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How Does Financing Impact Investment? The Role of Debt Covenants

SUDHEER CHAVA and MICHAEL R. ROBERTS*

ABSTRACT

We identify a specific channel (debt covenants) and the corresponding mechanism (transfer of control rights) through which financing frictions impact corporate investment. Using a regression discontinuity design, we show that capital investment declines sharply following a financial covenant violation, when creditors use the threat of accelerating the loan to intervene in management. Further, the reduction in investment is concentrated in situations in which agency and information problems are relatively more severe, highlighting how the state-contingent allocation of control rights can help mitigate investment distortions arising from financing frictions.

WHILE PREVIOUS RESEARCH HAS CLEARLY ANSWERED THE QUESTION of whether financing and investment are related, it has been much less clear on *how* financing and investment are related (Stein (2003)). In other words, the precise mechanisms behind this relationship are largely unknown. Further, the extent to which these mechanisms mitigate or exacerbate investment distortions arising from underlying financing frictions is largely unknown as well. The goal of this paper is to address these issues by identifying a specific mechanism through which financing frictions affect investment and by quantifying the impact of this mechanism on the distribution of investment.

To this end, we examine the impact of debt covenant violations on corporate investment. We focus our attention on violations of financial covenants, such as those requiring the maintenance of a minimum net worth or current ratio. Violations of financial covenants are often referred to as "technical defaults," which correspond to the violation of any covenant other than one requiring

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the payment of interest or principal. Upon breaching a covenant, control rights shift to the creditor, who can use the threat of accelerating the loan to choose her most preferred course of action or to extract concessions from the borrower to choose the borrower's most preferred course of action.

Covenant violations present a unique opportunity to examine the link between financing and investment for several reasons. First, the presence of covenants in financial contracts is motivated, and indeed rationalized (Tirole (2006)), by their ability to mitigate agency problems (Jensen and Meckling (1976) and Smith and Warner (1979)) and aid in securing financing through the pledging of state-contingent control rights (e.g., Aghion and Bolton (1992) and Dewatripont and Tirole (1994)). Thus, covenant violations identify a specific mechanism, the transfer of control rights, by which the misalignment of incentives can impact investment.

Second, covenants are ubiquitous in financial contracts such as public debt (Smith and Warner (1979)), private debt (Bradley and Roberts (2003)), and private equity (Kaplan and Stromberg (2003)).[1] As such, covenants, and the potential for violation, are relevant for a large number of firms in the economy. Finally, covenant violations often occur outside of financial distress and rarely lead to default or acceleration of the loan (Gopalakrishnan and Parkash (1995)). Thus, the potential impact of covenant violations on investment is not limited to a small fraction of firms facing unique circumstances. Rather, covenant violations occur frequently (Dichev and Skinner (2002)), and their discrete nature enables us to employ a novel empirical strategy aimed at identifying the impact of the transfer of control rights on corporate investment.

Specifically, covenant violations enable us to employ a regression discontinuity design to address the concern that investment, investment opportunities, and the distance between the accounting variable (e.g., net worth) and the covenant threshold (e.g., the specified minimum net worth) may be jointly determined. The discrete nature of the covenant violation generates a potentially exogenous source of variation in the distance to the covenant threshold that can be used to estimate the effect of covenant violations on corporate investment.

To see how this variation comes about, note that according to the covenant the borrower retains control rights as long as her net worth, for example, is above the covenant threshold. However, the instant that the borrower's net worth falls below this threshold, regardless of the amount, control rights shift to the creditor, who can then use the threat of accelerating the loan to take any number of actions that may impact the investment policy of the firm (e.g., increasing the interest rate on the loan, shortening the maturity of the loan, reducing the available funds, or directly intervening in the investment decisions of the firm). Thus, the distance to the covenant threshold is irrelevant for the purpose of understanding how the violation and subsequent transfer of control rights impact investment.

[1] Although Begley and Freedman (2004) show that the use of accounting-based covenants in public debt has declined over the last quarter century, reinforcing our motivation for focusing on privately held debt.

This irrelevance enables us to isolate the effect of the violation to the discontinuity occurring precisely at the covenant threshold. As such, we can incorporate a wide range of smooth functions of the distance to the covenant threshold directly in the regression specification in order to mitigate the concern that this distance contains information about investment opportunities. We are also able to examine the subsample of firms that are "close" to the covenant threshold, effectively homogenizing the violation and nonviolation states by restricting attention to only those states separated by a small difference in the distance to the covenant threshold. Intuitively, if a borrower has a covenant restricting net worth to be greater than \$1 billion, for example, then there should be little difference in the borrower when its net worth is \$1.05 billion versus \$0.95 billion but for the covenant violation.

Our results show that capital expenditures decline in response to a covenant violation by approximately 1% of capital per quarter—a 13% decline relative to investment prior to the violation. This finding is robust to the inclusion of a host of control variables in the regression specification, including firm and year-quarter fixed effects, measures of investment opportunities, measures of financial health, measures of debt overhang (Hennessy (2004)), measures of other contractual features (e.g., other covenant provisions), measures of possible earnings manipulation (e.g., abnormal accruals), and smooth functions (e.g., polynomials) of the distance to the covenant threshold. Further, using the subsample of observations that are close to the covenant threshold produces nearly identical results to those found in the broader sample. Thus, consistent with the intuition provided by control-based theories (e.g., Aghion and Bolton (1992), Dewatripont and Tirole (1994), and Gorton and Kahn (2000)), the transfer of control rights accompanying a covenant violation leads to a significant decline in investment activity, as creditors intervene in order to thwart inefficient investment or punish managers for perceived misbehavior.

We also find that the investment response to covenant violations varies systematically with several different ex ante proxies for the misalignment of incentives and information asymmetry between borrowers and lenders. Among borrowers in which agency and information problems are relatively more severe, the investment decline accompanying covenant violations is economically and statistically significantly larger than that found among borrowers in which these frictions are less severe. In fact, among borrowers in which agency and information problems are relatively mild, the investment decline accompanying covenant violations is generally indistinguishable from zero.

For example, firms with no previous dealings with their current lender, and therefore little reputational capital (Diamond (1989)), experience a sharp reduction in capital expenditures relative to their capital stock (1.7%) after violating a covenant, in contrast to the negligible change (0.2%) occurring among firms violating a covenant with their long-time lenders. Similarly, firms with loans from a single lender experience a significantly larger decline in investment (2.3%) relative to firms borrowing from a large lending syndicate (0.3%), consistent with larger lending syndicates alleviating the moral hazard problem present in borrowers (Bolton and Scharfstein (1996)). We also find that firms

with relatively larger stockpiles of cash experience a greater decline in investment (2.1%) compared to firms with smaller cash holdings (0.2%), consistent with the free cash flow problem identified by Jensen (1986) and the ability of creditors to mitigate this problem.

These results show that, in addition to their role in shaping the distribution of investment, the state-contingent allocation of control rights plays a potentially important role in mitigating investment distortions arising from financing frictions. After poor performance in firms in which agency and information problems are relatively severe, the transfer of control rights enables creditors to intervene in management and influence investment to ensure a fair return on their investment. An important by-product of these results is that they also offer an additional verification of our identification strategy. In so far as the ex ante measures of agency and information problems are largely uncorrelated with future discontinuous contractions in the investment opportunity set, these findings lend further support for a causal interpretation of our results.

Our paper is the first, of which we are aware, to empirically identify both a specific channel (debt covenants) and mechanism (the transfer of control rights) behind the financing and investment link documented in previous studies. Related to our paper are the studies by Whited (1992) and Hennessy (2004), both of which use structural econometric approaches to examine the impact of financing frictions in the debt markets on investment.[2] Their findings of a significant role for these frictions in the distribution of investment are consistent with our results. However, our empirical approach enables us to provide a direct estimate of the impact of these frictions on investment without imposing any a priori assumptions on the behavior of firms.

Our paper is also related to studies investigating the agency costs of debt. Using data similar to those used in this study, Dichev and Skinner (2002) suggest that the relative tightness of covenant restrictions and corresponding frequency of violations is inconsistent with lenders imposing serious consequences on borrowing firms. While we also observe that covenants are both set tightly and frequently violated, our evidence suggests that when agency and information problems are relatively severe, covenant violations carry serious repercussions in the form of reduced capital expenditures. Thus, another contribution of our paper is to show how the state-contingent allocation of control rights helps mitigate investment distortions arising from financing frictions. In this sense, our study is complementary to previous studies identifying a link between covenants and firm value (e.g., Kahan and Tuckman (1993), Beneish and Press (1995), and Harvey, Lins, and Roper (2004)) because our results identify a specific channel, capital expenditures, and mechanism, the transfer of control rights, through which agency conflicts can affect firm value.[3]

[2] Also related to our study is Lang, Ofek, and Stulz (1996), who show that firms with higher leverage tend to invest less—a result that they attribute to frictions in the debt market.

[3] This outcome is not obvious because the firm has many margins on which it can potentially respond to a covenant violation. For example, the firm can alter its labor policy, inventory investment, research and development expenses, advertising expenses, or even other financing policies (Roberts and Sufi (2007)).

Finally, our paper is related to studies investigating the resolution of technical default (e.g., Beneish and Press (1993), Chen and Wei (1993), DeFond and Jiambalvo (1994), Sweeney (1994), Gopalakrishnan and Parkash (1995), and Nini, Smith, and Sufi (2007)). In addition to identifying other implications of technical default via our discussions with commercial lenders (e.g., increases in collateral requirements, more frequent monitoring and reporting, and changes in banks' internal ratings and capital allocation), our evidence shows that these resolutions can impact investment activity in a significant manner, counter to the findings of Beneish and Press (1993).

The remainder of the paper proceeds as follows. Section I discusses the data and outlines the sample construction. Section II presents the theoretical motivation for our study by detailing the rationale for covenants and discussing why covenant violations might affect investment. Section III presents the results of our analysis examining the impact of covenant violations on investment. Section IV examines the relation between ex ante proxies for agency and information problems with cross-sectional variation in the investment response to covenant violations. Section V concludes.

I. Data and Sample Selection

Our choice of data is motivated by the fact that technical defaults occur almost exclusively in private debt issues, which contain relatively more and "tighter" covenants when compared to public debt issues (Kahan and Tuckman (1995)).[4] (By tighter, we refer to covenants in which the distance between the covenant threshold and the actual accounting measure is smaller.) That private debt issues contain more and tighter covenants is not surprising in light of the relatively lower renegotiation costs associated with private debt (Smith and Warner (1979) and Leftwich (1981)) due to the concentration of investors and active monitoring role played by most private lenders (Diamond (1984, 1991), Fama (1985), and Rajan (1992)). Indeed, Sweeney (1994) suggests that the few technical defaults observed in public debt issues are usually a consequence of cross-default provisions in the public debt and, consequently, do not correspond to an incremental default. Thus, our discussion and empirical analysis focuses on violations of covenants in private debt contracts or, more succinctly, loans.

A. Loan Data

Loan information comes from a July 2005 extract of Loan Pricing Corporation's (LPC) Dealscan database. The data consist of dollar-denominated private loans made by bank (e.g., commercial and investment) and nonbank (e.g., insurance companies and pension funds) lenders to U.S. corporations during the period 1981 to 2005. According to Carey and Hrycray (1999), the Dealscan

[4] See studies by Chava, Kumar, and Warga (2004) and Billett, King, and Mauer (2005) for details on public debt covenants, and Garleanu and Zwiebel (2005) for a theoretical explanation of covenant tightness.

database contains between 50% and 75% of the value of all commercial loans in the U.S. during the early 1990s. From 1995 onward, Dealscan coverage increases to include an even greater fraction of commercial loans. According to LPC, approximately 60% of the loan data comes from SEC filings (13Ds, 14Ds, 13Es, 10Ks, 10Qs, 8Ks, and registration statements). The rest of the data come from contacts within the credit industry and from borrowers and lenders—increasingly important sources over time.

The basic unit of observation in Dealscan is a loan, also referred to as a facility or a tranche. Loans are often grouped together into deals or packages. For example, in May of 2001, IBM entered into a $12 billion deal consisting of two loans: a 364-day facility for $4 billion and a 5-year revolving line of credit for $8 billion. Most of the loans used in this study are senior secured claims, features common to commercial loans (Bradley and Roberts (2003)). While the data contain information on many aspects of the loan (e.g., amount, promised yield, maturity, etc.), most pertinent to the analysis here is information on restrictive covenants.

Because information on covenants is fairly limited prior to 1994, we focus our attention on the sample of loans with start dates between 1994 and 2005, though the inclusion of loans starting earlier has no effect on our results. Additionally, we require that each loan contain a covenant restricting the current ratio, net worth, or tangible net worth to lie above a certain threshold. (Variable definitions are provided in Appendix A.) Because of obvious similarities, and to ease the discussion, we group loans containing a net worth or a tangible net worth covenant together and refer to them simply as net worth loans.

We focus on these covenants for two reasons, as elaborated by Dichev and Skinner (2002). First, they appear relatively frequently in the Dealscan database. Table I shows that covenants restricting the current ratio or net worth are found in 9,294 loans (6,386 packages) with a combined face value of over a trillion dollars (deflated to December 2000 by the All-Urban CPI). Second, and most importantly, the accounting measures used for these two covenants are standardized and unambiguous. This is in contrast to other covenants that restrict, for example, the ratio of debt to EBITDA. Depending on the specific loan, "debt" may refer to long-term debt, short-term debt, total debt, funded debt, secured debt, etc. Covenants relying on measures of leverage or interest payments face similar difficulties, which is consistent with the evidence provided by Leftwich (1983), who suggests that one way in which private lenders customize their contracts is through adjustments to GAAP when defining financial statement variables.

B. Sample Construction

Our starting point for the sample construction is the quarterly merged CRSP-Compustat database, excluding financial firms (SIC codes 6000-6999). We use quarterly, as opposed to annual, frequency accounting data because borrowers are required to file with their creditors periodic reports detailing their compliance with financial covenants. In the event of a covenant breach, borrowers must immediately notify the creditor, or lead arranger in the case of a syndicated

Table I
Summary of Covenant Restrictions

The table presents a list of covenant restrictions found in loans to nonfinancial firms in the intersection of the merged CRSP-Compustat database and Dealscan during the period 1994 to 2005. *Packages* are collections of loans (i.e., tranches) entered into under one collective agreement. *Loan Amount* corresponds to the face value of the loans and is deflated by the all-urban CPI (year 2000).

Covenant	Number of Loans	Number of Packages	Loan Amount ($Bil)		
			Average	Median	Total
Max. Debt to EBITDA	7,544	4,417	0.20	0.09	1,480.53
Min. (Tangible) Net Worth	7,196	4,931	0.13	0.03	926.67
Min. Fixed Charge Coverage	6,064	3,514	0.14	0.06	842.95
Min. Interest Coverage	5,856	3,486	0.22	0.10	1,299.70
Max. Leverage Ratio	2,401	1,748	0.32	0.15	758.06
Max. Debt to Tangible Net Worth	2,331	1,677	0.06	0.01	137.90
Min. Current Ratio	2,098	1,455	0.06	0.02	126.45
Min. Debt Service Coverage	1,906	1,186	0.07	0.01	126.08
Max. Senior Debt to EBITDA	1,654	857	0.14	0.09	231.34
Min. EBITDA	1,556	886	0.09	0.04	135.32
Min. Quick Ratio	779	555	0.02	0.01	19.16
Min. Cash Interest Coverage	321	165	0.19	0.10	60.70
Max. Debt to Equity	169	119	0.17	0.04	27.95
Max. Senior Leverage	20	10	0.23	0.12	4.54
Max. Loan to Value	19	8	0.05	0.02	0.97

loan. In many instances these compliance reports are filed at a quarterly frequency, to coincide with SEC reporting requirements; however, the frequency does vary. We therefore use the highest frequency accounting data available in order to get the most accurate assessment of when the covenant violation occurs.[5]

For brevity, we will refer to this subset as the Compustat sample. All variables constructed from these data are formally defined in Appendix A. Data from Compustat are merged with loan information from Dealscan by matching company names and loan origination dates from Dealscan to company names and corresponding active dates in the CRSP historical header file.[6] This merge results in 27,022 packages (37,764 loans) for 6,716 unique firms between 1987 and 2005. We then draw our sample containing firm-quarter observations in which firms are bound by either a current ratio or a net worth covenant during the period 1994 to 2005. Though our focus does not discriminate between these two covenants, we also split our sample into two mutually exclusive samples based on whether the loan contains a current ratio or a net worth covenant. We do this to provide insight into any differences between covenants when they occur. However, because of the similarity of the results for the two subsamples, we focus our attention on the combined sample for the regression analysis.

[5] Results using annual data produce qualitatively similar findings.

[6] We thank a number of research assistants over the years, as well as Michael Boldin and the Wharton Research Data Services (WRDS) staff for aid with this matching process.

Since covenants generally apply to all loans in a package, we define the time period over which the firm is bound by the covenant as starting with the earliest loan start date in the package and ending with the latest maturity date. In effect, we assume that the firm is bound by the covenant for the longest possible life of all loans in the package. We also require our investment measure and the covenant's corresponding accounting measure to be nonmissing. For current ratio loans, this process results in 5,428 firm-quarter observations corresponding to 499 firms that entered into 622 deals (927 loans). For net worth loans, this process results in 13,021 firm-quarter observations corresponding to 1,100 firms that entered into 1,453 deals (2,055 loans). Thus, our unit of observation is a firm-quarter, each of which either is or is not in violation of a particular covenant.

Because the sample selection procedure is not random, the ability to extrapolate any inferences beyond our sample is of potential concern and the usual caveat applies. However, Panel A of Table II examines this concern by comparing the characteristics of firms in Compustat to those in the current ratio and net worth samples. To ease the comparison, we focus on nonfinancial firms existing in Compustat since 1994. To mitigate the impact of outliers we trim all ratios at the upper and lower 2.5 percentiles in the Compustat population and at the upper and lower one percentiles in the current ratio and net worth samples. While some differences are evident, the three samples are, in fact, quite similar along many dimensions. Specifically, a comparison of the median ROA, capital-to-asset, and investment-to-capital ratios reveals economically similar characteristics. However, the covenant samples contain relatively larger firms, in terms of total assets, with smaller market-to-book ratios and Macro q, differences that are more acute for the net worth sample.[7] The covenant samples also contain firms with higher cash flows and leverage ratios relative to the Compustat population.

Panel B of Table II performs a similar exercise by comparing the loan characteristics in the current ratio and net worth samples to those in the matched Dealscan-Compustat population. Immediately, we see that the current ratio sample contains loans of smaller amounts. However, the median loan size does not vary substantially across the three samples and all three samples share the same median maturity (3 years) and promised yield (200 basis points above LIBOR). Even average promised yields and loan maturities are economically similar across the three samples. Thus, other than the size of the loan, the loans in our covenant samples are similar to those in the general population, at least in terms of maturity and promised yield, much like many of the firm characteristics.

[7] Macro q, an alternative measure of Tobin's q, is defined as the sum of debt and equity less inventory divided by the start-of-period capital stock (Salinger and Summers (1983)). This measure is recommended by Erickson and Whited (2000) as a superior proxy for Tobin's q, relative to the market-to-book ratio, because it improves measurement quality. We note that the large average and median values for Macro q are a consequence of our choice of sample period, 1994 to 2005, which contains a significant number of small firms with few tangible assets.

Table II

Firm and Loan Sample Selection Comparison

Panel A presents summary statistics—averages, [medians], and (standard errors)—for three samples of firm-quarter observations. The CRSP-Compustat sample consists of all firm-quarter observations from nonfinancial firms in the merged CRSP-Compustat database from 1994 to 2005. The Current Ratio sample consists of all firm-quarter observations from nonfinancial firms in the merged CRSP-Compustat database in which a covenant restricting the current ratio of the firm is imposed by a private loan found in Dealscan between 1994 and 2005. The Net Worth sample consists of all firm-quarter observations from nonfinancial firms in the merged CRSP-Compustat database in which a covenant restricting the net worth or tangible net worth of the firm is imposed by a private loan found in Dealscan between 1994 and 2005. Panel B presents summary statistics—averages, [medians], and (standard errors)—for three samples of loan observations. The Dealscan sample corresponds to all Dealscan loans that can be matched to nonfinancial firms in the merged CRSP-Compustat database between 1981 and 2005. The Current Ratio and Net Worth samples are as described above. (Tangible) Net Worth is measured in $ million deflated by the all-urban CPI to December 2000. Variable definitions appear in Appendix A.

Panel A: Firm Characteristics

	CRSP-Compustat		Current Ratio		Net Worth	
Variable	Mean [Median]	(*SE*)	Mean [Median]	(*SE*)	Mean [Median]	(*SE*)
Current Ratio	2.46	(0.00)	2.30	(0.02)	2.33	(0.02)
	[1.77]		[1.96]		[1.84]	
Net Worth	284.33	(1.19)	160.13	(4.87)	581.80	(15.40)
	[42.64]		[70.68]		[128.19]	
Tangible Net Worth	88.85	(0.49)	160.09	(4.87)	577.77	(15.41)
	[15.36]		[70.66]		[127.31]	
Log(Assets)	4.51	(0.00)	5.05	(0.02)	5.59	(0.02)
	[4.52]		[5.07]		[5.56]	
Market-to-Book	2.08	(0.00)	1.45	(0.02)	1.37	(0.01)
	[1.27]		[1.09]		[1.02]	
Macro q	13.52	(0.05)	8.05	(0.20)	8.14	(0.14)
	[4.39]		[3.74]		[3.16]	
ROA	0.00	(0.00)	0.03	(0.00)	0.03	(0.00)
	[0.02]		[0.03]		[0.03]	
Capital/Assets	0.29	(0.00)	0.31	(0.00)	0.31	(0.00)
	[0.22]		[0.24]		[0.25]	
Investment/Capital	0.08	(0.00)	0.08	(0.00)	0.07	(0.00)
	[0.05]		[0.05]		[0.04]	
Cash Flow	−0.19	(0.00)	0.09	(0.01)	0.05	(0.00)
	[0.05]		[0.08]		[0.07]	
Leverage	0.25	(0.00)	0.29	(0.00)	0.26	(0.00)
	[0.21]		[0.27]		[0.25]	
Firm-Quarter Obs	260,651		5,428		13,021	
Firms	14,083		499		1,100	

Panel B: Loan Characteristics

	Dealscan		Current Ratio		Net Worth	
Variable	Mean [Median]	(*SE*)	Mean [Median]	(*SE*)	Mean [Median]	(*SE*)
Loan Amount ($Mil)	188.52	(8.94)	56.78	(3.04)	138.63	(8.94)
	[25.00]		[20.00]		[25.00]	
Promised Yield (bp over LIBOR)	219.81	(3.11)	222.58	(3.97)	211.89	(3.11)
	[200.00]		[200.00]		[200.00]	
Loan Maturity (Months)	46.87	(0.60)	41.21	(0.84)	40.80	(0.60)
	[36.00]		[36.00]		[36.00]	
Deals	27,022		622		1,453	
Loans	37,764		927		2,055	

C. Covenant Violations

A firm is in violation of a covenant if the value of its accounting variable breaches the covenant threshold. In this study, that situation arises when either the current ratio or the net worth falls below the corresponding threshold. While conceptually straightforward, the measurement of the covenant threshold, and consequently the covenant violation, poses several challenges. For example, firms can enter into multiple overlapping deals, raising the issue of which covenant threshold the firm is bound by. Additionally, covenant thresholds can change over the life of the contract, either according to a fixed schedule or as a function of other accounting variables (e.g., net income). Finally, loans are sometimes amended after origination at the behest of the borrower. Thus, loans are dynamic contracts, whose evolution is not always perfectly observable to the econometrician. As such, we examine and discuss measurement issues in detail in Appendix B.

In Table III, we examine several characteristics of covenant violations beginning with their frequency of occurrence: 37% and 31% of the firms in the current ratio and net worth samples experience a covenant violation, respectively. Similarly, 32% and 25% of the deals experience a covenant violation, and

Table III
Summary of Covenant Violations

The table presents summary statistics—averages, [medians], and (standard errors). The Current Ratio sample consists of all firm-quarter observations from nonfinancial firms in the merged CRSP-Compustat database in which a covenant restricting the current ratio of the firm is imposed by a private loan found in Dealscan between 1994 and 2005. The Net Worth sample consists of all firm-quarter observations from nonfinancial firms in the merged CRSP-Compustat database in which a covenant restricting the net worth or tangible net worth of the firm is imposed by a private loan found in Dealscan between 1994 and 2005. *Fraction of Firms (Deals) [Obs] in Violation* is the fraction of firms (Deals) [firm-quarter observations] in each sample that experience a covenant violation. *Initial Covenant Tightness* is the difference between the actual accounting variable (current ratio or net worth) and the initial covenant threshold divided by the firm-specific standard deviation of the accounting variable. *Time to First Violation* is the time under the loan contract until a covenant violation occurs, where time has been normalized to the unit interval to account for variation in loan maturities.

	Current Ratio Sample		Net Worth Sample	
Measure	Mean [Median]	(*SE*)	Mean [Median]	(*SE*)
Fraction of Firms in Violation	0.37	(0.02)	0.31	(0.01)
	[0.00]		[0.00]	
Fraction of Deals in Violation	0.32	(0.02)	0.25	(0.01)
	[0.00]		[0.00]	
Fraction of Obs in Violation	0.15	(0.00)	0.14	(0.00)
	[0.00]		[0.00]	
Initial Covenant Tightness	1.09	(0.04)	0.68	(0.03)
	[0.84]		[0.56]	
Time to First Violation	0.50	(0.02)	0.48	(0.01)
	[0.46]		[0.44]	

15% and 14% of the firm-quarter observations are classified as in violation, respectively. The fourth row shows that this frequency is perhaps unsurprising in light of how tightly covenants are set at the loan origination. Relative to the firm-specific standard deviation of the underlying accounting variable, we see that current ratio and net worth thresholds are set approximately 1.1 and 0.7 standard deviations above the value of the current ratio and net worth at the start of the loan, respectively.[8] Finally, Table III shows that most covenant violations occur approximately mid-way through the loan, where we have normalized each loan's maturity to the unit interval. Overall, these results are reassuring in that they are broadly consistent with the findings of Dichev and Skinner (2002), whose data construction we follow.

II. The Link between Covenants and Investment: Theory and Practice

A. The Rationale for Covenants

Why would covenant violations affect investment? To answer this question, it is useful to first understand the rationale for covenants, which may be distinguished by the following economic taxonomy: covenants meant to prevent value reduction and covenants defining control rights (Gorton and Winton (2003) and Tirole (2006)). The former view begins by recognizing the incentives of managers, acting on behalf of shareholders, to take actions that expropriate bondholder wealth (e.g., Jensen and Meckling (1976) and Smith and Warner (1979)).[9] In so far as managers have incentives to reduce total firm value, which may be privately optimal, covenants can mitigate the reduction in value.

For example, large payments to shareholders decapitalize the firm putting future interest and principal payments at greater risk. Doing so may either demotivate managers or induce excessive risk-taking, that is, asset-substitution, which can create value losses (Jensen and Meckling (1976) and Dewatripont and Tirole (1994)). Alternatively, managers can issue new debt to finance negative NPV projects because the loss to current and diluted existing debtholders exceeds the NPV loss.[10] Not surprisingly, we often see covenants addressing these possibilities, such as restrictions on dividend payments and limitations on new debt issuances (Bradley and Roberts (2003)).

The second rationale for covenants is to define the allocation of control rights among the firm's claimants (Aghion and Bolton (1992) and Hart (1995)). This view comes from the optimal contracting literature, which builds on the

[8] We require at least eight nonmissing observations for each firm when estimating the firm-specific standard deviation of the current ratio, net worth, or tangible net worth.

[9] Of course, the redistribution of wealth from bondholders to shareholders, by itself, is not a motivation for the existence of covenants. To the extent that the expropriation is anticipated, the ex ante price of debt and equity will reflect the ex post wealth transfer so that total firm value will be unaffected. That is, the Modigliani and Miller (1958) irrelevance result will still attain.

[10] Note that dilution may occur even if the new debt is junior to the existing debt if the additional debt burden reduces management's incentives (Tirole (2006)).

original insight of Jensen and Meckling (1976) by assuming that the misalignment of incentives between managers and claimants leads to an endogenous security design that minimizes agency costs. Under this view, covenants define the circumstances under which debtholders are permitted to intervene in management. In such instances, the transfer of control rights can act as part of the incentive package offered to management: "good" behavior by management ensures continued control and any benefits associated with that control; "bad" behavior by management results in loss of control and any associated benefits. Conditional on performance being positively correlated with behavior, covenants act as a state-contingent control mechanism that increases pledgeable income and facilitates financing.

This second rationale is particularly relevant for our study, which focuses on financial covenants tied to firm performance. Assuming that the current ratio and net worth of a firm are positively correlated with good behavior on the part of the manager, a low current ratio or low net worth might indicate bad behavior (e.g., low effort, diversion of project returns, asset substitution, etc.). Sufficiently low values for these accounting ratios lead to a transfer of control rights from borrowers to creditors who can then use the threat of accelerating the loan to discipline managers via an array of actions, including waivers conditional on an improvement in the financial health of the firm, the inclusion of additional covenant restrictions, increased interest rates, and reduced allowable borrowings (Beneish and Press (1993), Chen and Wei (1993), DeFond and Jiambalvo (1994), and Sweeney (1994)).

Our discussions with commercial lenders revealed several additional actions often taken in response to covenant violations.[11] For example, several lenders mentioned changing the maturity of the loan, charging additional fees, increasing monitoring activities (e.g., more informal communications and more frequent reporting requirements), increasing collateral requirements, and direct involvement in capital budgeting decisions. Thus, accompanying most technical defaults is a renegotiation process that varies widely in terms of the actions taken by the creditor. We now turn to a more detailed discussion of these actions in order to answer the question posed at the outset of this section.

B. Implications for Investment

To understand why covenant violations can impact investment, we turn to both theory and practice for insight into the actions employed by creditors in response to a covenant violation. More precisely, we discuss the implications from theories of optimal contracting, as well as provide details of our discussions with a number of commercial lenders. While our conversations fall well short of a large-scale statistical survey, such as that of Graham and Harvey (2001), the lenders with whom we spoke have over 50 years of experience in commercial

[11] Our conversations with commercial lenders are discussed in more detail below.

lending.[12] As such, we found their insights into the renegotiation process to be invaluable and, often, closely aligned with the intuition provided by theory.

Consider the implications of theoretical models such as those of Aghion and Bolton (1992) and Dewatripont and Tirole (1994). The transfer of control rights to the creditor gives way for the creditor to choose her most preferred action, or to get the manager to bribe her into choosing the first-best action. In other words, the creditor can extract concessions from the borrower in order to choose a course of action that respects the manager's objectives. In the former case, where creditors seize control, the firm is either reorganized or liquidated, where reorganization of the firm refers to a "restructuring of claims" (p. 491, Aghion and Bolton (1992)) and liquidation refers to a broad class of actions including canceling projects, modifying projects, and actual liquidation of the firm (Dewatripont and Tirole (1994)). Thus, covenant violations can impact investment via the transfer of control rights.

Conditional on this transfer, creditors can take a number of actions, which may be broadly categorized into three groups. First, investment may be affected directly by creditors intervening in investment decisions. For example, some lenders acknowledge "advising" management to reduce investment expenditures after a covenant violation. The following quote from the third quarter 10-Q filing of Chart House Enterprises in 2003 exemplifies such a situation:[13]

> The lenders waived the Company's noncompliance with two loan covenant ratios... Pending the outcome of further discussions with the lenders, the Company elected to postpone any significant capital expenditures for remodels of restaurants as part of the Chart House restaurant revitalization program.

Lenders also suggest that covenant violations can lead them to direct firms away from growth-oriented investment projects to strategies generating more reliable short-term income streams, consistent with the risk-shifting implications of Gorton and Kahn (2000). Finally, Beneish and Press (1993) and Nini et al. (2007) show that creditors often incorporate explicit restrictions on capital expenditures after a covenant violation. Therefore, covenant violations can impact investment because of intervention in capital budgeting decisions.

Second, investment may be affected indirectly through transfers to investors or deadweight loss. For example, there can be direct costs associated with the covenant violation and ensuing renegotiation, such as penalties and recontracting fees, additional reporting and monitoring costs, as well as the opportunity cost of time spent by managers renegotiating the contract, as opposed to operating the firm. Several lenders noted that monitoring intensity often increased after a violation, an example of which is moving from quarterly to monthly, or

[12] We are particularly grateful for discussions with Rob Ragsdale, formerly of First Union; Terri Lins, formerly of Barclays, FleetBoston, and First Union/Wachovia; Horace Zona, formerly of UBS and Toronto Dominion and currently with First Union/Wachovia; Steven Roberts, formerly with Toronto Dominion; and Rich Walden, currently with JP Morgan Chase & Co.

[13] We thank Amir Sufi for sharing this quote with us.

even weekly, compliance reports. Lenders also indicated that covenant violations often lead to reductions in the bank's internal rating of the loan, a change that causes a corresponding increase in the bank's capital supporting the affected loan.[14] Theory predicts that these costs are ultimately passed on to the borrowing firm (e.g., Diamond (1984)) and, consequently, investment may be affected by the covenant violation because of these additional costs.

Finally, investment may be affected through a tightening credit constraint (e.g., Gorton and Kahn (2000)). As mentioned above, previous studies examining the resolution of technical default have shown that lenders often increase interest rates and reduce allowable borrowings (e.g., Beneish and Press (1993) and Chen and Wei (1993)). In a working paper version of this study (Chava and Roberts (2005)), we show similar results in the context of our data. Specifically, we find that in loans subsequent to a covenant violation, yield spreads over LIBOR increase by 73 and 46 basis points for the current ratio and net worth samples, respectively, while relative loan amounts and maturities often decrease as well. Additionally, other covenant restrictions, such as "sweep" or prepayment provisions become more punitive following a covenant violation. Thus, debt financing subsequent to a technical default appears relatively more expensive, an increase in the cost of capital that can impact investment.

Ultimately, both theory and practice suggest that covenant violations can impact investment via the transfer of control rights to creditors. The extent to which these actions impact investment is the focus of our empirical analysis. However, before turning to the empirical results in the next section, we caution the reader against interpreting the ex post investment response to covenant violations as either good or bad (i.e., increasing or decreasing firm value). Ex post intervention by debtholders can lead to both efficient outcomes, which thwart excessive risk-taking or negative NPV projects (e.g., Zender (1991)), and inefficient outcomes, which interfere with positive NPV projects because of the disciplinary role played by creditors (e.g., Dewatripont and Tirole (1994) and Gorton and Kahn (2000)). We take a closer look at the efficiency issue and the extent to which the transfer of control rights mitigates investment distortions arising from financing frictions in Section IV, where we examine whether the investment response accompanying covenant violations varies cross-sectionally with proxies for agency and information problems.

III. The Response of Investment to Covenant Violations

A. Nonparametric Analysis

Figure 1 presents average investment, defined as capital expenditures divided by the start of period capital stock, in event time relative to the first

[14] More precisely, several lenders indicated that each internal rating grade is inversely associated with the fraction of bank capital that supports the loan; a higher quality loan means a higher rating, which requires less bank capital. As loans are downgraded, the amount of bank capital set aside to support the loan increases. These actions are above and beyond any capital requirements imposed by bank regulations, such as the Basel Accords.

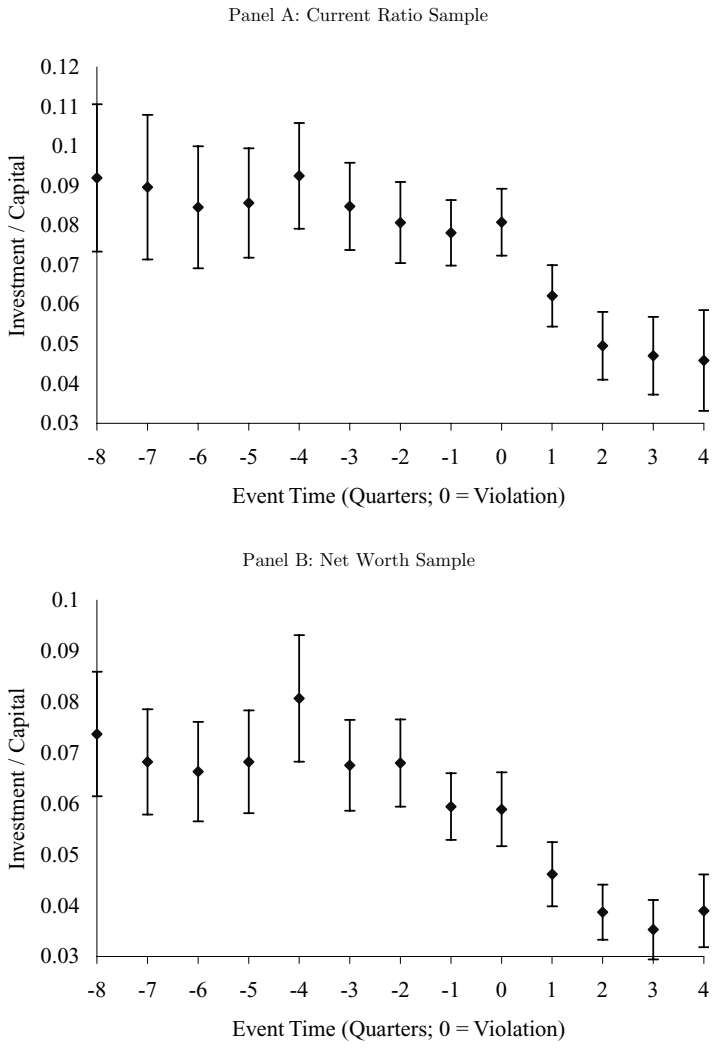

Figure 1. Investment in event time leading up to technical default. The sample consists of firm-quarter observations between 1994 and 2005 that satisfy the following requirements: (1) The observations correspond to a nonfinancial firm in the intersection of the merged CRSP-Compustat database and the Dealscan database; and (2) the observations correspond to a firm that has entered into a loan containing a covenant restricting their current ratio or net worth to lie above a certain threshold. The figures present average investment (quarterly capital expenditures divided by the start of period net physical, plant, property and equipment) in event time relative to the first time that a covenant is violated in a loan. Negative values correspond to the quarters prior to the violation, zero corresponds to the quarter of violation, and positive values correspond to the quarters following the initial violation. The average investment rates are denoted by the diamond in the center of each vertical band, which corresponds to a 95% confidence interval.

quarter in which a covenant violation occurs in a particular loan. Also presented are 95% confidence intervals, as indicated by the vertical width of the band surrounding the estimated average. Focusing on results for the current ratio sample in Panel A, we see that prior to the covenant violation (periods –8 through –1) the average investment rate is 8.6% per quarter. After the violation (periods 1 through 4), the average rate of investment is 5.1% per quarter. Additionally, there appears to be a break in average investment occurring immediately after the quarter in which the violation occurs. Panel B presents a relatively similar pattern for investment in our sample of net worth loans. Thus, the figures suggest a temporal break or discontinuity in investment coinciding with the violation.

Table IV presents summary statistics for firm characteristics in the net worth and current ratio samples, stratified by whether the firm is (Bind) or is not (Slack) in violation of the covenant. Consistent with Figure 1, we see an economically and highly statistically significant decline in investment, both in terms of averages and medians, when firms are in violation of their covenants. Average investment falls by 1.9% in the current ratio sample and 2.7% in the net worth sample. Relative to the average investment rates of 8% and 7% in nonviolation states, these declines correspond to a 26% and 39% drop in investment, respectively.

However, there is also significant heterogeneity in investment-related firm characteristics across the Bind and Slack delineation. For both current ratio and net worth samples, when a firm is in violation of a covenant, investment opportunities (market-to-book and Macro q) and cash flow are significantly lower, while leverage is significantly higher. These results suggest that in order to uncover the true impact of covenant violations on investment, we must control for variation in these other confounding characteristics.

B. Empirical Approach: A Regression Discontinuity Design

Hahn, Todd, and van der Klaauw (2001) note that "the regression discontinuity data design is a quasi-experimental data design with the defining characteristic that the probability of receiving treatment changes discontinuously as a function of one or more underlying variables" (p. 1). In the current context, covenant violations correspond to the treatment and nonviolations the control. What enables our research design to fit into the regression discontinuity paradigm is that the function mapping the distance between the underlying accounting variable and the covenant threshold into the treatment effect is discontinuous. Specifically, our treatment variable, $Bind_{it}$, is defined as

$$Bind_{it} = \begin{cases} 1 & z_{it} - z_{it}^{0} < 0 \\ 0 & \text{otherwise,} \end{cases} \tag{1}$$

where i and t index firm and year-quarter observations, z_{it} is the observed current ratio (or net worth), and z_{it}^{0} is the corresponding threshold specified by the covenant.

Table IV

Impact of Covenant Violation

The table presents summary statistics—averages, [medians], and (standard errors) for two samples. The Current Ratio sample consists of all firm-quarter observations from nonfinancial firms in the merged CRSP-Compustat database in which a covenant restricting the current ratio of the firm is imposed by a private loan found in Dealscan between 1994 and 2005. The Net Worth sample consists of all firm-quarter observations from nonfinancial firms in the merged CRSP-Compustat database in which a covenant restricting the net worth or tangible net worth of the firm is imposed by a private loan found in Dealscan between 1994 and 2005. These two samples are stratified by whether or not a firm-quarter observation is identified as being in violation (Bind) or not in violation (Slack) of the corresponding covenant. Variable definitions appear in Appendix A.

	Current Ratio				Net Worth			
	Bind		Slack		Bind		Slack	
Variable	Mean [Median]	(*SE*)	Mean [Median]	(*SE*)	Mean [Median]	(*SE*)	Mean [Median]	(*SE*)
Log(Assets)	4.972	(0.053)	5.068	(0.020)	4.824	(0.039)	5.716	(0.017)
	[4.999]		[5.090]		[4.723]		[5.678]	
Market-to-Book	1.118	(0.029)	1.501	(0.018)	1.129	(0.026)	1.404	(0.011)
	[0.912]		[1.129]		[0.845]		[1.051]	
Macro q	3.571	(0.247)	8.746	(0.225)	5.407	(0.293)	8.513	(0.157)
	[1.825]		[4.237]		[2.126]		[3.351]	
ROA	0.017	(0.002)	0.034	(0.001)	0.009	(0.001)	0.030	(0.000)
	[0.027]		[0.035]		[0.019]		[0.032]	
Capital/Assets	0.399	(0.010)	0.300	(0.003)	0.319	(0.005)	0.313	(0.002)
	[0.362]		[0.233]		[0.255]		[0.244]	
Investment/Capital	0.062	(0.003)	0.081	(0.001)	0.044	(0.001)	0.071	(0.001)
	[0.035]		[0.056]		[0.026]		[0.048]	
Cash Flow	−0.068	(0.017)	0.117	(0.005)	−0.123	(0.012)	0.079	(0.003)
	[0.030]		[0.092]		[0.016]		[0.075]	
Leverage	0.408	(0.008)	0.269	(0.003)	0.393	(0.006)	0.243	(0.002)
	[0.394]		[0.250]		[0.377]		[0.238]	
Firm-Quarter Obs	790		4,638		1,820		11,201	
Firms	184		487		342		1,076	

Our base empirical model for this section is

$$Investment_{it} = \alpha_0 + \beta_0\, Bind_{it-1} + \beta_1 X_{it-1} + \eta_i + \nu_t + \varepsilon_{it}, \tag{2}$$

where $Investment_{it}$ is the ratio of capital expenditures to the start-of-period capital, X_{it-1} is a vector of control variables, η_i is a firm fixed effect, ν_t is a year-quarter fixed effect, and ε_{it} is a random error term assumed to be correlated within firm observations and potentially heteroskedastic (Petersen (2006)). The parameter of interest is β_0, which represents the impact of a covenant violation on investment (i.e., the treatment effect). Because of the inclusion of a firm-specific effect, identification of β_0 comes only from those firms that experience a covenant violation. Therefore, we restrict our attention to the subsample of firms that experience at least one covenant violation; however, the estimated treatment effect using the entire sample of firms is qualitatively similar.

Our motivation for the specification in equation (2) comes from two sources, the first of which is an inability to precisely measure marginal q. Neoclassical q theory implies that investment is a function of only marginal q; any other effects, such as financing frictions, market power, adjustment costs, etc., are impounded into this measure (Gomes (2001)). While marginal q is empirically unobservable, Bakke and Whited (2006) identify a series of links between marginal q and its empirical proxy, Tobin's q, that highlight the role for other variables. Thus, to avoid a potential omitted variables bias in our estimated treatment effect, we incorporate other variables (e.g., cash flow—Cooper and Ejarque (2003), debt overhang—Hennessy (2004)) that measure the discrepancy between marginal q and its empirical proxy.

The second motivation for our empirical specification is that the nonlinear relation in equation (1) provides for identification of the treatment effect under very mild conditions. Indeed, in order for the treatment effect (β_0) to *not* be identified, it must be the case that the unobserved component of investment (ε_{it}) exhibits an identical discontinuity as that defined in equation (1), relating the violation status to the underlying accounting variable. That is, even if ε_{it} is correlated with the difference, $z_{it} - z_{it}^0$, our estimate of β_0 is unbiased as long as ε_{it} does not exhibit precisely the same discontinuity as $Bind_{it}$.[15]

Because the discontinuity is the source of identifying information, we also estimate equation (2) on the subsample of firm-quarter observations that are close to the point of discontinuity. To remove some of the subjectivity associated with the definition of "close," we turn to the literature on nonparametric density estimation (Silverman (1986)) to identify a robust measure of the optimal window width for a unimodal distribution.[16] For the current ratio (net worth)

[15] See Rauh (2006) for an application of a regression discontinuity design in the context of estimating investment-cash flow sensitivities.

[16] We use $0.79Rn^{-1/5}$, where R is the interquartile range and n is the number of observations. Alternative definitions produce quantitatively similar estimates and, thus, have little effect on our results. We note that the optimal window width, in and of itself, has little to do with our regression discontinuity design. Rather, our motivation for using nonparametric analysis to define what we

sample, the optimal window width is equal to 0.10 (0.09). To keep the definition simple and bolster statistical power, we formally define the "Discontinuity Sample" as those firm-quarter observations for which the absolute value of the relative distance between the accounting variable (current ratio or net worth) and the corresponding covenant threshold is less than 0.20, or approximately two window widths within the threshold. This restriction reduces our sample size by over 60%.

C. Primary Results

Panel A of Table V presents the estimation results for the entire sample consisting of loans containing either a current ratio or a net worth covenant (denoted "Entire Sample"). All specifications include both firm and year-quarter fixed effects, as indicated by the bottom of the table. The first column reveals that after removing both sets of fixed effects, covenant violations are associated with a decline in investment on the order of 1.5% of capital per quarter. Relative to an average quarterly investment rate of approximately 7.6% in nonviolation states, this estimate translates into a relative decrease in capital expenditures of almost 20%.

Specifications (2) through (5) incorporate additional control variables used in previous studies to address omitted variable concerns. The coefficient estimates on these additional variables (*Macro q*, *Cash Flow*, *Log(Assets)*, *lag cash flow*) are largely consistent with previous studies examining capital expenditures, at least in terms of signs (e.g., Bond and Meghir (1994), Erickson and Whited (2000, 2005)). However, their inclusion has little effect on the estimated impact of covenant violations, which lead to an average reduction in investment of over 1.0% per quarter. Even inclusion of the Hennessy (2004) debt overhang correction term leaves an economically and statistically large estimated treatment effect, despite reducing our sample size by almost one-third.[17] This result highlights the distinction between debt overhang and technical default: the former situation is based on lenders not forgiving existing debt, while the latter situation often results in further tightening of an existing credit constraint or direct intervention in the investment decision process.

The final two columns in Panel A attempt to further isolate the discontinuity corresponding to the covenant violation by including smooth functions of the distance from the default boundary into the specification. More precisely, *Default Distance (CR)* and *Default Distance (NW)* are defined as

$$\begin{aligned} \textit{Default Distance (CR)} &\equiv I_{(\textit{Current Ratio}_{it})} \\ &\quad \times \left(\textit{Current Ratio}_{it} - \textit{Current Ratio}_{it}^{0}\right) \\ \textit{Default Distance (NW)} &\equiv I_{(\textit{Net Worth}_{it})} \times \left(\textit{Net Worth}_{it} - \textit{NetWorth}_{it}^{0}\right), \end{aligned}$$

mean by close is simply to impose some structure on the definition that is removed from corporate behavior.

[17] We follow Hennessy, Levy, and Whited (2006) in imputing the value of this variable for unrated firms, though we construct this variable using quarterly data. See Appendix A for details.

Table V
Investment Regressions

The sample consists of firm-quarter observations between 1994 and 2005 that satisfy the following requirements: (1) The observations correspond to a nonfinancial firm in the intersection of the merged CRSP-Compustat database and the Dealscan database; and (2) the observations correspond to a firm that has entered into a loan containing a covenant restricting its current ratio or net worth to lie above a certain threshold. The table presents regression results, where the dependent variable in each regression is investment (the ratio of quarterly capital expenditures to capital at the start of the period). All independent variables are lagged one quarter, except for *Cash Flow*, which is contemporaneous with investment. Panel A presents the results for the entire sample. Panel B presents the results for the discontinuity sample, defined as those firm-quarter observations in which the absolute value of the relative distance to the covenant threshold is less than 0.20. All *t*-statistics (presented in parentheses) are robust to within-firm correlation and heteroskedasticity. Variable definitions appear in Appendix A.

Panel A: Entire Sample

	Specification						
Coefficient	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Intercept	0.058	0.070	0.093	0.067	0.071	0.069	0.068
	(9.62)	(15.04)	(3.31)	(13.87)	(3.10)	(14.87)	(14.73)
Bind	−0.015	−0.012	−0.013	−0.010	−0.007	−0.010	−0.008
	(−6.52)	(−5.26)	(−5.58)	(−4.11)	(−2.58)	(−4.40)	(−3.41)
Macro q		0.002	0.002	0.003	0.002	0.002	0.002
	( )	(6.74)	(6.67)	(5.16)	(4.43)	(6.59)	(6.63)
Cash Flow		0.008	0.007	0.004	0.012	0.008	0.007
	( )	(1.74)	(1.72)	(0.86)	(1.88)	(1.74)	(1.70)
Log(Assets)			−0.003				
	( )	( )	(−0.82)	( )	( )	( )	( )
Lag Cash Flow				0.010			
	( )	( )	( )	(2.09)	( )	( )	( )
(Macro q)^2				−0.000			
	( )	( )	( )	(−1.73)	( )	( )	( )
Debt Overhang					−0.030		
	( )	( )	( )	( )	(−1.88)	( )	( )
Default Distance (CR)						0.006	0.015
	( )	( )	( )	( )	( )	(2.47)	(3.51)
Default Distance (NW)						−0.000	−0.000
	( )	( )	( )	( )	( )	(−1.03)	(−0.32)
(Default Distance (CR))^2							−0.002
	( )	( )	( )	( )	( )	( )	(−2.77)
(Default Distance (NW))^2							−0.000
	( )	( )	( )	( )	( )	( )	(−0.22)
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	6,256	4,887	4,887	4,734	3,140	4,884	4,884
R^2	0.445	0.503	0.503	0.508	0.503	0.505	0.506

(*continued*)

where $I_{(Current\ Ratio_{it})}$ and $I_{(Net\ Worth_{it})}$ are indicator variables equal to one if the firm-quarter observation is bound by a current ratio or net worth covenant, respectively. The $Current\ Ratio^0_{it}$ and $Net\ Worth^0_{it}$ variables correspond to the covenant thresholds. In addition to isolating the treatment effect to the point of discontinuity, including these variables in the regression specification enables us to address the concern that the distance to the covenant threshold contains

Table V—*Continued*

Panel B: Discontinuity Sample					
	Specification				
Coefficient	(1)	(2)	(3)	(4)	(5)
Intercept	0.062	0.060	0.064	0.055	0.085
	(12.24)	(6.76)	(1.72)	(8.13)	(2.24)
Bind	−0.010	−0.010	−0.010	−0.009	−0.007
	(−2.79)	(−3.28)	(−3.28)	(−2.80)	(−2.07)
Macro q		0.003	0.003	0.000	0.002
	( )	(3.99)	(3.96)	(0.37)	(2.47)
Cash Flow		0.010	0.010	0.009	−0.001
	( )	(1.29)	(1.30)	(1.05)	(−0.08)
Log(Assets)			−0.001		
	( )	( )	(−0.12)	( )	( )
Lag Cash Flow				0.008	
	( )	( )	( )	(1.19)	( )
(Macro q)^2				0.000	
	( )	( )	( )	(2.83)	( )
Debt Overhang					−0.315
	( )	( )	( )	( )	(−2.48)
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year-Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes
Obs	2,329	1,923	1,923	1,873	1,337
R^2	0.543	0.609	0.609	0.621	0.609

information about future investment opportunities not captured by the other determinants. The results reveal that the current ratio distance does contain some information about investment opportunities, while the net worth distance is largely insignificant, perhaps because of its collinearity with cash flow.[18] Nonetheless, the estimated treatment effect of almost 1% per quarter is still economically and statistically large.

Panel B of Table V presents the estimation results using the Discontinuity Sample. Recall that this sample contains only those firm-quarter observations that fall within a narrow range (±0.20) around the covenant threshold. Overall, the results reinforce the findings for the broader sample: Investment declines sharply in response to a covenant violation. The estimates of this decline range from 1.0% to 0.7% and are statistically significant across all of the specifications.[19] We also note that the estimated coefficient for the debt overhang correction term increases in magnitude and statistical significance, reinforcing the insights of Hennessy (2004) and Hennessy et al. (2006) at the point where debt overhang is most likely to be relevant, namely, renegotiation.

[18] Including higher-order polynomial terms has a negligible effect on the results.

[19] For the discontinuity sample, we follow Angrist and Lavy (1999) and exclude smooth functions of the distance to the covenant threshold because the range of the distance in the discontinuity sample is narrow enough that the indicator function is a valid instrument without these controls.

In sum, capital expenditures decline significantly in response to covenant violations. We observe a quarterly decline in investment of approximately 1% of capital, a 13% decline relative to the level of investment outside of violation states. This finding is consistent with control-based theories highlighting the disciplinary role played by creditors who wish to derail inefficient investment or to discipline managers.

D. Robustness Tests

While theory provides little guidance on additional factors affecting investment beyond those examined in Table V, other factors may nonetheless be relevant if they impact the shadow value of capital but are not impounded in our proxy for Tobin's q. Additionally, it is important to understand the implications for our results of firms' abilities to influence the likelihood of a violation via strategic defaults. This subsection addresses these issues.

For example, while covenant violations are not directly associated with financial distress or insolvency (Dichev and Skinner (2002)), one potential concern is that the covenant violation coincides with a contraction in investment opportunities brought on by a deterioration in financial health. In Panels A and B of Table VI, we examine the entire sample and discontinuity sample, respectively, for the impact of incorporating *Leverage* (Lang et al. (1996)) and *Altman's Z-Score* (Altman (1968)) into our regression specification. Consistent with intuition, less financially healthy firms tend to invest less; however, the impact of covenant violations on investment is still significant.

Alternatively, our attribution of the estimated treatment effect to the current ratio or net worth covenant may be misplaced if other covenants in the debt contract are simultaneously being violated. Of course, such a finding is still consistent with the basic message of our paper that covenant violations impact investment via the transfer of control rights, albeit due to different covenants. We examine the impact of incorporating two additional proxies for other covenants contained in the contract. The first proxy is simply the number of financial covenants (e.g., debt-to-EBITDA, interest coverage ratio, etc.) contained in the contract, the second is an indicator variable identifying the presence of a prepayment, or "sweep," provision. Neither variable is statistically significant in either the entire sample or the discontinuity sample (Table VI), and their impact on our estimated treatment effect is negligible.[20]

Another potential concern is that firms may attempt to avoid violating a covenant via manipulation of their accounting statements. This activity is also broadly consistent with the basic message of our study, namely, that covenant violations bring about outcomes that run counter to the preferences of borrowers. Nonetheless, to test the effects of this behavior on our estimates, we incorporate into our regression measures of abnormal accruals, which, despite

[20] Unfortunately, information on sweep provisions is often missing in the Dealscan database, as evidenced by the number of observations in column (4) of Panels A and B. Examination of a subsample that excludes all deals with sweep provisions produces qualitatively similar findings.

Table VI
Investment Regressions—Robustness Tests

The sample consists of firm-quarter observations between 1994 and 2005 that satisfy the following requirements: (1) The observations correspond to a nonfinancial firm in the intersection of the merged CRSP-Compustat database and the Dealscan database; and (2) the observations correspond to a firm that has entered into a loan containing a covenant restricting its current ratio or net worth to lie above a certain threshold. The table presents regression results, where the dependent variable in each regression is investment (the ratio of quarterly capital expenditures to capital at the start of the period). All independent variables are lagged one quarter, except for *Cash Flow*, which is contemporaneous with investment. Panel A presents the results for the entire sample. Panel B presents the results for the discontinuity sample, defined as those firm-quarter observations in which the absolute value of the relative distance to the covenant threshold is less than 0.20. All *t*-statistics (presented in parentheses) are robust to within-firm correlation and heteroskedasticity. Variable definitions appear in Appendix A.

Panel A: Entire Sample

	Specification				
Coefficient	(1)	(2)	(3)	(4)	(5)
Intercept	0.089	0.063	0.070	0.127	0.058
	(11.91)	(12.72)	(8.52)	(10.53)	(6.20)
Bind	−0.008	−0.007	−0.012	−0.008	−0.011
	(−3.49)	(−3.05)	(−5.09)	(−2.65)	(−3.38)
Macro *q*	0.002	0.002	0.002	0.002	0.002
	(6.41)	(6.51)	(6.93)	(3.24)	(5.33)
Cash Flow	0.008	0.006	0.005	−0.003	0.003
	(1.88)	(1.50)	(1.21)	(−0.40)	(0.62)
Leverage	−0.049				
	(−3.22)	( )	( )	( )	( )
Altman's *Z*-Score		0.012			
	( )	(5.48)	( )	( )	( )
# Financial Covs.			−0.000		
	( )	( )	(−0.09)	( )	( )
Sweep Covenants				0.002	
	( )	( )	( )	(0.21)	( )
Abnor Current Accruals-TWW					0.061
	( )	( )	( )	( )	(1.83)
Abnor Current Accruals-DD					−0.029
	( )	( )	( )	( )	(−1.10)
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year-Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes
Obs	4,855	4,657	4,419	2,234	3,494
R^2	0.509	0.510	0.498	0.542	0.517

(*continued*)

being somewhat noisy (Dechow, Sloan, and Sweeney (1995)), have "the potential to reveal subtle manipulation strategies related to revenue and expense recognition" (DeFond and Jiambalvo (1994), p. 149). Column (5) in Table VI reveals that the abnormal accrual measures are largely insignificant in both

Table VI—*Continued*

Panel B: Discontinuity Sample					
	Specification				
Coefficient	(1)	(2)	(3)	(4)	(5)
Intercept	0.089	0.023	0.080	0.112	0.059
	(6.64)	(1.91)	(3.22)	(5.43)	(5.41)
Bind	−0.008	−0.007	−0.010	−0.008	−0.010
	(−2.66)	(−2.21)	(−3.35)	(−1.53)	(−2.79)
Macro q	0.003	0.003	0.003	0.004	0.003
	(3.79)	(3.70)	(4.84)	(4.17)	(2.22)
Cash Flow	0.009	0.013	0.008	−0.003	0.009
	(1.23)	(1.69)	(0.99)	(−0.23)	(0.90)
Leverage	−0.139				
	(−3.77)	( )	( )	( )	( )
Altman's Z-Score		0.026			
	( )	(5.05)	( )	( )	( )
# Financial Covs.			−0.005		
	( )	( )	(−0.99)	( )	( )
Sweep Covenants				0.000	
	( )	( )	( )	(0.01)	( )
Abnor Current Accruals-TWW					−0.046
	( )	( )	( )	( )	(−0.94)
Abnor Current Accruals-DD					0.051
	( )	( )	( )	( )	(1.38)
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year-Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes
Obs	1,919	1,816	1,752	949	1,395
R^2	0.623	0.610	0.607	0.665	0.644

the Entire and Discontinuity samples, and that the estimated treatment effect is unaffected by their inclusion.

We also re-estimate our models on the subsample of firm-quarter observations that are far from the covenant boundary, where "far" is defined as outside of the window defining our Discontinuity Sample. Intuitively, firms that are far from the boundary have little incentive to try to avoid a covenant violation because their distance from the threshold makes such avoidance impractical or irrelevant. The results are qualitatively similar to those presented in Tables V and VI and, as such, are not presented. Thus, while accounting manipulation may be an important element of corporate behavior, it does not appear to be responsible for our findings.

In addition to furthering the robustness of our results, these findings are reassuring for several reasons. First, commercial lenders have considerable experience in originating and monitoring loans, suggesting that, while possible, the ability of borrowers to consistently fool private lenders via accounting manipulation is limited. Further, most credit agreements spell out in great detail the precise definition and computation of financial covenants,

requiring "consistent application of GAAP" (Taylor and Sansone (2007), p. 294) both prior to and during the loan. Second, the repeated nature of the lending process makes the penalty for being caught potentially severe in that future financing with the current lender is threatened, as is financing with other lenders if they become aware of such behavior.

Finally, the survey evidence in Graham, Harvey, and Rajgopal (2005) suggests that managers are more likely to avoid covenant violations by cutting investment, as opposed to manipulating financial reports. Our findings here complement their survey evidence by documenting that creditor intervention following a covenant violation has significant consequences for borrowers. Additionally, their survey evidence suggests that our estimated effect may be conservative. Assuming that managers are more likely to cut investment to avoid a covenant violation when the relative costs of violating are high, then the observed violations occur when the relative costs of violating are low.[21]

A final concern is the impact of measurement error in q on our estimates (Erickson and Whited (2000)). To address this concern, we employ the reverse regression bounds approach of Erickson and Whited (2005) in order to ensure the robustness of the sign of our estimate. To manage the length of our study, we refer the reader to Erickson and Whited (2005) for details on this procedure and note only that our estimated treatment effect is robust to this concern because of a relatively low correlation with our proxy for q.[22] This low correlation also implies that any measurement error contained in our covenant violation indicator variable is likely to lead to the usual attenuation bias of the OLS coefficient (e.g., Greene (2003)). Thus, measurement error in our setting most likely leads to conservative estimates of the investment response to covenant violations.

IV. Cross-sectional Variation in the Investment Response

While the previous section focused on identifying the average investment response to covenant violations, there is good reason to expect cross-sectional variation in this response. In particular, because covenants are designed to mitigate agency problems, the consequences of a covenant violation should covary with the severity of this problem. Likewise, because information asymmetry may exacerbate any underlying agency problem by making it more difficult to observe, we expect the consequences of a covenant violation to covary with the severity of information asymmetry. Thus, for firms in which agency and information problems are relatively more severe, we should see a larger decline in

[21] For example, it is less costly for managers with poor investment opportunities to cut investment in order to avoid a covenant violation. Therefore, the observed violations have, on average, better investment opportunities than the unobserved sample of avoided violations. Given the better investment opportunities, banks would be less likely to force a reduction in investment among our observed sample of violations.

[22] More precisely, the estimated simple squared correlation bound for our experiment ranges from 0.16 to 0.20 depending on the particular assumption set, (b)–(d), from Erickson and Whited (2005) that we employ. Additionally, these estimates are quite accurate, all with standard errors less than 0.05.

investment relative to those firms in which these frictions are less severe, as creditors intervene in management.

The goal of this section is to test this hypothesis using several ex ante proxies for the misalignment of incentives and information asymmetry between borrowers and lenders. Doing so enables us to move closer to understanding the extent to which the state-contingent allocation of control rights helps to mitigate investment distortions brought on by underlying financing frictions. An important by-product of this analysis is that it also offers an additional test of our identification strategy. In so far as our ex ante proxies are largely uncorrelated with future discontinuous contractions in the investment opportunity set, this analysis can lend further support for a causal interpretation of our results.

A. Agency and Information Asymmetry Proxies

To ensure the robustness of our results, we examine five different proxies. Our first proxy is the presence of a credit rating. Since most firms with a credit rating have publicly traded debt, banks can learn from the information impounded in bond prices, consistent with a feedback effect documented in the equity markets by Chen, Goldstein, and Jiang (2006). Alternatively, unrated firms may simply be more risky, thereby exacerbating agency problems such as risk-shifting (Jensen and Meckling (1976)). Related to this first measure is our second proxy, the Whited and Wu (2006) index, which measures financial constraints. In so far as these constraints are driven by an underlying information or agency problem, the expectation is that more constrained firms will experience greater declines in investment relative to unconstrained firms.

Our third proxy is the number of historical lending relationships between the borrower and lender. Firms with more lending relationships with their current creditors have more reputational capital, all else equal. Consequently, these firms have more pledgable income because reputational considerations act to alleviate both agency and information problems (Diamond (1989) and Dahiya, Saunders, and Srinivasan (2003)). Thus, firms with more reputational capital should experience a smaller investment decline after violating a covenant.

Our fourth proxy is the size of the lending syndicate and is motivated by Bolton and Scharfstein (1996), who construct a model in which the number of creditors is chosen to minimize the loss of value in liquidation, while discouraging strategic defaults whereby managers divert cash to themselves. A key implication of their model is that "borrowing from many creditors disciplines managers by lowering their payoffs from strategic default; they have less incentive to divert cash flow to themselves"(pp. 2–3). That is, a firm that borrows from many creditors is less likely to breach a covenant due to misbehavior because the misalignment of incentives between managers and investors is smaller with many creditors. Therefore, we expect to see a smaller investment response to covenant violations in loans from large lending syndicates relative to violations in loans from small lending syndicates.

Our final proxy is the fraction of assets held in cash and is motivated by Jensen (1986), who suggests that uncommitted or free cash flow exacerbates

agency problems by providing managers with the capital to undertake inefficient investment. Accordingly, firms maintaining relatively large stockpiles of cash and liquid securities may be more prone to inefficient investment relative to firms without significant cash holdings. Thus, we expect to see a larger investment response to covenant violations among firms with large cash holdings relative to firms with low cash holdings.

B. Empirical Model

To test for the hypothesized differential investment responses, we expand the specification in equation (2) by interacting the covenant violation indicator with a particular proxy and examining the effect of each proxy in a separate regression. More precisely, the empirical model is

$$\begin{aligned} Investment_{it} = {} & \gamma_0 I_{(\omega)} Bind_{it-1} + \gamma_1 (1 - I_{(\omega)}) Bind_{it-1} \\ & + \Gamma_0 (I_{(\omega)}) X_{it-1} + \Gamma_1 (1 - I_{(\omega)}) X_{it-1} + \eta_i + \nu_t + \varepsilon_{it}, \end{aligned} \tag{3}$$

where $I_{(\omega)}$ is an indicator function equal to one if the event ω is true, and zero otherwise, and all other variables are as defined above. The indicator function corresponds to a particular proxy discussed above that is measured in the quarter prior to the start of the loan (e.g., the presence of a credit rating). Using the value of the proxy prior to the start of the loan reduces the potential for endogeneity between the ex ante proxy and future discontinuous shifts in the investment opportunity set. Thus, the covenant violation indicator variable, *Bind*, and each covariate in the X vector has two coefficients associated with it: one coefficient corresponding to the variables' interaction with $I_{(\omega)}$ and another corresponding to the variables' interaction with $(1 - I_{(\omega)})$.

Estimating equation (3) is similar to estimating equation (2) separately on two samples determined by the indicator function except that in equation (3) we do not interact any of the error components with the indicator function. Estimating the interacted model (equation (3)), as opposed to estimating the same model separately on two different samples, provides for an easier statistical analysis that compares the coefficients of different interactions from the same regression.[23] However, unreported analysis that estimates separate regressions on samples defined by the indicator function results in qualitatively similar findings.

All of the results are based on the set of control variables, X, containing *Macro q*, *Cash Flow*, *Size*, *Altman's Z-Score*, and the initial distance to the covenant threshold. We include this last control variable to account for the extent to which creditors incorporate potential future agency problems in the initial tightness of the covenant. Unreported analysis examining alternative specifications incorporating other firm and loan characteristics into the set of control variables reveals qualitatively similar findings.

[23] We thank Josh Rauh for suggesting this approach.

Table VII

Investment Regressions by Ex Ante Proxies for Agency and Information Problems

The sample consists of firm-quarter observations between 1994 and 2005 that satisfy the following requirements: (1) The observations correspond to a nonfinancial firm in the intersection of the merged CRSP-Compustat database and the Dealscan database; and (2) the observations correspond to a firm that has entered into a loan containing a covenant restricting its current ratio or net worth to lie above a certain threshold. The table presents firm fixed-effect investment regression results, where the dependent variable in each regression is investment (the ratio of quarterly capital expenditures to capital at the start of the period) and the general specification is:

$$Investment_{it} = \Gamma_0 I_{(\omega)} X_{it-1} + \Gamma_1 (1 - I_{(\omega)}) X_{it-1} + \eta_i + \nu_t + \varepsilon_{it},$$

where $I_{(\omega)}$ is an indicator function equal to one if ω is true and zero otherwise, X is a vector of lagged covariates (except for cash flow) including: an indicator variable equal to one if the observation is in violation of a covenant, cash flow, Macro q, the natural logarithm of total assets, Altman's Z-Score, and the distance to the covenant threshold at origination. Thus, the regression specification interacts an indicator variable corresponding to different proxies for information asymmetry and renegotiations costs with every right-hand side variable, X. Our indicator proxies are all measured in the quarter prior to the start of the loan and include: whether the borrower has had no (None) or more than two (Many) previous lending relationships with a lender in the current lending syndicate, whether the lending syndicate consists of one (Small) or more than five (Large) lenders, whether the ratio of cash and liquid assets to total assets prior to the start of the loan is in the lower (Low) or upper (High) third of the distribution, whether the Whited and Wu (2006) index prior to the start of the loan is in the upper (Constrained) or lower (Unconstrained) third of the distribution, and whether the firm has a credit rating. For presentation purposes, we present only the coefficient estimates corresponding to the covenant violation indicator variable. Also reported is a t-statistic of the difference between the two reported coefficients. All t-statistics (presented in parentheses) are robust to within firm correlation and heteroskedasticity. Panel A presents the results for the entire sample. Panel B presents the results for the discontinuity sample, defined as those firm-quarter observations in which the absolute value of the relative distance to the covenant threshold is less than 0.20. Variable definitions appear in Appendix A.

Credit Rating		WW Index		Lending Relations		Syndicate Size		Cash Holdings	
Panel A: Entire Sample									
No	−0.013	Constrained	−0.019	None	−0.017	Small	−0.023	High	−0.021
	(−4.586)		(−3.812)		(−4.706)		(−5.344)		(−3.499)
Yes	−0.005	Unconstrained	−0.007	Many	0.002	Large	−0.003	Low	−0.002
	(−1.185)		(−1.718)		(0.287)		(−0.912)		(−0.491)
T-Dif	1.665	T-Dif	1.790	T-Dif	2.488	T-Dif	3.825	T-Dif	2.808
Obs	4,370	Obs	2,528	Obs	3,066	Obs	3,170	Obs	2,717
Panel B: Discontinuity Sample									
No	−0.015	Constrained	−0.025	None	−0.017	Small	−0.023	High	−0.023
	(−3.619)		(−3.420)		(−3.683)		(−3.340)		(−2.206)
Yes	0.002	Unconstrained	0.001	Many	0.012	Large	0.003	Low	0.001
	(0.473)		(0.125)		(1.866)		(0.640)		(0.196)
T-Dif	2.551	T-Dif	2.879	T-Dif	3.616	T-Dif	3.281	T-Dif	2.026
Obs	1,721	Obs	1,033	Obs	1,260	Obs	1,230	Obs	1,073

C. Results

The results of our analysis are displayed in Table VII. For presentation purposes, we display only the estimated coefficients and t-statistics corresponding to γ_0 and γ_1, the coefficients on the two covenant violation variables, $I_{(\omega)}Bind_{it-1}$ and $(1 - I_{(\omega)})Bind_{it-1}$, respectively. The last two rows of each column present the number of observations in the regression (*Obs*) and the t-statistic of the difference between γ_0 and γ_1.

The first column shows that firms without a credit rating experience a larger decline in investment (1.3%) following a covenant violation relative to firms with a credit rating (0.5%). The second column investigates the association between the investment response accompanying covenant violations and the Whited and Wu index. To address measurement error concerns with this proxy, we focus on observations falling in the upper and lower third of the distribution for this measure (Greene (2003)). Constrained firms experience a 1.9% decline in investment following a covenant violation, in contrast to the 0.7% decline experienced by unconstrained firms. Both of these findings are consistent with creditors intervening in situations in which information asymmetry or agency problems are more severe.

The third column investigates the importance of reputational capital. We focus on loans in which the borrower has no historical lending relationship with its current creditor (None) and loans in which the borrower has at least three relationships (Many). These cutoffs remove 30% of the observations from the analysis, though alternative breakpoints of two or four yield similar results. The results show that firms violating a covenant with a new lender experience a significant decline in investment (1.7%) following a covenant violation. Firms violating a covenant with a long-time lender actually experience a slight increase in investment after a covenant violation (0.2%), though the magnitude is neither economically nor statistically significant. However, the difference between these two estimates, 1.9%, is economically and statistically large, consistent with the importance of lending relationships in mitigating the impact of agency and information problems on investment behavior.

To examine the incentive argument of Bolton and Scharfstein (1996), we categorize the size of the lending syndicate into two groups depending on whether there is only one lender (small) or more than five lenders (large). The choice of five lenders eliminates 27% of the observations from the analysis, but our results are qualitatively similar if we perturb this number by one unit in either direction. The results in Panel A indicate that covenant violations in loans with a single lender lead to a large decline in investment equal to 2.3% of capital per quarter. Covenant violations in loans with large lending syndicates, on the other hand, lead to a statistically insignificant decline in investment equal to 0.3%. The difference between these two responses (2.0%) is highly statistically significant and is consistent with large lending syndicates providing greater incentives for managers to behave.

Turning to our last proxy, cash holdings, we follow the same procedure as with the Whited and Wu index and focus only on the upper and lower third of the distribution for this proxy. Firms with relatively large cash holdings experience a significantly larger decline in investment (2.1%) accompanying a covenant violation relative to firms with low cash holdings (0.2%), consistent with the free cash flow hypothesis of Jensen (1986) and the ability of creditors to thwart this misbehavior.

The results from the Discontinuity sample, presented in Panel B, are similar to those found in the Entire sample. The only distinction between the findings in the two samples is that the differences found in the Discontinuity sample are

often even larger, statistically and economically, than those found in the Entire sample.

In sum, these results illustrate that the impact of covenant violations and the transfer of control rights on investment is closely tied to the extent of information and agency problems. In this sense, our findings suggest that the state-contingent allocation of control rights provides a useful mechanism for mitigating investment distortions created by financing frictions. Our findings here also reinforce a causal interpretation of our results, as there is little reason to suspect that the number of historical lending relationships or the size of the lending syndicate, for example, predict discontinuous contractions in firms' investment opportunity sets two years into the future. Finally, our findings compliment previous work (e.g., Kahan and Tuckman (1993), Beneish and Press (1995), and Harvey et al. (2004)) that links covenants to firm value by identifying a specific channel, capital expenditures, and mechanism, the transfer of control rights, by which agency conflicts can impact firm value.

V. Conclusion

This paper identifies a specific channel (debt covenants) and mechanism (the transfer of control rights) through which financing frictions impact investment. Using a regression discontinuity design, we find that capital expenditures decline by approximately 1% of capital per quarter in response to covenant violations—a 13% decline relative to the pre-violation level of investment. Additionally, this decline is concentrated among firms in which agency and information problems are relatively more severe. Thus, our results highlight how the state-contingent allocation of control rights mitigates investment distortions arising from financing frictions.

While shedding light on how financing affects investment, our study also raises new questions. One such question concerns which other channels, such as inventory, advertising, R&D, and financial policy, are affected by the control rights transfer accompanying covenant violations. Another question concerns whether or not the pledging of control rights helps to alleviate any financing constraints ex ante and mitigate underinvestment. Additionally, another question concerns whether or not there are macroeconomic implications of control rights transfers to creditors. We look forward to future research addressing these and other related questions.

Appendix A: Variable Definitions

Current Ratio: the ratio of current assets to current liabilities.

Net Worth: total assets minus total liabilities.

Tangible Net Worth: current assets plus net physical plant, property, and equipment plus other assets minus total liabilities.

Firm Size: the natural logarithm of total assets deflated by the all-urban CPI.

Market-to-Book: the ratio of the market value of assets to total assets, where the numerator is defined as the sum of market equity, total debt, and preferred stock liquidation value less deferred taxes and investment tax credits.

Macro q: the sum of total book debt and market equity less total inventories divided by the start-of-period capital stock measured by net property, plant, and equipment.

ROA: the ratio of operating income before depreciation to total assets.

Capital / Assets: the ratio of net property, plant, and equipment to total assets.

Investment: the ratio of capital expenditures to the start-of-period net property, plant, and equipment.

Cash Flow: ratio of income before extraordinary items plus depreciation and amortization to start-of-period capital.

Total Accruals: income before extraordinary items less net operating cash flow.

Working Capital Accruals: the sum of the change in inventory, the change in accounts receivable, and the change in other current assets less the sum of the change in accounts payable, the change in income tax payable, and the change in other current liabilities.

Leverage: the ratio of total debt from the balance sheet to total assets.

Altman's Z-Score: the sum of 3.3 times pre-tax income, sales, 1.4 times retained earnings, and 1.2 times net working capital all divided by total assets.

Debt Overhang Correction: defined as in Hennessy, Levy, and Whited (2006), except that we substitute quarterly data for annual data. More precisely, this measure is the product of long-term debt scaled by the capital stock, recovery ratio, and the value of the claim paying one dollar at default. Data on both recovery ratios and the value of a claim paying one dollar at default is available from Chris Hennessy's website (http://faculty.haas.berkeley.edu/hennessy/). When bond ratings are not available, we follow Hennessy, Levy, and Whited (2006) in constructing the imputed bond ratings based on the estimates from Blume, Lim, and Mackinlay (1998).

Abnor Current Accruals—DD: an annual measure of abnormal accruals based on the study by Dechow and Dichev (2002) and whose derivation closely follows that found in Bharath, Sunder, and Sunder (2006). Total current accruals are first constructed from the statement of cash flows (Hribar and Collins (2002)) as the sum of minus the change in accounts receivables, the change in inventory, the change in accounts payables, the change in taxes payable, and the change in other current assets. Total current accruals are then normalized by total assets and regressed on three variables:

(1) cash flow from operations last period divided by total assets this period,
(2) cash flow from operations this period divided by total assets this period, and
(3) cash flow from operations next period divided by total assets this period. The regression is run separately for each year and each of the Fama and French 38 industry groups. The parameter estimates from these regressions are then used to compute the normal current accruals

for each firm in a particular industry-year as the predicted values from the regression. The difference between the actual current accruals and the normal current accruals are abnormal current accruals.

Abnor Current Accruals—TWW: an annual measure of abnormal accruals based on the study by Teoh, Welch, and Wong (1998) and whose derivation closely follows that found in Bharath et al. (2006). Total current accruals are first constructed from the statement of cash flows (Hribar and Collins (2002)) as the sum of minus the change in accounts receivables, the change in inventory, the change in accounts payables, the change in taxes payable, and the change in other current assets. Total current accruals are then normalized by last period's total assets and regressed on two variables:

(1) the inverse of last period's total assets and
(2) the change in sales normalized by last period's total assets.

The regression is run separately for each year and each of the Fama and French 38 industry groups. The parameter estimates from these regressions are then used to compute the normal current accruals for each firm in a particular industry-year as the predicted values from the regression. One modification, however, is that the second regressor from the regression is replaced by the difference between the change in sales and the change in accounts receivables normalized by the start-of-period total assets for the computation of normal current accruals. The difference between the actual current accruals and the normal current accruals are abnormal current accruals.

Appendix B: Measurement of Covenant Violations

This appendix details the measurement of covenant violations and discusses several additional empirical tests undertaken to ensure the validity of our data. The first measurement issue concerns firms that enter into multiple deals during our period of investigation. If the deals do not overlap (i.e., the first deal matures prior to the start of the second deal), this situation is of little concern. When deals do overlap, we define the relevant covenant to be the tighter of the two unless the latter deal corresponds to a refinancing, in which case we define the relevant covenant to be that specified by the refinancing regardless of whether or not it is tighter than the earlier deal. Practically speaking, overlapping deals occur relatively infrequently in our samples, 92 in the current ratio sample and 258 in the net worth sample, and most these deals are refinancings, 80 and 196, respectively.[24]

[24] For a small number of overlapping loans, 8 in the current ratio sample and 38 in the net worth sample, we do not have information on whether the loan represents a refinancing of an earlier loan and, consequently, we exclude them from the analysis.

A second measurement issue concerns dynamic covenants that change over the life of the loan. For the current ratio sample, 79 of the 622 deals have dynamic covenants, the large majority of which increase from an initial value to a final value.[25] After speaking with a number of commercial lenders and examining a number of Tear Sheet—detailed loan document summaries available for a subset of loans—we choose to linearly interpolate the covenant thresholds over the life of the loan. For example, in August of 2000, American Ecology Corporation entered into a 2-year deal that required it to maintain a current ratio above 0.75 at the start of the loan and above 1.2 at the end of the loan. Thus, our interpolation scheme implies quarterly changes in this threshold equal to 0.064.

For the net worth sample, the covenant often changes over time with a fraction of positive net income or a fraction of stock issuances. However, our extract of Dealscan, obtained directly from LPC in the form of Microsoft Access database, contains somewhat limited information on the latter of these two types of adjustments, or "buildup" to which they are sometimes referred. Specifically, we have information on whether or not the net worth threshold adjusts with net income and by what fraction of net income the threshold adjusts. We also have information on whether or not the net worth covenant adjusts with stock issuances; however, we do not have information on what fraction of stock issuances the threshold adjusts. Therefore, we exclude all deals containing a stock issuance adjustment to the net worth covenant, and focus only on those deals in which the net worth covenant is either constant (712) or adjusts only with a fraction of positive net income (741).

To further ensure the accuracy of our data, we download every available Tear Sheet from LPC to compare to our data. Tear Sheets are available for 2,697 deals as of October 2006. We hand match every Tear Sheet to the deals in our net worth sample using the name of the borrower and several loan details (e.g., start date of the loan, loan amount, maturity, etc.), which results in a total of 425 matches. A comparison of the data from our extract with the corresponding information in the Tear Sheets reveals a near perfect match, but for a few isolated typos that we correct.

Nonetheless, to ensure the validity of our data and the robustness of our results, we re-estimate the regressions presented in Tables V and VI on three separate subsamples of loans:

(1) loans containing a current ratio covenant but not a net worth covenant,
(2) loans containing a net worth covenant but not a current ratio covenant, and
(3) loans containing a constant current ratio covenant or a net worth covenant with Tear Sheet information.

[25] Two of the 79 deals report a decreasing trend (i.e., a loosening of the restriction) and 9 report a fluctuating (i.e., nonmonotonic) threshold.

The union of the first two samples comprises the entire sample used throughout the paper, while the last sample mimics that used by Dichev and Skinner (2002). The coefficient estimates and corresponding t-statistics for these samples are all qualitatively similar to those presented in Tables V and VI.

Another measurement concern consists of post-origination amendments to the contract that are distinct from refinancings and that are brought on by renegotiations outside of technical default (Roberts and Sufi (2008)). In so far as these amendments impact the specification of the covenant threshold or the maturity of the contract, they are relevant for our measurement of when a covenant violation occurs. As such, we gather post-origination amendments from LPC and link them to our samples via the loan identifiers initially provided with our data extract. After hand-coding the details of the relevant amendments, we suitably adjust the affected loan details on the date of the amendment.

A final consideration concerns 15% and 7% of the current ratio and net worth loans, respectively, that are in violation of their covenants in the quarter of the loan origination—a phenomenon also encountered by Dichev and Skinner (2002). For our reported analysis, we simply exclude these loans on the premise that the violation is an error, perhaps because of an unobservable subtlety in the definition of the covenant, though their inclusion has an insignificant effect on our results.

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