1985 and 1992. We excluded the same industries as in the older set, and we ruled out mergers as before. However, we did not require that companies have uninterrupted published information. This left 5554 firms with at least one observation between 1985 and 1992. The following variables were obtained from Compustat for the newer and the older sets:

The *bond rating dummy* equals one if a firm has a bond rating. When a corporation is rated, it almost always has a positive amount of publicly traded debt: in the older set there were only 18 of 5529 observations where a company had a bond rating and no publicly traded debt, and 135 observations where a firm had some public debt and no bond rating. Since these two deviations represented less than 3% of the observations, we assume that a bond rating is equivalent to having some bonds outstanding. The *commercial paper rating dummy* equals one if a firm has a commercial paper rating. *Size* is defined as the logarithm of

deflated sales. Our deflator is the average producer price index, which takes a value of 1 in 1990. *Tangible assets* were defined as net property plant and equipment as a fraction of total assets; both components are measured at book value and taken at the beginning of the company's fiscal year.

Cash flow is defined as operating income scaled by sales. Operating income equals sales less general expenses less cost of goods sold less taxes plus extraordinary items; we did not subtract interest payments since this is probably an endogenous variable, inasmuch as firms choose their leverage and lenders simultaneously. One problem with this variable occurs when corporations have very low sales; in this case, the denominator is close to zero and the cash flow variable becomes extremely large. This is a serious problem for the newer set of firms as manifested by their 1992 value of skewness (-62.4) and kurtosis (4808). To correct this, we logistically modified cash flow in both series $e = 1/[1 + \exp(-CF_{it})]$, so that the variable lies between 0 and 1. Although this functional form is certainly arbitrary, it is not more so than the original definition. Moreover, the transformation has no effect on the results for the older sample, where there are no significant outliers. For the newer sample, we checked the robustness of this transformation by running the regressions using cash flow defined as operating income over sales, and trimming observations where this exceeded five in absolute value; our conclusions remained unchanged. *Profitability and risk*: We calculated the median cash flow for each two-digit SIC industry group, using the firms in our newer set on a year-by-year basis. Industry profitability was defined as the median industry cash flow, averaged from 1985 to 1992; the standard deviation of this gave us a measure of risk by industry group. We matched a firm's profitability and risk with the profitability and risk of its associated two-digit SIC industry group.

The following variables come from the Federal Reserve: *Real interest rate* is defined as the 1-year Treasury-bill rate less expected inflation. We use the Livingston index of inflation expectations from the Federal Reserve Bank of Philadelphia, adjusting it to be a 1-year forecast; the interest rate series is matched to the end of each firm's fiscal year. *Intermediary earnings*, from the Federal Reserve's flow of funds accounts, are the undistributed profits for all financial intermediaries divided by their beginning-of-year assets.

Table 1 summarizes the variables we use. Tangible assets, size, and the corporate governance variables proxy for the severity of bankruptcy costs, while the other variables are directly related to our theoretical model.

To give an idea of the static differences between the older and newer datasets, Table 2 shows summary statistics for 1992. These numbers reveal that even firms large enough to be tracked by Compustat rarely use publicly traded debt: in 1992, the median corporation in the newer

Table 1
Summary of variables retrieved used

Variable	Description
Ratio _{<i>t</i>} (m_{it}) (*)	Percent of long-term debt held in publicly traded instruments
Bond rated _{<i>t</i>}	Dummy variable, equals 1 if the firm has a bond rating
Commercial paper rated _{<i>t</i>}	Dummy variable, equals 1 if the firm has a c.p. rating
Size _{<i>t</i>}	log(Sales)
Tangible assets _{<i>t</i>}	Property, plant, and equipment as a fraction of total assets
Cash flow _{<i>t</i>}	Operating income divided by sales, transformed
Industry profitability	Median cash flow of the two-digit SIC industry
Industry risk	Standard deviation cash flow of the two-digit SIC industry
Real interest rate _{<i>t</i>}	One year Treasury-bill yield less expected inflation
Financial int. earnings _{<i>t</i>}	Intermediary undistributed profits over total assets
Family controlled (*)	Dummy variable, equals 1 if the firm is family controlled
Large shareholders (*)	Percent of shares held by "insiders" as defined by SEC
Institutional investors (*)	Percent of shares held by institutional investors
Age (*)	1992 less earliest recorded establishment date

(*) Available only for the older set. All variables with subscript *t* vary year by year.

Table 2
Summary statistics for the old and new datasets, 1992

	Mean	Median	Min.	Max.	Std. Dev.
Older set, 291 firms					
Bond rated	0.320	0.000	0.000	1.000	0.467
Commercial paper rated	0.271	0.000	0.000	1.000	0.446
Ratio m_{it}	0.226	0.000	0.000	1.000	0.358
Size	6.246	6.279	1.182	10.94	1.866
Cash flow	0.525	0.523	0.462	0.655	0.018
Industry profitability	0.521	0.519	0.506	0.563	0.009
Industry risk	0.002	0.002	0.001	0.019	0.003
Tangible assets	0.414	0.376	0.066	0.919	0.166
Leverage	0.214	0.194	0.000	1.243	0.160
Family controlled	0.461	0.000	0.000	1.000	0.499
Large shareholders	0.358	0.291	0.000	1.000	0.267
Institutional investors	0.449	0.489	0.000	0.887	0.227
Age	66.97	66	22	155	30.33
Newer set, 3194 firms					
Bond rated	0.142	0.000	0.000	1.000	0.349
Commercial paper rated	0.067	0.000	0.000	1.000	0.250
Size	4.191	4.206	-4.43	11.78	2.520
Cash flow	0.496	0.520	0.000	1.000	0.116
Industry profitability	0.525	0.519	0.506	0.624	0.018
Industry risk	0.003	0.001	0.001	0.035	0.005
Tangible assets	0.299	0.227	0.000	0.989	0.240
Leverage	0.287	0.223	0.000	4.489	0.345
Age ¹	29.70	17.00	0.000	161.0	31.34

The variables are described in Table 1.

¹The age variable for the new dataset was taken from a random sample of 150 firms within that set.

set had \$67 million in sales, and yet less than 15% and 7% of these firms had a bond or commercial paper rating, respectively; for the older set, 32% and 28% of the companies had a bond or commercial paper rating in 1992, respectively. The difference arises because firms in the older set are more mature, larger, and have a higher proportion of

tangible assets than companies in the newer set. For example, the median age of a firm in the older set is 66 years, while the median age of companies in the new set was 17 years. The fact that a corporation survives 20 years and is thus in the old set also suggests that its default rate is extremely low. It is clear that there are significant *static* differences between our datasets; we have yet to test if there are important *behavioral* disparities between mature and young firms.

3. Empirical Results

The empirical findings in this section are that large companies with abundant cash and collateral tap the credit markets directly, that these markets cater to safe and profitable industries, and they are most active when riskless rates or intermediary earnings are low. We want to understand whether these results imply that intermediaries are good screeners, good reorganizers, both, or neither. We start by showing that our theoretical framework is robust, so that corporate attributes affect lender choice as predicted by the model regardless of the firm's age or of the maturity of its obligations. In the second part of our analysis we use our richest dataset to study how firms choose their lenders intertemporally. This allows us to show that certain macroeconomic variables have a powerful effect on the way in which firms choose their lenders. We also demonstrate that the process of lender selection varies dramatically during business cycles; we argue that this and other evidence favors a framework that sees banks as reorganizers rather than as screeners. We close our empirical analysis by exploring the asymmetry of entry and exit into the markets for publicly traded debt.

3.1 Empirical robustness of our theoretical predictions

We divided our cross-sectional data into four groups to study the likelihood with which firms in the new and old sets issue bonds or commercial paper. Our previous description of these sets has made it clear that firms from the old sample are larger, more mature, and hold more tangible assets than companies in the newer dataset. It is also evident that bonds and commercial paper stand at opposite extremes of the maturity spectrum. Thus it is perhaps surprising that corporate attributes have the same effect on lender choice in all four subsamples. These results are reassuring because they say that even though age and maturity play a role in the process of lender selection, the distinction between public and private debt is very relevant.

3.1.1 Robustness across datasets. To test whether old and young firms have different sensitivities to corporate attributes, we ran separate probits for the newer and older sets, assessing the probability of being

Table 3
Cross-sectional probit regressions for old and new datasets, 1992

Estimation method	Probit	Probit	Probit	Probit
Dependent variable (1 ≡ rated, 0 ≡ not)	Bond Rated ₉₂	Commercial paper Rated ₉₂	Bond Rated ₉₂	Commercial paper Rated ₉₂
Dataset	Old	Old	New	New
No. of observations	291	291	4817	4817
R ²	0.5285	0.6274	0.3515	0.3662
Constant	-15.835 (10.070)	-14.387 (12.661)	-9.9119* (0.9892)	-8.0121* (1.4604)
Size ¹	0.7427* (0.0794)	1.1248* (0.1376)	0.5132* (0.0209)	0.6548* (0.0348)
Cash Flow ¹	4.1687 (7.6758)	27.510* (10.657)	2.6603* (1.1310)	6.8747* (1.8607)
Industry profitability	15.674 (21.070)	-16.178 (27.192)	8.1841* (2.0506)	-3.1955 (3.2544)
Industry risk	-9.247 (57.516)	-44.314 (82.232)	6.3499 (8.3101)	-17.4448 (15.9976)
Tangible assets ¹	0.2175 (0.7566)	-0.2635 (0.9334)	0.2469 (0.1801)	0.7407* (0.27207)

This table shows the results of running a probit regression that assesses the probability of having a rating, depending on the firm's attributes. The regressors are described in Table 1, and standard errors are in parentheses.

*Indicates that the regressor is significantly different from zero at the 5% level.

¹Indicates that the regressor has been averaged from 1985 to 1992.

rated in 1992. Since these probits are based on cross-sectional attributes, interest rates and intermediary earnings were not used as regressors. We also took the 1985–1992 average of any time-varying regressor to account for the fact that a 1992 bond rating may reflect old issuances.

Table 3 shows that wherever a variable is significant, its effect is as predicted by the CSV model. Size and cash flow are the attributes that can most accurately predict a firm's choice of lenders. Although the other attributes generally confirm our predictions, their statistical significance in these regressions is low and uneven.

We perform a likelihood ratio test to verify the hypothesis that the explanatory variables affect young and mature firms similarly; the test says that one cannot reject that the slope coefficients for the newer and older sets are identical.⁵ In other words, combining the two datasets yields the same slope coefficients, provided that each sample has different intercepts. We found that the intercepts differed by 0.286,⁶ and that the probability of being rated would on average rise by 3.06% if a company switched from the new to the old set. Figure 3 shows how switching from the new to the old dataset affects the probability of

⁵ The test uses the bond rating data and is done at the 5% confidence level. The *p*-value of the test is .087.

⁶ The *t*-statistic of the difference was 2.604.

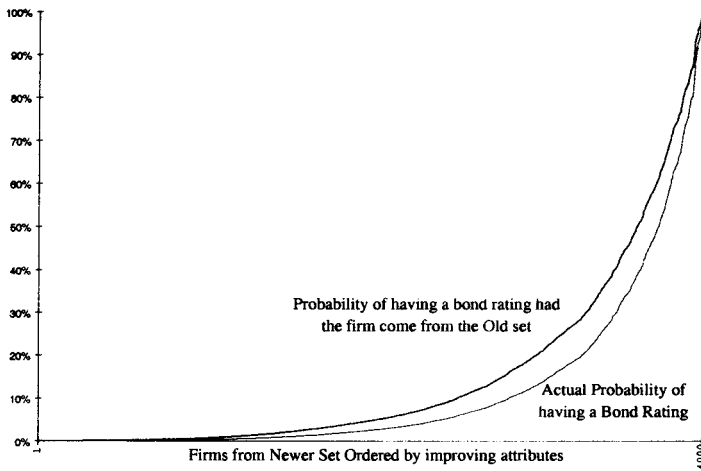


Figure 3
The effect of age on the likelihood of being rated

This figure orders firms from the new set by improving attributes in the *x*-axis. The dotted line plots the company's likelihood of being bond rated. The solid line plots the firm's likelihood of being rated if it had come from the old dataset.

being rated. The inequality in intercepts may clarify the role that age plays in lender selection, particularly if we can assume that the only unmeasured factor distinguishing the two sets is the difference in firm age. To verify this effect, we sampled 150 corporations from the new dataset: the average age in this sample was 30 years, which was 37 years less than the average age in the old set. This difference suggests that age affects lender choice in a statistically significant sense, although its economic impact is modest. The likelihood ratio test also confirms our assertion that there are important static differences between young and mature firms, and yet their marginal behavior is similar.

3.1.2 Robustness across maturities. Table 3 also suggests that corporate attributes affect bond and commercial paper markets similarly. For instance, firms with high cash flows issue bonds and commercial paper rather than bank debt. We know that commercial paper has a shorter maturity than bank loans, and that bank loans have a shorter maturity than bonds. How can maturity drive these results? One explanation is that companies with high cash flows prefer debt with extreme maturities. A more natural interpretation of the evidence is that firms with high cash flows issue publicly traded obligations, whether they are short or long term.

We run a likelihood ratio test to verify the hypothesis that the commercial paper and bond markets are similar to each other. This test indicates that one cannot reject that the slope coefficients for the bond and commercial paper probits are the same.⁷ The intercept is allowed to vary because firms with identical attributes are more likely to have a bond rather than a commercial paper rating. The difference in intercepts would occur if banks' reorganizational or screening advantage is more pronounced for short-term ventures, so companies have to be all the better to justify going to the commercial paper market. These results show that even though maturity plays an important role in the process of lender selection, it is still true that the fundamental distinction between publicly traded and privately held debt is relevant across different time horizons.

3.2 Intertemporal lender selection: empirical evidence and theoretical implications

In Section 3.2 we move away from the cross-sectional data to study a long panel of firms. This allows us to fully exploit our dataset, to describe how firms choose their lenders intertemporally, and to examine the two banking theories more closely. The panel study shows that the risk-free rate and intermediary earnings are important determinants of a company's choice of lenders. There is also some evidence to suggest that banks are most likely to use their superior knowledge to reorganize rather than to screen projects; thus whenever the two banking theories are at odds, the reorganizational framework delivers more accurate predictions. This framework can also explain more naturally why the process of lender selection varies so much during business cycles. Our analysis concludes with an investigation of whether and why firms enter and exit the public debt markets asymmetrically. We contend that the strong asymmetry of entry and exit suggests that banks' advantage—their superior knowledge—is blunted after a corporation has used the public debt markets for the first time.

3.2.1 Importance of macroeconomic variables for lender selection. We begin by motivating the use of a lagged dependent variable regression for our analysis. Let us first state some basic accounting identities: debt at time t equals past debt plus new issues less retirements, as shown in Equation (6). The superscripts $\bar{\theta}$ and $\underline{\theta}$ indicate whether obligations are publicly traded or privately held, and their sum equals total long-term debt: $D_{it} \equiv D_{it}^{\bar{\theta}} + D_{it}^{\underline{\theta}}$. To start, we assume that retirements are a fraction of past obligations, a fraction that does not vary across debt

⁷The hypothesis test uses the old dataset and is done at the 5% confidence level; its p -value is 0.061.

types or firms, so $R_{it}^j = [1 - \tilde{\alpha}]D_{it-1}^j; j = \underline{\theta}, \bar{\theta}$. In addition, we assume that debt issues are proportional to outstanding liabilities: $I_{it} = \lambda D_{it-1}$. The issuance of different types of debt is governed by the bond demand $h(x_{it})$ defined in Proposition 2: $I_{it}^{\bar{\theta}} = h(x_{it})I_{it}$ and $I_{it}^{\underline{\theta}} = [1 - h(x_{it})]I_{it}$. The ratio m_{it} of bonds to total long-term debt behaves as in Equation (7), where $h(x_{it})$ has been linearized.

$$D_{it}^j = D_{it-1}^j + I_{it}^j - R_{it}^j \quad I_{it}^j \geq 0 \quad R_{it}^j \in [0, D_{it-1}^j] \quad j = \underline{\theta}, \bar{\theta} \tag{6}$$

$$m_{it} = \frac{D_{it}^{\bar{\theta}}}{D_{it}} = \frac{\tilde{\alpha}D_{it-1}^{\bar{\theta}} + \lambda h(x_{it})D_{it-1}}{[\tilde{\alpha} + \lambda]D_{it-1}} = \alpha m_{it-1} + [1 - \alpha][\beta'x_{it}] \tag{7}$$

Table 4
Lagged dependent variable regression: old dataset, 1975–1992

Estimation method	LDV	LDV
Dependent variable	Ratio m_{it}	Ratio m_{it}
No. of observations	5238	5238
R^2	0.8840	0.8842
α	0.9094* (0.0091)	0.9069* (0.0094)
Constant	-3.0958* (1.5084)	-2.5247 (1.5028)
Size _{<i>t</i>}	0.1113* (0.0095)	0.0915* (0.0133)
Cash flow _{<i>t</i>}	3.9348* (1.5150)	3.2691* (1.5024)
Industry profitability	1.5448 (3.1195)	1.2254 (3.0430)
Industry risk	-7.3420 (9.1468)	-6.8912 (8.9078)
Tangible assets _{<i>t</i>}	0.1823 (0.1353)	0.2254 (0.1333)
Real interest rate _{<i>t</i>}	-3.8893* (1.1813)	-3.8452* (1.1464)
Financial int. earnings _{<i>t</i>}	-0.5447* (0.1467)	-0.5375* (0.1435)
Family controlled		-0.0377 (0.0371)
Large shareholders		-0.0808 (0.0636)
Institutional investors		0.1629 (0.1070)
Age		0.0002 (0.0007)

This table presents the estimates of $m_{it} = \alpha m_{it-1} + [1 - \alpha][\beta'x_{it}]$, where m_{it} is firm i 's use of publicly traded debt at time t , and x_{it} are its attributes. The variables are all explained in Table 1, and the heteroscedastic-consistent standard errors in parentheses.

*Indicates that the regressor is significantly different from zero at the 5% level.

The p -value for the test that the error term from this model is not $AR1$ is 0.1803, which means we can accept the hypothesis that there is no $AR1$ component.

Simple accounting identities and strong assumptions imply that the ratio m_{it} can be estimated as a lagged dependent variable regression; the estimates are shown in Table 4. The results support our framework, since all coefficients are in the direction predicted by the theory and most are significant. The second column of Table 4 shows that the inclusion of a firm's age and ownership structure does not affect other coefficients.⁸ We should note that even though the explanatory power in Table 4 is quite high, much of this power comes from the lagged dependent variable. Without the lagged variable, the R^2 for the model with and without the governance variables would drop to 0.392 and 0.373, respectively.

One of the most noteworthy insights from our panel analysis is that macroeconomic conditions have a powerful effect on how firms choose their lenders, so that a fall in intermediary earnings or riskless rates pushes corporations to the bond market. Our theoretical explanation for these results is as follows: a drop in bank earnings generates more frictions with depositors and raises the intermediary's opportunity cost of capital; this magnifies bondholders' comparative advantage and allows them to increase their market share. A fall in the risk-free rate loosens creditors' participation constraints; this lowers verification and raises the potential rent $d(x)$ that bondholders get by matching bank rates. In equilibrium, these rents disappear as bondholders cut rates faster than intermediaries and therefore gain new clients.

Although each one of the corporate governance variables is statistically insignificant, they are jointly significant,⁹ and imply that the more closely held a firm is, the more likely it is to rely on intermediaries. How can we explain this? One possibility is that closely held corporations require more prolonged interventions; in our model, the loss function would satisfy $\delta_{x_i}(x) > 0$ for $x_i =$ family firms, insider shareholders, and $\delta_{x_i}(x) < 0$ for institutional investors. The only data on this subject, from Gilson, Kose, and Lang (1990), indicates that companies with a greater number of *shareholders* have a higher chance of restructuring privately (i.e., faster and cheaper), which supports our model.

Table 4 shows that age does not affect lender choice significantly. This is not surprising, given the life span of the firms in the old set: it probably does not matter whether a firm is 91 or a 100 years old; it

⁸ We cannot reject the hypothesis that the coefficients of the financial attributes remain the same after including the governance variables. The hypothesis test is done at the 5% confidence level, and its p -value is 0.6314.

⁹ The Wald test for the hypothesis that the three variables (family controlled, large shareholders, and institutional investors) are jointly zero is 10.34, with a p -value of .0159, so it can reject at 5% level the hypothesis that these variables are jointly zero. A similar test was performed in all regressions where corporate governance variables were used (Tables 6 and 7). The Wald test yielded 8.918 and 44.172, with a p -value of .0304 and .0000, respectively, so the corporate governance variables are everywhere jointly significant.

matters a lot whether a company is 1 or 10 years old. These results and those in Section 3.1 are consistent with Petersen and Rajan (1994), who show that the impact of age on lender choice is most important when companies are young, and that marginal increases in a firm's age are unimportant by their 30th year.

To assess the economic significance of our results, Table 5 displays the change in the ratio m_{it} (in standard deviations) for a one standard deviation increase in the explanatory variable. We first show the effect of raising a variable permanently; we also display the effect of a 1-year shift for time-varying regressors. For example, Table 5 predicts that m_{it} rises by 0.162 standard deviations when cash flow rises permanently by one standard deviation. Hence, if a company with no bonds experienced a permanent 0.06 increase in its cash flow, it would replace 6% of its privately held debt with bonds.

Table 5 indicates that size, intermediary earnings, riskless rates, and cash flow are the variables with the strongest impact on how firms choose their lenders. Next in importance are tangible assets and the concentration of institutional investors. Last in economic significance are industry risk, concentration of large shareholders, family control, industry profitability, and age. One interpretation of these results is that cash flow and size summarize very well a firm's likelihood and cost of default; that macroeconomic variables have a powerful statistical and economic impact on how firms choose their lenders; that corporate governance variables have a moderate impact on creditor selection; and that industry averages and age have a relatively weak effect on the type

Table 5
The economic impact of corporate attributes on debt selection

Across firms:		Permanent shock			
Size	Cash flow	Industry profitability	Industry risk	Tangible assets	Interest rates ¹
0.590	0.162	0.040	-0.076	0.110	-0.308
Intermediary earnings ¹	Family control	Large shareholders	Institutional investors	Age	
-0.386	-0.066	-0.076	0.130	0.024	
Across time:		One-period shock			
Size	Cash flow	Tangible assets	Intermediary earnings	Interest rates	
0.028	0.023	0.067	-0.081	-0.103	

The table displays the change in the ratio m_{it} (in standard deviations) for a one standard deviation increase in the explanatory variable; we use the estimates in Table 4, column 3 to create this table. The first two rows consider a permanent increase in the explanatory variable, while the last row considers a one-period increase in the explanatory variable.

¹Measures the long-run impact on a given company, not across firms.

The variables are explained in Table 1.

of obligations issued by a company. Finally, tangible assets is a corporate attribute with weak statistical significance but a sizeable economic impact; this suggests that collateralizability may be a relevant attribute, but that we have a less-than-perfect measure for it.¹⁰

3.2.2 Stability of the coefficients during business cycles. The econometric model we have just outlined can be used to investigate if the determinants of debt choice have a differential impact across the business cycle. We relax our previous assumptions by allowing debt retirements and issues to vary across time, so $R_{it}^j = [1 - \tilde{\alpha}_t]D_{it-1}^j$ and $I_{it} = \lambda_t D_{it-1}$, where $j = \theta, \bar{\theta}$. The issuance of debt types is governed by the bond demand $h(x_{it})$ defined in Proposition 2: $I_{it}^{\bar{\theta}} = h(x_{it})I_{it}$ and $I_{it}^{\theta} = [1 - h(x_{it})]I_{it}$. The ratio now becomes

$$m_{it} = \frac{D_{it}^{\bar{\theta}}}{D_{it}} = \frac{\tilde{\alpha}_t D_{it-1}^{\bar{\theta}} + \lambda_t h(x_{it}) D_{it-1}}{[\tilde{\alpha}_t + \lambda_t] D_{it-1}} = \alpha_t m_{it-1} + [1 - \alpha_t] h(x_{it}). \quad (8)$$

Equation (8) says that m_{it} is more sensitive to changes in corporate attributes when companies issue more debt or when they retire fewer securities. If we did not control this, we may wrongly conclude that the determinants of lender choice matter more in recessions, simply because in these periods firms may be issuing more debt. We construct $\alpha_t = \tilde{\alpha}_t / [\tilde{\alpha}_t + \lambda_t]$ from our older set, where $1 - \tilde{\alpha}_t$ and λ_t are the median rates of retirement and issuances of long-term debt in year t . Equation (9), which assumes that $h(x_{it})$ is linear, introduces a time-varying parameter φ_t to allow for the possibility that the determinants of lender choice vary over time. Estimates of Equation (9) with an additive normal error are shown in Table 6:

$$m_{it} = [\alpha_t + \varphi_t] m_{it-1} + [1 - \alpha_t - \varphi_t] [\beta' x_{it}]. \quad (9)$$

Figure 4 plots the estimated coefficients φ_t against the percentage change in property plant and equipment investment by nonfinancial corporations, as reported by the flow of funds accounts. There is a strong positive correlation, and the slope coefficient has a t -statistic of 4.00. The fact that φ_t is small during investment downturns means that the determinants of lender selection are more important during these periods. This suggests that markets classify firms more sharply during recessions, and that small changes in attributes have a big impact on the type of debt issued. To illustrate this, consider the impact of a temporary one standard deviation increase in size and cash flow in 1975 and

¹⁰ Not that there is an easy solution for this: other proxies for collateral such as inventories, marketable securities, or book-to-market ratios are even more statistically insignificant.

Table 6
Stability of coefficients: old dataset, 1975–1992

Estimation method	NLS		Ratio _{<i>t</i>}	
Dependent variable	Ratio _{<i>t</i>}		Ratio _{<i>t</i>}	
No. of observations	5238		5238	
R ²	0.8872		φ _{<i>t</i>}	φ _{<i>t</i>}
Constant	-2.9618*	φ ₇₅	-0.0006	φ ₈₇
	(1.5006)		(0.0667)	(0.0457)
Size _{<i>t</i>}	0.0972*	φ ₇₆	0.1948*	φ ₈₈
	(0.0138)		(0.0191)	(0.0238)
Cash flow _{<i>t</i>}	3.3984*	φ ₇₇	0.2213*	φ ₈₉
	(1.5148)		(0.0103)	(0.0511)
Industry profitability	1.9867	φ ₇₈	0.1929*	φ ₉₀
	(3.0333)		(0.0167)	(0.0334)
Industry risk	-12.2517	φ ₇₉	0.1637*	φ ₉₁
	(8.6450)		(0.0201)	(0.0219)
Tangible assets _{<i>t</i>}	0.2788*	φ ₈₀	0.1588*	φ ₉₂
	(0.1415)		(0.0270)	(0.0248)
Real interest rate _{<i>t</i>}	-6.4648*	φ ₈₁	0.1749*	
	(1.9750)		(0.0152)	
Financial int. earnings _{<i>t</i>}	-0.5666*	φ ₈₂	0.1763*	
	(0.1631)		(0.0196)	
Family controlled	-0.0353	φ ₈₃	0.0407	
	(0.0404)		(0.0504)	
Large shareholders	-0.1156	φ ₈₄	0.1302*	
	(0.0696)		(0.0215)	
Institutional investors	0.1190	φ ₈₅	0.0748	
	(0.1162)		(0.0491)	
Age	0.0006	φ ₈₆	0.0997*	
	(0.0008)		(0.0384)	

This table estimates $m_{it} = [\alpha_t + \varphi_t]m_{it-1} + [1 - \alpha_t - \varphi_t][\beta'x_{it}]$, where m_{it} is firm i 's use of publicly traded debt at time t , x_{it} is its attributes, and φ_t is a time-varying parameter to be estimated. We construct $\alpha_t = \bar{\alpha}_t / [\bar{\alpha}_t + \lambda_t]$ from our older set, where $1 - \bar{\alpha}_t$ and λ_t are the median rates of retirement and issuances of long-term debt in year t ; other variables are explained in Table 1. Heteroscedastic-consistent standard errors are in parentheses, and regressors with * are significantly different from zero at the 5% level.

1984, the years with the largest decrease and increase in investment. An increase in size raised m_{it} by 0.12 standard deviations in 1975, while a similar change in 1984 raised the ratio by only 0.03 standard deviations. Similarly, a cash flow increase raised m_{it} by 0.04 standard deviations in 1975, while a similar increase in 1984 left m_{it} virtually unchanged.

These results bear on a macroeconomic debate about how monetary policy affects real economic activity. One view, held by Kashyap, Stein, and Wilcox (1993), argues that a monetary contraction raises banks' cost of capital; this effect prevents bank-dependent companies from borrowing and investing, and is called the bank-lending channel of monetary policy. The other view held by Oliner and Rudebusch (1996) is that lenders uniformly flee from low quality firms during monetary contractions, preventing these firms from borrowing and investing; this is called the broad credit channel of monetary policy. This debate has been difficult to settle because the macroeconomic implications of these hypotheses are almost identical. Our panel data results, however, were

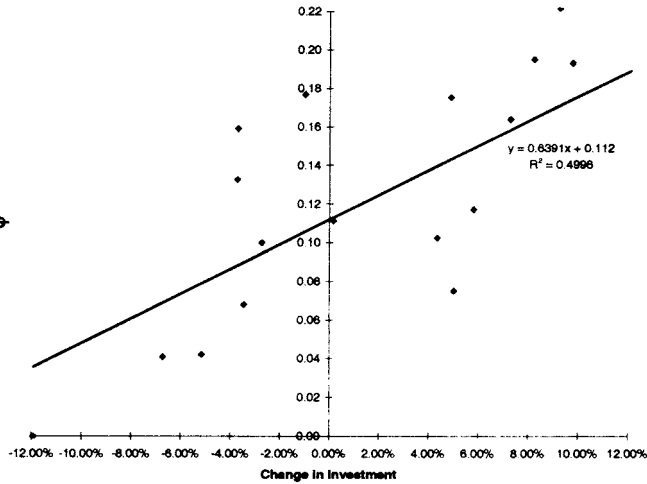


Figure 4

This figure shows the behavior of φ_t during business cycles, where φ_t is estimated from $m_{it} = [\alpha_t + \varphi_t]m_{it-1} + [1 - \alpha_t - \varphi_t]\hat{\beta}'x_{it}$ and where m_{it} is firm i 's use of publicly traded debt, α_t is estimated from the retirement and issuance data, and x_{it} is corporate attributes. The estimated φ_t is shown in Table 6.

able to distinguish the theories and to lend more support to the broad credit mechanism than to the bank-lending channel of monetary policy. Our results confirm Oliner and Rudebusch's flight to quality story, namely, that corporate attributes have a sharper impact on one's choice of lenders during recessions than in booms. On the other hand, we found that firms were more likely to use intermediated debt when interest rates are high. This is consistent with our theoretical framework, but contradicts one of the bank-lending channel's key predictions.

Can these findings shed any light on the different theories of banking? This is a difficult question because intermediaries are probably both good screeners and reorganizers. Furthermore, firms where default is likely and costly probably suffer ex ante agency problems as well, that is, are companies where unmonitored managers will choose projects that are detrimental to creditors or to outside shareholders. One can confront these two theories with the fact that corporate attributes are more critical in recessions than in booms. Those who believe that banks are good screeners rather than good reorganizers would need to make two separate points: they need to argue that agency problems worsen more dramatically among, "bad" firms than among "good" corporations in downturns, which is plausible. They would also have to argue that these agency problems arise not from ex post behavior in the face of corporate distress (asset substitution, underinvestment, looting, etc.) but

from some ex ante problem unrelated to corporate failure, which is implausible. It is implausible because one of the most inescapable facts of recessions is the increase in corporate default rates. We think that a reorganizational theory of banking can explain the facts more simply: one could argue that default probabilities increase unevenly in recessions, that is, that downturns are more damaging to weak companies than to high-grade corporations. An uneven increase in default rates accentuates each of the lenders' comparative advantages, so that previously borderline borrowers are now clearly sorted out.¹¹ One can also test the two theories of banking by looking at companies with few ex ante incentive misalignments but high ex post reorganization costs. Family firms could be one such case: their ex ante incentives seem well aligned with those of outside equity holders and debtholders, since families normally own a large stake in the company they control [Jensen and Meckling (1976)] and dread the nonpecuniary effects of bankruptcy. One could also make a similar argument for closely held corporations. Ceteris paribus, closely held or family controlled firms are less likely to need banks if all that mattered was their screening ability. Nevertheless, we find that the effect goes the other way.

3.2.3 Entry and exit into publicly traded debt markets. This section explores why companies enter and exit the markets for publicly traded debt asymmetrically, that is, why a firm does not abandon the public debt markets until its attributes have deteriorated well past the point at which it joined these markets. We argue that this happens because after joining the public debt markets, a firm permanently reduces informational asymmetries, lowering intervention costs and blunting banks' comparative advantage at extracting hidden information.

An alternative account for asymmetric entry and exit is based on a strategic refinancing argument: this argument says that a firm issues bonds if its attributes cross a threshold; such a corporation would then lock in a certain coupon rate. Suppose now that the company's attributes deteriorate: while it is true that bank loans are cheaper than issuing new bonds, the cheapest source of funds are the mispriced old bonds. This induces the firm to stay in the bond market even after its attributes have deteriorated past the entry threshold. We try to rule this story out by analyzing bond *issues* rather than bond *levels*, and by looking at the commercial paper market, whose short-term nature precludes any explanation based on strategic refinancing, since all redemptions take place within a year.

¹¹ Another way of understanding this explanation is by noting that an improvement in attributes increases a firm's survival rate more dramatically in recessions than in booms; this possibly raises the demand for timely interventions if firms begin to misbehave (i.e., to gamble, to underinvest, to loot), but which is not to be confused with ex ante screening.

To develop the econometric framework, we use accounting identities to link levels and issues of long-term debt as follows:

$$D_{it}^{\bar{\theta}} \equiv \tilde{\alpha}_{it}^{\bar{\theta}} D_{it-1}^{\bar{\theta}} + I_{it}^{\bar{\theta}}$$

$$D_{it}^{\theta} \equiv \tilde{\alpha}_{it}^{\theta} D_{it-1}^{\theta} + I_{it}^{\theta},$$

where $D_{it}^{\bar{\theta}}$ is firm i 's bonds outstanding at time t , $1 - \tilde{\alpha}_{it}^{\bar{\theta}}$ is firm i 's bond retirement rate at time t , and $I_{it}^{\bar{\theta}}$ is firm i 's new issues of bonds at time t . Bank loans behave analogously. We assume different rates of retirement for bonds and bank loans, but hold these retirement rates fixed across companies and time, so $\tilde{\alpha}_{it}^{\bar{\theta}} = \tilde{\alpha}^{\bar{\theta}}$ and $\tilde{\alpha}_{it}^{\theta} = \tilde{\alpha}^{\theta}$. We calculated the median bond retirement rate from corporations which only had bonds outstanding. This retirement rate was 0.0393, implying that a typical bond has a maturity of 25.5 years. The median retirement rate for intermediated debt, which we constructed analogously, was 0.1318. This implies that privately held obligations have a maturity of 7.6 years. We estimated the issuance of different debt instruments, $I_{it}^{\bar{\theta}}$ and I_{it}^{θ} , by using data on the outstanding debt, the above retirement rates and accounting identities: we then estimated the demand for bonds $\hat{h}(x_{it})$ as follows:

$$\hat{h}_{it} = \begin{cases} 0 & \text{if } I_{it}^{\bar{\theta}} < I_{it}^{\theta} & \text{bank loans are issued} \\ 1 & \text{if } I_{it}^{\bar{\theta}} \geq I_{it}^{\theta} & \text{bonds are issued.} \end{cases}$$

In the theoretical section we assumed that firms issue either bank or bond debt. This turns out to be a good approximation of reality, since only 12% of the observations had a positive number of issues of both securities. For short-term debt, an excellent indicator of h_{it} is whether a firm has a commercial paper rating or not. A firm will have a rating only if it has some commercial paper outstanding; this is possible only if the firm issued such an obligation during the year. Thus $\hat{h}_{it} = 1$ if the firm has a commercial paper rating, and $\hat{h}_{it} = 0$ if it has no such rating.

We assume that the decision function is imperfectly observed, so that the true variable is $d(x_{it}, \hat{h}_{it-1}) + \epsilon_{it}$, where ϵ_{it} is a mean zero error with a normal distribution $G(\cdot)$. We also assume that arm's length investors have a greater advantage if all else is held equal and a firm had previous access to the public debt markets, so $d(x; \text{previous exposure}) > d(x; \text{no exposure})$. More concretely, we define $d(x_{it}, 0) \equiv d(x_{it})$ and $d(x_{it}, 1) \equiv d(x_{it}) + c$, with $c > 0$. Thus a company with recent exposure to the public debt markets ($h_{it-1} = 1$) remains in these markets with probability $G(c + d(x_{it}))$, while a firm with identical attributes x_{it} but without previous exposure to the public debt markets ($h_{it-1} = 0$) joins them with probability $G(d(x_{it})) < G(c + d(x_{it}))$. Likewise, a company with previous exposure to the public debt markets

leaves them with probability $G(-c - d(x_{it}))$, while an identical firm without such exposure remains out of these markets with probability $G(-d(x_{it})) > G(-c - d(x_{it}))$. The log likelihood is given in Equation (10), assuming $d(x_{it}) = \beta'x_{it}$.

$$\begin{aligned} \log(L_{it}) = & [1 - \hat{h}_{it-1}] [1 - \hat{h}_{it}] \log[G(-\beta'x_{it})] \\ & + [1 - \hat{h}_{it-1}] \hat{h}_{it} \log[G(\beta'x_{it})] \\ & + \hat{h}_{it-1} [1 - \hat{h}_{it}] \log[G(-c - \beta'x_{it})] \\ & + \hat{h}_{it-1} \hat{h}_{it} \log[G(c + \beta'x_{it})] \end{aligned} \quad (10)$$

Table 7 shows the estimates of the maximum likelihood estimation, which is identical to a probit with a lagged dependent variable. Apart from the coefficient on tangible assets, which is not significant, all parameter estimates conform with the CSV model's predictions. Moreover, corporate governance variables have the same sign as in the lagged dependent variable regressions, with the family firm dummy and

Table 7
Entry-exit to bond market: old dataset, 1975–1992

Estimation method	Maximum likelihood	Maximum likelihood
No. of observations	5516	5516
Constant	-12.7564*	-13.0853*
	(2.6816)	(-2.7963)
Size	0.3433*	0.2822*
	(0.0174)	(0.0213)
Cash flow	5.7916*	3.6669*
	(1.6976)	(1.7598)
Industry profitability	12.3364*	15.1881*
	(5.3777)	(5.5635)
Industry risk	-2.9762	-10.2025
	(14.5098)	(15.0420)
Tangible assets	-0.1177	0.0028
	(0.1993)	(0.2026)
Real interest rate	-2.8166*	-3.2087*
	(1.6011)	(1.6188)
Financial int. earnings	-0.6418*	-0.6907*
	(0.1881)	(0.1900)
Family controlled		-0.1226*
		(0.0572)
Large shareholders		-0.1851
		(0.1207)
Institutional investors		0.8797*
		(0.1631)
Age		0.0002
		(0.0009)
c (asymmetric threshold)	0.9832*	0.9413*
	(0.0581)	(0.0585)

This table shows the results of maximizing the likelihood in Equation (10) for bond market issues. The parameter c measures the asymmetry of entry and exit into the bond markets; the other variables are explained in Table 1. Standard errors are in parentheses, and * means that the regressor is significantly different from zero at the 5% level.

Table 8
Entry-exit to commercial paper market: new dataset, 1986–1992

Estimation method	Maximum likelihood
No. of observations	20,888
Constant	– 3.2907* (1.1884)
Size _{<i>t</i>}	0.3335* (0.0251)
Cash flow _{<i>t</i>}	4.8223* (1.2380)
Industry profitability	– 7.6024* (2.5278)
Industry risk	7.7158 (10.4276)
Tangible assets _{<i>t</i>}	0.4810* (0.2268)
Real interest rate _{<i>t</i>}	0.0389 (0.0323)
Financial int. earnings _{<i>t</i>}	– 1.3427* (0.4467)
<i>c</i> (asymmetric threshold)	3.8819* (0.0873)

This table shows the results of maximizing the likelihood in Equation (10) for commercial paper issues. The parameter *c* measures the asymmetry of entry and exit into the bond markets; the other variables are explained in Table 1. Standard errors are in parentheses, and * means that the regressor is significantly different from zero at the 5% level.

the concentration of institutional investors becoming statistically significant. The constant *c* was positive as predicted by the model, so firms will continue to use publicly traded debt even after their attributes have dropped below the entry threshold.

Table 8 displays the same estimates for commercial paper. The table shows that firms with large sales or high cash flows are more likely to issue commercial paper. Note that industry profitability has the opposite effect to the one predicted by the theory, while tangible assets become significant in the direction predicted by the theory. Again, the constant *c* was positive, as predicted by the model.

To appraise these results, Figure 5 plots the probability of issuing commercial paper depending on a firm’s recent history. Companies are ordered by improving attributes in the *x*-axis. The bottom line shows the likelihood $G(d(x_0))$ of issuing commercial paper, assuming that a firm had no exposure to the commercial paper market the previous year. The upper line displays the probability $G(d(x_0) + c)$ of issuing commercial paper for a firm with identical attributes, but with previous exposure to the commercial paper market. Figure 5 shows that once a firm has entered the commercial paper market, it is likely to stay there even after its attributes have deteriorated well below the entry threshold, and that history is enormously important in determining a firm’s choice of lenders.

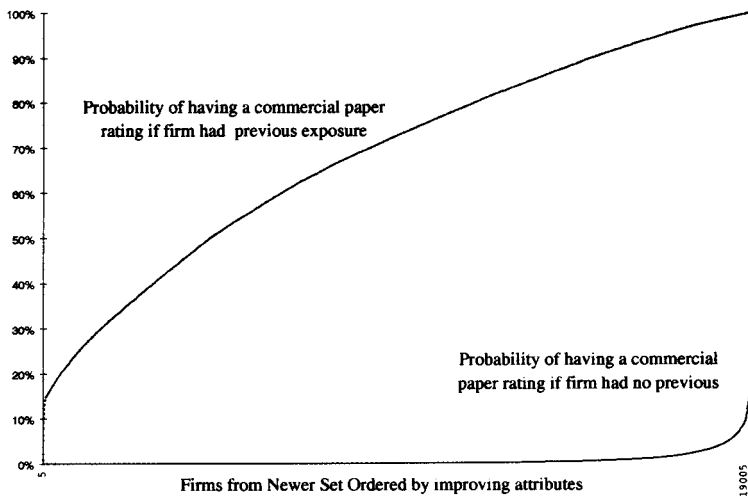


Figure 5
This figure shows the probability of having a commercial paper rating depending on whether a firm was or was not in the market the previous year.

The above results also suggest that information is one of the key factors distinguishing intermediaries from arm's length investors. Whether you believe that banks use their superior knowledge to screen projects or to reorganize, the fact is that their informational advantage will fade once a company has exposed itself to the capital markets for the first time.

4. Conclusion

We have developed a theoretical model that seems to explain accurately how firms select their lenders. The model is based on the simple insight that publicly traded and privately held debt have advantages that dominate in different situations. The advantage of privately held debt is that it allows for less damaging intervention in distress. Publicly traded obligations offer the security directly to arm's length investors; this factor is especially valuable when a firm is less likely to default, that is, when the services of the middleman are less needed. Those attributes that make a firm less likely to default (high and stable cash flows, high profitability, low real interest rates) or reduce the cost of failure (size, ample collateral, low entrenchment) induce companies to tap the public debt markets directly. The evidence presented in this article broadly supports this mode of analysis. We found that the same factors induce firms to choose commercial paper and corporate bonds. This shows that

the distinction of publicly traded and privately placed debt is economically relevant at the short and long end of the maturity spectrum.

Our empirical work uncovered other results worth mentioning. We discovered that the determinants of lender choice are most crucial during investment downturns, suggesting that there is a flight to quality during those periods. This, together with our results on the effect of interest rates on lender choice, supports a broad credit channel theory of how monetary policy affects real economic activity.

We also showed that once a firm has entered the markets for publicly traded debt, it will stay there even after its attributes have fallen well below the original entry threshold. This result implies that superior information to screen or reorganize projects is one of the key advantages that intermediaries have. To investigate the relative explanatory power of these two bank activities (to screen or to reorganize) we looked at closely held corporations and family firms; these companies have strong ex ante incentives to choose good projects, although they may be difficult to deal with in financial distress. The screening theory of banking suggests that, ceteris paribus, closely held or family firms are less likely to borrow from intermediaries, while we found the opposite result. This finding suggests that banks' informational advantage over arm's length investors is best captured by a theory that sees banks as reorganizers rather than as project screeners.

Appendix

Before we begin the proofs, let us redefine the lenders economic profit as

$$\begin{aligned} U(x; \theta, b) &= \mu b[1 - F(b)] + [1 - \theta\delta(x)] \int_0^b \mu s f(s) ds - [1 - e][r_f + \pi(x; \theta)] \\ &= \mu \int_0^b [1 - F(s)] J(x; s, \theta) ds - [1 - e][r_f + \pi(x; \theta)], \end{aligned}$$

where $J(x; s, \theta) \equiv 1 - \theta\delta(x)s\rho(s)$ is the so-called virtual surplus that is widely used in mechanism design. We will identify an increase in risk in the manner of Rothschild and Stiglitz (1970), so $\int_{-\infty}^k F_\sigma(s; x) ds > 0$ and $\int_{-\infty}^{\infty} F_\sigma(s; x) ds = 0$, plus $\rho_\sigma(s) > 0$.

We will also state and prove a lemma that relates the existence of a lending equilibrium and the value of the dual of the lenders maximization problem, defined below:

$$M(x; \theta) \equiv \max_b \left[\begin{array}{l} U(x; \theta, b) \\ s.t. V(x; b) \geq 0 \end{array} \right].$$

Let us also define $b_u(x; \theta)$ as the point where the lender's utility attains a maximum, that is, where $U_b(x; \theta, b_u) \equiv 0$. The existence and uniqueness of $b_u(x; \theta)$ will be shown in the main proof.

Lemma 1. $x \in S(\theta)$ if and only if $M(x; \theta) \geq 0$.

Proof. (i) If $M(x; \theta) < 0$, investor θ can never break even from lending to a firm with attributes x . This implies that no lending takes place, so $x \notin S(\theta)$. (ii) If $M(x; \theta) > 0$,

there exists a profit maximizing rate b^* satisfying the following properties: $b^* \leq b_u(x; \theta)$, $U(x; \theta, b^*) > 0$ and $V(x; b^*) \geq 0$. We claim that $U(x; \theta, b) < 0$ for all $b < [1 - e]r_f/\mu$; to see this, rewrite Equation (3):

$$U(x; \theta, b) = [1 - F(b)][\mu b - (1 - e)r_f] + \int_0^b [\mu s - (1 - e)r_f]f(s) ds - \theta \delta(x) \int_0^b s f(s) ds - (1 - e)\pi(x; \theta).$$

Since the first and second terms of this equation are negative for $b < [1 - e]r_f/\mu$, and the last two terms are always negative, we establish our claim. By the intermediate value theorem there exists a unique point $b \in ([1 - e]r_f/\mu, b^*)$, where $U(x; \theta, b) = 0$. Since the entrepreneurs' utility rises as b falls, their participation constraint is satisfied at b , for $V(x; b) > V(x; b^*) \geq 0$. Thus we have $x \in S(\theta)$. (iii) If $M(x; \theta) = 0$, one can verify that the b^* , which solves the maximization, also satisfies the definition of equilibrium and thus $x \in S(\theta)$. ■

A.1 Proof of Proposition 1

A) If $(x_i, x_{-i}) \in S(\theta)$, then all $(x'_i, x_{-i}) \in S(\theta)$, where x'_i satisfies $(x'_i - x_i)U_{x_i} \geq 0$.

Proof. We will show that the maximal payoff is monotonic in its arguments with $\text{sgn}(M_{x_i}) = \text{sgn}(U_{x_i})$. Define the maximal lender payoff as

$$M(x; \theta) = \max_{b \in P(x)} U(x; \theta, b)$$

$$P(x) = \left\{ b: V(x; b) \equiv \mu \int_b^\infty [s - b]f(s) ds - er_f \geq 0 \right\} = \{b: b \leq b_v(x)\},$$

where $b_v(x)$ is defined by $V(x; b_v) \equiv 0$. Since $U(x; \theta, b)$ is quasi-concave with respect to b , we solve this as a Lagrange multiplier problem:

$$L = U(x; \theta, b) + \lambda [b_v(x) - b]$$

$$L_b = U_b(x; \theta, b) - \lambda = [1 - F(b)]J(x; b, \theta) - \lambda = 0$$

$$L_\lambda = b_v(x) - b \geq 0 \quad \lambda \geq 0$$

$$\lambda L_\lambda = 0.$$

If $L_\lambda > 0$, we have an unconstrained problem, and hence $U_b(x; \theta, b_u) = 0 \Rightarrow J(x; b_u, \theta) \equiv 0$. The existence of a unique unconstrained maximization rate $b_u(x; \theta)$ hinges on the increasing hazard rate property. We find that $\partial b_u/\partial x_i > 0$ for $x_i = v, z, \sigma$ and $\partial b_u/\partial \theta < 0$ using the implicit function proposition. If $L_\lambda = 0$, entrepreneurs' participation constraint is binding and the solution to the problem is b_v , where $V(x; b_v) \equiv 0$. We find that $\partial b_v/\partial x_i > 0$ for $x_i = \mu, \sigma$ and $\partial b_v/\partial x_i < 0$ for $x_i = e, r_f$ using the implicit function proposition. The constrained maximization rate b^* is given in Equation (A.1); we apply this to look at the derivatives of the dual $M(x; \theta) \equiv U(x; \theta, b^*)$:

$$b^*(x; \theta) = \min[b_v(x), b_u(x; \theta)] \tag{A.1}$$

$$M_{x_i}(x; \theta) = U_{x_i}(x; \theta, b^*) + U_b(x; \theta, b^*) \frac{db^*}{dx_i}. \tag{A.2}$$

When $b^* = b_u$ the second argument of Equation (A.2) is zero (this is an application of the envelope proposition) and thus $M_{x_i} = U_{x_i}$. We need to show that $\text{sgn}(M_{x_i}) = \text{sgn}(U_{x_i})$ when the participation constraint is binding ($b^* = b_v$). To use this constraint we exploit

Table A.1
Partial derivatives of payoff functions

Argument x_i	$U_{x_i}(x; \theta, b)$	$V_{x_i}(x; \theta, b)$
b	$\mu[1 - F(b; x)]J(x; b, \theta)$	$-\mu[1 - F(b)] < 0$
v	$-\mu\theta\delta_v(x)\int_0^b sf(s; x) ds > 0$	0
e	$[r_f + \pi(x; \theta)] > 0$	$-r_f < 0$
z	$-\mu\theta\delta_z(x)\int_0^b sf(s; x) ds > 0$	0
μ	$\int_0^b [1 - F(s; x)]J(x; s, \theta) ds > 0$	$\int_0^b [1 - F(s; x)] ds > 0$
σ	$-\mu\int_0^b [F_\sigma(s; x)J(x; s, \theta) + \theta\delta(x)s\rho_\sigma(s)[1 - F(s; x)]] ds < 0^1$	$-\mu\int_0^b F_\sigma(s; x) ds > 0$

the fact that $V(x; b_v) \equiv 0$ to use the implicit function proposition

$$U_b(x; \theta, b^*) \frac{db^*}{dx_i} = \mu[1 - F(b)]J(x; b, \theta) \left[\frac{-V_{x_i}}{V_b} \right] = [1 - \theta\delta(x)b\rho(b)]V_{x_i}$$

$$M_{x_i}(x; \theta) = U_{x_i}(x; \theta, b^*) + J(x; b, \theta)V_{x_i}(x; \theta, b^*).$$

When $b^* = b_v < b_u$ we have that $U_b(x; \theta, b^*) > 0 \Rightarrow J(x; b, \theta) > 0$. This fact and the derivatives in Table A.1 imply that $\text{sgn}(M_{x_i}) = \text{sgn}(U_{x_i})$, and thus $M(x; \theta)$ is a monotonic function of its arguments x . Hence if $M(x_i, x_{-i}; \theta) \geq 0$, then $M(x'_i, x_{-i}; \theta) \geq 0$ for all x'_i satisfying $(x'_i - x_i)U_{x_i} \geq 0$. This result and Lemma 1 proves Proposition 1(i). ■

B) $S(\bar{\theta}) \subset S(\underline{\theta})$, if $\pi(x; \underline{\theta}) \leq [\bar{\theta} - \underline{\theta}]\delta(\underline{v}, \underline{z})\int_0^{\hat{b}} sf(s; x) ds$, \hat{b} as defined in Equation (A.5).

Proof. First we write the difference in payoffs if both lenders charge the same rate, $b^*(x; \bar{\theta})$ —defined in Equation (A.1)—that maximizes bondholders' economic payoff for $\forall x \in S(\bar{\theta})$:

$$U(x; \underline{\theta}, b^*) - U(x; \bar{\theta}, b^*)$$

$$= \mu[\bar{\theta} - \underline{\theta}]\delta(x)\int_0^{b^*(x; \bar{\theta})} sf(s; x) ds - [1 - e]\pi(x; \underline{\theta}) \geq 0. \quad (\text{A.3})$$

The assumption that the intermediaries are better off at the profit maximizing rate is true if the following conditions are satisfied:

$$\pi(x; \underline{\theta}) \leq [\bar{\theta} - \underline{\theta}]\delta(\underline{v}, \underline{z})\int_0^{\hat{b}} sf(s; x) ds \leq \mu[\bar{\theta} - \underline{\theta}]\delta(x)\frac{\int_0^{b^*(x; \bar{\theta})} sf(s; x) ds}{[1 - e]} \quad (\text{A.4})$$

$$\hat{b} \equiv \min\left[b_v(\underline{\mu}, \underline{\sigma}, \bar{e}, \bar{r}_f), b_u(\underline{v}, \underline{z}, \underline{\sigma}; \bar{\theta})\right] \leq b^*(x; \bar{\theta}). \quad (\text{A.5})$$

The inequalities in Equations (A.4) and (A.5) follow from $\mu > 1, \partial b_v/\partial x_i > 0$ for $x_i = \mu, \sigma, \partial b_u/\partial x_i < 0$ for $x_i = e, r_f$, and $\partial b_u/\partial x_i > 0$ for $x_i = v, z, \sigma$. Equation (A.3) implies that $M(x; \theta) \geq U(x; \underline{\theta}, b^*(\bar{\theta})) \geq U(x; \bar{\theta}, b^*(\bar{\theta})) \equiv M(x; \bar{\theta}) \forall x \in S(\bar{\theta})$. This result and Lemma 1 prove Proposition 1 (ii). ■

C) Equilibrium rates $b(x; \theta)$ satisfy $\text{sgn}\left(\frac{d^2b}{dx_i d\theta}\right) = \text{sgn}(b_{x_i}) = \text{sgn}(-U_{x_i})$.

Proof. At the equilibrium bankruptcy $b(x; \theta), U(x; \theta, b) \equiv 0$. From our discussion in Lemma 1, the equilibrium satisfies $b(x; \theta) < b_u(x; \theta)$; thus $J(x; b, \theta) > J(x; b_u, \theta) \equiv 0$ and thus $U_b(x; \theta, b) = \mu[1 - F(b)]J(x; b, \theta) > 0$. We assume that we are at a crossing

point, so $b_\theta(x; \theta) = 0$; this assumption implies:

$$\frac{db(x; \theta)}{d\theta} = -\frac{U_\theta(x; b, \theta)}{U_b(x; \theta, b)} = 0 \Rightarrow U_\theta(x; b, \theta) = 0 \tag{A.6}$$

$$U_\theta(x; b, \theta) = -\mu\delta(x)\int_0^b sf(s)ds - (1 - e)\pi_\theta(x; \theta) = 0.$$

Given that there is a crossing point, we will prove that it is unique. First, use the implicit function proposition to obtain b_{x_i} ; then use $U_{b\theta} = -\mu[1 - F(b)]\theta\delta(x)b\rho(b) < 0$:

$$\frac{db}{dx_i} = -\frac{U_{x_i}(x; \theta, b)}{U_b(x; \theta, b)} \Rightarrow \text{sgn}(b_{x_i}) = \text{sgn}(-U_{x_i}) \tag{A.7}$$

$$\frac{d^2b}{dx_i d\theta} = \frac{U_{x_i}U_{b\theta} - U_bU_{x_i\theta}}{U_b^2} = -\frac{\delta(x)b\rho(b)U_{x_i} + J(x; b, \theta)U_{x_i\theta}}{\mu[1 - F(b)][J(x; b, \theta)]^2}. \tag{A.8}$$

For $x_i = r_f, \phi$, we have $U_{x_i\theta} = 0$, so Equation (A.8) reduces to

$$\frac{d^2b}{dx_i d\theta} = -\frac{\delta(x)b\rho(b)U_{x_i}}{\mu[1 - F(b)][J(x; b, \theta)]^2} \Rightarrow \text{sgn}\left(\frac{d^2b}{dx_i d\theta}\right) = \text{sgn}(-U_{x_i}).$$

For $x_i = v, z$, we have $\theta U_{x_i\theta} = U_{x_i}$, so Equation (A.8) simplifies to

$$\frac{d^2b}{dx_i d\theta} = -\frac{U_{x_i}}{\theta\mu[1 - F(b)][J(x; b, \theta)]^2} \Rightarrow \text{sgn}\left(\frac{d^2b}{dx_i d\theta}\right) = \text{sgn}(-U_{x_i}).$$

For $x_i = \mu, \sigma$, we have

$$\begin{aligned} \frac{d^2b}{d\mu d\theta} &= -\frac{\delta(x)\int_0^b [1 - F(s; x)][b\rho(b) - s\rho(s)]ds}{\mu[1 - F(b; x)][J(x; b, \theta)]^2} < 0 \\ \frac{d^2b}{d\sigma d\theta} &= \frac{\delta(x)\int_0^b [(b\rho(b) - s\rho(s))F_\sigma(s) + s\rho_\sigma(s)[1 - F(s)]]ds}{[1 - F(b)][J(x; b, \theta)]^2} > 0. \end{aligned}$$

Thus $b_{\mu\theta} < 0, b_{\sigma\theta} > 0, \text{sgn}(b_{x_i\theta}) = \text{sgn}(-U_{x_i})$. For $x_i = e$, Equation (A.8) reduces to

$$U_e(x; b, \theta) = (r_f + \pi) = \frac{\mu\int_0^b [1 - F(s; x)]J(x; s, \theta)ds}{1 - e} \tag{A.9}$$

$$U_{e\theta}(x; b, \theta) = \pi_\theta(x; \theta) = -\frac{\mu\delta(x)\int_0^b sf(s)ds}{1 - e} \tag{A.10}$$

$$\begin{aligned} \frac{d^2b}{ded\theta} &= \frac{\delta(x)b\rho(b)[r_f + \pi] + J(x; b, \theta)\pi_\theta(x; \theta)}{\mu[1 - F(b)][J(x; b, \theta)]^2} \\ \frac{d^2b}{ded\theta} &= \frac{\delta(x)[b\rho(b)\int_0^b [1 - F(s)]J(x; s, \theta)ds - J(x; b, \theta)\int_0^b sf(s)ds]}{(1 - e)[1 - F(b)][J(x; b, \theta)]^2} \\ \frac{d^2b}{ded\theta} &= \frac{\delta(x)\int_0^b [1 - F(s)][b\rho(b)J(x; s, \theta) - s\rho(s)J(x; s, \theta)]}{(1 - e)[1 - F(b)][J(x; b, \theta)]^2} \\ \frac{d^2b}{ded\theta} &= \frac{\delta(x)\int_0^b [1 - F(s)][b\rho(b) - s\rho(s)]}{(1 - e)[1 - F(b)][J(x; b, \theta)]^2} < 0. \end{aligned}$$

Thus $\text{sgn}(b_{e\theta}) = \text{sgn}(-U_e)$. These cases establish the single crossing property condition. ■

B.1 Proof of Proposition 2

Assume $U_b(x; \bar{b}, \bar{b}) > 0$. In that case $h(x) = 0$ if $d(x) < 0$ and $h(x) = 1$ if $d(x) > 0$ for all $x \in S(\underline{\theta})$. $d_{x_i}(x; b) > 0$ for $x_i = z, v, e, \mu$ and $d_{x_i}(x; b) < 0$ for $x_i = \sigma, r_f, \phi$.

Proof. We will go by cases to prove the relationship of $h(x)$ and $d(x)$:

A) $x \in S(\underline{\theta})/S(\bar{\theta})$. (i) Since $x \in S(\underline{\theta})$ there exists a $\underline{b}(x; \underline{\theta})$ where $U(x; \underline{\theta}, \underline{b}(x; \underline{\theta})) = 0$ and $V(x; \underline{b}(x; \underline{\theta})) > 0$. (ii) Using Lemma 1 and the fact that $x \notin S(\bar{\theta})$, then any b such that $V(x; b) > 0$ implies that $U(x; \bar{\theta}, b) < 0$. (iii) Since at the equilibrium rate $\underline{b}(x; \underline{\theta})$ we have $V(x; \underline{b}(x; \underline{\theta})) > 0$, it then follows from (ii) that $U(x; \bar{\theta}, \underline{b}(x; \underline{\theta})) < 0$. Hence $d(x) < 0$ from Equation (4). (iv) Since firms cannot borrow from bondholders then we have $h(x) = 0$.

B) $x \in S(\underline{\theta}) \cap S(\bar{\theta})$. An equilibrium rate exists for both lender types. (i) The bank lending rate $\underline{b}(x; \underline{\theta})$ satisfies $\underline{b}(x; \underline{\theta}) < b^*(x; \underline{\theta}) \equiv \min[b_u(x; \underline{\theta}), b_l(x; \underline{\theta})]$, where $b_u(x; \underline{\theta})$ is defined in Equation (A.1). (ii) Proposition 1(i) shows that $U(x; \bar{\theta}, b)$ attains its peak at $b_u(x; \bar{\theta})$. (iii) A consequence of the assumption that $U_b(x; \bar{\theta}, \bar{b}) > 0$ is that $\underline{b}(x; \underline{\theta}) < b_u(x; \bar{\theta})$. Facts (i) and (iii) imply that $\underline{b}(x; \underline{\theta}) < b^*(x; \bar{\theta}) \equiv \min[b_u(x; \bar{\theta}), b_l(x; \bar{\theta})]$.

$d(x) < 0$ implies that $U(x; \bar{\theta}, b) < 0$. (i) Further, $U(x; \bar{\theta}, b) < 0$ for all $b < \underline{b}$ since $U_b(x; \bar{\theta}, b) > 0$ for all $b < \underline{b} < b_u(x; \bar{\theta})$. (ii) Since there exists an equilibrium for bondholders, Lemma 1 implies that $U(x; \bar{\theta}, b^*(x; \bar{\theta})) > 0$. (iii) The equilibrium rate for bondholders is $b(x; \bar{\theta}) \in (b(x; \underline{\theta}), b^*(x; \bar{\theta}))$ by the intermediate value theorem. Fact (iii) says that the equilibrium bank rates are lower than the equilibrium bond rates, $b(x; \underline{\theta}) < b(x; \bar{\theta})$ and companies borrow from banks [i.e., $h(x) = 0$].

$d(x) > 0$ implies that $U(x; \bar{\theta}, b(x; \underline{\theta})) > 0$. (i) From the discussion in Lemma 1, we know that $U(x; \bar{\theta}, b) < 0$ for $b < [1 - e]r_f/\mu$. (ii) Thus $b(x; \bar{\theta}) \in ([1 - e]r_f/\mu, b(x; \underline{\theta}))$ by the intermediate value theorem. Fact (ii) says that the equilibrium bond rates are lower than the equilibrium bank rates, $b(x; \bar{\theta}) < b(x; \underline{\theta})$ so firms borrow from bondholders [i.e., $h(x) = 1$]. These cases prove the relationship between $h(x)$ and $d(x)$. Regarding the partial derivatives, we find that

$$\begin{aligned} d(x) &= \frac{U(x; \underline{b}, \bar{\theta})}{1 - e} = \frac{\mu \int_0^{\underline{b}} [1 - F(s; x)] J(x; s, \bar{\theta}) ds}{1 - e} - r_f \\ &= \pi(x; \underline{\theta}) - \frac{[\bar{\theta} - \underline{\theta}] \mu \delta(x) \int_0^{\underline{b}} sf(s; x) ds}{1 - e}. \end{aligned}$$

For $x_i = v, z, \phi, r_f, \mu, \sigma$, the derivative of Equation (4) reduces to

$$\begin{aligned} d_{x_i}(x) &= \frac{1}{1 - e} \left[U_{x_i}(x; \underline{b}, \bar{\theta}) + U_b(x; \underline{b}, \bar{\theta}) \frac{d\underline{b}}{dx_i} \right] \\ &= \frac{1}{1 - e} \left[U_{x_i}(x; \underline{b}, \bar{\theta}) - U_b(x; \underline{b}, \bar{\theta}) \frac{U_{x_i}(x; \underline{b}, \underline{\theta})}{U_b(x; \underline{b}, \underline{\theta})} \right] \\ d_{x_i}(x) &= \frac{1}{[1 - e]J(x; \underline{b}, \underline{\theta})} \left[J(x; \underline{b}, \underline{\theta}) U_{x_i}(x; \underline{b}, \bar{\theta}) - J(x; \underline{b}, \bar{\theta}) U_{x_i}(x; \underline{b}, \underline{\theta}) \right] \\ d_v(x) &= - \frac{[\bar{\theta} - \underline{\theta}] \mu \delta_v(x)}{[1 - e]J(x; \underline{b}, \underline{\theta})} \int_0^{\underline{b}} sf(s) ds > 0 \\ d_z(x) &= - \frac{[\bar{\theta} - \underline{\theta}] \mu \delta_z(x)}{[1 - e]J(x; \underline{b}, \underline{\theta})} \int_0^{\underline{b}} sf(s) ds > 0 \end{aligned}$$

$$d_\phi(x) = \frac{J(x; \underline{b}, \bar{\theta})}{J(x; \underline{b}, \underline{\theta})} \pi_\phi(x; \underline{\theta}) < 0 \quad d_{r_f}(x) = -\frac{[\bar{\theta} - \underline{\theta}] \delta(x) \underline{b} \rho(\underline{b})}{J(x; \underline{b}, \underline{\theta})} < 0$$

$$d_\mu(x) = \frac{[\bar{\theta} - \underline{\theta}] \delta(x)}{[1 - e] J(x; \underline{b}, \underline{\theta})} \left[\int_0^{\underline{b}} [\underline{b} \rho(\underline{b}) - s \rho(s)] [1 - F(s; x)] ds \right] > 0$$

$$d_\sigma(x) = \frac{-[\bar{\theta} - \underline{\theta}] \mu \delta(x)}{[1 - e] J(x; \underline{b}, \underline{\theta})} \int_0^{\underline{b}} [[\underline{b} \rho(\underline{b}; x) - s \rho(s; x)] F_\sigma(s; x) + s \rho_\sigma(s) [1 - F(s)]] ds < 0.$$

Given our assumptions on stochastic dominance [i.e., that $\int_0^k F_\sigma(s) ds > 0$, $\rho_\sigma(s) > 0$], it is clear that $d_\sigma(x) < 0$. For $x_i = e$, the derivative of the $d(x)$ —after using the fact that $U(x; \underline{\theta}, \underline{b}) = 0$ —reduces to

$$d_e(x) = \frac{[\bar{\theta} - \underline{\theta}] \delta(x)}{[1 - e]^2 J(x; \underline{b}, \underline{\theta})} \left[\underline{b} \rho(\underline{b}) (1 - e) [r_f + \pi(x; \underline{\theta})] - \mu J(x; \underline{b}, \underline{\theta}) \int_0^{\underline{b}} s f(s) ds \right]$$

$$d_c(x) = \frac{[\bar{\theta} - \underline{\theta}] \mu \delta(x)}{[1 - e]^2 J(x; \underline{b}, \underline{\theta})} \int_0^{\underline{b}} [[1 - F(s)] \underline{b} \rho(\underline{b}) J(x; s, \theta) - J(x; \underline{b}, \underline{\theta}) s f(s)] ds$$

$$d_e(x) = \frac{[\bar{\theta} - \underline{\theta}] \mu \delta(x)}{[1 - e]^2 J(x; \underline{b}, \underline{\theta})} \left[\int_0^{\underline{b}} [\underline{b} \rho(\underline{b}) - s \rho(s)] [1 - F(s; x)] ds \right] > 0.$$

This finishes the proof of Proposition 2. ■

References

- Besanko, D., and G. Kanatas, 1993, "Credit Market Equilibrium with Bank Monitoring and Moral Hazard," *Review of Financial Studies*, 6, 213–232.
- Bolton, P., and D. Sharfstein, 1996, "Optimal Debt Structure and the Number of Creditors," *Journal of Political Economy*, 104, 1–25.
- Brown, D., C. James, and R. Mooradian, 1992, "Private versus Public Creditor Experience in Distressed Firm Debt Restructurings," in E. Altman (ed.), *Bankruptcy and Distressed Restructurings: Analytical Issues and Investment Opportunities*, New York University Salomon Center, Irwin, N.Y.
- Calomiris, C., C. Himmelberg, and P. Wachtel, 1994, "Commercial Paper, Corporate Finance, and the Business Cycle: A Microeconomic Perspective," Working Paper 4848, NBER, September.
- Cantillo, M., 1998, "A Theory of Corporate Capital Structure and Investment," Working Paper 255, IBER, University of California, Berkeley.
- Diamond, D., 1991, "Monitoring and Reputation: The Choice Between Bank Loans and Directly Placed Debt," *Journal of Political Economy*, 99, 689–721.
- Franks, J., and W. Torous, 1994, "A Comparison of Financial Recontracting in Distressed Exchanges and Chapter 11 Reorganizations," *Journal of Financial Economics*, 35, 349–370.
- Fudenberg, D., and J. Tirole, 1991, *Game Theory*, MIT Press, Cambridge, MA.
- Gale, D., and M. Hellwig, 1985, "Incentive-Compatible Debt Contracts: The One Period Problem," *Review of Economic Studies*, 52, 647–663.
- Gilson, S., J. Kose, and L. Lang, 1990, "Troubled Debt Restructurings: An Empirical Study of Private Reorganization of Firms in Default," *Journal of Financial Economics*, 27, 315–353.

Holmstrom, B., and J. Tirole, 1997, "Financial Intermediation, Loanable Funds and the Real Sector," *Quarterly Journal of Economics*, 112, 663–692.

Ingersoll, J., 1987, *Theory of Financial Decision Making*, Rowman & Littlefield, New York.

Jensen, M., and W. Meckling, 1976, "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure," *Journal of Financial Economics*, 3, 305–360.

Kashyap, A., J. Stein, and D. Wilcox, 1993, "Monetary Policy and Credit Conditions: Evidence from the Composition of External Finance," *American Economic Review*, 83, 78–98.

Mackie-Mason, J., 1990, "Do Firms Care Who Provides Their Financing?", in R. G. Hubbard (ed.), *Asymmetric Information, Corporate Finance and Investment*, University of Chicago Press, Chicago.

Oliner, S., and G. Rudebusch, 1996, "A Comment on Monetary Policy and Credit Conditions: Evidence from the Composition of External Finance," *American Economic Review*, 86, 300–309.

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

Rajan, R., 1992, "Insiders and Outsiders: The Choice Between Informed and Arm's-Length Debt," *Journal of Finance*, 47, 1367–1400.

Resnick, A., and B. Weintraub, 1980, *Bankruptcy Law Manual*, WG & L, Boston.

Rothschild, M., and J. Stiglitz, 1970, "Increasing Risk: I. A Definition," *Journal of Economic Theory*, 2, 225–243.

Tashjian, E., R. Lease, and J. McConnell, 1996, "An Empirical Analysis of Prepackaged Bankruptcies," *Journal of Financial Economics*, 40, 135–162.

Townsend, R., 1979, "Optimal Contracts and Competitive Markets with Costly State Verification," *Journal of Economic Theory*, 21, 265–293.

Warner, J. B., 1977, "Bankruptcy Costs: Some Evidence," *Journal of Finance*, 26, 337–348.

Wright, J., 1995, "Explaining Fluctuations in the Composition of Firms External Finance: New Tests of the Bank Lending Channel," working paper, Stanford University.