The Loan Covenant Channel: How Bank Health Transmits to the Real Economy*

Gabriel Chodorow-Reich
Harvard University and NBER

Antonio Falato
Federal Reserve Board

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Abstract

We document the importance of covenant violations in transmitting bank health to nonfinancial firms using a new supervisory data set of bank loans. More than one-third of loans in our data breach a covenant during the 2008-09 period, providing lenders the opportunity to force a renegotiation of loan terms or to accelerate repayment of otherwise long-term credit. Lenders in worse health are less likely to grant a waiver and more likely to force a reduction in the loan commitment following a violation. Quantitatively, the reduction in credit to borrowers with long-term credit but who violate a covenant accounts for an 11% decline in the volume of loans and commitments outstanding during the 2008-09 crisis, a similar magnitude to the total contraction in credit during that period. We conclude that the transmission of bank health to nonfinancial firms occurs largely through the loan covenant channel.

*Chodorow-Reich: chodorowreich@fas.harvard.edu; Falato: antonio.falato@frb.gov. We thank David Scharfstein, Andrei Shleifer, Jeremy Stein, Amir Sufi, and numerous seminar participants for helpful comments. The views expressed herein are those of the authors and not necessarily those of the Federal Reserve Board of Governors or the Federal Reserve System.

1. Introduction

A large literature documents the importance of the health of the banking sector for nonfinancial firm outcomes such as investment and employment.[1] Most recently, the 2008-09 period contained both a financial crisis and the deepest recession in the United States in 60 years. Yet, at the start of the financial panic in 2008 only 10% of bank loans had remaining maturity of less than one year. This fact raises a puzzle: why didn't long-term credit insulate existing borrowers from the health of their lenders during the panic?

We document the role of loan covenant violations in transmitting the health of the financial system to outcomes at corporate borrowers. Loan covenants, also known as non-pricing terms, appear in nearly all commercial loan contracts. They circumscribe the set of actions a borrower may take (nonfinancial covenants) or specify minimum or maximum thresholds for cash flow or balance sheet variables (financial covenants). Breaching of a covenant threshold puts a borrower into technical default and gives the lender the right to accelerate repayment of the loan. Far from unusual events, roughly one-quarter of corporate loans breach a covenant during a typical year before the 2008-09 financial crisis and one-third of loans breach a covenant each year during the financial crisis. Thus, loan covenant violations increase lenders' bargaining power and provide them broad opportunity to renegotiate contract terms when their own internal cost of funds rises. We refer to the transmission of lender health to existing borrowers through the forced renegotiation of contract terms as the loan covenant channel.

We quantify the covenant channel in the context of the 2008-09 financial crisis using a new

[1] See e.g. Peek and Rosengren (2000); Lin and Paravisini (2012); Chodorow-Reich (2014); Benmelech et al. (2015) for evidence from the United States and Gan (2007); Amiti and Weinstein (Forthcoming); Bentolila et al. (Forthcoming) for evidence in other countries.

supervisory data set of syndicated loans. The data contain the identities of borrowers and lenders and follow individual loans over time, including compliance with covenants. Following the violation of a covenant, a lender may accelerate repayment, force a renegotiation of the loan contract, or simply waive or reset the covenant with no further impact on the loan. Our data track each of these potential outcomes. Using these data we document the two facts cited above which make the loan covenant channel a potentially important transmission mechanism: most bank loans have long stated maturity but many loans breach covenants.

For a causal assessment of the covenant channel we turn to variation in the cross-section of lenders during the 2008-09 financial crisis. The write-downs on assets linked to real estate loans led to an enormous decline in the market equity of the U.S. financial sector and coincided with a sharp increase in bank funding costs. Both factors increased the internal cost of funds at lenders. A body of evidence documents the transmission from the reduction in credit supply at lenders to outcomes at nonfinancial firms during the crisis (Campello et al., 2010; Duchin et al., 2010; Campello et al., 2011; Chodorow-Reich, 2014; Duygan-Bump et al., 2015; Siemer, 2016). However, banks varied greatly in their exposure to the crisis.

Our empirical exercises ask whether the outcome of a covenant violation during the 2008-09 crisis depends on the lead lender's financial health. We assign lender health by combining three measures constructed in Chodorow-Reich (2014). These measures capture banks' exposure to the crisis through counterparty risk and mortgage-related writedowns. Identification requires that covenant violators of less healthy and healthier lenders have otherwise similar characteristics. We show that borrowers of healthy and less healthy lenders have similar propensities to violate a covenant, similar overall leverage, and similar supervisory ratings. Our main sample

consists only of those loans not due to mature within the year. Absent a covenant violation, these loans should have insulated borrowers from the immediate consequences of the financial condition of the lenders providing them.

We find strong evidence of less healthy lenders using covenant violations to contract credit. Conditional on breaching a threshold, the likelihood of a reduction in the loan commitment rises by 24 p.p. for borrowers of the least healthy lenders relative to the healthiest lenders and the average loan size falls by 23%. Smaller, more concentrated syndicates and syndicates with a larger lead lender share exhibit greater sensitivity to lender health in determining the outcome of a covenant violation, consistent with increased incentive and ability for the lead lender to organize a response in these syndicate structures.

A number of results further support the causal interpretation of these findings. First, we find no reduction in credit from unhealthy lenders to borrowers with long-term credit who do not violate a covenant, suggesting that borrowers of less healthy lenders did not experience a correlated decline in loan demand. Second, adding borrower and loan-level controls increases the explanatory power of the regressions but, consistent with ex ante balancing of firms and borrowers, the point estimates remain extremely stable. Third, the lead lender's share of the loan commitment declines after a violation if the lead has poor health, providing "within-loan" evidence that what shifts is the lead lender's credit supply function. Fourth, we conduct placebo exercises in which we reestimate the baseline specification in the non-crisis period of 2006-07. We do not find any differential treatment of borrowers who breach a covenant in 2006-07 based on lender health in 2008-09. Fifth, we show robustness to plausible alternative definitions of lender health including using the health of the pre-crisis lender to address concerns of endogenous

sorting of lenders and borrowers after the crisis started.

We next turn to the consequences of the credit contraction for the borrower. If a borrower whose previous relationship lender contracted credit could easily switch to a new lender, idiosyncratic fluctuations in bank health would have little real effect. The concentration of credit contraction on covenant violators makes such switching difficult because of the difficulty of obtaining new credit while in technical default. Indeed, covenant violators of unhealthy lenders appear unable to substitute at all toward other lenders or toward non-bank credit. Instead, we show that these borrowers increase the utilization on their existing credit lines, draw down cash holdings, and reduce investment and employment relative to firms which violate a covenant but have a healthier lender. These results echo previous literature which has found an adverse effect of a covenant violation on debt issuance (Roberts and Sufi, 2009a; Nini et al., 2012), investment (Chava and Roberts, 2008; Nini et al., 2012), and employment (Falato and Liang, 2016), but with the added twist that the health of the lender crucially affects the consequences for the borrower.

Finally, we perform an aggregation calculation to assess the macroeconomic importance of the loan covenant channel. We find that total credit and commitments outstanding contracted by 5.8% in 2008 and 5.9% in 2009 solely as the result of borrowers who started the year with a long-term loan contract but nonetheless had their borrowing limit lowered by an unhealthy lender following a covenant violation. This magnitude is economically significant; for example, it roughly equals the contraction in the total stock of credit (including commitments) outstanding between 2007 and 2009. We conclude that the transmission of bank health to nonfinancial firms occurs largely through the loan covenant channel.

We discuss related literature next. Section 2 provides institutional background on covenants in loan contracts. Section 3 describes the supervisory data and documents the two key facts regarding the maturity of bank credit and the prevalence of covenant violations. Section 4 introduces the lender health measures and the cross-sectional identification strategy. Section 5 reports borrower and loan level effects of lender health on the aftermath of a covenant violation. We perform the aggregation exercise in section 6. Section 7 concludes.

Related literature. A first related literature studies the transmission of bank health to the real economy and the importance of firm-bank relationships. Bernanke (1983) is a seminal reference and Chodorow-Reich (2014) overviews more recent papers. These papers find a rapid transmission from lender health to firms; for example, Chodorow-Reich (2014) finds borrowers of lenders in worse health during the 2008-09 financial crisis had lower employment within 9 months of the Lehman Brothers bankruptcy. The prevalence of long-term contracts poses a challenge for this literature insofar as they would insulate many borrowers from the health of their lender. We show how covenant violations create a transmission channel even to borrowers with nominally long-term contracts. Other explanations include lumpiness or granularity in the economy together with strong effects in exactly the subset of borrowers needing to refinance or new credit (Almeida et al., 2012; Benmelech et al., 2015; Siemer, 2016) and precautionary saving by firms anticipating future credit contraction (Almeida et al., 2004; Bacchetta et al., 2014; Melcangi, 2016; Xiao, 2017). We view these channels as complementary and our contribution as highlighting the quantitative importance of the covenant channel. Additionally, since lower quality borrowers are more likely to violate covenants, the covenant channel offers a novel explanation for why many papers find empirically that the effects of bank health concentrate

on smaller, lower quality borrowers.

A second literature, already cited, documents the negative consequences to the firm of violating a covenant (Chava and Roberts, 2008; Roberts and Sufi, 2009a; Nini et al., 2012; Falato and Liang, 2016). Our results suggest that the overall effect reported in these studies may mask important response heterogeneity based on the health of the lender.[2]

A third related literature concerns the renegotiation of debt contracts and the purpose and consequences of covenants. The theoretical literature has traditionally viewed covenants as a means to overcome the agency problem inherent in lending contracts by limiting the possible actions taken by the borrower and shifting control to the lender if the borrower's financial condition deteriorates (Aghion and Bolton, 1992; Nini et al., 2009; Gârleanu and Zwiebel, 2009; Acharya et al., 2014b; Bradley and Roberts, 2015). Yet, covenant violations occur routinely and lenders often provide waivers for the violation while taking minimal additional action. Our paper complements the borrower-centric view by showing that covenants also allow lenders to adjust loan terms when *lender* health deteriorates, consistent with the symmetric view of incomplete contracting in Hart and Moore (1988).

More broadly, as emphasized by Roberts and Sufi (2009b), Mian and Santos (2011), Denis and Wang (2014), and Roberts (2015), almost all long-term debt contracts undergo renegotiation prior to maturity. Roberts and Sufi (2009b), Denis and Wang (2014), and Roberts (2015) find evidence of borrower characteristics affecting the timing and outcome of such negotiations but do not consider individual lender health as a determinant. The sharp shift in bargaining power toward lenders following a covenant violation creates a natural means for lender health to affect

[2]In independent work we discovered after circulating an initial draft of this paper, Acharya et al. (2014a) find that better capitalized lenders granted more waivers to public borrowers during the financial crisis.

the renegotiation process. The ubiquity of renegotiation even in the absence of a violation suggests lender health could affect recontracting for an even larger set of borrowers.

Finally, a macroeconomic literature studies the link between banks and the real economy in dynamic general equilibrium models (Gertler and Kiyotaki, 2010; He and Krishnamurthy, 2013; Brunnermeier and Sannikov, 2014). These models typically assume one period or continuously updated contracts. Our results provide some justification for this simplification by showing that even long-term contracts have de facto much shorter horizons due to loan covenants. These models also have the implication that unhealthy banks will especially want to reduce credit to riskier borrowers because the value of a marginal dollar of losses rises as the bank moves closer to its default boundary. Because covenant violators are riskier than the overall population of firms, through the lens of these models loan covenants allow banks to reduce credit to exactly those borrowers to whom they most value a reduction in exposure.

2. Institutional Background

This section provides a brief overview of covenants in loan contracts. We highlight two features as most relevant to the existence of a loan covenant channel. First, absent a covenant violation, missed payment, or unusual circumstance, a lender cannot renege on a loan commitment before the stated maturity. Second, the violation of a loan covenant gives the lenders the right but not the obligation to immediately terminate the loan commitment including demanding repayment of any outstanding principal and interest. Thus, upon and only upon violation of a covenant do lenders have discretion to reduce their existing loan commitments to borrowers current on their obligations.

Examination of an actual loan contract illustrates these features. In October 2006, Lifetime Brands, Inc. and a lending syndicate with HSBC as the administrative agent agreed to extend the maturity of a credit line to April 2011. As a public company, Lifetime Brands filed a copy of the amended agreement with the SEC.[3] While we use this agreement as an example, the important features are typical of corporate loan contracts to mid-size and large firms.

Section 2 of the contract specifies the obligations of the lenders: "Subject to the terms and conditions set forth herein, each Lender having a Revolving Commitment agrees to make Revolving Loans to the Borrower (p.18)." That is, as long as the borrower remains compliant with the terms of the loan, the lenders must provide funds. This contractual requirement constitutes the essence of a credit line.

Table 1 lists the covenants in the agreement. The left panel lists affirmative covenants, or actions the borrower must take to remain in compliance. These include measures such as providing timely financial statements to the lenders and maintaining fire insurance on the firm's properties holdings. The right panel lists negative covenants. Many of these, such as restrictions on other borrowing, have in common with the affirmative covenants that compliance is directly under the borrower's control.

Most important to our study are the two financial covenants, leverage ratio and interest coverage ratio, which may be violated due to changes in financial conditions not directly under the borrower's control. As defined in sections 1.01, 7.12, and 7.13 of the agreement, the leverage ratio covenant prohibits the borrower from permitting the ratio of consolidated senior secured debt to a four-quarter trailing moving-average of consolidated ebitda (earnings before interest,

[3]The filing is available at https://www.sec.gov/Archives/edgar/data/874396/000091068006001052/ex99-1_f8k10312006.htm (accessed July 20, 2017).

Table 1: Loan Covenants in the Sample Credit Agreement

Affirmative Covenants	Negative Covenants
Financial statements and other information (6.01)	Indebtedness (7.01)
Notices of material events (6.02)	Liens (7.02)
Existence; conduct of business (6.03)	Fundamental changes (7.03)
Payment of obligations (6.04)	Investments, loans, advances, guarantees and acquisitions (7.04)
Maintenance of properties (6.05)	Asset sales (7.05)
Books and records; inspection rights (6.06)	Sale and lease-back transactions (7.06)
Compliance with laws (6.07)	Hedging agreements (7.07)
Use of proceeds (6.08)	Restricted payments (7.08)
Notice of certain changes (6.09)	Transactions with affiliates (7.09)
Insurance (6.10)	Restrictive agreements (7.10)
Additional subsidiaries (6.11)	Amendment of material documents (7.11)
Information regarding collateral (6.12)	Leverage ratio (7.12)
Casualty and condemnation (6.13)	Interest coverage ratio (7.13)
Intellectual property; further assurances (6.14)	Prepayments of indebtedness (7.14)
	Capital expenditures (7.15)
	Fiscal year (7.16)
	ERISA obligations (7.17)

tax, depreciation and amortization) to exceed 3:1 except following an acquisition approved by the lenders, while the interest coverage ratio covenant prohibits the borrower from permitting the ratio of the four-quarter trailing moving average of ebitda to interest expense to be less than 4:1 at the end of any fiscal quarter. For these covenants, a decline in earnings could cause an involuntary violation by the borrower.

Section 8 of the agreement defines default and the remedies available to the lender. Events of default include failure to make a principal or interest payment on a loan (8.01(a-c,f,j)), the filing of an involuntary or voluntary bankruptcy petition on behalf of the borrower (8.01(h,i)), and,

crucially, if "the Borrower shall fail to observe or perform any covenant, condition or agreement contained in Sections 6.02, 6.03, 6.08, 6.11, 6.12, 6.13 or 6.14 or in Article 7" (8.01(d), p.56). Section 8.02 (p.58) specifies contract remedies:

(a) "in the case of an Event of Default specified in Section 8.01(h) or 8.01(i) [i.e. a bankruptcy filing], without declaration or notice to the Borrower, the Revolving Commitments (including the Letter of Credit Commitment) shall immediately and automatically terminate, and the Loans, all accrued and unpaid interest thereon and all other amounts owing under the Loan Documents shall immediately become due and payable, and

(b) in all other cases, upon the direction of the Required Lenders, the Administrative Agent shall, by notice to the Borrower, declare all of the Revolving Commitments (including the Letter of Credit Commitment) to be terminated forthwith, whereupon such Revolving Commitments (including the Letter of Credit Commitment) shall immediately terminate, or declare the Loans, all accrued and unpaid interest thereon and all other amounts owing under the Loan Documents to be due and payable forthwith, whereupon the same shall immediately become due and payable."

Thus, under section 8.02(b) a covenant violation has the same contractual impact as a missed payment. Both give lenders the right but not the obligation to terminate the credit line and make any outstanding amounts immediately payable. This discretion makes the health of the lenders potentially relevant to the resolution of a covenant violation.[4]

[4]The subsequent evolution of this particular loan agreement has anecdotal value in illustrating the covenant channel. Recall the stated maturity provided a credit line through April 2011. According to the firm's FY2008 10K filing (https://www.sec.gov/Archives/edgar/data/874396/000091068009000143/f10k12312008.htm, pp. 8,21), the lenders agreed to modify the covenant terms and thresholds in March and September 2008 in anticipation of declining firm sales. Even so, the firm violated one of the revised covenants in December 2008. In March 2009,

3. Data on Covenant Compliance and Loan Outcomes

Our data on loan contracts and covenant compliance come from the Shared National Credit Program (SNC). We describe the main features here and provide additional details in the online appendix. We then present two key facts concerning the maturity of bank credit and the prevalence of covenant violations.

3.1. SNC

The Shared National Credit Program (SNC) is a joint supervisory data set of the Federal Reserve, FDIC, and Office of the Comptroller of the Currency. Employees of these institutions may use the data for research purposes. SNC collects information on all loans of at least $20 million shared by three or more unaffiliated financial institutions under the regulatory purview of one of the SNC supervisors. For each loan in SNC, we observe the borrower, loan type, drawn and undrawn balance on December 31st of the reporting year, and the ownership shares of the syndicate lead lender and all participants including institutions not regulated by a SNC supervisor.[5]

The syndicated lending market covered by SNC accounts for a large share of total lending volume in the U.S. economy. As shown in figure A.1, the full SNC universe contained $1.2 trillion of loans drawn and $2.79 trillion of loans drawn and unused commitments outstanding as of the end of 2007. For comparison, the Consolidated Reports of Condition and Income (Call

the firm signed an amended agreement which again modified the covenant terms and thresholds and reduced the maximum amount borrowable under the agreement.

[5]The official term for the unit of observation in the SNC data set is a credit. A credit may consist of multiple facilities jointly arranged by the same syndicate and signed on the same date. The corresponding term in the Thomson Reuters DealScan database is a package. For simplicity, in the text we use "loan" interchangeably with SNC credit.

Reports) contained $1.44 trillion of commercial and industrial loans drawn and $2.37 trillion of unused commitments not associated with real estate or credit cards from all U.S. commercial banks on that date.[6] Thus, while our analysis cannot speak directly to the effects on small firms not included in the SNC data, the loans in SNC aggregate to a quantitatively large share of the U.S. corporate loan market. In the remainder of the paper we further exclude a small share of loans not listed as a term loan or credit line and loans to financial borrowers.

3.2. SNC Covenant Review Sample

In 2006 SNC began collecting information on covenant compliance for a subset of loans covering about 1/3 of the loan volume in the SNC universe. We refer to loans in this subset as the covenant review sample. For each loan in the covenant sample, SNC obtains information on covenants and compliance throughout the year from loan documentation augmented by supervisory inquiries to the banks when information is missing or incomplete.

The SNC covenant sample offers important advantages over previous data sets. Unlike the Thomson Reuters DealScan database which collects information on newly originated syndicated loans, SNC carefully tracks loans after origination including subsequent modifications and covenant compliance. A number of papers have added some of this information by starting from the DealScan database and either hand-collecting information on subsequent loan outcomes from public filings (Nini et al., 2009; Roberts and Sufi, 2009b; Nini et al., 2012; Denis

[6]Besides the $20 million threshold and syndication requirement for inclusion in the SNC data, totals in the Call Reports and SNC may differ because SNC includes the part of loans provided by non-bank lenders if they are part of a syndicate covered by SNC, because SNC may include some lending not classified as commercial and industrial in the Call Reports, and because the residual category for unused commitments in the Call Report data may contain non commercial and industrial loans. While these differences affect the levels, figure A.1 shows that the growth rates of aggregates in the two data sets track each other closely. As an alternative benchmark, since November 2012 the Federal Reserve Survey of Terms of Business Lending has reported the fraction made under syndication of all origination volume of commercial and industrial loans made by commercial banks; averaged across all months from November 2012 through August 2016, this fraction is 47.5%.

and Wang, 2014; Roberts, 2015; Freudenberg et al., 2015) or by matching to Compustat to track financial ratios encoded in covenants (Chava and Roberts, 2008; Falato and Liang, 2016). Relative to these data sets, SNC contains many more observations per year including a representative share of non-public borrowers, contains supervisory information on covenant compliance including when the breach results in a waiver, and contains information on the lender's response to the violation.

Table 2 reports summary statistics for the pre-crisis and crisis periods for the full SNC universe of term loans and credit lines to nonfinancial borrowers (columns 1 and 4), for the subset of these loans in the covenant sample (columns 2 and 5), and for those loans in the covenant sample for which we have a measure of the health of the lead lender (columns 3 and 6, described shortly). Table 2 and figure A.2 show that the coverage of the SNC covenant sample has increased over time. During the crisis years of 2008-09, the covenant sample contains about one-third of the number of loans and loan volume as the full SNC universe, up from roughly one-quarter before the crisis. Loans in the covenant sample are of similar average size and maturity, exhibit a similar breakdown between term loans and credit lines, have similar utilization rates, and have similar propensities to get modified as those in the full universe. While the covenant sample purports to overweight loans rated below best quality or "pass," the composition of borrower credit quality remains similar to the SNC universe.[7]

[7]Not shown in the table, the share of credits rated as best (worst) quality or pass (loss) is about 91% (0.16%) in the SNC universe and about 85% (0.27%) in the covenant sample. The sector composition of loans in the covenant sample is also similar to the SNC universe and broadly representative of the sectoral composition of the U.S. economy – more than one-quarter of loans are to firms in the services sector and roughly one-third are to firms in manufacturing or retail. Loans to bank borrowers ($< 0.5\%$) and loans to non-bank financial borrowers (8%) make up a small share of SNC and our results are robust to not excluding them.

Table 2: Summary Statistics

Sample:	Pre-crisis (2006-07)			Crisis (2008-09)		
	Universe	Covenant	Lender-covenant	Universe	Covenant	Lender-covenant
	(1)	(2)	(3)	(4)	(5)	(6)
			Loans of any maturity			
Fraction 1+ year remaining	0.91	0.92	0.92	0.88	0.88	0.89
			Loans with 1+ year maturity remaining			
Loan characteristics						
Mean maturity (years)	3.30	3.34	3.36	2.61	2.78	2.75
Fraction 2+ years remaining	0.85	0.88	0.89	0.74	0.79	0.79
Mean log total committed	18.66	18.85	18.95	18.74	18.76	18.91
Fraction credit line	0.61	0.59	0.60	0.51	0.49	0.49
Fraction *Credit reduced*	0.27	0.26	0.26	0.37	0.38	0.38
Fraction *Waiver*		0.32	0.32		0.37	0.36
Fraction *New credit*	0.17	0.15	0.14	0.08	0.06	0.06
Mean lead lender share	0.19	0.14	0.15	0.18	0.14	0.14
Mean loan utilization rate	0.53	0.56	0.55	0.61	0.64	0.63
Borrower characteristics						
Fraction publicly-traded	0.37	0.38	0.40	0.36	0.37	0.39
Mean log assets		12.58	12.76		12.68	12.82
Mean leverage		0.49	0.49		0.53	0.50
Fraction passing risk rating		70.78	70.68		47.17	45.96
Covenant violation frequency						
$Bind_t$		0.25	0.24		0.34	0.33
$Bind_t$, private borrowers		0.27	0.27		0.36	0.34
$Bind_t$, excluding waivers		0.09	0.08		0.11	0.10
$Bind_{t-1:t}$		0.29	0.28		0.39	0.37
Loan-year observations	11,247	2,676	2,478	11,979	4,059	3,420
Unique borrowers	4,769	1,309	1,166	4,992	1,704	1,409
Total committed ($Tr)	2.01	0.55	0.50	2.04	0.72	0.65

Notes: The table reports summary statistics for the pre-crisis (2006-07) and crisis (2008-09) periods and for three samples. Columns with header "Universe" report summary statistics for the universe of credit lines and term loans to nonfinancial borrowers in the full SNC data set. Columns with header "Covenant" report summary statistics for the subset of these loans in the SNC covenant sample. Columns with header "Lender-covenant" report summary statistics for our final sample of all credit lines and term loans in the covenant sample to nonfinancial borrowers and where the lead lender is in the Chodorow-Reich (2014) lender health data set. *Credit reduced* equals 1 if either the loan is terminated before maturity or the loan commitment is reduced. *Waiver* equals 1 if the lender grants a covenant waiver or modifies the covenant. *New credit* equals 1 if the borrower obtains new credit. $Bind_t$ and $Bind_{t-1:t}$ are indicator variables equal to 1 if a loan breached a covenant in the current or either the current or previous year, respectively. Total committed is the sum of loans outstanding and unused commitments averaged over the two year period.

3.3. Maturity and Covenant Violation Frequency

We now document two key facts using the SNC data.

Fact 1: Bank credit has long maturity. The vast majority of bank loans are of long maturity. As shown in table 2, in both the full SNC data and the covenant sample roughly 90% of all loans and commitments outstanding at the end of 2007 had at least 1 year of maturity remaining. Conditional on a loan having a year maturity remaining, the mean remaining maturity at the end of 2007 was about 3.3 years.[8] The long maturity of bank debt constricts the channels through which bank health can transmit to borrower outcomes. In the remainder of the paper, we restrict attention to loans with at least one year maturity remaining in order to focus on seemingly insulated borrowers. Because of the rarity of loans with shorter maturity, imposing this sample restriction has only a small practical effect on our results.

Fact 2: Many loans breach covenants. For each loan in the covenant sample, SNC reports whether the loan remains in compliance throughout the year. If the loan remains compliant, SNC reports whether it would have been noncompliant but for a covenant waiver or reset granted by the lender. We consider a covenant to bind in either circumstance and define the variable $Bind_t$ to equal 1 if a loan breaches any covenant threshold during year t.

Covenant violations occur routinely. According to table 2, roughly one-quarter of loans in the SNC covenant sample breach a covenant during a typical year before the 2008-09 financial

[8]The maturity of loans in SNC closely resembles the maturity structure of all long-term debt. Of firms in Compustat with positive long-term debt outstanding, the median amount due in less than one year is about 5% of the total and the 75th percentile is less than 20%. Across all firms in Compustat, the median firm has long-term debt of less than 0.2% of assets maturing within a year and the 75th percentile firm has maturing debt of less than 2% of assets. These ratios are roughly the same for debt due in each of 2007, 2008, and 2009. The ratios are based on all firms in the Compustat Annual file with non-negative revenue, assets, investment, or cash, with assets greater than each of cash, investment, and property, plant, and equipment, and with assets of at least $10 million and asset growth of lower than 200%.

crisis and one-third breach a covenant in each crisis year. This high violation frequency makes the covenant channel potentially quantitatively significant.

It is important to validate the high violation frequency in the covenant sample with respect to the full SNC universe and to previous studies. The high violation frequency does not appear to reflect particular attributes of the covenant sample. We have already discussed the similarity of various loan characteristics between the full SNC universe and loans in the covenant sample. To more directly assess similarity along dimensions which predict a covenant violation, we run the loan-level regression in the covenant sample:

$$Bind_{l,b,f,t} = \sum_{I} \beta_{1,I,t}[\text{Industry=I}]_f + \beta_{2,t}[\text{Log committed}]_{l,t} + \beta_{3,t}[\text{Utilization}]_{l,t} + \beta_{4,t}[\text{Credit line}]_{l,t} + \sum_{P} \beta_{5,P,t}[\text{Loan purpose=P}]_{l,t} + \sum_{R} \beta_{6,R,t}[\text{Loan rating=R}]_{l,b,f,t} + e_{l,b,f,t}. \quad (1)$$

The regression in equation (1) projects $Bind_{l,b,f,t}$, the indicator for loan l from bank b to firm f violating a covenant in year t, on a set of variables observed in both the covenant sample and the full universe. These variables include borrower industry, loan size, loan utilization rate, loan type, loan purpose (working capital, general purpose, etc.), and, importantly, categorical variables for the internal rating of the loan, each interacted with year. We then use the coefficients from equation (1) to impute $Bind_t$ for the full SNC universe. Effectively, this exercise re-weights the covenant sample using relevant features of the SNC universe. The imputed fraction of covenant violations in the SNC universe is 0.23 pre-crisis and 0.30 in the crisis, very close to the values for the covenant sample. Thus, if we had data on covenant violations for the SNC universe, we would expect to find a violation frequency very similar to that in the covenant sample.

The violation frequency in SNC does exceed that reported in previous studies. It is instructive to compare to two prominent earlier approaches to determine why. Dichev and Skinner (2002), Chava and Roberts (2008), and Falato and Liang (2016) use Compustat to follow current ratio and net worth covenants reported at inception in DealScan. Dichev and Skinner (2002) report that roughly 30% of loans violate one of these covenants at some point during the life of the loan. However, this approach mechanically understates the frequency of total violations because it considers only two types of covenants and contains measurement error due to covenant thresholds changing after the initial loan contract (Denis and Wang, 2014; Roberts, 2015). In an innovative approach, Roberts and Sufi (2009a), Nini et al. (2009), and Nini et al. (2012) scrape SEC 10-Q and 10-K filings of publicly-traded firms looking for phrases associated with violations. Roberts and Sufi (2009a) find just 1% of firms rated A or above report a violation in a typical year, rising to 9% for B rated borrowers and 18% for borrowers rated CCC or worse. Nini et al. (2012) use an improved version of the text-scraping algorithm and find roughly 12% of all publicly-traded firms report a violation in each of 2006 and 2007. Yet, while their data cover all covenant types, SEC regulation S-X governing disclosure does not require firms to report violations if they obtain an amendment or waiver before the end of the reporting period. Indeed, while each year roughly 25% of loans in the SNC covenant sample breach a covenant during 2006 or 2007, only 9% of loans breach a covenant and do not receive a waiver in the same year.[9] Finally, both previous approaches necessarily cover only

[9]We can more directly assess the importance of waivers in explaining the different violation propensities between SNC and Nini et al. (2012, hereafter NSS) by comparing firm-years which appear in both the NSS data set and the SNC covenant sample. In the 601 overlapping firm-years covering the period 2006-2008, the violation propensity in SNC is roughly double that in NSS, reflecting 140 firm-years in which SNC identifies either a covenant violation or a covenant waiver while according to the NSS data the firm made no mention of such a violation or waiver in a regulatory filing. (There are 26 firm-years in which NSS identify a violation where SNC does not. These reflect cases where a firm obtained a preemptive waiver, for example in anticipation of missing a filing deadline or taking a one-time charge-off on earnings, where a firm had multiple loans and violated a covenant on a loan not in the

publicly-traded borrowers. In the SNC data, private borrowers exhibit slightly higher violation propensities than publicly-traded borrowers.

Following a violation, a lender may choose to waive or reset the covenant or may force repayment or restructuring of the loan. In practice, the resolution of a loan restructuring process can take a few months to achieve. In what follows we therefore use as our main measure the variable $Bind_{t-1:t} = \max\{Bind_{t-1}, Bind_t\}$ which equals 1 if a loan breached a covenant in either the current or previous year.[10]

4. Identification Based on Variation in Lender Health

For a causal assessment of the covenant channel we turn to variation in the cross-section of lenders. The 2008-09 period offers a useful laboratory for studying the transmission from banks to corporate borrowers because the origins of the financial distress lay outside the corporate loan sector. Rather, prominent explanations include the exposure of financial institutions to real estate markets and toxic assets, counterparty risk and network proximity to failing institutions, and liability structure and susceptibility to shadow bank runs (see e.g. Ivashina and Scharfstein, 2010; Cornett et al., 2011; Erel et al., 2011; Fahlenbrach et al., 2012; Santos, 2011). Our measures of lender health, adopted from Chodorow-Reich (2014), reflect these forces.

SNC sample, and a few cases where we could not identify from the SEC filing why the NSS procedure assigned a violation.) We are grateful to Amir Sufi for providing us with the Nini et al. (2012) data set.

[10]Loans can contain cross-default provisions by which a covenant breach on one loan triggers technical default on another. We have experimented with defining $Bind_{t-1:t}$ based on whether any loan to the borrower breaches a covenant with no meaningful changes in our loan-level analysis. Similarly, our results remain quantitatively similar if we use $Bind_t$ as our main measure of a violation. Nini et al. (2012) emphasize that covenant terms tighten following a violation with the possible implication that the likelihood of violating a covenant in 2009 depends on the 2008 health of the lender. The backward-looking two-year treatment window negates this problem because the value in 2009, $Bind_{2008:2009}$, equals 1 for any loan which violates a covenant in 2008 and in particular does not depend on the outcome of the violation.

4.1. Lender Health Measures

The first measure, originally proposed by Ivashina and Scharfstein (2010), identifies a bank's exposure to Lehman Brothers through the fraction of the bank's syndication portfolio in which Lehman Brothers had a lead role. This exposure affected banks directly through the syndicated market as firms with credit lines provided by Lehman Brothers drew down the remainder of their credit line as a precautionary measure following the Lehman bankruptcy, resulting in a draining of liquidity from other syndicate members. The second lender health variable measures a bank's exposure to private-label mortgage-backed securities through the correlation of its daily stock return with the return on the ABX AAA 2006-H1 index in the fourth quarter of 2007. The ABX AAA 2006-H1 index follows the price of residential mortgage-backed securities issued during the second half of 2005 and with a AAA rating at issuance. The correlation indicates the market's perception of the bank's exposure to the mortgage crisis. The third measure is 2007-08 trading revenue as a share of assets, as most writedowns occurred on the trading book. For brevity of presentation, we extract the first principal component of the three measures of lender health and create a rank-normalized variable *Bad Lender* as the rank of the first principal component relative to all lenders divided by the number of lenders. The variable *Bad Lender* therefore lies on the unit interval with the lender in worst health receiving a value of 1. Our main results are not sensitive to using this measure or one of the three subcomponents.

Syndicated loans such as those in the SNC data include a lead lender and participant lenders. The lead lender manages the servicing of the loan, provides the largest share of the funds, and typically cannot sell its share of the loan in the secondary market. Most loan contracts require the agreement of lenders providing at least 51% of the commitment to accelerate repayment or

modify loan terms following a covenant breach.[11] Because the lead lender retains the largest share of the loan, plays an organizing role among syndicate members, and as the servicing agent has responsibility for carrying out any renegotiation, in our main results we assign lender health on the basis of the lead lender only. Effectively, we assume the lead lender is always pivotal in resolving a covenant violation. Our main results are robust to broader definitions of the health of the syndicate as we show in section 5.1.3.

Following Chodorow-Reich (2014), we construct the measure for the 43 most active lead lenders in the syndicated lending market.[12] As shown in columns (3) and (6) of table 2, more than 90% of the loan volume in the covenant sample comes from loans with lead lenders in our lender data set. Loans from these lenders appear similar to the full covenant sample along all dimensions.

4.2. Identification

The validity of the lender health measures for causally assessing the covenant channel requires that they have predictive power for bank lending behavior and that assignment of borrowers and lenders before the crisis be "as good as random". "As good as random" means that borrowers of lenders in worse health not differ systematically from borrowers of lenders in better health along dimensions such as credit demand during the crisis. We briefly summarize evidence from Chodorow-Reich (2014) and then provide new evidence of balancing of observable characteristics

[11] For example, the credit agreement described in section 2 defines the "Required Lenders" in Section 8.02(b) as "(i) Lenders having Revolving Exposures and unused Revolving Commitments representing not less than 51% of the sum of the total Revolving Exposures and unused Revolving Commitments at such time and (ii) in any event not less than two Lenders. (p.15)"

[12] We use the version of these measures provided at http://scholar.harvard.edu/files/chodorow-reich/files/final_bank_variables.xlsx. About one-quarter of these lenders are foreign-owned or otherwise not under the regulatory purview of the SNC supervisors and therefore excluded from the SNC data unless the participants include multiple supervised lenders. Unlike in DealScan where many loans list multiple lead arrangers, the SNC supervisors always identify a single lead arranger as the servicing agent.

in SNC. Section 5 presents additional evidence of "as-good-as-random" assignment.

Chodorow-Reich (2014) discusses both elements of the validity requirement. Starting with predictive power, Chodorow-Reich (2014, table III) shows that each bank health measure can explain a substantial part of the cross-section of new lending during the 2008-09 period. The origin of the 2008-09 crisis outside of the corporate loan sector makes "as good as random" assignment a priori plausible. Nonetheless, sorting of banks and borrowers might occur. However, Chodorow-Reich (2014, table IV) finds that borrowers of different lenders appear ex ante similar along observable characteristics such as the employment decline in the borrower's industry or county. Chodorow-Reich (2014, table V) further shows balancing holds along unobserved characteristics using a specification with borrower fixed effects. Finally, financial markets before the crisis, as embodied in spreads on credit default swaps, did not predict the subsequent distress in the bank sector, making it unlikely higher quality borrowers could have purposefully chosen more stable lenders.

Table 3 provides evidence of "as good as random" assignment from the balancing of borrower and loan characteristics by lender health in the SNC data. The left panel includes all loans in our sample, while the right panel restricts to loans which violate a covenant. Starting with the left panel, borrowers of lenders below and above the median of crisis lender health had statistically indistinguishable mean assets, leverage, and supervisory risk rating at the start of the crisis. The balancing along these variables, all drawn from SNC data, complements the similarities in geography and industry reported in Chodorow-Reich (2014). Of particular interest here, loans from lenders in good and bad health had statistically similar covenant tightness before the crisis

Table 3: Balancing

	All borrowers			$Bind_{t-1:t} = 1$		
	Less healthy lenders	Healthier lenders	t-stat. of equality	Less healthy lenders	Healthier lenders	t-stat. of equality
Variable mean:						
$100 \times Bind_{t-1:t}$ (crisis)	37.96	36.59	0.82			
Covenant tightness (pre-crisis)	1.93	4.79	0.52			
Log assets (pre-crisis)	12.72	12.81	1.17	10.98	11.11	0.35
Leverage (pre-crisis)	0.50	0.49	1.21	0.54	0.53	0.93
Risk rating (pre-crisis)	70.04	71.51	0.56	42.20	44.69	0.93
Observations (crisis)	1,673	1,747	3,420			
Observations (pre-crisis)	1,215	1,263	2,478	358	335	693

Notes: The table reports selected summary statistics by lender health. "Healthier lenders" are those for which *Bad Lender* <median and "Less healthy lenders" are those for which *Bad Lender* >median, where *Bad Lender* is the rank of the lead lender's health normalized to lie on the unit interval, with a value of 1 corresponding to the least healthy lender.

and exhibited similar propensities to violate a covenant during the crisis.[13]

The balancing of ex ante characteristics of borrowers and loans which violate a covenant most directly affects the validity of our analysis below. Comparing the left and right panels, covenant violators overall tend to be smaller and have ex ante riskier loans and higher pre-crisis leverage. Crucial to our identification assumption, however, violators who had borrowed from healthier and less healthy lenders have nearly identical size and pre-crisis leverage and similar risk ratings. We cannot reject equality of means for any variable. Together, these results all suggest that any differential outcome for covenant violators of healthier and unhealthy lenders was due to the lenders' response to a covenant violation and not ex ante characteristics of the borrowers.

[13]Covenant tightness refers to the percent distance from threshold of the most tightly binding covenant. We obtain this variable from text fields accompanying the SNC covenant sample. These text fields do not have a uniform layout, limiting the sample for this variable only to 696 pre-crisis observations.

5. Empirical Results

We present empirical results at the borrower and loan level. First, we use linear probability models to show how a lender's response to a covenant violation during 2008 or 2009 depends on its own health. Placebo exercises and a "within borrower" estimator bolster our causal interpretation of the results. We also show the response is larger for credit lines than term loans, for smaller, more concentrated syndicates, and syndicates where the lead has a larger share. Next, we measure the change in total credit at the loan and borrower level and show that affected borrowers do not substitute toward other sources of credit. Last, we report evidence of transmission of the covenant channel to balance sheet and real outcomes such as investment and employment.

5.1. Loan-Level Outcomes

We start with linear probability models to explore how loan terms change following a covenant violation, depending on lender health. Our main outcome variable, *Credit reduced*, equals 1 if either the loan is terminated before maturity or the loan commitment is reduced. The structure of SNC allows us to follow a loan through amendments, modifications, and refinancing in constructing this variable. We consider *Credit reduced* to be the broadest measure of whether a loan changes in a way unfavorable to the borrower. As a caveat, we do not observe in SNC whether the interest rate changes, an issue we return to briefly below.

5.1.1. Non-parametric Evidence

Table 4 shows a non-parametric version of our first main result using the variable *Credit reduced* and comparing loans with lenders in the top and bottom quartile of lender health. During the

Table 4: Non-parametric Evidence

	Fraction *Credit reduced* = 1		
	$Bind_{t-1:t} = 0$	$Bind_{t-1:t} = 1$	Difference
Healthiest lenders (*Bad Lender* <25th percentile)	0.316 [N=529]	0.369 [N=319]	0.053
Least healthy lenders (*Bad Lender* >75th percentile)	0.320 [N=489]	0.506 [N=365]	0.186
Difference	0.004	0.137	0.133

Notes: The table reports the fraction of loans in each cell terminated before maturity or experiencing a decline in the loan commitment (*Credit reduced* = 1). The sample consists of all loans in the SNC covenant sample at the start of 2008 or 2009, with at least one year maturity remaining, and with a lead lender in the lender health data set. *Bad Lender* is the rank of the lead lender's health normalized to lie on the unit interval, with a value of 1 corresponding to the least healthy lender. *Bind* is an indicator variable which equals 1 if a borrower violated a covenant in either the current or previous year. The brackets report the number of observations in each cell.

crisis, roughly one-third of loans which do not have a covenant violation undergo an unfavorable modification. This number may reflect renegotiation forced by the lender before a covenant violation occurred, a mutually agreed reduction in credit limit, or an offsetting decline in the interest rate which we do not observe. The propensity is similar for borrowers of healthy and less healthy lenders, suggesting bad lender health by itself does not negatively affect the provision of credit to borrowers who already have a loan. Borrowers who violate a covenant have a higher likelihood of experiencing a bad loan outcome. For borrowers of healthier lenders, the likelihood rises by 5.3 percentage points. For borrowers of less healthy lenders, the likelihood rises by 18.6 percentage points. The additional 13.3 percentage points rise in the probability of a bad outcome is the non-parametric difference-in-difference estimate of the effect of having a lender in bad health following a covenant violation on receiving a bad loan outcome.

5.1.2. Baseline Regression Evidence

Table 5 reports the regression version of the difference-in-difference estimator. The regression version allows us to make lender health a continuous rather than binary variable and to control for covariates. The specification takes the form:

$$Y_{l,b,f,t} = \beta_0 + \beta_1[Bad\ Lender_b] + \beta_2\left[Bind_{l,t-1:t}\right] + \beta_3[Bad\ Lender_b \times Bind_{l,t-1:t}]$$
$$+ \gamma' X_{l,f,t} + \epsilon_{l,b,f,t}, \tag{2}$$

where $Y_{l,b,f,t}$ denotes an outcome in period t for loan l to firm f with lead bank b and $X_{l,f,t}$ may include borrower or loan covariates. We report standard errors two-way clustered by borrower and lead lender.[14] For readability, all coefficients in table 5 are multiplied by 100.

The first column of table 5 repeats the exercise of table 4 with no additional covariates but the continuous measure of lender health. Since we have normalized the lender health measure to lie on the unit interval, the coefficient on the interaction *Bad lender* $\times$ *Bind* of 23.9 has the interpretation that a borrower of the lender in worst health is 23.9 percentage points more likely to receive a credit reduction following a covenant violation in 2008 or 2009 than is a borrower of the healthiest lender. The difference is statistically significant at the 1% level. In column (2) we add year and industry fixed effects, in column (3) control additionally for borrower size, leverage, and risk rating, and in column (4) control for the borrower covariates and loan purpose and type. While the explanatory power of the regression rises with the controls, the magnitude and statistical significance of the interaction coefficient remains quite stable. The stability of

[14] We cluster along the lead lender dimension because the treatment *Bad Lender* is homogeneous across loans from the same lead lender. The borrower dimension accounts for borrowers with multiple loans in the sample each with a different lead lender. The sample contains relatively few such borrowers and the standard errors are virtually unchanged if we cluster by lead lender only.

Table 5: Loan Commitment Terminated or Reduced

	Dependent variable: *Credit reduced*				
	(1)	(2)	(3)	(4)	(5)
Bad Lender	−4.1	−3.0	−3.2	−0.8	−2.3
	(5.8)	(5.6)	(5.7)	(5.2)	(7.7)
Bind	6.1**	4.6	4.2	5.2**	6.6
	(2.6)	(3.1)	(2.9)	(2.6)	(5.3)
Bad Lender × *Bind*	23.9***	25.2***	25.1***	23.7***	24.2**
	(6.4)	(6.5)	(6.5)	(6.3)	(11.0)
Year, Industry FE	No	Yes	Yes	Yes	Yes
Borrower controls	No	No	Yes	Yes	Yes
Loan controls	No	No	No	Yes	Yes
Distance control	No	No	No	No	Yes
R^2	0.066	0.085	0.087	0.116	0.128
Observations	3,420	3,420	3,420	3,420	934

Notes: The table reports linear probability model regressions of the form: $Y_{l,b,f,t} = \beta_0 + \beta_1[Bad\ Lender] + \beta_2\,[Bind] + \beta_3[Bad\ Lender \times Bind] + \gamma' X_{l,b,t} + \epsilon_{l,b,f,t}$. The sample consists of all loans in the SNC covenant sample at the start of 2008 or 2009 with at least one year maturity remaining and a lead lender in the lender health data set. The dependent variable *Credit reduced* equals 1 if either the loan is terminated before maturity or the loan commitment is reduced. *Bad Lender* is the rank of the lead lender's health normalized to lie on the unit interval, with a value of 1 corresponding to the least healthy lender. *Bind* is an indicator variable which equals 1 if a borrower violated a covenant in either the current or previous year. Reported coefficients are multiplied by 100. Borrower controls: log assets, leverage, risk rating. Loan controls: loan purpose, loan type. Distance control: percent distance from threshold of most tightly binding covenant at start of observation year. Standard errors two-way clustered by borrower and lead lender reported in parentheses. *,**,*** indicate significance at the 10, 5, and 1 percent levels, respectively.

the coefficient reflects the sample balancing in table 3 and is consistent with the identification requirement that borrowers be "as good as randomly assigned" to lenders. Column (5) adds the percent distance from the threshold of the most tightly binding covenant for a subsample of loans for which we were able to encode information in SNC on the covenants themselves. This control addresses the possible concern that covenant violations on loans from worse lenders may be more severe than violations on loans from lenders in better health; again, the point estimate remains virtually unchanged.[15] Because the coefficient remains stable across these specifications and

[15]Re-estimating the specification in column (4) on the same subsample as in column (5) gives an interaction coefficient of 25.1 (s.e.=11.6).

to maximize the sample, in the remainder of the paper we report only specifications including the full set of borrower and (if applicable) loan controls and year and industry fixed effects as in column (4). Similar to table 5, we find very similar quantitative results whether or not we include these control variables.

The small and statistically insignificant estimate of β_1, the coefficient on the main effect for *Bad Lender*, also merits comment. The near zero (indeed slightly negative) coefficient indicates that borrowers attached to bad lenders but who did not violate a covenant did not experience any higher likelihood of having their credit diminished. This result rules out a correlated decline in loan demand and voluntary reduction of credit across all borrowers of less healthy lenders as an explanation for why these banks reduced lending. Rather, it points to the importance of the covenant channel – borrowers who did not breach a covenant started the year with a loan contract with maturity remaining of at least one year and the long-term contract insulated them from the health of their lender.[16]

Table 6 reports difference-in-difference results for two other binary outcomes, receiving a waiver or reset on a covenant violation and having the loan commitment increased. In column (1), the dependent variable $Waiver$ equals 1 if the lender grants a covenant waiver or modifies the covenant. Usually such waivers occur only after a violation, but they can also happen without a violation imminent. While a waiver can come with conditions and does not necessarily imply a violation gets resolved without adverse consequences to the borrower, the absence of a waiver

[16]The economic interpretation of the main effect on *Bad Lender* explains why we include it in the regression rather than a lender fixed effect. Nonetheless, if we replace the term $\beta_1[Bad\ Lender_b]$ in equation (2) with a lender fixed effect α_b, we obtain nearly identical estimates of the main effect on *Bind* β_2 and the interaction coefficient β_3. For example, in the specification corresponding to column (4), we obtain $\beta_2 = 5.2$ (s.e.=2.4) and $\beta_3 = 23.6$ (s.e.=6.1). We also find in unreported regressions based on merging the SNC data with loan pricing information in DealScan an increase in interest costs for covenant violators of unhealthy lenders, a result again inconsistent with a voluntary reduction in loan amount.

Table 6: Waiver and New Credit

Dependent variable:	*Waiver*	*New credit*
	(1)	(2)
Bad Lender	3.8	3.9
	(3.3)	(2.4)
Bind	75.3***	−1.5
	(1.7)	(1.9)
Bad Lender × *Bind*	−66.5***	−8.9*
	(10.7)	(4.7)
Year, Industry FE	Yes	Yes
Borrower, Loan Controls	Yes	Yes
R^2	0.511	0.224
Observations	3,420	3,420

Notes: The table reports linear probability model regressions of the form: $Y_{l,b,f,t} = \beta_0 + \beta_1[Bad\ Lender] + \beta_2\,[Bind] + \beta_3[Bad\ Lender \times Bind] + \gamma' X_{l,b,t} + \epsilon_{l,b,f,t}$. The sample is the same as table 5. In column (1) the dependent variable *Waiver* equals 1 if the lender grants a covenant waiver or modifies the covenant. In column (2) the dependent variable *New credit* equals 1 if the borrower obtains new credit. *Bad Lender* is the rank of the lead lender's health normalized to lie on the unit interval, with a value of 1 corresponding to the least healthy lender. *Bind* is an indicator variable which equals 1 if a borrower violated a covenant in either the current or previous year. Reported coefficients are multiplied by 100. Borrower controls: log assets, leverage, risk rating. Loan controls: loan purpose, loan type. Standard errors two-way clustered by borrower and lead lender reported in parentheses. *,*** indicate significance at the 10 and 1 percent levels, respectively.

does signal either an especially long and difficult renegotiation or a termination of the loan agreement. Not surprisingly, the probability of receiving a waiver rises sharply if the loan would otherwise be in technical default. The main effect on *Bind* indicates that for the healthiest lender, 75% of violations receive a waiver. The coefficient on the interaction of -67 means that only about 8% of loans from lenders in the worst health receive a waiver.

Column (2) examines whether violating a covenant and having a lender in bad health also affects the likelihood of a borrower receiving an expansion in credit available. Specifically, *New credit* equals 1 if the existing loan commitment increases or the borrower obtains new credit not connected to its existing outstanding loans. Unlike a reduction or canceling of a credit line, which a lender may have a statutory right to do following a violation, an expansion

of credit constitutes a positive outcome for a borrower. Nonetheless, violating a covenant may restrict the borrower's outside option in obtaining financing from a different source and lenders can exploit their bargaining power against such borrowers by refusing to negotiate a refinancing or offer additional credit. The regression evidence is consistent with this theory. Breaching a covenant causes a roughly 9 p.p. lower probability of the borrower obtaining an expanded credit commitment if the loan came from the least healthy lender.

5.1.3. Robustness and Specification Tests

Table 7 reports robustness to the measure of lender health. As a benchmark, column (1) reproduces column (4) of table 5 and shows our baseline regression of the effect of lender health and a covenant violation on the likelihood that a borrower receives a credit reduction. Column (2) replaces the measure of lender health with the health of the pre-crisis lead lender, defined using loans outstanding in June 2007.[17] Therefore, it uses only information on borrower-lender matches made before lender health during the crisis became apparent. In practice, the stickiness of bank-borrower relationships makes lender health in June 2007 highly correlated with lender health at the start of 2008 or 2009 and we obtain very similar quantitative results using the June 2007 health variable.

Columns (3)-(6) demonstrate the robustness to including the health of syndicate participants, in columns (3) and (4) using a commitment share-weighted mean of syndicate health and in columns (5) and (6) using a commitment share-weighted median. The weighted mean is a natural alternative to the health of the lead. Recalling that the standard loan contract requires

[17]This date falls a few weeks before the implosion of the two Bear Stearns hedge funds which marked the start of the subprime crisis, but at a point when few observers expected significant financial disruption. For example, the Federal Reserve meeting statement from June 28, 2007 acknowledges "ongoing adjustment in the housing sector" but expects the economy to expand "at a moderate pace over coming quarters" and sees the "risk that inflation will fail to moderate as expected" as the "predominant policy concern."

Table 7: Robustness to Lender Health Measure

Lender health based on:	Dependent variable: *Credit reduced*					
	Crisis lead (baseline)	June 2007 lead	Crisis syndicate-weighted mean		Crisis syndicate-weighted median	
	(1)	(2)	(3)	(4)	(5)	(6)
Bad Lender	−0.8	−9.8	−16.5	−4.7	−10.4	−2.2
	(5.2)	(6.3)	(10.4)	(9.7)	(6.6)	(7.2)
Bind	5.2**	8.2**	−2.6	1.9	3.2	5.9
	(2.6)	(3.3)	(7.6)	(4.4)	(5.3)	(4.2)
Bad Lender × *Bind*	23.7***	27.3***	33.0**	27.2***	21.6**	19.0**
	(6.3)	(5.1)	(15.3)	(9.5)	(10.5)	(8.6)
Impute non-bank using lead	n.a.	n.a.	No	Yes	No	Yes
Year, Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Borrower, Loan Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,420	2,844	3,420	3,420	3,420	3,420

Notes: The table reports linear probability model regressions of the form: $Y_{l,b,f,t} = \beta_0 + \beta_1[Bad\ Lender] + \beta_2[Bind] + \beta_3[Bad\ Lender \times Bind] + \gamma' X_{l,b,t} + \epsilon_{l,b,f,t}$. Column (1) reproduces column (4) of table 5. In column (2) the sample and variable definitions are the same as in column (1) except that the sample excludes loans to borrowers without a loan in SNC as of June 2007 and lender health assignment is based on the lead lender as of June 2007. In columns (3)-(6) the sample and variable definitions are the same as in column (1) except that lender health assignment is based on the weighted mean health of banks in the crisis syndicate (column 3), the weighted mean health of the crisis syndicate imputing the health of the lead for non-banks (column 4), the weighted median health of banks in the crisis syndicate (column 5), or the weighted median health of the crisis syndicate imputing the health of the lead for non-banks (column 6). In all columns, the dependent variable *Credit reduced* equals 1 if either the loan is terminated before maturity or the loan commitment is reduced; *Bad Lender* is normalized to lie on the unit interval, with a value of 1 corresponding to the least healthy lender; and *Bind* is an indicator variable which equals 1 if a borrower violated a covenant in either the current or previous year. Reported coefficients are multiplied by 100. Borrower controls: log assets, leverage, risk rating. Loan controls: loan purpose, loan type. Standard errors two-way clustered by borrower and lead lender reported in parentheses. *,**,*** indicate significance at the 10, 5, and 1 percent levels, respectively.

the agreement of lenders providing at least 51% of the commitment to accelerate repayment or modify loan terms following a covenant breach, the weighted median assigns *Bad Lender* based on the health of the marginal lender required to build a coalition to renegotiate the loan. As a caveat, we lack a measure of the health of non-bank participants such as hedge funds, pension funds, or CLOs. For the average loan, these non-bank participants provide 40% of the total commitment. However, non-bank participants typically play a relatively passive role

in syndicate management. We therefore assume they either follow the banks in the syndicate (columns 3 and 5) or follow the direction of the lead (columns 4 and 6) and impute a health measure for the non-banks accordingly. Using either the weighted mean or weighted median measure and either assumption for the non-banks yields similar (and statistically significant) point estimates of the coefficient on *Bad Lender* × *Bind*, β_3, as the baseline coefficient in column (1). The larger standard errors for β_3 in columns (3)-(6) compared to column (1), however, accord with our baseline assumption that the lead lender health alone best captures the health of the pivotal member in resolving a covenant violation.

Table 8 reports three additional specification tests which further support a causal interpretation of the main result. First, in column (1) we estimate the difference-in-difference specification (2) with the dependent variable $Y_{l,b,f,t}$ the change in the lead lender's share of the loan commitment. If a decline in its health caused the lead lender to force a tightening of credit provision following a covenant violation, we should expect the lead lender's share of the renegotiated loan to decline on average. If instead the tightening of credit reflected only some unobservable attribute of the borrower, the lead lender share should remain constant or even increase due to enhanced agency problems between the lead and the other syndicate members. Notably, using the change in the lead's share as the dependent variable in equation (2) is akin to having bilateral credit to a borrower as the dependent variable but including a borrower-loan fixed effect. This specification therefore closely resembles the "within estimator" of Khwaja and Mian (2008) in that it differences out any heterogeneity across borrowers in loan demand. The negative coefficient for the interaction term in column (1) indicates a reduction in lending by the lead lender relative to other syndicate participants, consistent with the tightening of credit

Table 8: Specification Tests

Dependent variable:	Change in lead lender share	*Credit reduced* in 2006-07 (Placebo exercises)	
Lender health based on:	Crisis lead	Crisis lead	2006/2007 lead
	(1)	(2)	(3)
Bad Lender	1.2	3.5	−2.2
	(2.5)	(3.9)	(6.4)
Bind	−4.1*	13.9**	16.1***
	(2.4)	(5.7)	(5.3)
Bad Lender × *Bind*	−10.9**	2.9	10.3
	(5.2)	(10.5)	(11.5)
Year, Industry FE	Yes	Yes	Yes
Borrower, Loan Controls	Yes	Yes	Yes
Observations	2,289	2,047	2,478

Notes: The table reports regressions of the form: $Y_{l,b,f,t} = \beta_0 + \beta_1[Bad\ Lender] + \beta_2\,[Bind] + \beta_3[Bad\ Lender \times Bind] + \gamma' X_{l,b,t} + \epsilon_{l,b,f,t}$. In column (1) the sample and variable definitions are the same as in table 5 except that the sample excludes loans which disappear by the end of the year and the dependent variable is the change in the fraction of the loan commitment from the lead lender. In columns (2) and (3) the sample consists of loans in the SNC covenant sample at the start of 2006 or 2007 with at least one year maturity remaining and the dependent variable is based on outcomes in 2006 and 2007. In column (2) lender health assignment is based on the lead lender at the start of the crisis. In column (3) lender health assignment is based on the lead lender at the start of 2006 or 2007. In all columns, the dependent variable *Credit reduced* equals 1 if either the loan is terminated before maturity or the loan commitment is reduced; *Bad Lender* is the rank of the crisis health of the assigned lender as of the period indicated in the table header normalized to lie on the unit interval, with a value of 1 corresponding to the least healthy lender; and *Bind* is an indicator variable which equals 1 if a borrower violated a covenant in either the current or previous year. Reported coefficients are multiplied by 100. Borrower controls: log assets, leverage, risk rating. Loan controls: loan purpose, loan type. Standard errors two-way clustered by borrower and lead lender reported in parentheses. *,**,*** indicate significance at the 10, 5, and 1 percent levels, respectively.

reflecting the increase in internal cost of funds for the lead lender. The magnitude, a decline in commitment share of about 11 percentage points, is equal to roughly two-thirds of the sample mean lead commitment share of 15% during the crisis reported in table 2.

Columns (2) and (3) of table 8 report placebo exercises. In column (2) we keep the measure of lender health assigned to each borrower the same as in our baseline specification but re-estimate the difference-in-difference regressions from table 5 for the likelihood of a credit commitment reduction in 2006 and 2007. This exercise asks whether borrowers of lenders in worse health during the crisis were treated differently before the crisis upon violating a covenant. In column

(3) we keep the measure of lender health the same but reassign borrowers to their lender as of the start of 2006 or 2007. This exercise asks whether banks in worse health in 2008 and 2009 always treat covenant violators worse, or whether the differential treatment occurs only during the financial crisis. In neither case can we reject that the differential treatment occurred only during the crisis. The estimates of the interaction term coefficient β_3 are small in magnitude and statistically indistinguishable from zero. The harsh treatment of covenant violators by unhealthy banks during the crisis appears to reflect the health of the bank and not some time-invariant bank or borrower characteristic.[18]

5.1.4. Heterogeneity

The structure of loan contracts offers predictions for how the intensity of the treatment effect of having an unhealthy lender and violating a covenant may vary by type of borrower and loan. Table 9 explores this treatment heterogeneity. The table reports the coefficients β_3 and $\beta_{3,I}$ from the fully-interacted regression:

$$\begin{aligned} Y_{l,b,f,t} = \beta_0 + \beta_1[Bad\ Lender] + \beta_2\,[Bind] + \beta_3[Bad\ Lender \times Bind] + \gamma' X_{l,b,t} \\ + \beta_{0,I}[I] + \beta_{1,I}[Bad\ Lender \times I] + \beta_{2,I}\,[Bind \times I] + \beta_{3,I}[Bad\ Lender \times Bind \times I] \\ + \gamma_I'\,[X_{l,b,t} \times I] + \epsilon_{l,b,f,t}, \end{aligned} \tag{3}$$

where I is an indicator variable described in the table header. Thus, β_3 is numerically equivalent to the coefficient from a separate regression including only observations for which variable I takes

[18] In contrast, we find positive and statistically significant evidence that unconditionally having a covenant binding lowers credit in the pre-crisis period ($\beta_2 > 0$ in columns (2) and (3)). Of course, this result does not invalidate the placebo exercise. We would expect lenders to use covenant violations to restrict credit on some loans even outside the crisis. But this outcome should not occur differentially at lenders more impacted by the crisis, exactly as we find.

Table 9: Heterogeneity

Interaction variable I:	Dependent variable: *Credit reduced*			
	Credit line	High lead share	Small syndicate	Concentrated syndicate
	(1)	(2)	(3)	(4)
Bad Lender × *Bind*	17.4***	14.8*	8.4	10.2
	(4.2)	(8.4)	(11.7)	(9.8)
Bad Lender × *Bind* × I	16.6**	25.7**	27.5**	23.9**
	(5.4)	(11.6)	(11.3)	(10.2)
Main effects	Yes	Yes	Yes	Yes
Main effects×I	Yes	Yes	Yes	Yes
Year, Industry FE	Yes	Yes	Yes	Yes
Year, Industry FE ×I	Yes	Yes	Yes	Yes
Borrower, Loan Controls	Yes	Yes	Yes	Yes
Borrower, Loan Controls ×I	Yes	Yes	Yes	Yes
Observations	3,420	3,420	3,420	3,420

Notes: The table reports linear probability model regressions of the form: $Y_{l,b,f,t} = \beta_0 + \beta_1[Bad\ Lender] + \beta_2[Bind] + \beta_3[Bad\ Lender \times Bind] + \gamma' X_{l,b,t} + \beta_{0,I}[I] + \beta_{1,I}[Bad\ Lender \times I] + \beta_{2,I}[Bind \times I] + \beta_{3,I}[Bad\ Lender \times Bind \times I] + \gamma_I'[X_{l,b,t} \times I] + \epsilon_{l,b,f,t}$. The sample is the same as table 5. The dependent variable *Credit reduced* equals 1 if either the loan is terminated before maturity or the loan commitment is reduced. *Bad Lender* is the rank of the lead lender's health normalized to lie on the unit interval, with a value of 1 corresponding to the least healthy lender. *Bind* is an indicator variable which equals 1 if a borrower violated a covenant in either the current or previous year. In column (1), I is an indicator variable for whether the loan is a credit line. In column (2), I is an indicator variable for whether the lead lender's share of the loan commitment is above the sample median. In column (3), I is an indicator variable for whether the number of syndicate members is below the sample median. In column (4), I is an indicator variable for whether the Herfindahl index of loan commitment shares is above the sample median. Reported coefficients are multiplied by 100. Borrower controls: log assets, leverage, risk rating. Loan controls: loan purpose, loan type. Standard errors two-way clustered by borrower and lead lender reported in parentheses. *,**,*** indicate significance at the 10, 5, and 1 percent levels, respectively.

a value of 0, while $\beta_3 + \beta_{3,I}$ is numerically equivalent to the coefficient from a separate regression including only observations for which variable I takes a value of 1. The statistical significance of $\beta_{3,I}$ answers whether the data reject the null hypothesis of a homogeneous coefficient on [*Bad Lender* × *Bind*] in the two subsamples.

The first column of table 9 explores heterogeneity along the dimension of loan type. Because reducing the size of a term loan requires immediate repayment while reducing the limit on a credit line can impact only the unused portion of the commitment, the latter may have a less

immediately drastic effect on borrowers. If so, lenders may more readily take action when the loan is a credit line than if it is a term loan. Column (1) shows that this heterogeneity holds in the data. While unhealthy lenders reduce credit to covenant violators with both term loans and credit lines, the likelihood of a credit reduction is nearly double if the loan is a credit line and the difference is statistically significant at the 5% level.

Columns (2)-(4) explore the importance of the syndicate structure. In column (2), the interaction variable equals 1 if the lead's share of the total commitment is above the sample median, in column (3) the interaction variable equals 1 if the number of syndicate members is below the sample median, and in column (4) the interaction variable equals 1 if the concentration (herfindahl index) of the lender shares is above the sample median. Smaller, more concentrated, syndicates and those with a larger lead share are more likely to reduce credit. The larger effect for loans with a higher lead share is again indicative of the lead lender having a special role in the syndicate due to its monitoring and organizing responsibilities and responding to greater incentive to organize and oversee a renegotiation when it provides a larger share of the loan commitment.[19] The results in columns (3) and (4) suggest that smaller, more concentrated syndicates may be easier to organize.

[19] Alternatively, since the variable *Bad Lender* reflects the health of the lead lender, the variable may simply better proxy for the true health of the pivotal syndicate member when the lead provides a larger share of the commitment. While we cannot rule out this possibility, in unreported regressions we also find a statistically significant larger treatment effect for loans with a higher lead share even when we define *Bad Lender* using the weighted median lender's health as described in the previous subsection. Thus, the positive interaction term appears to reflect true dependence on the lead's share. We also have experimented with removing from the sample the roughly 18% of loans for which the lead lender does not retain any part of its share. Excluding these "originate-to-distribute" loans raises the *Bad Lender* × *Bind* coefficient from 23.7 as reported in column (4) of table 5 to 30.4 (s.e.=8.1), consistent with the result in column (2) of table 9.

5.2. Effect on Credit Available and Substitution

We have seen that lenders react differently to covenant violations depending on their own health. We now examine the effect on total credit available to the borrower.

Whether the health of a borrower's lender matters to the borrower depends on the ease with which a borrower can substitute new credit from an alternative lender. Previous literature has motivated costly switching from asymmetric information between old and new lenders (Williamson, 1987; Sharpe, 1990; Hachem, 2011; Darmouni, 2016). An even simpler debt-overhang explanation may apply in the case of covenant violators – lenders will not make new loans to borrowers in technical default as uncertain resolution of the violation deters other lenders from offering new credit.

Column (1) of table 10 reports estimates of equation (2) where the dependent variable is the percent change in the total amount committed and the sample contains only loans which began the year with remaining maturity greater than one year and remain in existence at the end of the year. Thus, this column shows the intensive margin change in credit at the loan level. The interaction coefficient of -13.2 indicates a 13 percentage points intensive margin decline in loan commitment for loans which trigger a violation and where the lender is in poor health.

Column (2) adds to the sample loans which began the year with maturity greater than one year but are prematurely terminated and imputes a value of 0 for the end of year commitment on terminated loans. We also add to the end of year commitment any new credit from syndicates with lead bank b to firm f.[20] Thus, column (2) captures the intensive and extensive margin of

[20]While SNC treats amendments or refinancing as a continuation of the same loan, very large changes in loan structure or changes to the syndicate may result in the creation of a new loan identifier. Aggregating to the lender-borrower level ensures we do not erroneously impute a loan termination when in fact the lending relationship continued with a different loan identifier. The aggregation includes loans in the full SNC universe which do not

Table 10: Effect on Total Credit Available

Dependent variable:	%Δ (Total committed)			$\Delta \frac{\text{Non-SNC debt}}{\text{Assets}}$	$\Delta \frac{\text{Debt issuance}}{\text{Assets}}$
Aggregation:	Loan intensive margin	Loan all margins	Borrower	Borrower	Borrower
	(1)	(2)	(3)	(4)	(5)
Bad Lender	1.1	0.2	12.4	−0.3	1.3
	(2.0)	(4.4)	(9.4)	(6.3)	(1.5)
Bind	−2.6**	−3.2	−8.1***	4.4	0.1
	(1.1)	(4.0)	(2.5)	(3.7)	0.5
Bad Lender × *Bind*	−13.2***	−22.9***	−26.0***	−8.8	−4.5**
	(3.2)	(7.5)	(8.9)	(9.1)	(2.0)
Year, Industry FE	Yes	Yes	Yes	Yes	Yes
Borrower controls	Yes	Yes	Yes	Yes	Yes
Loan controls	Yes	Yes	No	No	No
Frequency	Annual	Annual	Annual	Annual	Long-difference
Dep. var. source	SNC	SNC	SNC	SNC	Compustat
Observations	2,289	3,420	1,803	1,525	376

Notes: The table reports OLS regressions of the form: $Y = \beta_0 + \beta_1[Bad\ Lender] + \beta_2\,[Bind] + \beta_3[Bad\ Lender \times Bind] + \gamma' X + \epsilon$. In column (1) the sample is the same as table 5 except it excludes loans which disappear by the end of the year; in column (2) the sample is the same as table 5; in column (3) the sample contains all loans in the SNC universe to a borrower in the table 5 sample and the data are collapsed to the borrower level; in column (4) the sample contains all borrowers in the table 5 sample with at least one SNC loan outstanding at the end of the year; and in column (5) the sample contains all borrowers in the table 5 sample which we match to Compustat. *Bad Lender* is the rank of the lead lender's health normalized to lie on the unit interval, with a value of 1 corresponding to the least healthy lender. *Bind* is an indicator variable which equals 1 if a borrower violated a covenant in either the current or previous year. In column (1) the dependent variable $Y_{l,b,f,t}$ is the percent change in total committed credit associated with loan l. In column (2) the dependent variable $Y_{b,f,t}$ is the percent change in total committed credit on loans from lead lender b to borrower f. In column (3) the dependent variable $Y_{f,t}$ is the percent change in total committed credit aggregated across all loans to borrower f in the SNC universe. In column (4) the dependent variable $Y_{f,t}$ is the change in total non-SNC debt, defined as total debt less the drawn portion of SNC loans, as a percentage of beginning of period total book assets. In column (5) the dependent variable is the change from 2007 to 2009 in issuance of long-term debt less reduction in long-term debt as a percentage of 2007 total book assets, winsorized at the 1% level. SNC Borrower controls: log assets, leverage, risk rating. Loan controls: loan purpose, loan type. Standard errors two-way clustered by borrower and lead lender (columns 1 and 2) or borrower and worst lead lender (columns 3-5) reported in parentheses. *,**,*** indicate significance at the 10, 5, and 1 percent levels, respectively.

credit available from lead bank b to firm f. Including loan terminations causes the interaction coefficient to rise by about two-thirds in absolute value relative to the specification including only the intensive margin. Across these two columns and similar to the results in table 5, the

appear in the covenant sample.

much smaller coefficients on the main effects for *Bad Lender* and *Bind* reflect the insulation of borrowers with long-term loan contracts who do not violate a covenant from the health of their lender in the case of *Bad Lender* and the pervasiveness of covenant waivers granted by lenders in good health in the case of *Bind*.

Column (3) aggregates to the borrower level. Here and elsewhere, when we aggregate to the borrower level we define both *Bind* and *Bad Lender* as the maximum across all loans for firms with multiple loans in the covenant sample. The dependent variable is the percent change in all loans to the borrower in the full SNC universe. Analyzing the effect on loan commitment at the borrower level allows for any substitution margin by borrowers toward lenders already servicing different loans or the opening of new loans. We find even larger percent declines in credit available after aggregating to the borrower level. Because the denominator of the dependent variable in column (3) includes all loan commitments to the borrower and therefore (weakly) exceeds the denominator in column (2), the larger interaction coefficient in column (3) indicates that affected borrowers receive *less* credit from other lenders.[21] While this result implies a complete absence of substitution toward other lenders, it is consistent with the result in column (2) of table 6 that affected borrowers are less likely to open a new loan and with the reluctance of lenders to provide new loans to a borrower with an unresolved covenant violation.

Columns (4) and (5) examine whether borrowers substitute non-bank sources of credit. In column (4), we use the measure of total debt reported in SNC. This variable has the advantage

[21]Recall that the SNC universe contains all loans of at least $20 million shared by three or more unaffiliated financial institutions under the regulatory purview of one of the SNC supervisors. If borrowers substitute loans not in the SNC universe, then the result in column (3) could overstate the magnitude of the total bank credit decline. However, we have estimated a similar specification for the number of new loans reported by a borrower in DealScan, which does not condition on the identity of the lender, and also find a reduced likelihood of a new loan reported in DealScan for borrowers of unhealthy lenders who violate a covenant.

that we observe it for all borrowers, including non-public borrowers, but the drawback that a borrower must appear in SNC at the end of the year for us to observe the debt measure so that the column (4) sample excludes borrowers whose loans were terminated. To isolate substitution toward non-SNC debt, we subtract from the total the sum of SNC term loans and the drawn part of SNC credit lines and compute the difference between the beginning and end of the year as a percentage of beginning of period total assets. We find no evidence of affected borrowers substituting toward non-SNC credit; the coefficient on the interaction term $Bad\ Lender \times Bind$ is statistically insignificant and the point estimate is negative.

In column (5) we study the effect on debt issuance reported in Compustat. While the restriction to firms which we can match to Compustat reduces the number of observations, it avoids the censoring problem of borrowers which leave the SNC data.[22] In all specifications using a dependent variable from Compustat we report long-difference regressions of the form:

$$Y_{f,2007-2009} = \beta_0 + \beta_1[Bad\ Lender_b] + \beta_2 Bind_{f,2007:2009} + \beta_3[Bad\ Lender_b \times Bind_{f,2007:2009}] + \gamma' X_f + \epsilon_{f,2007-2009}, \quad (4)$$

where $Y_{f,2007-2009}$ is the change in a variable between 2007 and 2009 associated with firm f which had loans from bank b. By differencing, we control for any unobserved level differences across borrowers. The coefficient β_3 identifies the effect of violating a covenant sometime between 2007 and 2009 and having a bad lender on the outcome. The interaction term in column (5) indicates that long-term debt issuance falls for the affected borrowers. Together, the results in columns (4) and (5) appear inconsistent with any ability to substitute toward non-bank debt for these

[22]The merge uses company names and the string matching algorithm SAS SPEDIS. We manually review each proposed match for accuracy. The online appendix provides additional details on the merge procedure. We winsorize all Compustat variables at the 1% level.

borrowers, as technical default prevents the issuance of other debt.[23]

5.3. Balance Sheet Adjustment and Real Outcomes

We now turn to how borrowers adjust to lower credit. Previous research has found evidence of both lender health (e.g. Chodorow-Reich, 2014) and covenant violations (Chava and Roberts, 2008; Nini et al., 2012; Falato and Liang, 2016) negatively affecting firm investment and employment. Here we ask to what extent the interaction of these two variables matters above the main effects.

We first discuss financial margins of adjustment which substitute for higher credit limits or loan balances. Column (1) of table 11 shows using SNC data that the credit line utilization rate rises for covenant violators of less healthy lenders.[24] The coefficient of 0.086 indicates an increase in utilization of 8.6 percentage points relative to a baseline utilization rate of 62% during the crisis reported in table 2. Column (2) shows using Compustat data and the long-difference specification (4) that firms also adjust by drawing down cash reserves. Together, the higher utilization of credit lines and the drawing down of cash reserves reinforce our causal interpretation that the decline in credit to these borrowers reflects a supply contraction and not a lower demand for borrowing by covenant violators of unhealthy lenders.

Columns (3) and (4) of table 11 report real outcomes using Compustat data. The harsher

[23]We have also investigated new issuance of public debt using the Mergent FISD database and again find a negative and statistically significant coefficient on new debt issuance for firms which violate a covenant and have a lender in bad health.

[24]Because borrowers with multiple credit lines may substitute across lines, we aggregate all credit lines to the borrower level and compute the change in utilization for borrowers with at least one loan outstanding at the beginning and end of the year. Higher utilization can result either from a draw down of the unused portion of the credit line or a reduction in the credit limit. The evidence in table 10 suggests at least part of the higher utilization reflects the reduction in credit limits by unhealthy lenders. We do not interpret this mechanical effect as innocuous for the borrower, however, as firms value the flexibility and insurance aspects of having unused credit commitments. Otherwise, they would never open credit lines.

Table 11: Financial and Real Adjustment

Dependent variable:	Credit utilization	Δ Cash/ Assets	Δ Capex/ Assets	Employment growth
	(1)	(2)	(3)	(4)
Bad Lender	−0.023	0.021	0.028	0.010
	(0.030)	(0.036)	(0.020)	(0.070)
Bind	−0.006	0.015	−0.037	−0.008
	(0.009)	(0.016)	(0.030)	(0.047)
Bad Lender × *Bind*	0.086***	−0.071**	−0.077**	−0.112**
	(0.025)	(0.030)	(0.037)	(0.050)
Industry FE	Yes	Yes	Yes	Yes
Borrower controls	Yes	Yes	Yes	Yes
Frequency	Annual	Long-difference	Long-difference	Long-difference
Dep. var. source	SNC	Compustat	Compustat	Compustat
Observations	1,525	376	376	376

Notes: The table reports OLS regressions of the form: $Y = \beta_0 + \beta_1[Bad\ Lender] + \beta_2 Bind + \beta_3[Bad\ Lender \times Bind] + \gamma' X + \epsilon$. In column (1) the sample contains all borrowers in the table 5 sample with at least one SNC loan outstanding at the end of the year and the data are collapsed to the borrower-year level. In columns (2)-(4) the sample is borrowers in the table 5 sample which also appear in Compustat and the data are collapsed to the borrower level. *Bad Lender* is the rank of the lead lender's health normalized to lie on the unit interval, with a value of 1 corresponding to the least healthy lender. *Bind* is an indicator variable which equals 1 if a borrower violated a covenant in either the current or previous year. In column (1) the dependent variable is the annual change in the utilization across all loans to borrower f. In columns (2)-(4) the dependent variable is the change from 2007 to 2009 in: the ratio of cash to total book assets (column 2); the ratio of capital expenditure to total book assets (column 3); or the log of the number of employees (column 4), winsorized at the 1% level. Borrower controls: log assets, leverage, risk rating. Standard errors two-way clustered by borrower and worst lead lender reported in parentheses. *,**,*** indicate significance at the 10, 5, and 1 percent levels, respectively.

treatment of a covenant violation by less healthy lenders transmits into lower investment and employment. For both investment (column 3) and employment growth (column 4), the interaction term is statistically significant and the magnitude is larger than any of the main effects.[25]

[25]The absence in Compustat of private borrowers as well as some borrowers with missing information in either 2007 or 2009 reduces the sample size by a factor of about four. As a result, many of the main effect coefficients are not statistically significant. The exclusion of private borrowers also may reduce the employment effects relative to Chodorow-Reich (2014), who found the effects of lender health on employment were largest for small borrowers and borrowers without access to public debt markets.

6. Aggregation

The previous section showed that unhealthy lenders squeeze borrowers who trigger a covenant violation and that this interaction matters to loan and borrower-level outcomes. We now quantify the total decline in the stock of credit, including commitments, during the crisis mechanically attributable to the loan covenant channel.

Aggregate data provide some context. The total stock of credit outstanding (including new loans and commitments) in the full SNC universe contracted by 9.7% between 2007 and 2009, or a simple average of 4.6% per year.[26] One can decompose this 4.6% into the part coming from loans which start the year with at least one year maturity remaining and the remainder which combines credit to new borrowers and the net change in credit on expiring loans:

$$\underbrace{-4.6\%}_{\text{Total credit}} = \underbrace{-3.3\%}_{\text{Non-maturing loans}} + \underbrace{-1.3\%}_{\text{Expiring credit and new loans}} . \tag{5}$$

According to equation (5), more than two-thirds of the aggregate decline in credit resulted from lower credit on non-maturing loans. The dominance of this margin suggests covenant violations may have played a quantitatively important role.

We next use our regression results to quantify the aggregate decline due to the covenant channel. Column (2) of table 10 reported an interaction coefficient point estimate of $\beta_3 = -22.9$ for the intensive and extensive margin percent change in loan volume for loans from unhealthy lenders and which violate a covenant. Using this value, the in-sample fitted decline in lending

[26] Total credit grew from \$2.79T to \$2.88T between the end of 2007 and 2008 and then fell to \$2.52T in 2009. We do the decomposition which follows separately in each year and report a simple average.

Table 12: Aggregate Importance

	$t = 2008$	$t = 2009$
	(1)	(2)
SNC covenant sample decline due to interaction	5.8%	5.9%

Notes: The table reports the ratio $-\left(\beta_3 \sum_l Bad\ Lender_b \times Bind_{l,t-1:t} \times Commit_{l,t-1}\right) / \left(\sum_l Commit_{l,t-1}\right)$.

volume (including unused commitments) due to unhealthy lenders squeezing violators is:

$$\text{Fitted decline} = -\left(0.01 \times \beta_3\right) \times \sum_l Bad\ Lender_b \times Bind_{l,t-1:t} \times Commit_{l,t-1}, \qquad (6)$$

where $Commit_{l,t-1}$ is the loan commitment at the end of the previous year. The contribution to total credit growth in the SNC covenant sample is this sum divided by total initial credit committed and is reported in table 12. At the end of 2008, 5.8% of the dollar commitments outstanding as of the end of 2007 had disappeared due to unhealthy lenders contracting credit on loans which violated covenants. The corresponding decline in 2009 is 5.9%. Therefore, by the end of 2009 the loan covenant channel accounted for an 11.4% decline in the stock of credit outstanding relative to 2007.

Discussion. The 11.4% reduction in credit due to the loan covenant channel exceeds the 9.7% total decline in credit outstanding between 2007 and 2009. Of course, the 11.4% contraction is relative to the counterfactual trend. Total credit likely would not have stayed flat if bank health hadn't deteriorated, as either rising borrower demand (total credit including on non-maturing loans had increased in each year before the crisis) or a decline in credit demand due to the weak economy would have impacted the quantity of credit. Without taking a stand on this counterfactual, we cannot provide an exact contribution share of the covenant channel to the

overall transmission of lender health to corporate borrowers. Nonetheless, it seems unlikely that borrower credit demand could have increased much during the severe recession of 2008 and 2009. We conclude that the transmission of bank health to nonfinancial firms occurs largely through the loan covenant channel.

7. Conclusion

We have investigated the importance of lender health in determining the response to a covenant violation. Using a new supervisory data set of bank loans, we document a higher covenant violation propensity than found in previous work, with more than one-third of loans breaching a covenant each year during 2008 and 2009. Lenders in worse financial condition are less likely to grant a waiver and more likely to force a reduction in the loan balance following a violation. Quantitatively, the reduction in credit to borrowers with long-term credit but who violate a covenant accounts for an 11% decline in the volume of loans and commitments outstanding between 2007 and 2009.

The quantitative significance of the covenant channel raises important questions for future research. We highlight four implications not explored in this paper. First, when writing loan contracts ex ante, do lenders and borrowers internalize the effective option to shorten maturity which covenants offer? Our results suggest they should. However, a body of research finds that managers may be overconfident in their outlook for their firm (Malmendier and Tate, 2015), in which case they may underestimate the likelihood of breaching a financial covenant or the consequences of doing so. Intriguingly, loans with less strict covenants became more common following firms' experiences during the 2008-09 crisis. Second, given a need for banks

to delever, is concentrating the credit contraction on covenant violators socially efficient? We showed that smaller, ex ante riskier firms are more likely to violate covenants. Firms with less collateral, such as R&D intensive firms, may also have higher violation rates because of the substitutability of collateral and covenant tightness as protection for lenders. Whether the covenant channel focuses credit reductions on the riskiest borrowers or on R&D intensive borrowers with a high growth path matters for the welfare implications. Third, our evidence comes from a particularly acute crisis period. While such episodes merit special attention due to their macroeconomic importance, the pervasiveness of covenant violations in non-crisis periods means that this channel may also matter in more tranquil times. Fourth, the literature on covenants has almost exclusively used U.S. data. Yet, the transmission of bank health to corporate borrowers appears active in other countries as well. Do covenant violations abroad play as important a role as they do in the United States? If not, what is the transmission mechanism?

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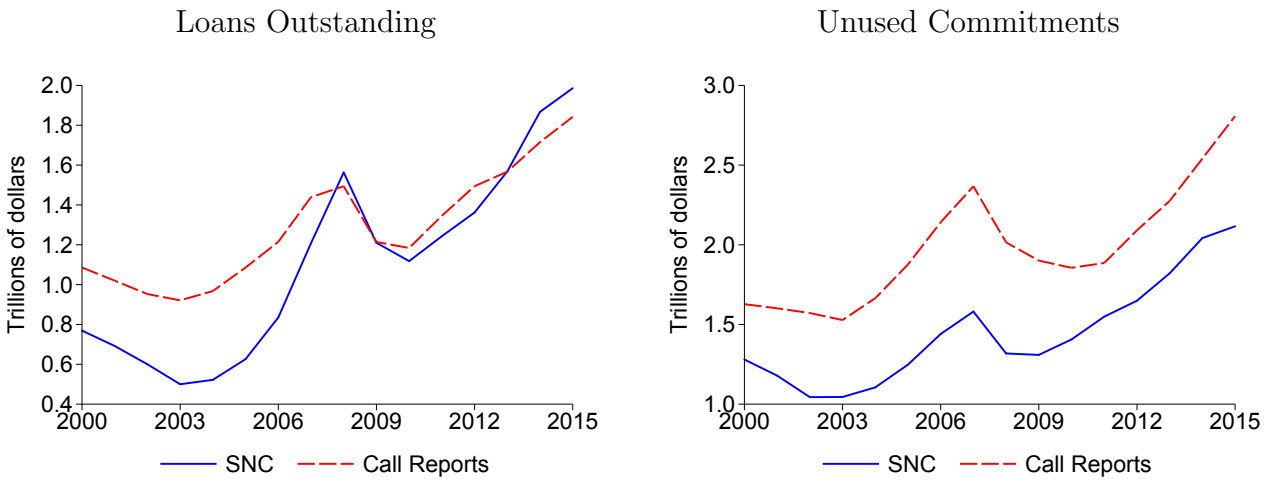
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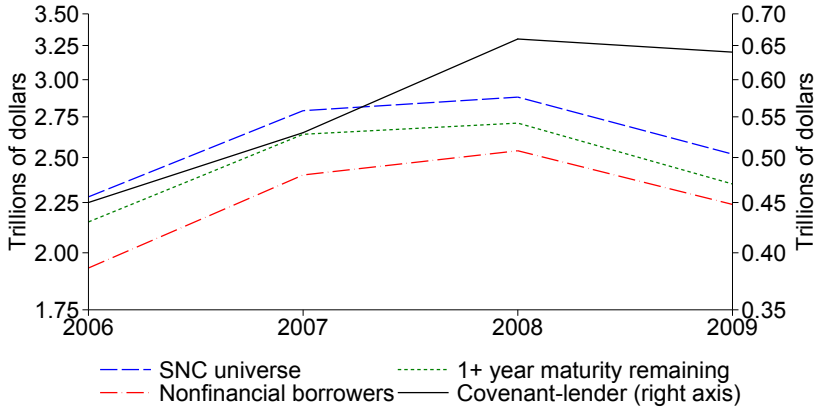
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Figure A.1: Comparison of SNC to Call Report Data



Notes: The left panel plots the dollar amount of SNC loans outstanding and Consolidated Reports of Condition and Income (Call Reports) commercial and industrial loans. The right panel plots the dollar amount of SNC unused loan commitments and Call Report unused commitments not associated with real estate or credit cards. SNC data: https://www.federalreserve.gov/newsevents/pressreleases/files/bcreg20160729a1.pdf (accessed March 27, 2017). Aggregated Call Report data from the FDIC Quarterly Banking Profile: https://www.fdic.gov/bank/analytical/qbp/timeseries/BalanceSheet.xls (accessed November 2, 2016).

Figure A.2: SNC Sample Comparison



Notes: The figure reports the dollar amount of total loans outstanding and unused commitments in the SNC universe (blue line); the preceding less loans with less than one year maturity remaining (green line); the preceding less loans to financial borrowers (red line); and in our final sample of all term loans and credit lines to nonfinancial borrowers in the SNC covenant sample with a lead lender in the Chodorow-Reich (2014) data set and which start the year with at least one year of maturity remaining.

The Loan Covenant Channel: How Bank Health Transmits to the Real Economy

Online Appendix

Gabriel Chodorow-Reich Antonio Falato

July 2017

A. Details of Sample Construction and Variable Definitions

This appendix gives additional details on how we construct the main sample and the variables used for our analysis. The variables used in this paper are extracted from four major data sources: the Shared National Credit Program (SNC), Loan Pricing Corporation's (LPC) Dealscan database, COMPUSTAT, and Capital IQ. For each data item, we indicate the relevant source in square brackets.

To construct our sample, we start with the universe of loans by firms incorporated in the United States that have covenant information available in SNC. From SNC we retrieve information on covenant compliance as well as loan (non-price) terms and basic borrower characteristics. The information on covenants and compliance is from the supervisory review of SNC loans, which covers annually about 1/3 of the loan volume in the SNC universe. The supervisors gather the information from loan documentation and follow up directly with the banks when needed such as in instances when the information is either missing or incomplete.

While conceptually straightforward, the measurement of covenant violations poses several challenges. Specifically, SNC allows us to deal with four main measurement issues following the standard practice in the literature. First, firms can have multiple loan deals during a given year in our sample period. For the case when multiple deals overlap (i.e., one deal matures after the start of another deal) and the analysis is at the borrower level, we define covenant compliance to be the tightest (i.e., we classify a borrower covenants to be binding if they are binding on at least one of the borrowers' credits in any given year) unless it corresponds to a refinancing deal, in which case we define the relevant covenant status to be that specified by the refinancing credit regardless of whether or not it is tightest. Second, for the case when there are dynamic covenants that change over the life of the loan, SNC includes complete information on the covenant dynamics, which we use to define the compliance status over the life of the loan accordingly. Third, SNC also includes complete information on post-origination amendments to the loan contract, which we also use to

define compliance status over the life of a loan Finally, since our data has a lower annual (and not quarterly) time frequency than existing studies, we opted for including a relatively small fraction (number) of the newly originated loans, 5.6% (181), that are classified as non-compliant in the year of the loan origination, a phenomenon also encountered by Dichev and Skinner (2002) and Chava and Roberts (2008).

Finally, we retrieved information on loan pricing from Dealscan, as well as borrower balance sheet information from Compustat for publicly-traded firms and from Capital IQ for privately-held firms. The final step of our data assembly process was to merge the SNC loan data with information from these sourced by matching company names. Firms in the SNC universe were compared to firms in each of these additional data sources using a standard matching algorithm (see, for example, Lee and Mas (2012)), which is the SAS SPEDIS function. This function matches company names in each of the additional data sources to company names in SNC based on a "spelling distance," which considers those comparisons with a spelling distance below a predetermined threshold as candidate matches. For the cases when the algorithm matches a company in SNC to more than one company name in any of the additional data files we selected the lowest spelling distance as the candidate match. Research assistants reviewed every match and manually dropped those where, based on company headquarter location (state and city) and web searches from multiple sources including company web sites, Lexis-Nexis, Google, and Factiva, they assessed that the automated procedure resulted in an incorrect match. As a final quality check of the matching procedure, we retrieved an additional match file by using the same procedure for the Dealscan-Compustat linking file from Chava and Roberts (2008), which is available at Michael Robert's web page, and verified that the resulting firm identifiers (gvkeys) were the same as those from our merge with Dealscan.

The variables used in the analysis are defined as follows.

Main Explanatory Variables:

Bind is a dummy that takes value of one for any given loan-year when the borrower is either non-compliant with any of its loan covenants or compliant after receiving a waiver or an amendment in a given year, i.e., if the borrower either breaches a covenant threshold in any given firm-year or a covenant is reset or waived so that an otherwise non-compliant borrower would remain in compliance. [SNC]

Bad Lender is based on Chodorow-Reich (2014) and is the cumulative density (cdf) of the beginning-of-the-period lead-lender exposure to asset-backed securities as measured by the correlation of their daily stock return with the return on the ABX AAA 2006-H1 index (*ABX Exposure*), to balance sheet losses not directly affected by the corporate loan portfolio as measured by the ratio of 2007-2008 trading account losses to total assets (*B/S Exposure),* and to the Lehman failure as measured by the fraction of a bank's syndication portfolio where Lehman Brothers had a lead

role (*LEHMAN Exposure*), in turn. We use factor analysis to aggregate over these individual exposure proxies and extract an overall exposure proxy which is measured as the cumulative density (cdf) of the (first) principal component of the three individual proxies calculated using the entire SNC universe (*ALL*).

Outcome Measures:

Credit Reduced is a dummy that equals one for either existing loans that end before their most recently stated maturity in a given year and are not followed by a new loan to the borrower from the current lead lender or for existing loans that experienced a reduction in the total dollar amount limit the borrower is legally allowed to borrow up to according to the loan contract terms in a given year relative to the previous year. We are able to track loan paths over time because each loan in SNC is assigned a unique permanent credit identifier, which remains unchanged throughout the life of the loan including in those years when loan terms are amended or modified or when the loan is refinanced. [SNC]

New Credit is a dummy that equals one for either new loans that are originated to a given borrower by a new lead lender (i.e., by a lead lender that had not previously extended a loan to the borrower) or for existing loans that experienced an increase in the total dollar amount limit the borrower is legally allowed to borrow up to according to the loan contract terms in a given year relative to the previous year. We are able to track loan paths over time because each loan in SNC is assigned a unique permanent credit identifier, which remains unchanged throughout the life of the loan including in those years when loan terms are amended or modified or when the loan is refinanced. [SNC]

Waiver is a dummy that equals one if any of the loan covenants are waived or reset in a given year. [SNC]

Lead Share (Committed) is the ratio of the dollar amount limit the lead lender is legally committed to lend divided by the total dollar amount limit the borrower is legally allowed to borrow according to the loan contract terms in a given year. [SNC]

Lead Amount (Committed) is the natural logarithm of the dollar amount limit the lead lender is legally committed to lend up to according to the loan contract terms in a given year. [SNC]

limit the lender is legally committed to lend divided by the total dollar amount limit the borrower is legally allowed to borrow according to the loan contract terms in a given year. [SNC]

dollar amount limit the lender is legally committed to lend up to according to the loan contract terms in a given year. [SNC]

exposure (the dollar amount the lender has extended which has not been repaid) divided by the dollar amount limit the lender is legally committed to lend up to according to the loan contract terms in a given year. [SNC]

Loan Utilization Rate is the ratio of the loan balance (the dollar amount the borrower has drawn which has not been repaid) divided by the total dollar amount limit the borrower is legally allowed

to borrow according to the loan contract terms in a given year. [SNC]
Loan spread (%) is the all in spread on a given loan, including fees. [Dealscan]
Cash/Assets is the sum of cash and cash equivalents (item 1) over lagged total book assets (item 6). [Compustat]
Capex/Assets is capital expenditures (item 128) over lagged total book assets (item 6). [Compustat]
Employment Growth is the ratio of the total number of employees (item 29_t) minus the lagged total number of employees (item 29_{t-1}) divided by the lagged total number of employees (item 29_{t-1}). [Compustat]
Debt Issuance/Assets is issuance of long-term debt (item 111) minus reduction in long-term debt (item 114) plus changes in current debt (item 301) over lagged total book assets (item 6) [Compustat]

Firm and Industry Variables:

Sample-Split Variables:
Credit line is a dummy variable for whether the loan is a credit line. [SNC]
High Lead Share is a dummy variable for whether the lead share is above the sample median in a given year. [SNC]
Small Syndicate is a dummy variable for whether the number of syndicate members is below the sample median in a given year. [SNC]
Concentrated Syndicate is a dummy variable for whather the Herfindahl index of loan commitment shares (calculated as the sum of squared shares across lenders) is above the sample median in a given year. [SNC]

Additional Controls:
Loan origination year is a full set of dummies that equal one for each year in which any given loan was originated. [SNC]
Loan purpose is a full set of dummies that equal one for each of the loan purpose categories included in SNC, such as, for example, M&As, CAPEX, working capital, general corporate purposes. [SNC]
Loan type is a full set of dummies that equal one for each of the loan type categories included in SNC, such as, for example, term loan, revolving credit, non-revolving line of credit. [SNC]
Borrower industry is a full set of dummies that equal one for each of the 8 borrower sector categories included in SNC, such as, for example, manufacturing, services, distribution. [SNC]
Loan size is the natural logarithm of the total dollar amount limit the borrower is legally allowed to borrow up to according to the loan contract terms in a given year. [SNC]
Borrower size is the natural logarithm of the book value of assets. [SNC]
Leverage is the ratio of total book debt to book value of assets. [SNC]
Risk rating is a score that ranges between 0 and 4 for each of the five supervisory risk rating categories assigned to a loan in a given year. The five supervisory risk rating categories are as

follows: Pass (for loans that are considered to be in good standing), Special Mention (for loans that are in good standing but have potential weaknesses that, if left uncorrected, could result in further deterioration of the repayment prospects), Substandard (for loans that are inadequately protected by the current sound worth and paying capacity of the borrower or of the collateral pledged, if any), Doubtful (for loans that are considered substandard and, in addition, have weaknesses that make collection or liquidation in full, on the basis of available current information, highly questionable or improbable), and Loss (for loans that are considered uncollectible and of so little value that their continuance as bankable assets is not warranted and, as such, should be promptly charged off). [SNC]