Market Conditions and Contract Design: Variations in Debt Covenants and Collateral

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Abstract

Contracts scholars have catalogued some of the rigidities that exist in contract design. Some have observed that boilerplate provisions are remarkably resistant to change, even in the face of shocks such as adverse judicial interpretations. Empirical studies of debt contracts and collateral, in contrast, suggest that covenant and collateral terms (1) are customized to the characteristics of the borrower and (2) evolve in response to changes in market conditions, such as expansion and contraction in the supply of credit. Building on the moral hazard and adverse selection theories of covenants and collateral, this essay argues that an expansion (contraction) of credit will not only lead to a decrease (increase) in interest rate but also necessitate a reduction (expansion) of covenants and collateral through lessening (worsening) the moral hazard and adverse selection problems. The essay concludes with observations about possible implications from the analysis.

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Introduction

The phenomenon of rigidity in contract design has received considerable attention in legal scholarship. For example, the learning and network benefits of standardization can impede customization and innovation in contract terms.[2] Contracting parties are reluctant to take the risk of departing from provisions that have been interpreted and enforced by the courts.[3] Moreover, institutional features of the legal profession and of law firms in particular (such as hourly billing) encourage the repeated use of standard terms, or "boilerplate."[4]

At the same time, many contract provisions—particularly, the non-boilerplate provisions—do vary significantly across parties and across time. While, for example, provisions in sovereign debt contracts might be rigid even in the face of undesirable judicial interpretation,[5] covenants in commercial debt contracts do vary considerably in their scope, intensity and tightness across borrowers of different characteristics. There is clearly a significant degree of customization and malleability in covenant patterns over time.[6]

Financial economists have advanced theories to explain customization and have tested them empirically against samples of private and public debt contracts. Borrowers and lenders tailor covenants to address information problems—adverse selection and moral hazard—that afflict their relationships. The severity of these problems and the cost of addressing them with covenants depend on the characteristics of borrower and lender in each contract. It is now well established in both finance and law scholarship that the parties do customize their covenants according to firm-specific characteristics.

A distinct issue is whether and how covenant patterns evolve over time in response to changes in macroeconomic and market conditions. Although these associations have received less attention, the studies to date suggest that GDP growth, interest rates and market competitiveness affect the choice of covenants. In this paper, we analyze the effect of changes in the supply and demand of credit on covenants, including collateral provisions.

While market participants generally understand the role of moral hazard and adverse selection in the design of covenants, their explanations seem incomplete as to why debt contracts swing over time between "covenant-lite" versions that impose

[2] See, e.g., Marcel Kahan and Michael Klausner, Standardization and Innovation in Corporate Contracting (Or "The Economics of Boilerplate"), 83 Va. L. Rev. 713 (1997).
[3] [cites]
[4] [cites]
[5] See Stephen Choi and Mitu Gulati, Innovation in Boilerplate Contracts: An Empirical Examination of Sovereign Bonds, Emory L.J. ; Mitu Gulati and Robert E. Scott, The Three and a Half Minute Transaction: Boilerplate and the Limits of Contract Design (forthcoming 2012)
[6] What constitutes contract "innovation" in this respect is open to debate.

minimal restrictions on borrowers and versions that impose tighter, more expansive covenant restrictions. Practitioners label different formulations of covenants as "lender-friendly" or "borrower-friendly." They explain the choice between these two poles in terms of the allocation of bargaining power or market power. The source of such power appears to be imbalances in market demand and supply. For example, a market is "lender-friendly" when demand for credit exceeds supply and thereby puts an upward pressure on interest rates. Practitioners suggest that this also yields "lender-friendly" covenants.

Covenant-lite deals became common through the first half of the past decade until the onset of the financial crisis in 2007, and market observers attributed this to the excess supply of credit.[7] The market for covenant-lite loans collapsed in the second half of that year and this was followed by a period of more extensive and tighter covenants during 2007-09. Reports suggested that covenant-lite deals then emerged again because of the excess supply of investment funds, at least for higher-grade borrowers.[8] The following recent explanation by a partner at law firm of Paul, Weiss is typical:

> Covenant-lite (cov-lite) loans became widespread at the top of the last credit cycle before the 2007 credit crunch. During the credit crunch, however, new cov-lite loans largely disappeared from the market because lenders had *greater market power* to reject these types of borrower-friendly deals….[S]tarting in 2010, cov-lite loans began reappearing in the syndicated loan market. Borrowers can obtain cov-lite loans because of market dynamics. At the top of the last credit cycle, there was an *oversupply of capital*, and *lenders competed* for deals from private equity sponsors and borrowers. Because there was a *greater supply* of capital than there was demand to borrow capital, borrowers had *more leverage* to

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[7] In a report by Standard & Poor's on the eve of the financial crisis in mid-2007, the ratings agency observed that "Strong loan market liquidity and the continued pace of private equity sponsored LBOs are driving a record volume of leveraged loans in 2007. Such favorable market factors, combined with growing investor demand from structured finance vehicles and hedge funds, have allowed bank facilities with weakened 'covenant-lite' loan structures to emerge as the instruments of choice for many issuers. As the volume of leveraged loans reaches an all-time high, the proportion of covenant-lite facilities has increased tremendously… It remains to be seen whether leveraged loans will revert to more traditional structures when the credit cycle turns…. There has already been some pushback so far this year as market conditions begin to soften, with certain transactions unable to get through syndication without a robust covenant package." Standard & Poor's, THE LEVERAGING OF AMERICA: COVENANT-LITE LOAN STRUCTURES DIMINISH RECOVERY PROSPECTS 2 (July 18, 2007).

[8] E.g., Kate Laughlin, Covenant-lite loans are back but investors hope to limit mistakes, Financial Times (November 24, 2010) ("today's loan market is for the most part a seller's environment where investors are flush with cash they need to put to work… [S]ome investors buying the covenant-lite deals are not solely loan investors, so in their hunt for high-yielding paper, covenant concerns are a low priority"); Michelle Sierra Laffitte, *IFR-Covenant-lite buyout loans return to US loan market*, (January 31, 2011) at http://www.cnbc.com/id/41347717 ("As the market gets hotter, companies are expected to try to reduce spreads and slash covenants in deals that were completed recently"); Michael Aneiro, Global Finance – Aleris Debt Sale: 'Covenant-Lite', Wall St. J., C3 (February 7, 2011) ("[D]emand has pushed the average junk-bond yield down to 7.01%... and has allowed issuers to water down investor protections, or covenants, that govern new offerings").

negotiate looser and more favorable terms, including cov-lite structures.[9] [emphasis added]

Such accounts of the effect of bargaining or market power on covenants are oversimplified, but common.[10] They beg the question of why lenders would not exploit their power more profitably by increasing interest rates instead of covenant protection. The link between bargaining power and lender- or borrower-friendly covenants is more complicated. We show in this paper that there is often an intermediate step: market conditions change price which in turn causes a change in covenants or collateral provisions. The key to our analysis is that changes in price do not simply alter the division of the gains from trade. When adverse selection or moral hazard issues are present, changes in price affects the severity of these problems and thereby have a significant bearing on the optimal design of covenants.

Consider the effect a higher interest rate has on the problem of adverse selection. As Stiglitz and Weiss demonstrate, an increase in the interest rate attracts a riskier pool of borrowers, including perhaps some borrowers who wish to finance projects with negative net present value.[11] This reduces the expected surplus from the loan: the rise in price can reduce the size of the surplus. The lender may be inclined to mitigate this adverse effect by adjusting the non-price terms—specifically, by strengthening the collateral or covenant provisions—to better differentiate less risky borrowers from the riskier ones. The riskier the borrower, the less willing he is to promise a broad set of covenants or pledge a large amount of collateral, because he knows that he is more likely to violate the covenants or to turn over the collateral to the lender. As the interest rate rises, the adverse selection problem gets worse and attracts even riskier borrowers, motivating the lender to further strengthen the collateral and covenant provisions.

Changing interest rates can also affect the borrower's post-borrowing behavior; in other words, it can affect the severity of the moral hazard problem. As the interest rate rises, the borrower's claim on the residual cash-flow from projects decreases. When the lender cannot directly control borrower's behavior by contract, the decrease in the residual cash-flow increases the incentive of the borrower to invest in projects with higher private benefits but with potentially negative net present value. To combat this heightened moral hazard problem and corresponding reduction in contractual surplus, the lender must adjust the covenant and collateral provisions to re-align the borrower's incentive.[12] Conversely, when the interest rate falls, the borrower's claim on the cash-flow rises, making broad covenants or large collateral less valuable.

[9] Eric Goodman, *Covenant-Lite Loans: Traits and Trends*, Practical Law The Journal 36, 37 (September 2011)

[10] We have observed elsewhere similar explanations given to representations and warranties and closing conditions in corporate acquisition agreements. Some of the information analysis in this essay may be also helpful in clarifying the connection between bargaining power and non-price terms in that context. Albert Choi and George Triantis, *The Effect of Bargaining Power on Contract Design*, Va. L. Rev. (forthcoming).

[11] Joseph E. Stiglitz and Andrew Weiss, *Credit Rationing in Markets with Imperfect Information*, 71 Am. Econ. Rev. 393 (1981).

[12] Boot, Thakor, Udell, *Secured Lending and Default Risk: Equilibrium Analysis, Policy Implications and Empirical Results*, 101 Econ. J. 458 (1991)("allowing the increase in the risk-free real interest rate to

The paper is organized as follows. In section I, we review some of the theory and empirical results concerning customization of covenants and their adjustment to macroeconomic and market changes. In section II, we focus on the relationship between market conditions, interest rates and covenants, to offer a theoretical explanation for the empirical finding associating higher interest rates with more extensive and tighter covenants. We present numerical examples showing that a higher interest rate increases the severity of the adverse selection or moral hazard problems, leading to more extensive collateral requirements. A more sophisticated model, from which the numerical examples are derived, is relegated to the appendix. Section IV offers some implications of our analysis. We suggest how our theory can be empirically distinguished from the practitioner's bargaining power story. The last section concludes with thoughts for future research.

I. Explaining Variations in Debt Covenants

A. Firm-specific Determinants and Customization

Debt covenants are promises whose breach triggers default, acceleration of principal and matured interest, and the right of the lender to enforce its claim to the accelerated debt against the assets of the borrower. Two common forms of covenants are (1) promises to take or refrain from taking specified actions (insure assets, selling assets, making distributions, borrowing, etc.) and (2) thresholds whose violation triggers default (such as debt-to-equity or other financial ratios, the initiation of litigation or regulatory action against the borrower, etc.). Covenants serve both as ex ante deterrents (in the former group) and as trip wires (particularly in the latter group) that set the conditions under which the control over assets is transferred from the borrower to the lender.[13] The finance literature treats collateral as a type of covenant, since the borrower thereby promises to turn over the collateral assets in the event of default.[14] For reasons outlined below, covenants vary along several dimensions. They may be more or less extensive in restricting greater or fewer types of borrower actions. Or, ratios may be set more or less tightly compared to the actual condition of the borrower at the time of contracting.[15]

Covenants yield benefits by addressing problems arising from the private information held by the borrower. First, restrictive covenants constrain various forms of

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translate into a higher collateral requirement rather a higher interest rate on the loan helps to reduce the agency costs of the transaction")

[13] Philipe Aghion and Patrick Bolton, *An Incomplete contracts Approach to Financial Contracting*, 59 Rev. Econ. Stud. 473 (1992); Mathias Dewatripont and Jean Tirole, *A Theory of Debt and Equity: Diversity of Securities and Manager-Shareholder Congruence*, 109 Qu. J. Econ. 1027 (1994).

[14] We follow here the convention in finance scholarship of using "covenants" in broad terms to include collateral provisions. Of course, this does not capture the importance of collateral in giving a secured creditor priority over others. However, this feature will not be a factor in our numerical analysis later in the paper because there is only one creditor. Therefore, the inter-creditor priority ranking is not implicated, only the foreclosure right of the lender.

[15] Some of the finance scholarship uses the measures of "intensity" (in relation to the restrictiveness of covenants) and "tightness" introduced by Michael Bradley and Michael R. Roberts, *The Structure and Pricing of Corporate Debt Covenants* (2004).

post-borrowing moral hazard, particularly the inefficient risk-taking incentive of the borrower.[16] Second, a borrower may agree to covenants to credibly convey private information about its prospects and future opportunities.[17] Similarly, a lender may require covenants in some of its agreements to screen its borrowers.[18] Third, covenants specify the conditions for transferring control from shareholders (and their agents) to the lenders, when the lenders are likely to have superior (but not perfect) decision-making incentives.[19]

These benefits vary with the characteristics of borrowers in many respects. Stricter covenants are more likely (as is more collateral) when there is greater information asymmetry: for example, when the borrower does not have an extensive track record.[20] They are also more likely when there is a greater concern about moral hazard: for example, when the borrower has significant latitude in decision making and heightened risk-taking incentives indicated by high leverage[21] or low credit rating.[22] In addition, the value of covenants is greater when the lender is a skilled monitor.[23]

While beneficial, covenants impose offsetting costs of three types. First, the restrictions of covenants may be over-inclusive and constrain the borrower's flexibility to take good, as well as bad actions. Second, the transfer of control may be costly because the lender has inefficient incentives, such as to liquidate the firm's assets prematurely and destroy their going-concern value. Third, although the parties may avoid this inefficiency by renegotiation, the renegotiation can be costly. Indeed, financial thresholds are

[16] Clifford Smith and Jerold Warner, *On Financial Contracting: An Analysis of Bond Covenants*, 7 J. Fin. Econ. 117 (1979)

[17] E.g., Nicholae Garleanu and JeffreyH. Zwiebel, *Design and Renegotiation of Debt Covenants*, 22 Rev. Fin. Stud. 749 (2009) (restrictive covenants signal fewer risk-shifting opportunities); Cem Demiroglu and Christopher M. James, *The Information Content of Bank Loan Covenants*, 23 Rev. Fin. Stud. (2010)(larger stock price reaction to announcement of loans with tight covenants).

[18] Regarding collateral as signal of quality, see Alan Schwartz, *Security Interests and Bankruptcy Priorities*, 10 J. Legal Stud. 1, 14-21 (1981). Building on the Stiglitz and Weis theory of credit rationing, supra note --, Helmut Bester, *Screening vs. Rationing in Credit Markets with Imperfect Information*, 75 Am. Econ. Rev. 850 (1985) shows that rationing could disappear if banks could require different amounts of collateral as a screening device. David Besanko and Anjan V. Thakor, *Collateral and Rationing: Sorting Equilibria in Monopolistic and Competitive Credit Markets*, 28 Int. Econ. Rev. 671 (1987), on the other hand, shows whether banks will use collateral or rationing as a screening device depends on the market structure: monopolist will ration credit while collateral will be used in a perfectly competitive market. See also Hildegard C. Wette, *Collateral in Credit Rationing in Markets with Imperfect Information: Note*, 73 Am. Econ. Rev. 442 (1983).

[19] Philippe Aghion and Patrick Bolton, *An Incomplete Contracts Approach to Financial Contracting*, 59 Review of Economic Studies 473 (1992).

[20] E.g., Gabriel Jimenez, et al., *Determinants of collateral*, 81 J. Fin. Econ. 255 (2005)(in a sample of bank loans to Spanish firms from 1984-2002, negative association between collateral and borrower's risk, where the borrower's risk is private information).

[21] Richard Lowery and Malcolm Wardlaw, *Agency Costs, Information, and the Structure of Corporate Debt Covenants* (working paper oct. 11, 2011)

[22] Greg Nin, David C. Smith and Amir Sufi, *Creditor control rights and firm investment policy*, 92 J. Fin. Econ. 400 (2009)(capital expenditure restriction more likely as borrower's credit quality deteriorates).

[23] Raghuram Rajan and Andrew Winton, *Covenants and Collateral as Incentives to Monitor*, 50 J. Fin. 1113 (1995)(covenants used to encourage monitoring).

commonly tripped, even in the absence of financial distress, so that the necessity of renegotiation is often quite likely.[24]

Like the benefits of covenants, the costs vary across contexts and also determine customization choices among covenants. All else equal, covenant is more desirable when the likelihood of violation and the cost of renegotiation is lower. When the borrower is a growth firm, for example, its contracts are less likely to restrict capital expenditures and may rely instead on financial ratio trip-wires.[25] Extensive and tight covenants are more common when the debt is private and is held by a small number of institutional investors rather than when it is public, because renegotiation is easier in the former case. They are also more common when the interests of the lender and borrower are likely to converge in the event of default, thereby avoiding the agency costs of lender control.[26]

B. Market and Macroeconomic Determinants

Covenants patterns vary over time and in particular, empirical studies in finance show that covenant patterns and collateral vary with GDP growth, the risk-free rate of interest and the concentration of lending markets.[27] Protective covenants are, for example, more likely during recessions than in boom periods.[28]

For our purposes, the more significant finding is that covenant patterns become more extensive and tighter as the rate of interest rises. This relationship is relatively well documented empirically.[29] A similar association is observed with amount of collateral

[24] Ilia D. Dichey and Douglas J. Skinner, *Large-Sample Evidence on the Debt Covenant Hypothesis*, 40 J. Accounting Res. 1091 (2002); Michael R. Roberts and Amir Sufi, *Control Rights and Capital Structure: An Empirical Investigation*, 44 J. Fin. 1657 (2009).

[25] Matthew T. Billett, et al., *Growth Opportunities and the Choice of Leverage, Debt Maturity and Covenants*, 62 J. Fin. 697 (2007).

[26] Matthew T. Billett, et al., supra note --; Demiroglu and James, supra note --; Sudheer Chava and Michael R. Roberts, *How Does Financing Impact Investment? The Role of Debt Covenants*, 63 J. Fin. 2085 (2008).

[27] On the effect of market concentration, see e.g., Besanko and Thakor, Collateral and rationing: sorting equilibria in monopolistic and competitive credit markets, 28 Int'l Econ. Rev 671 (1987); Besanko and Thakor, Competitive equilibria in the credit market under asymmetric information, 42 J. Econ. Theory 167 (1987); Jimenez et al, supra note --.

[28] Bradley and Roberts, supra note --. But see Greg Nini, Amir Sufi and David Smith, *Creditor Control Rights and Firm Investment Policy*, 92 J. Fin. Econ. 400 (2009)(controlling for firm performance and credit quality, incidence of capital expenditure restriction covenants do not vary significantly across the years of their sample (1996-2005)). On a closely related issue of why lending standards tend to relax when there is a boom, Giovanni Dell'Ariccia and Robert Marquez, *Lending Booms and Lending Standards*, 41 J. Fin. 2511 (2006) presents a theory where a sudden increase in demand for loans (from new borrowers) can lessen the concern each bank has about whether a loan application is from a new borrower or from a borrower that was rejected by another bank. As the likelihood that a loan application is from a new borrower rises, the banks, in perfect competition, are more likely to drop or lower the collateral requirement.

[29] Nini, Smith and Sufi, supra note – (positive relationship between interest rate and covenant breadth); Zhipeng Zhang, *Recovery Rates and Macroeconomic Conditions: The Role of Loan Covenants* (2009)(same); Roberts (2004); Michael Bradley and Michael R. Roberts, *The Structure and Pricing of Corporate Debt Covenants* (2004); Matthew T. Billett, Tao-Hsien Dolly King, and David C. Mauer, *Growth Opportunities, Choice of Leverage, Debt Maturity, and Covenants*, 62 Journal of Finance 697 (2007)

pledged by the borrower.[30] As observed in the introduction, practitioners attribute changes in the breadth or tightness of covenants, as well as the collateral requirements, to swings in the relative bargaining power caused, in turn, by changes in the supply and demand conditions of credit markets. For instance, the tightening of credit or the expansion of demand for it, leads not only to higher interest rates but also more extensive covenants. Conversely, an increase of supply, or drop in demand, leads to looser covenants, known in the trade as "covenant-lite" agreements. Finance practitioners find this unremarkable: when more lenders are chasing fewer deals, they are compelled to accept lighter covenant protections.[31] The unanswered question, however, is why they would not prefer a contract with a lower interest rate and the same covenant protection. The opposite question may be posed in the context of a tighter credit market: why do lenders ask for stronger covenants rather than (even) higher interest rates or fees?

We refine the practitioner understanding by beginning with the standard financial economics explanation for covenants and collateral: they are second-best mechanisms for mitigating the problems of adverse selection and moral hazard.[32] The next section demonstrates how fluctuations in interest rate can exacerbate or reduce these problems and thereby change the optimal covenant or collateral patterns.

II. Interest Rate Increases and Adverse Selection

We noted above that as credit markets become tighter (lender-friendly) and lenders demand higher payback amounts (either in principal or interest), the adverse selection problem worsens, forcing borrowers to offer more collateral or a broader set of covenants. When the lender wants to achieve a target rate of return, it is generally true that she will demand a larger payback amount from the riskier borrower than from the less risky one. But, when the bank raises the target interest rate, i.e., as the market becomes more lender friendly, the payback terms that the lender must impose on the riskier borrower rise faster than those for the less risky borrower. This in turn makes the terms intended for the less risky type more attractive for the riskier borrower, and to achieve separation and avoid being pooled with the risky borrower, the less risky borrower has to offer more collateral or covenant protection than before.

To illustrate the point, suppose a borrower needs a loan of $100 from the bank to implement a project. The bank's information is limited to the fact that the borrower might be of safe or risky type with equal probabilities. While both types can generate a verifiable *cash flow* of either $200 or $0, the safe borrower is more likely to generate the $200 cash flow than the risky type. Let's assume that the safe borrower's probability of

[30] Boot, et al. (1991), supra note --. Jiminez et al., supra note --, find that the *likelihood* of collateral is lower during periods of tight monetary policy or higher interest rates than loose policy, but if granted, the amount of collateral pledged increases when interest rates are higher. Id., at 274-5.

[31] Supra note – and accompanying text.

[32] See generally, Jean-Jacques Laffont and David Martimort, THE THEORY OF INCENTIVES: THE PRINCIPAL-AGENT MODEL (2002) and Patrick Bolton and Mathias Dewatripont, CONTRACT THEORY (2005).

producing $200 cash flow is 90% while that of the risky borrower is 80%.[33] In other words, the safe type has a 10% chance of defaulting on the loan while the risky type's defaulting probability is 20%. Suppose also that the credit market is competitive so that the bank is demanding an expected net return of 0% from the borrower. That is, the bank demands to receive, in expectation, $100 for the $100 loan. To make the example straightforward, let's assume that if the borrower produces $0 cash flow, the bank cannot collect anything from her. This may be the case, for example, because state law enforcement remedies entail delays that enable debtors to abscond or squander their assets.

If the bank could identify the borrower's type, the bank would set the payback amount accordingly. From the safe type, the bank would demand the payment of (about) $111 and from the risky type, $125.[34] Since the safe type will generate the cash flow of $200 with 90% probability, the bank would collect $111 from her with 90% probability, producing an expected return of $100 (≈$111×0.9). Similarly, the bank would receive $125 from the risky borrower with 80% probability, again producing an expected return of $100 (=$125×0.8). Not surprisingly, the bank would demand a higher payback term from the risky type because it knows that there is a 20% chance, as opposed to 10% chance, that it will not be able to recoup anything from her.

What happens if the bank cannot identify the borrower's type? If the bank were to offer the foregoing menu of contracts, one consisting of $111 principal and the other with $125 for a loan of $100, it is clear that both types of borrower will choose the one with $111 principal. Since both types know that they won't have to pay the bank back anything when the cash flow is $0, they would strictly prefer any loan with a lower payback amount. When both types choose the $111 loan, the bank will no longer make the 0% net return in expectation. While the safe type will generate an expected 0% net return for the bank, the risky type will generate an expected net return of about −11.2% (=(0.8)×($111)/($100)−1). When both types of borrower simply choose the loan with the lower payback amount, the bank will offer one contract with a payback amount of $118 (=$100/(0.85)) to receive its expected net return of 0%.[35]

If the bank wanted to discriminate based on borrower type, the bank could demand covenant protection or collateral from the borrower as a screening device. In this

[33] The surplus from contract, therefore, is $80 and $60, respectively, when the lender's opportunity cost of capital is 0%. When the lender's opportunity cost of capital rises to 10%, the surplus reduces to $70 and $50, respectively.

[34] We can divide the payment term into two parts: principal and interest. Principal can be set at the face value of the original loan ($100) while the rest will be considered interest. With respect to the safe type, the implicit interest rate is 11% while for the risky type, 25%. Throughout the example, we won't make this formal distinction and lump them together as "payback" amount.

[35] In this example, there is actually no efficiency loss from pooling. Separating equilibrium is the one with lower social welfare due to the deadweight loss imposed through the use of collateral. See Aghion and Hermalin (1990). This is partly due to the fact that the return from project is invariant to the amount of investment. If we were to make the marginal rate of return depend on the size of the investment, pooling equilibrium will generate inefficiency. We assume away such complications to make the example simple and straightforward.

example, we consider collateral as a screening device, allowing the bank to adjust the amount of assets that are pledged. The example could be adapted to the use of covenants (restrictive or trip-wire), in which case the variable would be the number and probability of states of the world in which the lender could seize control of the borrower's assets. The key property of either screening mechanism is that they impose costs that are more severe on the lower-quality borrower. Indeed, in both cases, the screening produces inefficiency either in the suboptimal deployment of assets or in the cost of renegotiation. We use collateral as the mechanism here for convenience.

Suppose that the borrower can pledge some of its assets as collateral, which the bank can possess immediately if the borrower defaults: i.e., when the borrower produces a $0 cash flow. Turning the collateral over to the bank is inefficient ex post because the borrower values the collateral more than the bank. In other words, there is a significant probability that the collateral assets are worth more as part of the borrower's going concern than sold to third parties. Specifically, we assume that for every $1 in expected worth of collateral in the borrower's control, the bank values it at $0.60. Despite the inefficiency, the safe borrower would be willing to post collateral to signal its type to the bank and, in return, receive a loan with lower payback terms. This is the well-known problem of excessive screening (or signaling).

How much collateral would the safe type borrower have to post in order to achieve separation? This depends on the incentive of the risky type borrower. That is, if the bank were to offer two types of loans, one with collateral and lower payback amount and the other with no collateral and higher payback amount, the risky type should prefer the latter over the former. In addition, the bank needs to be able to make its expected net return of 0% from both types. In equilibrium, the bank will offer two loan contracts: one with $125 of payback and $0 of collateral and the other with $106 payback and $77 of collateral. The risky type will choose the former while the safe type will choose the latter.[36]

	Payback Terms	Collateral
Safe Borrower	$106	$77
Risky Borrower	$125	$0

Table 1: Loan Offers by the Bank with 0% Net Expected Return

Compared to the case where the safe type were being pooled with the risky type and had to promise to payback $118 for a $100 loan, the safe type is better off when she could signal her attribute to the bank using collateral. Previously, under the loan with $118 payback terms but no collateral, the safe borrower was expecting to earn $73.8

[36] It is fairly straightforward to see that these loan contracts satisfy the three conditions of (1) risky type preferring the one with no collateral; (2) safe type preferring the one with collateral; and (3) the bank making the 0% net expected return from both types. When the safe type chooses the loan with $77 collateral, the bank makes, in expectation, (0.9)×($106)+(0.1)×(0.6)×($77)–$100≈$0. For the risky type, if she were to choose the loan with no collateral, she will make (0.8)×($200–$125)=$60. If she were to choose the loan with $77 collateral, instead, she expects to make (0.8)×($200–$106)–(0.2)×($77)=$59.8. See the technical appendix for a more general model.

(=(0.9)×($200–$118)). Now, by pledging $77 of collateral but with $106 payback terms, the safe borrower expects to earn $76.9 (=(0.9)×($200–$106)–(0.1)×($77)). Previously, when the bank could not identify borrower's type and had to demand payback based on the pooled recovery rate, the safe type was implicitly subsidizing the risky type's borrowing.[37] Now, although the safe borrower has to incur some cost by having to post collateral, the benefit of lower payback amount outweighs the cost. This inefficient separation outcome is well-known in the literature. We build on it here to explore the effect on the separation equilibrium of a change in the interest rate (caused by an exogenous change in market conditions).

Now suppose that the supply of credit tightens so that the bank demands a 10% net return from the borrower to meet its higher opportunity cost of capital. That is, the bank will demand, in expectation, $110 from the borrower for a $100 loan. As a benchmark, if the bank could identify the borrower type, the bank would charge different interest rates depending on the type, without having to resort to a collateral provision. From the risky type, the bank would impose the payback term of $137.50 and for the safe type, the payback term would rise to about $122.22. Regardless of the market conditions that affect the size of the surplus, the non-price terms stay constant to maximize the surplus, in this case no collateral, while only the price terms shift to reflect the changes in market conditions or market power.

If the bank cannot identify the borrower type, of course, the bank resorts to a collateral provision as a screening mechanism. For the risky type, the bank could simply raise the payback terms from $125 to $137.50 without demanding any collateral. For the safe type, however, merely raising the payback terms, without changing the collateral provision, is not sufficient. To see this, suppose the bank were to raise the payback terms for the safe type from $106 to $117. When the safe type chooses this loan, the bank makes, in expectation, a net return of 10% from the safe type.

However, it is no longer in the risky type's interest to stay with the loan with no collateral. If she were to choose the loan with $137.50 payback and $0 collateral, she would expect to earn $50 (=(0.8)×($200−$137.5)). If she were to, instead, choose the loan with $117 payback and $77 collateral, her expected return would be $51 (=(0.8)×($200–$117)–(0.2)×($77)). If the bank were to distinguish between safe and risky type borrower, the bank would also raise the amount of collateral from $77 to $83. If the bank offers two loans, one with $137.50 payback with $0 collateral and the other with $117 payback and $83 collateral, it is no longer in the risky borrower's incentive to choose the latter.

	Payback Terms	Collateral
Safe Borrower	$117	$83
Risky Borrower	$137.50	$0

Table 2: Loan Offers by the Bank with 10% Net Expected Return

[37] When the bank was demanding a payback of $118 with no collateral, the risky borrower was expecting to get (0.8)×($200−$118)=$65.6. Under separation, the risky type earns (0.8)×($200−$125)=$60.

Why does the bank demand more collateral from the safe type when the market return rises? The reason lies in the manner in which the payback terms change with respect to each type of borrower. While the fact that the bank demands higher payback terms from both types—from $106 to $117 for the safe type and from $125 to $137.50 for the risky type—is not surprising, what is important is that as the bank's demanded rate rises, the payback terms for the risky type rises faster (in absolute terms) than that for the safe type. Holding everything else constant (including the collateral), the loan offer with a lower payback amount now becomes even more attractive for the risky borrower than before. In other words, a tighter lending market exacerbates the problem of adverse selection.

Since the collateral (or covenants) is serving mainly as the screening (signaling) device, the bank demands more collateral (or more extensive covenants) to achieve separation when the adverse selection problem worsens. Conversely, as the credit condition relaxes or as the bank's opportunity cost of capital falls, the amount of collateral (covenants) shrinks because the information problems are less severe and these terms themselves create ex post efficiency losses.

III. Interest Rate Increases and Borrower Moral Hazard

The root of the moral hazard problem is the incentive of the borrower to take self-interested actions that jeopardize the lender's prospect of repayment. Finance and legal scholarship refers to these actions in various terms, including risk-substitution and the extraction of private benefits. Moral hazard is a contracting challenge because the lender cannot perfectly monitor (and, therefore, cannot contractually stipulate) the borrower's post-borrowing behavior. For instance, suppose after borrowing $100, the borrower can choose among two different types of project: A or B. Project A produces a higher cash-flow and a higher combined return, but project B produces (more) private benefit for the borrower which cannot be shared with the lender. To make this concrete, suppose, as before, that both projects have two possible cash-flows: $200 or $0. Project A has a 60% chance of producing $200 while project B's chance is only 40%. On the other hand, project B confers a non-transferrable private benefit to the borrower in the cash-equivalent amount of $20. Hence, the expected total returns are $120 for project A (60% multiplied by $200) and $100 for project B (40% multiplied by $200 plus $20).

Although both the lender and the borrower may want the borrower to commit contractually to choose A over B, they cannot do so in a complete contract because the borrower's choice is either not observable to the lender or not verifiable to the court. Unless the borrower can commit, the lender expects the borrower to choose B and will, therefore, decline to lend. To see this, suppose the bank demands to earn, in net, 0% and lends the borrower $100 with a payback term of $167. However, once the borrower takes the $100 loan, it is no longer in the borrower's interest to choose A. If she were to implement project A, her expected return is $19.8 (=(0.6)×($200−$167)). If she were to choose B, instead, her expected return is $33.2 (=(0.4)×($200−$167)+$20). The bank, knowing this, may demand the entire cash-flow of $200 in case of success, but that is still insufficient for the 0% net expected return: (0.4)×($200)−$100=−$20. Once the bank knows that the borrower will choose project B, the bank will decline to lend and the parties fail to realize the potential surplus from trade.

Pledge of collateral (e.g., borrower's personal assets) can solve this commitment issue.[38] By promising to turn over her own assets in case the borrower defaults on the payment promise, the borrower can pre-commit not to undermine her ability to pay back the lender. Collateral can impose a serious penalty against the borrower for non-payment. So long as enough collateral has been pledged to neutralize the adverse incentive of the borrower, the lender receives the implicit promise from borrower not to embark on project B and can be assured of receiving the requisite payment to, at least, break even.

To see how this works in our numerical example, suppose the bank demands a payback term of $148 with a collateral of (slightly above) $48 in case the borrower defaults, i.e., in case the cash-flow is $0. After taking out the $100 loan, now it is in the borrower's interest to implement project A over B. If she were to do so, her expected return is $12 (=(0.6)×($200–$148)–(0.4)×($48)). If she were to choose B, instead, her expected return would be $12 (=(0.4)×($200–$148)–(0.6)×($48)+$20). Hence, when the collateral is slightly more than $48, the $20 of certain private benefit is not sufficient for the borrower to choose the inefficient project. The bank receives its expected return ((0.6)×($148)+(0.4)×(0.6)×($48)≈$100) and is willing to lend on these terms. As in the adverse selection example, this function of collateral (and covenants) is well-known in the literature, and we now turn to analyzing the effect of an increase in interest rate (caused by a market change in the balance of supply and demand for credit).

Suppose that supply tightens so that the cost of funds rises to 10%. It is fairly straightforward to see that merely raising the payback amount will not yield a sufficient return. Suppose that the bank were to demand a payback of $165 (instead of $148) with the same collateral of $48 from the borrower. If the borrower to implement project A, the borrower's expected return is $1.80 (=(0.6)×($200–$165)–(0.4)×($48)). If she were to implement project B, instead, her expected return is $5.20 (=(0.4)×($200–$165)–(0.6)×($48)+$20). The borrower no longer has the incentive to choose the efficient project. To restore that incentive, the bank will have to raise both the payback amount and the collateral, payback amount from $148 to $160 and the collateral from $48 to $60.[39]

When the market condition tightens and the lender demands a higher (expected) payment from the borrower, the use of collateral becomes more important in solving the moral hazard problem. The borrower continues to capture the full private benefit from

[38] Covenants also attempt to control borrower's behavior indirectly by imposing restrictions on amount of borrowing, sales and purchases, and business lines. Although they may be closer, compared to collaterals, in regulating the borrower's behavior, they are still indirect and prone to create inefficiencies, for instance, by preventing the borrower from undertaking positive net present value projects.

[39] With this loan agreement, if the borrower to choose project A, she expects to earn $0 (=(0.6)×($200–$160)–(0.4)×($60)), whereas from project B, $0 (=(0.4)×($200–$160)–(0.6)×($60)+$20). The bank's expected net return is (0.6)×($160)+(0.4)×(0.6)×($60)–$100=$10.4.

project B. However, as the amount due to the lender increases, the borrower -- as the residual claimant—is entitled to a smaller share of the remaining project payoffs. To combat this heightened moral hazard problem, the lender requires that the borrower post more collateral (or more extensive covenants). Conversely, as the lending conditions become more relaxed, to the extent that collaterals impose a deadweight loss, the lenders demand less collateral to solve the moral hazard problem.

Bank's Net Return	Payback Terms	Collateral
0%	$148	$48
10%	$160	$60

Table 3: Loan Contracts to Address Moral Hazard Problem

Under both adverse selection and moral hazard theories, the amount of collateral (or the extensiveness of the covenants) that the lender requires from borrowers rises or falls as the underlying lending market tightens or loosens. The reason is not simply the redistribution of market or bargaining power, as indicated by practitioners. It stems from the effect of the consequent changes in price on the severity of the moral hazard or the adverse selection issue. In the former, tighter lending market decreases the borrower's residual return, thereby worsening the commitment problem. In the latter, riskier borrower is more tempted to pool with the less risky type because her payback amount is (and should be) more sensitive to the underlying market conditions.

In the appendix, we make our arguments more concrete by presenting simple, game theoretic models of adverse selection and moral hazard in the commercial lending market. Although the basic intuitions have been laid out already, the models reveal some subtle, deeper, implications, some of which we explore in the next section. The presentation of the intuition in the current section has also benefitted from looking at these models more closely.

IV. Implications

Our paper has, so far, been an attempt to describe and understand a stylized phenomenon in commercial loan and debt contracts. We establish how the effect on contract design is mediated through the information problems described above, rather than the more direct impact articulated by practitioners, where the terms shift due to changes in relative market power. Both stories predict that as the market conditions change both the price and the non-price terms will move in favor of the party that attains more leverage. Similarity notwithstanding, the theories diverge on at least a few predictive dimensions which make them empirically distinguishable and testable.

First, in our information story, although it is true that the average covenant terms move in favor of the party with more "leverage" as the market condition shifts, the change in market condition also affects the *variance* with which the parties use covenants. In the credit market, the average amount of collateral or the breadth of the covenants rises as the supply becomes tighter. At the same time, because the collateral that the less risky borrowers must pledge increases while that for the risky borrower stays relatively constant, the variance or the spread on the pledged collateral (or the covenant breadth) should also rise. Similarly, as the market clearly interest rate rises, the collateral needed to combat the heightened moral hazard problem increases for the leveraged borrower (with a higher risk of misbehavior), but stays relatively constant for the borrower with greater equity stake. The simple bargaining power story does not predict the same increase in variance because the lender with greater market power will demand more collateral or more extensive set of covenants from all types of borrower.

Second, the presence of asymmetric information is crucial in the adverse selection analysis and the problem of incomplete contracting is necessary in the moral hazard story. If these problems are addressed through other market or governance mechanisms, covenants and collateral are less valuable and less susceptible to the influence of changes in market demand and supply (or "bargaining power"). The information story also implies that the companies that do not have any informational issues (due, for instance, to extensive analyst coverage or long history of default-free borrowing) will be much more immune to the changes in the market condition.[40] In contrast, the simple bargaining power story is unaffected by the presence or absence of these mechanisms because the lender—by hypothesis—uses the more onerous non-price terms as a surplus extraction mechanism.

Third, in the information story, the informational problems are either exacerbated or relaxed through the changes in the lender's opportunity cost of capital. Without that change, the non-price terms (collateral or covenants) in lending agreements should remain constant. So, for instance, if the lending market, due to some exogenous change such as a sudden, unpredicted wave of intra-industry mergers, gets more concentrated without any corresponding change in the opportunity cost of capital, our story suggests that the non-price terms should remain relatively constant,[41] whereas the bargain power story predicts that the non-price terms will become more lender favorable.

Conclusion

Debt covenants, in both public and private debt agreements, vary over time in their breadth and intensity. Practitioners attribute many of these changes to market shifts in demand and supply, which they often refer to as shifts in bargaining power. We present in this essay the theoretical mechanism by which these market changes might lead to adjustments in patterns of covenants and collateral, because of their effect on interest rates. A broader implication, across many other types of contracts, is that price terms in contracts have efficiency as well as distributional consequences. They affect selection biases and incentives and are thereby important factors in the design of non-

[40] Even under the bargain theory story, one may argue that the highest credit rating companies also have more bargaining power against the lending market. The distinction might, therefore, be more relevant for smaller companies with very good credit rating or extensive analyst review.

[41] This assumes that the amount of capital available for lending will not change after the mergers. If, for some reason, the mergers also decrease the capital availability, regardless of the increase in the lender's market power, it can also increase their opportunity cost of capital. We also need to be careful in recognizing and controlling for the fact that intra-industry mergers are, sometimes caused by the external shocks, such as the general shift in market opportunity cost of capital.

price terms. Finance scholarship has identified several drivers of contract innovation in capital markets—such as shocks from new regulation or the emergence of new risks in the economic environment. To these, we can add what might otherwise appear to be relatively innocuous shifts in demand and supply conditions. We believe that this introduces a fruitful area for future research in contract innovation.

Technical Appendix A: An Adverse Selection Model of Collateral in Lending

Suppose there are two players, a borrower and a lender, who are both risk-neutral. The borrower borrows money from the lender to implement a project that has an uncertain outcome. The outcome of the project can be either success or failure. If the project succeeds, it produces a cash flow of R, whereas if it fails, it produces a cash flow of 0. The probability of producing a successful outcome depends on the borrower's "type." The borrower can be of two types: good or bad. Let's assume that the probability of producing a successful outcome, depending on the type, is given by $1 > p > q > 0$.

The project requires an initial investment of I and the lender demands a net rate of return of r, which means that the lender is demanding to receive, in expectation, $(1 + r)I$. We will treat the rise in the lender's demanded interest rate as a tighter lending market (or as the lending have more market power). Although the good type borrower has a higher chance of producing a successful outcome, we assume that both types have a positive net present value project: $pR > qR > (1 + r)I$.[42]

The timing of the game is as follows. In the first period ($t = 1$), Nature determines the borrower's type: good type is chosen with probability α, where $1 > \alpha > 0$. The realized type is observed by the borrower but not the lender. In the second period ($t = 2$), the borrower and the lender sign a contract, which consist of the cash flow that the borrower promises to pay the lender in case the project is successful and the value of collateral (to the borrower) that the lender can take from the borrower in case the project fails: (R_i, C_i).[43] After signing the contract, the lender lends the money and the borrower implements the project.

In the third period ($t = 3$), the cash flow is realized. If the project is a success, the lender receives the contractually promised payment of R_i whereas if the project is a failure, the lender acquires the collateral that is worth C_i to the borrower. To reflect the concern that the collateral (working capital) often loses its going-concern value when transferred to the lender, we assume that the collateral is worth only βC_i to the lender, where $1 > \beta > 0$.

Suppose both players observe the realized borrower's type. In this case, both types of borrower can implement their projects without having to pledge any collateral. For each type, the lender will demand R_i, such that $pR_g = (1 + r)I$, $qR_b = (1 + r)I$ and $C_i = 0$, which implies $R_b = \frac{(1+r)I}{q} > \frac{(1+r)I}{p} = R_g$. The lender demands a higher cash flow from the bad type to reflect the higher chance of failure. This is also efficient, since

[42] The assumption that both projects have positive net present value is not important. If the bad project has a negative net present value, in a socially optimal equilibrium, the lender should lend only to the good-type while still requiring some collateral so as to prevent the bad-type from participating in the market.
[43] For convenience, we can assume that the borrower proposes the contract and the lender either accepts or rejects it. However, it does not matter who proposes the contract in this model, due to the assumption that the lender's expected return is tied down by the market conditions. Even if the lender were to make a take-it-or-leave-it offer to the borrower, the lender would still want to use collateral as a screening device.

the borrower's collateral does not lose its going-concern value. If we measure the social welfare by the net return from both projects, with both parties are informed of the borrower's type, the equilibrium social welfare is $\alpha(pR-(1+r)I)+(1-\alpha)(qR-(1+r)I)$.

If the lender does not observe the borrower's type, the efficient solution cannot be achieved. This is because the bad type strictly prefers the contract for the good type since it demands a lower cash flow payment in case of success: $R_b > R_g$. One possible equilibrium, a pooling equilibrium, is for the lender to charge an average rate for both types. Given that the lender faces the good type borrower with probability α, the lender can set the payment term $\bar{R}$, with $C = 0$ where $(\alpha p + (1-\alpha)q)\bar{R} = (1+r)I$. Compared to the efficient equilibrium, the good type borrower pays more and the bad type pays less: the good type subsidizes the bad type.

Another possibility is for the good type to signal to the lending market by pledging collateral to separate itself from the bad type. Suppose the good type pledges $C_g > 0$ as collateral, which the lender can possess in case the project produces zero cash flow. In a separating equilibrium, since the market will be able to distinguish between the types, the bad type will not have any incentive to pledge collateral, i.e., $C_b = 0$. So, while the good type offers a contract $(R_g, C_g > 0)$ to the market, the bad type offers $(R_b, C_b = 0)$.

To achieve separation in a competitive lending market, the contracts need to satisfy four conditions:

$$pR_g + (1-p)\beta C_g = (1+r)I$$
$$qR_b = (1+r)I$$
$$p(R-R_g) - (1-p)C_g \geq p(R-R_b)$$
$$q(R-R_b) \geq q(R-R_g) - (1-q)C_g$$

The first two equalities guarantee that the lender will break even with respect to both types (lender's participation condition). The two weak inequalities (borrower's incentive compatibility conditions) achieve separation: good type prefers the contract with collateral while the bad type prefers the contract with no collateral.

In models like this, it typically is the case that, in addition to the lender's participation condition(s), the bad type's incentive compatibility condition is the one that binds. In other words, we need to make sure that the bad type does not want to pretend to be a good type rather than the other way around. This produces three equalities: the first two break even conditions for the market and the bad type's incentive compatibility condition. Since there are three unknowns (with $C_b = 0$), we can solve the system of equations. In equilibrium, we get

$$C_b = 0$$

$$R_b = \frac{(1+r)I}{q}$$
$$C_g = \frac{(p-q)(1+r)I}{p(1-q)-q(1-p)\beta}$$
$$R_g = \frac{(1+r)I}{p} - \frac{(1-p)\beta}{p} \cdot \frac{(p-q)(1+r)I}{p(1-q)-q(1-p)\beta}$$

Note that, in equilibrium, the good type offers a positive amount of collateral to the lender as a signal of high quality and, partly in return, receives a (substantially) lower interest rate: $R_g < \frac{(1+r)I}{p} < \frac{(1+r)I}{q} = R_b$. The equilibrium social welfare is given by $\alpha\big(pR-(1-p)(1-\beta)C_g-(1+r)I\big)+(1-\alpha)(qR-(1+r)I)$, which is lower when compared to the case with symmetric information due to good type's (potential) loss of going-concern value on its collateral.

What happens to the contract terms when the lending market tightens? From the equilibrium contract terms, we get

$$\frac{\partial C_b}{\partial r} = 0$$
$$\frac{\partial R_b}{\partial r} = \frac{I}{q} > 0$$
$$\frac{\partial C_g}{\partial r} = \frac{(p-q)I}{p(1-q)-q(1-p)\beta} > 0$$
$$\frac{\partial R_g}{\partial r} = \frac{I}{p}\left(\frac{p(1-q)-p(1-p)\beta}{p(1-q)-q(1-p)\beta}\right) > 0$$

Not surprisingly, the cash flow demanded in case of success, for both types, will rise as the lender's opportunity cost of capital rises: $\frac{\partial R_i}{\partial r} > 0$. What is interesting is that the good type borrower has to put up more collateral to credibly signal its type to the market: $\frac{\partial C_g}{\partial r} > 0$.

Why does the market demand more collateral from the good type borrower when the market tightens? The reason has to do with the fact that, not only does the bad type need to guarantee a higher cash flow in case of success compared to the good type ($R_b > R_g$), when the lender's opportunity cost rises, the amount of cash flow the bad type needs to guarantee to the lender rises faster compared to the amount of cash flow the good type needs to guarantee $\left(\frac{\partial R_b}{\partial r} > \frac{\partial R_g}{\partial r}\right)$. In other words, the bad type's promised cash flow is more sensitive to the lender's opportunity cost of capital. As the difference between the respective cash flows rises, the contract for the good type becomes more attractive for the bad type, and in order to achieve separation, the good type needs to pledge even more collateral.

This can be more easily seen from the bad type's incentive compatibility condition. In equilibrium, we know that the bad type's incentive compatibility condition binds: $q(R - R_b) = q(R - R_g) - (1-q)C_g$. We also know that because the lending market just breaks even, $R_b = \frac{(1+r)I}{q}$, a small increase in the lender's opportunity cost of capital, from r to r', will imply that the bad type's interest rate will have to rise proportionally: $R'_b \approx R_b + \frac{I}{q}$. If the good type's interest rate is also rising proportional to its true risk characteristics, $R'_g \approx R_g + \frac{I}{p}$, then the bad type's incentive not to mimic the good type will be destroyed: $q(R - R'_b) < q(R - R'_g) - (1-q)C_g$. To achieve separation, therefore, the good type has to rely more on costly collateral and less by adjusting its interest rate. In fact, from the equilibrium conditions, we see that

$$\frac{\partial R_g}{\partial r} = \frac{I}{p}\left(\frac{p(1-q) - p(1-p)\beta}{p(1-q) - q(1-p)\beta}\right) < \frac{I}{p}$$

That is, the good type's interest rate is less sensitive to the rise in the lender's opportunity cost of capital than its true characteristic dictates.

In sum, when the lending market tightens because the lender's opportunity cost of capital rises, there will be a higher dispersion of interest rates, i.e., $R_b - R_g$ rises, and at the same time, the lender will require more costly collateral from the good type borrower, i.e., the contract term becomes more inefficient.

Technical Appendix B: A Moral Hazard Model of Collateral in Lending

In the current model, there still are only two risk-neutral players, a borrower and a lender, but the borrower has only one type. Instead, the borrower has a choice over projects: good or bad. The outcome of both projects can be either success or failure and, as before, if the project succeeds, it produces a cash-flow of R, whereas if it fails, it produces a cash-flow of 0. The good project has a higher chances of being successful than the bad project in that if we let p and q be the respective probabilities of success, we assume that $1 > p > q > 0$. The bad project, on the other had produces a certain private benefit of $B > 0$ for the borrower.

Both projects require an initial investment of I, and the lender demands an expected rate of return of r, which means that for the loan of I, the lender must receive, in expectation, $(1 + r)I$. As before, we will treat the rise in the lender's demanded rate of return as a tighter lending market. Unlike the previous model, we assume that only the good project has a positive net cash-flow, $pR > (1 + r)I > qR$, and that despite the private benefit, the good project is more efficient: $pR > qR + B$.

The timing of the game is as follows. In the first period ($t = 1$), the borrower and the lender signs a lending agreement, which consist of the cash-flow that the borrower promises to pay the lender in case the project is successful and the value of collateral (to the borrower) that the lender can take from the borrower in case the project is a failure: (R_s, C). The agreement cannot condition payment on either the realization (or size) of the private benefit (B) or the type of project the borrower has chosen: the contract is incomplete. After signing the contract, in the second period ($t = 2$), the borrower chooses among the projects to implement.

In the third period ($t = 3$), the verifiable cash-flow is realized. If the project is a success, the lender receives the contractually promised payment of R_s whereas if the project is a failure, the lender acquires the collateral that is worth C to the borrower. To reflect the concern that the collateral (working capital) often loses its going-concern value when transferred to the lender, we assume, as in the adverse selection model, that the collateral is worth only βC to the lender, where $1 > \beta > 0$.

If the parties can choose and enforce which project to implement, the contract will require the borrower to implement the good project with no collateral and R_s will be chosen so as to satisfy the lender's demanded expected return: $pR_s^* = (1 + r)I$. Suppose the parties use the same contract but without the choice of project clause. The borrower's returns, from choosing either the good or the bad projects, are $p(R - R_s^*)$ and $B + q(R - R_s^*)$, respectively. To make the problem interesting, let us assume that $B + q(R - R_s^*) > p(R - R_s^*)$, so that the borrower will always prefer the bad project. Clearly, if the lender were to offer $(R_s, C) = (R_s^*, 0)$ without the choice of project clause, the lender will not receive its expected return.

If the choice of project cannot be stipulated, one way of inducing the borrower to implement the good project is by requiring the borrower to post collateral. Because the borrower suffers a loss when the project is a failure, this can neutralize the perverse incentive that was created through the positive private benefit from the bad project. In order for the borrower to choose the good project while the lender breaks even, we need

$$pR_s + (1-p)\beta C = (1+r)I$$
$$p(R - R_s) - (1-p)C \geq q(R - R_s) - (1-q)C + B$$

The first condition is the lender's expected return condition. The second inequality (borrower's incentive compatibility condition) requires the borrower's private return from implementing the good project to be higher than that from the bad project.

In equilibrium, the lender will demand the just enough collateral for the borrower's incentive condition to be satisfied with equality.

$$pR_s + (1-p)\beta C = (1+r)I$$
$$p(R - R_s) - (1-p)C = q(R - R_s) - (1-q)C + B$$

When we solve for the optimal contract, we get

$$R_s = \frac{(1+r)I}{p} - \frac{(1-p)\beta}{(1-p)\beta + p}\left\{\frac{B}{p-q} + \frac{(1+r)I}{p} - R\right\}$$
$$C = \frac{p}{(1-p)\beta + p}\left\{\frac{B}{p-q} + \frac{(1+r)I}{p} - R\right\}$$

From the expressions, it is clear that $\frac{\partial R_s}{\partial r} = \frac{\partial C}{\partial r} > 0$. That is, as the demands a higher expected net return from the borrower, i.e., lending market tightens, both the payback and the collateral amounts demanded by the bank rise.

The higher expected return required by the lender is not being satisfied through higher payback amount alone. The reason can be seen directly from the borrower's incentive compatibility condition. From the optimal solution that satisfies

$$p(R - R_s) - (1-p)C = q(R - R_s) - (1-q)C + B$$

when the lender attempts to raise R_s to satisfy the higher expected return condition, because $p > q$, the left hand side of the condition falls at a faster rate than the right hand side, leading the borrower to choose the bad project. In other words, it becomes more difficult for the lender to provide the right incentive to the borrower: the moral hazard problem worsens. To restore the original incentive, the lender must also raise C because requiring more collateral has a smaller negative effect on the good project than the bad project.