Loan Covenants Meet Monetary Policy: The Distance to Violation Effect

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Abstract

We study the role of loan-level financial covenants in determining the firm investment channel of monetary policy. We find that out of all covenant-types, the minimum interest coverage covenant, which sets a minimum ratio of earnings to interest payments, interacts robustly with monetary shocks. When there is a positive monetary shock, the farther away a firm is from violating its interest coverage threshold, the more responsive it is to a monetary shock in terms of investment. This finding is robust to controlling for factors known to affect the transmission of monetary policy to firm investment. The intuition is that in an environment with agency frictions, a firm that is farther away from violating its interest coverage covenant faces a lower marginal cost and borrows more to invest in riskier projects.

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1. Introduction

Within the credit channel theory of monetary policy, credit market frictions are thought to amplify the effects of monetary policy. Credit market frictions, in turn, predominantly arise from informational asymmetry and agency costs (Bernanke and Gertler (1995), Bernanke et al. (1999)). Yet, a key instrument directly used to mitigate these agency costs, debt covenants, remains relatively underexplored in relation to the credit channel.

It is natural to study debt covenants in relation to the credit channel theory. Debt covenants are contractual provisions that limit the borrower's range of circumstances or actions. Upon violation, lenders impose penalties such as receiving the legal right to renegotiate lending terms, demanding immediate repayment of outstanding debt, influencing firm policies, etc. This transfer of control rights to the lender and/or the ability to restrict certain actions by the borrowers helps mitigate agency frictions (Jensen and Meckling, 1976). Covenants play a significant role in agency and credit market frictions because they are ubiquitous in debt agreements, reduce the external cost of borrowing (Bradley and Roberts 2015), and their violation is costly (Roberts and Sufi, 2009).

We focus on loan-level financial covenants in this paper, which are one kind of debt covenants. Financial covenants, triggered when specific financial ratios fall below predetermined contractual levels, are ideal for this context because of their widespread presence in contracts and the ease of measuring them (for example, Roberts and Sufi (2009), Griffin et al. (2019)). Furthermore, it enables us to measure how far a firm is from violating its covenant threshold - called distance to covenant violation. The distance to covenant violation measure in financial debt covenants, well-known in the finance and accounting literature, is particularly suitable for understanding how agency costs constrain a firm. This is because it not only reflects current compliance but is also indicative of potential future violations. Although penalties can be imposed only upon actual violations, firms, wary of future breaches, often adopt precautionary measures such as reducing investment (Adler, 2020).

We study the relevance of distance to covenant violation measure for the transmission of monetary policy to firm investment and have novel empirical findings. We find that the interest coverage covenant has a significant effect on investment for the years 1990-2007. A firm has approximately a 2.21 higher investment rate when it is one standard deviation further away from violating its interest covenant threshold in the presence of a 1 unit expansionary monetary shock.

Our empirical results are robust to alternate specifications and measures of monetary policy and firm investments. The results hold even after controlling for factors previously known to affect the transmission of monetary policy to firm investment such as size (Gertler and Gilchrist (1994)), distance to default (Ottonello and Winberry (2020), liquidity (Jeenas (2018)) and age (Cloyne et al. (2019))

Finally, we address any concerns regarding endogeneity using a placebo test. If the covenant type that a firm accepts in a loan is itself endogenous to its future investment decisions, our results may be biased. Crucially, we conduct a placebo test where we see if the interest coverage metric, i.e., earning to interest payment ratio, itself transmits monetary policy to firm investment. We find that the earnings to interest payment ratio matters for monetary policy transmission only in the presence of a loan covenant. Thus, it is the covenant and the associated agency costs that affects the firm behavior and investment rather than firm optimization on their loan terms based on their balance sheet. Also, if the monetary shocks are truly exogenous, then their interaction with covenants, even if endogenous should still produce unbiased results.

Related Literature. Our paper contributes to three main strands of literature. The first strand includes macroeconomic models in which financial frictions plays an important role in amplifying and propagating monetary shocks to the economy. Bernanke et al. (1999), in their seminal work, introduce the financial accelerator mechanism in a representative firm New Keynesian model.

More recently, various papers study the heterogeneity in transmission of monetary policy depending on various firm-level characteristics like size (Gertler and Gilchrist (1994)), distance to default (Ottonello and Winberry (2020), liquidity (Jeenas (2018)) and age (Cloyne et al. (2019)). Caglio et al. (2021) study the heterogeneity of monetary policy transmission and risk-taking between SMEs and large listed firms, notably, for the post-financial crisis period. Darmouni et al. (2020) study the role of bond financing in monetary transmission. We contribute to this literature by focusing on how distance to financial covenant thresholds plays a role in the transmission of monetary policy. Our results are robust to controlling for these other firm-level characteristics.

The second strand, in the finance and accounting space, considers the impact of financial covenants and violation on firm behavior. Examples include Chava and Roberts (2008), Chodorow-Reich and Falato (2021), Demerjian and Owens (2016), Murfin (2012), Nini et al. (2009), Roberts and Sufi (2009) and Griffin et al. (2019). We add to this literature by focusing on interaction of financial covenants and monetary policy.

More narrowly, our work is closely related to that of Greenwald (2019). Greenwald (2019) focuses on a particular channel of interest rate transmission induced by the structure of interest coverage covenants. Our paper differs from Greenwald in two main aspects. Firstly, Greenwald compares the investment responses of firms which contain interest coverage covenants to those that contain debt to earnings covenants. I, on the other hand, compare how the same firm's behavior changes when its distance to covenant threshold is further away. Thus, Greenwald focuses on permanent heterogeneity between firms depending on covenant type, whereas We focus on heterogeneity in circumstances within the same firm. Secondly, when it comes to the empirical specification, we focus on the impact of high frequency monetary shocks while Greenwald focuses on changes in 3-month T-Bill rates.

The third main strand of literature highlights the dominance of earnings-based borrowing constraints for firms as opposed to collateral-based borrowing constraints. Recent contributions are Lian and Ma (2021), Drechsel (2018) and Kermani and Ma (2020). We contribute to this literature by showing how one of the earnings-based borrowing constraint, specifically interest rate coverage constraint, interacts with monetary shocks, in terms of distance to this constraint.

Roadmap. The rest of this paper proceeds as follows. Section 2 describes the data construction. Section 3 provides empirical results. Section 4 attempts to explain the empirical results with a model. Section 5 concludes.

2. Data

Our sample combines quarterly Compustat data with monetary policy shocks and Dealscan loan-covenant data. The monetary shocks, the construction of Compustat quarterly variables and sample selection and period closely follows that of OW (see supplemental material A).

Monetary shocks. Monetary shocks are measured using the high-frequency, event study approach advanced by Gürkaynak et al. (2005) and Gorodnichenko and Weber (2016). The shock series begins in January 1990, when the Fed Funds futures market opened, and ends in December 2007. The ending date is chosen to steer clear of the financial crisis, since Chodorow-Reich and Falato (2021) document that the enforcement of covenant violations changed substantially during this period, especially depending on the lender's health. This end date also avoids the zero lower bound period. We time aggregate the high-frequency shocks to the quarterly frequency in order to merge them with the firm-level data. We construct a moving average of the raw shocks weighted by the number of days in the quarter after the shock occurs. The time aggregation strategy ensures that the shocks are weighted by the amount of time firms have had to react to them. Our results are robust to the alternative time aggregation of simply summing all the shocks that occur within the quarter, as in Wong (2019). The summary statistics of the monetary shocks are described in Table 3.

Firm-Level Variables. We use firm-level variables from quarterly Compustat. The dataset contains rich balance sheet information which is one of the reasons for its popularity. The panel length is long to control for within-firm variation, and the quarterly frequency is high enough. The main disadvantage of Compustat is that it excludes privately held firms. Our main measure of investment is $\Delta \log k_{jt+1}$, where k_{jt+1} is the book value of the tangible capital stock of firm j at the end of period t.

Loan-Level Variables. We merge syndicated loan data from Loan Pricing Corporation (LPC) Dealscan database with Compustat quarterly database following the linking procedure in Chava and Roberts (2008). DealScan is the most widely used dataset for corporate loans, with comprehensive coverage (Bradley and Roberts (2015)), especially for large syndicated loans. According to LPC, approximately half of the loan data are from SEC and the other half is obtained from contacts within the credit industry and from borrowers and lenders. DealScan provides data on covenant specifications and thresholds associated with each loan contract. There are 18 covenant types which can broadly be classified as earnings-based, asset-based, networth-based and liquidity based (see appendix A for details). The corresponding accounting variables for these 18 covenant types are compiled from Compustat variables using the definitions as in Demerjian and Owens (2016), (see Appendix A). These apply at the "package" level in Dealscan terminology, i.e. throughout the tenure of the loan contract, which could be a five year or a ten year contract.

One disadvantage of the Dealscan dataset is that it only contains the covenant threshold information negotiated at loan origination. If the contract is renegotiated, the new covenant threshold is not generally updated in the database. If a firm has two different "packages" or loan contracts, both restricting the same covenant type, we choose the most restrictive threshold. We calculate the difference between the Dealscan threshold and the corresponding accounting variable from Compustat database for each covenant type and each firm-quarter. A larger positive distance to threshold means that a firm is farther away from violating the covenant threshold. A negative distance implies that the firm has violated its covenant. This difference is henceforth referred to as distance to threshold.

Background on Debt covenants. The covenant selection associated with a loan is the result of a bargaining process between the lender (Murfin (2012)) and the borrower (Demerjian (2007)). Violation of a covenant could give the lender the power to demand immediate repayment of the loan, renegotiate the loan contract for a higher interest rate, etc. Thus, these covenant threshold not only matter for the issuance of new debt but also for maintaining old debt. Also, importantly, cross-default clauses are ubiquitous in loan contracts. As a result, every loan with a cross-default clause may potentially be accelerated after a firm violates a financial covenant on one of the loans and that violation is not pre-waived. Lian and Ma (2021) and Adler (2020) show bunching at covenant threshold levels indicating that firms actively try to avoid crossing covenant threshold to avoid the repercussions that follow.

We focus on the five most popular covenants (excluding minimum fixed charge coverage covenant) that occur in more than 10k firm-quarter observations in our sample. The minimum fixed charge coverage covenant, although third most popular, is excluded from this focus because Demerjian and Owens (2016) show that this particular covenant definition varies a lot from contract to contract and their corresponding Compustat definition is correct only 2% of the time. In descending order of their popularity, the covenants are (1) Max Debt/EBITDA (2) Min Interest coverage which is Min EBITDA/Interest payments (3) Max Leverage (4) Min Networth (5) Min Tangible networth. The Compustat definitions for these variables follow Demerjian and Owens (2016) (see Appendix A).

Figure 1 plots their relative popularity of over time. The first two are related to a firm's earnings, the next one to firm's assets and the remaining two related to the networth of the firm. Earnings-based covenants became more popular over time while the other types' popularity eventually declined. The second most popular covenant, minimum interest coverage covenant, is the covenant of interest. Since only 9% of Dealscan loans are on the basis of fixed interest rate, the interest rate that a firm faces depends on the interest rate that central banks charge and hence monetary policy could be influential for this covenant. Greenwald (2019) clubs this particular covenant with fixed charge coverage covenant, cash interest coverage and debt service coverage because all these covenants depend on earnings and interest rates. Greenwald then focuses on the covenant that is the tightest (or the closest to violation) out of them all. We, however, do not group these covenants together and focus only on the interest coverage covenant because (1) the last two covenant types are present in very few observations and the fixed charge coverage covenant Compustat definition is wrong 98% of the times as shown in Demerjian and Owens (2016) and (2) the standard deviation for all these covenant types differ and thus comparability is hard (Murfin (2012)). Our results are robust to grouping the interest coverage covenant with cash interest coverage and debt service coverage covenants, and focusing on the tightest covenant.

Table 1 shows the key moments for investment, distance to interest coverage covenant, leverage and distance to default for the period 1983 to 2019. The number of observations for distance to covenant is far lesser, because this can only be calculated for a firm-quarter in which the firm took a loan which had an interest coverage covenant attached to it. Table 2 shows the correlation between the variables distance to interest coverage covenant, leverage and distance to default. Although the distance to covenant measure is significantly negatively correlated with leverage and positively correlated with distance to default, the correlation is quite weak. Also, the empirical results hold controlling for leverage and distance to default. This shows that distance to covenant threshold captures a different dimension other than default, and is indicative of capturing agency frictions as the finance literature generally suggests.

Table 1: Summary Tables of Firm-Level Variables - Marginal Distributions

	$\Delta \log k_{jt+1}$	dc_{jt}	ℓ_{jt}	dd_{jt}
Mean	0.006	23.822	0.264	5.830
Median	-0.004	3.287	0.203	4.782
S.D.	0.095	376.548	0.352	5.091
95th Percentile	0.130	55.339	0.722	15.279
Observations	376814	41987	376814	236935

Notes: Summary statistics of firm-level variables for the period $1983\text{q}3$ to $2019\text{q}4$.$\Delta \log k_{jt+1}$ is the change in the capital stock, dc_{jt} is the distance from violating interest coverage threshold conditional on firms having the interest coverage threshold covenant, ℓ_{jt} is the ratio of total debt to total assets, dd_{it} is the firm's distance to default.

3. Empirical Results

Specification. We estimate variants of the following baseline empirical specification

$$\begin{aligned} \Delta \log k_{jt+1} = \alpha_j + \alpha_{st} + \Sigma_k \left[\beta_k \mathbb{1}_{j,t,k} \left(x^k_{jt-1} - \mathbb{E}_j \left[x^k_{jt}\right]\right) \varepsilon^{\text{m}}_t\right] \\ + \Sigma_k \left[\zeta_k \mathbb{1}_{j,t,k} \left(x^k_{jt-1} - \mathbb{E}_j \left[x^k_{jt}\right]\right)\right] + \Gamma' Z_{jt-1} + e_{jt} \end{aligned} \tag{1}$$

where α_j is a firm j fixed effect, α_{st} is a sector s by quarter t fixed effect, ε^{m}_t is the quarterly monetary policy shock,$\mathbb{1}_{j,t,k}$ is a dummy indicating whether

Table 2: Summary Tables of Firm-Level Variables - Correlation Matrix

	dc_{jt}	ℓ_{jt}	dd_{jt}
dc_{jt}	1.00		
ℓ_{jt}	-0.07	1.00	
	(0.00)		
dd_{jt}	0.11	-0.39	1.00
	(0.00)	(0.00)	

p-values in parentheses

Notes: Correlation statistics of firm-level variables for the period $1983\text{q}3$ to $2019\text{q}4$. dc_{jt} is the distance from violating interest coverage threshold conditional on firms having the interest coverage threshold covenant, ℓ_{jt} is the ratio of total debt to total assets, dd_{it} is the firm's distance to default.

firm j has covenant k attached to any of its loans at time t, x_{jt}^k is the firm's distance to threshold for covenant k, $\mathbb{E}_j\left[x_{jt}\right]$ is the average value of x_{jt} for a given firm over the sample, Z_{jt-1} is a vector of controls, and e_{jt} is a residual. Our main coefficient of interest is β_k, which measures how the semi-elasticity of investment $\Delta \log k_{jt+1}$ with respect to monetary shocks ε_t^{m} depends on the within-firm variation in the financial position $x_{jt}^k - \mathbb{E}_j\left[x_{jt}^k\right]$.

Number of factors that simultaneously affect investment and financial position are controlled for. The firm fixed effects α_j capture permanent differences in investment behavior across firms and the sector-by-quarter fixed effects α_{st} capture differences in how broad sectors are exposed to aggregate shocks. The vector Z_{jt1} includes total assets, sales growth, current assets as a share of total assets, a dummy for $x_{jt-1}^k < 0$, i.e., dummy for if covenant k is violated, and a fiscal quarter dummy. The vector Z_{jt-1} also includes the interaction of financial position with the previous quarter's GDP growth in order to control for differences in cyclical sensitivities across firms.

The interaction of within-firm variation in financial position with the monetary shock $(x^k_{jt-1} - E_j[x^k_{jt}])\epsilon^m_t$ ensures that the results are driven by how a *given* firm responds to a monetary shock when it has further away from violating covenant threshold k than usually. Thus permanent heterogeneity, captured by how the group of firms generally farther away from the covenant threshold respond to monetary shocks is eliminated (see Appendix). Also, this specification is chosen because in our model, firms are exante homogeneous and there is no permanent heterogeneity.

Results. Table 4 reports the results from estimating the baseline specification (1). There are two normalizations to make the estimated coefficient β^k easily interpretable. First, for all covenant type k, we standardize the firm's demeaned distance to violating covenant threshold k, $x^k_{jt} - E_j[x^k_{jt}]$ over the entire sample, so their units are standard deviations in our sample. Second, we normalize the sign of the monetary shock ϵ^m_t so that a positive value corresponds to a cut in interest rates. The first three columns in Table 4 show that only the interest coverage covenant interacts with monetary shock to produce a significant effect on investment. Column (1) implies that a firm has approximately a 2.21 higher semi-elasticity of investment to monetary policy when it is one standard deviation further away from violating interest covenant threshold. Note that this elasticity is almost double of that of the variable distance to default in the OW specification. Other covenants do not significantly affect the semi-elasticity of the firm. One important difference between distance to covenant threshold and distance to default is that distance to covenant measure can only be constructed for those quarters in which the firm has taken a Dealscan loan and on which the particular covenant type k was imposed. That is the main reason for our focusing on only five covenants, because enough observations exist for these covenants to get a precise enough estimate of β^k. Adding firm-level controls Z_{jt-1} in Column (2) does not significantly change this point estimate. Note that the $R^2 = 0.12$ in comparable to that of OW basline specification results.

Column (3) removes the sector-by-quarter fixed effects in order to estimate the average effect of a monetary shock:

$$\Delta \log k_{jt+1} = \alpha_j + \alpha_{sq} + \gamma\epsilon_t^m + \Sigma_k \beta^k (x_{jt-1}^k - E_j[x_{jt}^k])\epsilon_t^m + \Gamma_1' Z_{jt-1} + \Gamma_2' Y_{t-1} + e_{jt} \quad (2)$$

where α_{sq} is a sector s by quarter q seasonal fixed effect and Y_t is a vector with four lags of GDP growth, the inflation rate, and the unemployment rate. The average investment semi-elasticity for distance to interest coverage covenant is roughly 2.75. Hence, the interaction coefficient implies an economically meaningful degree of heterogeneity.

Table 5 also reports the results from the baseline specification (1) but only including the interest coverage covenant. The coefficients and standard deviation for all the three columns are similar, to the main specification results for the interaction term with respect to interest coverage covenant. Also, the semi-elasticity of investment with respect to a monetary shock, i.e., the coefficient γ in specification (2) is estimated to be 2.47, which is substantial and comparable to the OW baseline specification result. we focus on specification including only interest coverage covenant with firm-level controls Z_{jt1} for the remainder of the paper.

Dynamics. We estimate the specification (1) for k = interest coverage covenant type k using Jorda (2005)-style local projection

$$\Delta \log k_{jt+h} - \log k_{jt} = \alpha_{jh} + \alpha_{sth} + \beta_h^k \left(x_{jt-1}^k - \mathbb{E}_j \left[x_{jt}^k \right] \right) \varepsilon_t^{\mathrm{m}} + \Gamma'_h Z_{jt-1} + e_{jth}, \quad (3)$$

where $h \geq 1$ indexes the forecast horizon. The coefficient β_h^k measures how the cumulative response of investment in quarter $t+h$ to a monetary policy shock in quarter t depends on the firm's demeaned distance to covenant threshold k, $x_{jt-1}^k - \mathbb{E}_j \left[x_{jt}^k \right]$ in quarter $t-1$. This helps assess the implications of cumulative change in capital.

Figure 2 shows that firms with higher distance from violating the interest coverage covenant threshold are consistently more responsive to the shock **for up to one and half years later**. These long-run differences, however, are imprecisely estimated with larger standard errors.

Placebo Test. The distance to interest coverage covenant is simply the earnings to interest payments of a firm minus its covenant threshold (which generally tends to be a constant for the tenure of the contract for most firms in Dealscan). To make sure the investment response that we get are driven by the presence of covenants and not simply by the metric earnings to interest payments ratio, we conduct a placebo test. We run the regression

$$\Delta \log k_{jt+1} = \alpha_j + \alpha_{st} + \delta \left(x_{jt-1} - \mathbb{E}_j \left[x_{jt} \right] \right) \varepsilon_t^{\mathrm{m}} + \beta \mathbb{1}_{cov,ic,t-1} \left(x_{jt-1} - \mathbb{E}_j \left[x_{jt} \right] \right) \varepsilon_t^{\mathrm{m}} + \Gamma' Z_{jt-1} + e_{jt}$$

where $\mathbb{1}_{cov,ic,t-1}$ is a dummy that is equal to 1 when interest coverage covenant is present. The variable of interest x_{jt-1} is earnings to interest payments ratio. All the other variables are the same as the baseline regression with firm controls. The only difference is that the Z_{jt-1} contains two additional controls: $\mathbb{1}_{cov,ic,t-1} \left(x_{jt-1} - \mathbb{E}_j \left[x_{jt} \right] \right)$ and $\mathbb{1}_{cov,ic,t-1} \left(x_{jt-1} - \mathbb{E}_j \left[x_{jt} \right] \right)$ interacted with lagged GDP growth rate. Table 6 shows that it is only in the presence of interest coverage covenant that earnings to payments ratio predicts future investment, thus emphasizing the role of covenants in firm investment decisions.

Exogeneity of covenants. Loan covenant selection depends on both borrower's (Demerjian (2007)) and lender characteristics (Murfin (2012)). If the covenant type that a firm accepts is itself endogenous to its future investment decisions, our results may be in question. Firstly, our results are robust to a wide variety of firm controls and robustness checks (see below). It is plausible that lender characteristics that decide on a covenant are not going to be influence by borrower's investment directly. Apart from that, Griffin et al. (2019) shows that when it comes to firm default, earnings-based covenants reduce ratio of false positives to false negatives as compared to other types of covenants leading to their widespread adoption in the past twenty years. Thus, the increasing adoption of interest coverage covenant could be due to it being recognized as a better signal of firm default rather than something endogenous to the firms.

Robustness Checks and Additional Results Appendix B shows that the results hold for the following variety of robustness checks.

Controlling for interaction of firm-level controls Z_{jt-1} and monetary shock. We add an interaction term between monetary shock and the firm-level controls to the baseline regression. This includes an an interaction term between monetary shock and a dummy variable which is equal to 1 if covenant is violated. Results are similar.

Not demeaning distance to threshold: The distance to violating interest covenant threshold is not demeaned by $E_j x_{jt}$. $x^k_{jt-1}\epsilon^m_t$ becomes the new variable of interest. Estimates are more imprecise showing that demeaning distances helps remove some component of permanent heterogeneity.

Excluding interaction term with lagged GDP growth. If monetary shocks were truly exogenous, this interaction term between distance to threshold and lagged GDP growth rate is not needed to get consistent estimates for our variable of interest in large samples. However, the largest shocks occur at the beginning of the two recessions in our sample. Hence this interaction term is included. But, our results are robust to excluding this term.

Interacting with lagged inflation or unemployment growth rate instead of lagged GDP growth. Results are slightly stronger when including lagged GDP growth rate instead of lagged inflation or unemployment rate.

Expansionary versus Contractionary shock. Results hold for both kinds of shocks.

Controlling for Information Channel of monetary policy. Following Miranda-Agrippino and Ricco (2021)), we control for Greenbook forecasts and revisions. Results are robust to controlling for the information channel.

Post 1994. Focusing on period 1994 onwards when Fed started making announcements. Results are robust.

Controlling for lagged investment. Lagged investment is good predictor of future investment. Results are robust to controlling for lagged investment although the R^2 slightly increases.

Other firm-level covariates: Results are robust to controlling for interactions of the monetary shock with other firm-level covariates (such as sales growth, future sales growth, size, or liquidity).

Other financial covariates. Results are robust to controlling for interactions of the monetary shock with other financial covariates like size, cash, dividend payments.

Alternative time aggregation. Results are robust, albeit weaker, if monetary shocks in a quarter are aggregated as a simple sum as in Wong (2019).

Target and Path effect. Following Gürkaynak et al. (2005), we decompose monetary policy announcements into a "target" component that affects the level of the yield curve and a "path" component that affects the slope of the yield curve. Only the interaction of distance to interest covenant threshold with target component is significant. Thus, the heterogeneity in responses of firms is primarily driven by how monetary policy affects the overall level of interest rates rather than long rates in particular.

High and Low interest rate environment. We divide the fed funds rate in our sample rate as high or low depending on if the fed funds rate is higher or lower than the median. We rerun the baseline regression separately for high and low interest rate environments and find that firms one standard deviation away from violating interest coverage threshold respond more strongly to a monetary shock in low interest rate environments rather than high interest rate environments.

Comparison to the literature Several papers in the literature argue that certain firm level characteristics are important for heterogeneity in response to monetary shocks. We show that our firm-level dimension is new, and is important over and beyond these existing measures (see Appendix C for details).

Ottonello and Winberry (2020) show that firm default characteristics such as leverage matter for monetary policy transmission. Our results are robust to controlling for firm leverage. Bernanke et al. (1999) suggest that smaller firms tend to respond more to monetary policy. Our results are robust to controlling for size of the firm in the manner that they did. Jeenas (2018) shows that firms with more liquid assets are more responsive to monetary policy. Our results are robust to controlling for the liquid assets of the firm. Cloyne et al. (2019) suggest that younger non-dividend paying firms respond the most to monetary policy. Our results are robust to controlling for age. Our results are also robust to controlling for firm volatility of sales which has been considered an important determinant.

4. Conclusion and next steps

Existing research has clearly established that firms have strong incentives to maintain loan-level covenants. Thus, covenants play an important role in firm-level real outcomes such as investment. Introduction of interest rate related covenants, and their increasing popularity can help transmit monetary shocks to firms, and we show that the effects are stronger for firms farther away from violating this constraint.

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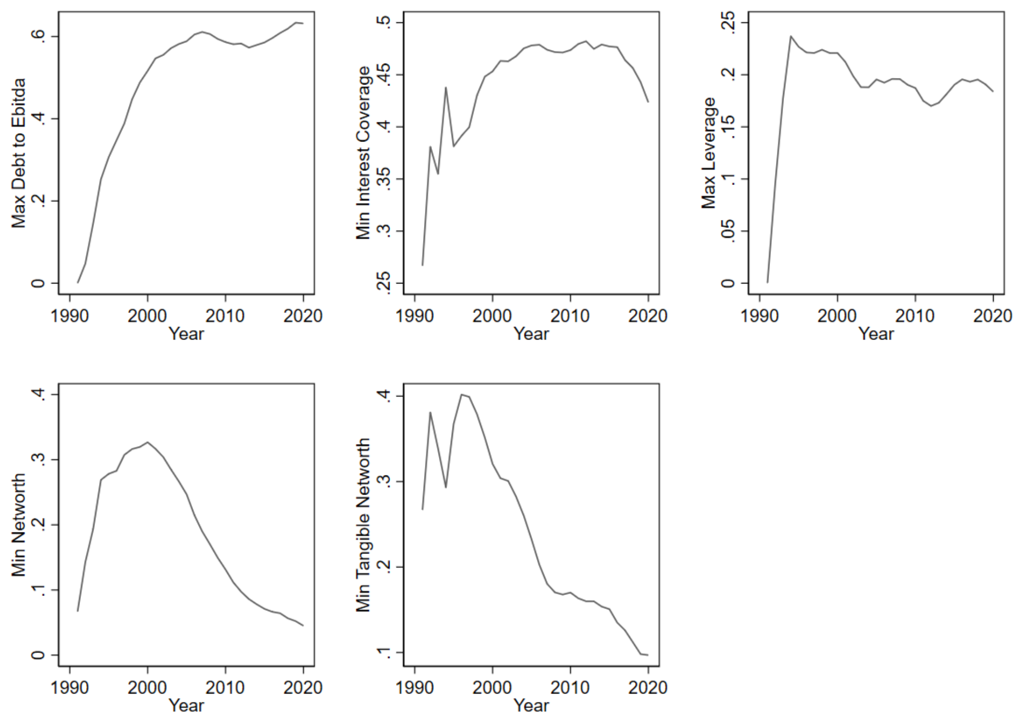
List of Tables and Figures

Figure 1: Covenant popularity over time



Data source: Dealscan. The prevalence of five different covenant types is plotted. The y-axis shows the total number of firms that had a particular covenant type in year t divided by the total number of firms that were imposed at least one covenant (out of the total 18 covenants) in year t. The numbers each may add up to greater than one because the same firm can be imposed multiple covenants. Interest Coverage covenant requires firms to maintain a minimum EBITDA to interest payments ratio whereas Leverage covenant imposes an upper limit on Debt to Assets ratio. Other three covenants are self explanatory.

Table 3: Summary Statistics of Monetary Policy Shocks

	High Frequency	Smoothed	Sum
Mean	-0.0185	-0.0429	-0.0421
Median	0	-0.0127	-0.00509
S.D.	0.0855	0.108	0.124
Min	-0.463	-0.480	-0.479
Max	0.152	0.233	0.261
Observations	164	71	72

Notes: Summary statistics of monetary policy shocks for the period $1/1/1990$ to $12/31/2007$. ”High frequency” shocks are estimated using the event study strategy as in Gürkaynak et al. (2005) and Gorodnichenko and Weber (2016). ”Smoothed” shocks are time aggregated to a quarterly frequency using the weighted average described in OW Supplemental Materials A. ”Sum” refers to time aggregating by simply summing all shocks within a quarter.

Table 4: Heterogeneous response of investment to monetary policy

	(1)	(2)	(3)
debt-to-ebitda × ffr shock	0.22	0.22	0.12
	(0.45)	(0.49)	(0.74)
interest coverage × ffr shock	2.21***	2.13***	2.75***
	(0.49)	(0.50)	(0.49)
leverage × ffr shock	-0.49	-0.34	0.66
	(0.77)	(0.75)	(0.97)
networth × ffr shock	-0.17	-0.19	1.14
	(0.73)	(0.77)	(0.75)
tangible networth × ffr shock	-0.44	-0.46	-0.90
	(0.73)	(0.72)	(0.81)
Observations	217435	217435	158717
R^2	0.108	0.121	0.127
Firm controls	no	yes	yes
Time sector FE	yes	yes	no
Time clustering	yes	yes	yes

Notes: Results from estimating $\Delta \log k_{jt+1} = \alpha_j + \alpha_{st} + \Sigma_k \left[\beta_k \mathbb{1}_{j,t,k} \left(x^k_{jt-1} - \mathbb{E}_j \left[x^k_{jt}\right]\right) \varepsilon^{\mathrm{m}}_t\right] + \Gamma' Z_{jt-1} + e_{jt}$ where all variables are defined in the main text or as in Table 5. k includes the debt to ebitda covenant, interest coverage covenant, leverage covenant, networth covenant and tangible networth covenant.

Table 5: Heterogeneous response of investment to monetary policy

	(1)	(2)	(3)
interest coverage × ffr shock	2.22***	2.15***	2.97***
	(0.50)	(0.51)	(0.52)
ffr shock			2.47***
			(0.72)
Observations	217435	217435	158717
R^2	0.107	0.121	0.126
Firm controls	no	yes	yes
Time sector FE	yes	yes	no
Time clustering	yes	yes	yes

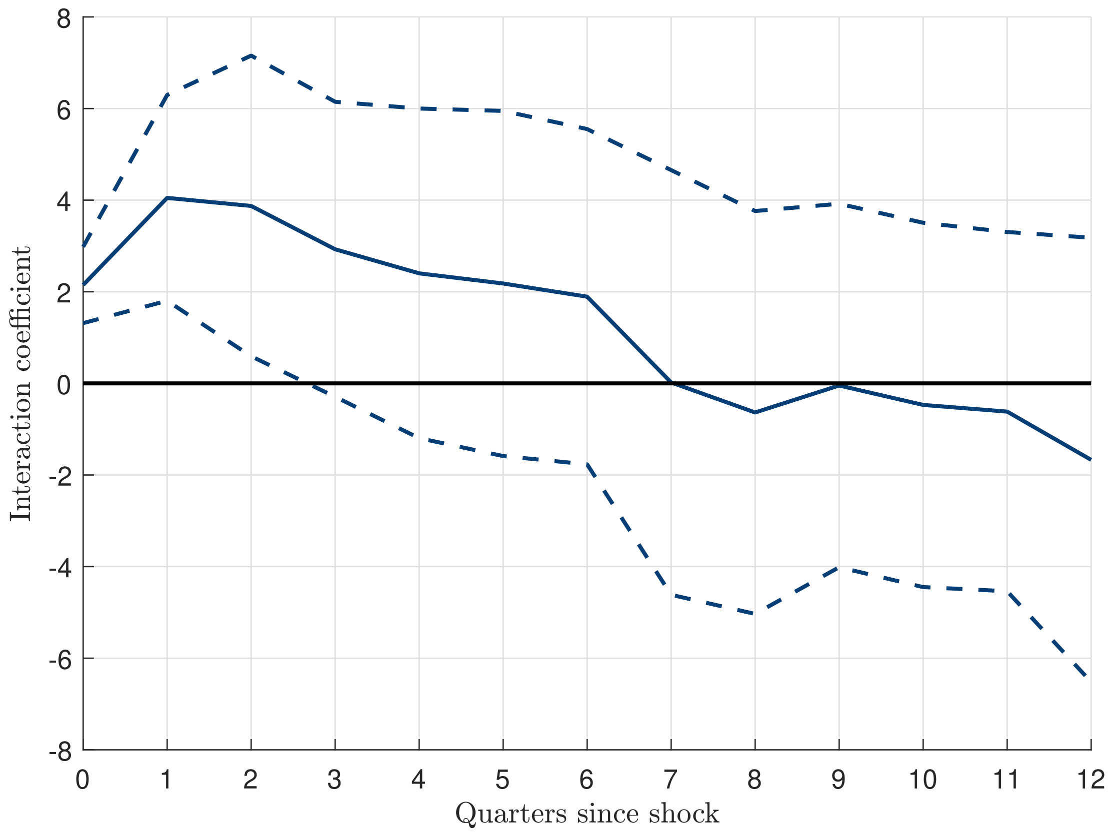
Notes: Results from estimating $\Delta \log k_{jt+1} = \alpha_j + \alpha_{st} + [\beta \mathbb{1}_{cov,ic} (x_{jt-1} - \mathbb{E}_j [x_{jt}]) \varepsilon_t^{\mathrm{m}}] + \Gamma' Z_{jt-1} + e_{jt}$ where α_j is a firm fixed effect,,α_{st} is a sector-by-quarter fixed effect, financial position x_{jt} is the distance from violating interest coverage covenant threshold, $E_j[x_{jt}]$ is the average of x_{jt} for firm j in the sample, ϵ_t^m is the monetary shock, and Z_{jt-1} is a vector of firm-level controls containing $x_jt - 1$, sales growth, size, current assets as a share of total assets, an indicator for fiscal quarter, and the interaction of demeaned financial position with lagged GDP growth. Standard errors are two-way clustered by firms and quarter. We have normalized the sign of the monetary shock ϵ_t^m so that a positive shock corresponds to a decrease in interest rates. We have standardized $(x_{jt} - E[x_{jt}])$ over the entire sample. Column (3) removes the sector-quarter fixed effect α_{st} and estimates $\Delta \log k_{jt+1} = \alpha_j + \alpha_{sq} + \gamma \epsilon_t^m + \beta(x_{jt-1}^k - E_j[x_{jt}^k])\epsilon_t^m + \Gamma_1' Z_{jt-1} + \Gamma_2' Y_{t-1} + e_{jt}$, where Y_t is a vector with four lags of GDP growth, the inflation rate, and the unemployment rate.

Table 6: Heterogeneous response of investment to monetary policy

	(1)
Earnings/interest payments × ffr shock	0.63
	(0.39)
Earnings/interest payments × ffr shock × covenant (dummy)	3.43*
	(1.84)
Observations	174490
R^2	0.132
Firm controls	yes
Time sector FE	yes
Time clustering	yes

Notes: Results from estimating $\Delta \log k_{jt+1} = \alpha_j + \alpha_{st} + \delta \left(x_{jt-1} - \mathbb{E}_j \left[x_{jt}\right]\right) \varepsilon_t^{\mathrm{m}} + \beta \mathbb{1}_{cov,ic} \left(x_{jt-1} - \mathbb{E}_j \left[x_{jt}\right]\right) \varepsilon_t^{\mathrm{m}} + \Gamma' Z_{jt-1} + e_{jt}$ where α_j is a firm fixed effect,α_{st} is a sector-by-quarter fixed effect, financial position x_{jt} is the earnings to interest payments ratio, $E_j[x_{jt}]$ is the average of x_{jt} for firm j in the sample, ϵ_t^m is the monetary shock, and Z_{jt-1} is a vector of firm-level controls containing $x_j t - 1$, $\mathbb{1}_{cov,ic} x_{jt-1}$, sales growth, size, current assets as a share of total assets, an indicator for fiscal quarter, and the interaction of demeaned financial position with lagged GDP growth, along with its interaction with $\mathbb{1}_{cov,ic}$. Standard errors are two-way clustered by firms and quarter. We have normalized the sign of the monetary shock ϵ_t^m so that a positive shock corresponds to a decrease in interest rates. We have standardized $(x_{jt} - E[x_{jt}])$ over the entire sample.

Figure 2: Dynamics of differential response of monetary shocks



Notes: dynamics of the interaction coefficient between distance from interest coverage thresholds and monetary shocks over time. Reports the coefficient β_h over quarters h from $\log k_{jt+h} \log k_{jt} = \alpha_{jh} + \alpha_{sth} + \beta_h(x_{jt-1} - E_j[x_{jt}])\epsilon_t^m + \Gamma_h' Z_{jt-1} + e_{jth}$, where all variables are defined in the notes for Table 5. Dashed lines report 90% error bands.

Appendix

A. Covenant Types

The different covenant types in the Dealscan data are as follows:

1. **Max. Debt to EBITDA (Earnings-based)**
2. Max. Senior Debt to EBITDA
3. Min. Cash Interest Coverage
4. Min. Debt Service Coverage
5. Min. EBITDA
6. Min. Fixed Charge Coverage
7. **Min. Interest Coverage**
8. Max. Debt to Equity **(Leverage-based)**
9. **Max. Leverage ratio**
10. Max. Net Debt to Assets
11. Max. Senior Leverage
12. Min. Equity to Asset Ratio
13. Min. Net Worth to Total Asset **(Networth-based)**
14. Max. Debt to Tangible Net Worth
15. **Net Worth**
16. **Tangible Net Worth**

17. Min. Current Ratio **(Liquidity-based)**

18. Min. Quick Ratio

The first seven are earnings-related covenants, next five are leverage-related, next four are networth related and the last two are liquidity based. The ones in the bold are popular, and in focus throughout the paper. The definition of most of these covenants as per Demerjian and Owens (2016) is in the table 7 below. Frequency" reports the % of loans where the actual covenant definition is identical to their standard definition in their selected sample. Noticeably, Min. Fixed Charge Coverage has been correct only 2.7% of the time, although it is very popular in loan contracts.

Table 7: Covenant Definition as in Demerjian and Owens (2016)

Dealscan covenant	Standard definition	Compustat implementation	Frequency
Min. Interest Coverage	EBITDA/Interest Expense	OIBDPQ/XINTQ	76.3 %
Min. Cash Interest Coverage	EBITDA/Interest Paid	OIBDPQ/INTPNY	76.8 %
Min. Fixed Charge Coverage	EBITDA/(Interest Expense+Principal+Rent Expense)	OIBDPQ/XINTQ+lag(DLCQ)+ XRENT	2.7 %
Min. Debt Service Coverage	EBITDA /(Interest Expense+Principal)	OIBDPQ/XINTQ+ lag(DLCQ)	37.9 %
Max. Debt-to-EBITDA	Debt/EBITDA	DLTTQ+DLCQ/OIBDPQ	91.0 %
Max. Senior Debt-to-EBITDA	Senior Debt/EBITDA	DLTTQ+ DLCQ-DS/OIBDPQ	89.4 %
Max. Leverage	Debt/Assets	DLTTQ+ DLCO/ATQ	84.5 %
Max. Senior Leverage	Senior Debt/Assets	DLTTQ+DLCQ-DS/ATQ	86.8 %
Max. Debt-to-Tangible Net Worth	Debt/TNW	DLTTQ+DLCQ/ATQ-INTANQ-LTQ	52.9 %
Max. Debt-to-Equity	Debt/NW	DLTTQ+ DLCQ /ATQ-LTQ	47.6 %
Min. Current Ratio	Current Assets/Current Liabilities	ACTQ/LCTQ	95.4 %
Min. Quick Ratio	Account Receivable+Cash and Equivalents/Current Liabilities	RECTQ+ CHEQ/LCTQ	66.7 %
Min. EBITDA	EBITDA	OIBDPQ	97.4 %
Min. Net Worth	NW	ATQ-LTQ	33.7 % / 96.9 %
Min. Tangible Net Worth	TNW	ATQ-INTANQ-LTQ	32.5 % / 99.5 %

Table presents the common definitions suggested by Demerjian and Owens (2016).All flow variables are annualized (summing the current plus prior three quarters) for both income statement and statement of cash flow variables "Frequency" reports the % of loans where the actual covenant definition is identical to their standard definition in their selected sample. For Min. NetWorth and Min.Tangible NetWorth, they report two frequencies:including/excluding the effects of escalators.

B. Robustness checks

Table 8: Controlling for monetary shock with violation dummy

	(1)
d2cov7 $\times$ ffr shock (dummy)	2.15***
	(0.51)
Observations	217435
R^2	0.121
Firm controls	yes
Time sector FE	yes
Time clustering	yes

Notes: Results from estimating $\Delta \log k_{jt+1} = \alpha_j + \alpha_{st} + [\beta \mathbb{1}_{cov,ic} (x_{jt-1} - \mathbb{E}_j [x_{jt}]) \varepsilon_t^{\mathrm{m}}] + \Gamma' Z_{jt-1} + \delta' Z_{jt-1} \varepsilon_t^{\mathrm{m}} + e_{jt}$ where all variables are defined in the main text or the notes to Table 5.

Table 9: Not demeaning distance to interest coverage threshold

	(1)	(2)	(3)
interest coverage × ffr shock	2.12**	2.04**	2.93***
	(0.98)	(0.96)	(0.98)
ffr shock			2.47***
			(0.73)
Observations	217435	217435	158717
R^2	0.107	0.121	0.126
Firm controls	no	yes	yes
Time sector FE	yes	yes	no
Time clustering	yes	yes	yes

Notes: Results from estimating $\Delta \log k_{jt+1} = \alpha_j + \alpha_{st} + [\beta \mathbb{1}_{cov,ic}(x_{jt-1}) \varepsilon_t^{\mathrm{m}}] + \Gamma' Z_{jt-1} + e_{jt}$ where all variables are defined in the main text or the notes to Table 5. Column (3) removes the sector-quarter fixed effect α_{st} and estimates $\Delta \log k_{jt+1} = \alpha_j + \alpha_{sq} + \gamma \epsilon_t^m + \beta(x_{jt-1}^k - E_j[x_{jt}^k])\epsilon_t^m + \Gamma_1' Z_{jt-1} + \Gamma_2' Y_{t-1} + e_{jt}$, where Y_t is a vector with four lags of GDP growth, the inflation rate, and the unemployment rate.

Table 10: Excluding interaction with lagged GDP growth rate

	(1)	(2)
interest coverage × ffr shock	1.60***	2.31***
	(0.49)	(0.51)
ffr shock		2.46***
		(0.72)
Observations	217435	158717
R^2	0.121	0.126
Firm controls	yes	yes
Time sector FE	yes	no
Time clustering	yes	yes

Notes: Results from estimating $\Delta \log k_{jt+1} = \alpha_j + \alpha_{st} + [\beta \mathbb{1}_{cov,ic} (x_{jt-1} - \mathbb{E}_j [x_{jt}]) \varepsilon_t^{\mathrm{m}}] + \Gamma' Z_{jt-1} + e_{jt}$ where all variables are defined in the main text or the notes to Table 5. However, Z_{jt-1} does not include the interaction term between x_{jt-1} and lagged GDP growth rate. Column (3) removes the sector-quarter fixed effect α_{st} and estimates $\Delta \log k_{jt+1} = \alpha_j + \alpha_{sq} + \gamma \epsilon_t^m + \beta(x_{jt-1}^k - E_j[x_{jt}^k])\epsilon_t^m + \Gamma_1' Z_{jt-1} + \Gamma_2' Y_{t-1} + e_{jt}$, where Y_t is a vector with four lags of GDP growth, the inflation rate, and the unemployment rate.

Table 11: Lagged inflation or unemployment rate instead of GDP growth rate

	(1)	(2)	(3)
interest coverage × ffr shock	2.20***	1.69***	1.69***
	(0.49)	(0.49)	(0.56)
interest coverage × dlog gdp	0.24**		
	(0.10)		
interest coverage × cpi		0.01	
		(0.11)	
interest coverage × ur			-0.00
			(0.00)
Observations	217435	217435	217435
R^2	0.107	0.107	0.107
Firm controls	yes	yes	yes

Notes: Results from estimating the baseline specification (1) for interest coverage covenant alone as in Table 5 Column (2). Column (1) displays results with a control of variable of interest interacted with lagged gdp growth rate as in Table 5, Column (2) with lagged inflation and Column (3) with lagged unemployment rate instead.

Table 12: Expansionary versus Contractionary shock

	(1)	(2)
interest coverage × ffr shock	2.10***	
	(0.50)	
interest coverage × positive ffr shock		2.19***
		(0.60)
interest coverage × negative ffr shock		1.80**
		(0.76)
Observations	217435	217435
R^2	0.121	0.121
Firm controls	yes	yes
Time sector FE	yes	yes
Time clustering	yes	yes

Notes: The second column results from estimating $\Delta \log k_{jt+1} = \alpha_j + \alpha_{st} + \beta_1 \mathbb{1}_{cov,ic} (x_{jt-1} - \mathbb{E}_j [x_{jt}]) \mathbb{1}_{pos} \varepsilon_t^{\mathrm{m}} + \beta_2 \mathbb{1}_{cov,ic} (x_{jt-1} - \mathbb{E}_j [x_{jt}]) \mathbb{1}_{neg\epsilon} \varepsilon_t^{\mathrm{m}} + \Gamma' Z_{jt-1} + e_{jt}$ where all variables are defined in the main text or the notes to Table 5. The first column results are the results from simply running the baseline specification (1) for interest coverage covenant alone.

Table 13: Greenbook Forecast Revisions

	(1)	(2)	(3)
interest coverage × ffr shock	2.07***	2.43***	2.98***
	(0.50)	(0.55)	(1.08)
Observations	217435	217435	217435
R^2	0.121	0.121	0.121
Firm controls	yes	yes	yes
Forecast rev	GDP	GDP	GDP
controls		Inflation	Inflation
			Unemployment

Notes: Results from estimating the baseline specification (1) for interest coverage covenant alone, including as controls in the interaction between our variable of interest, $x_{jt-1} - E_j[x_{jt}]$, and forecast revisions of output growth, inflation, and unemployment in FOMC announcements.

Table 14: Greenbook Forecasts

	(1)	(2)	(3)
interest coverage × ffr shock	2.29***	2.22***	2.26***
	(0.48)	(0.57)	(0.61)
Observations	217435	217435	217435
R^2	0.121	0.121	0.121
Firm controls	yes	yes	yes
Forecast rev	GDP	GDP	GDP
controls		Inflation	Inflation
			Unemployment

Notes: Results from estimating the baseline specification (1) for interest coverage covenant alone, including as controls in the interaction between our variable of interest, $x_{jt-1} - E_j[x_{jt}]$, and forecast revisions of output growth, inflation, and unemployment in FOMC announcements.

Table 15: Post 1994

	(1)	(2)
interest coverage × ffr shock	2.10***	2.27***
	(0.49)	(0.46)
Observations	172759	172759
R^2	0.134	0.134
Firm controls	yes	yes
Time sector FE	yes	yes
Time clustering	yes	yes
Controls Greenbook Forecast Revisions	no	yes

Notes: Column (1) results from estimating specification (1) only for interest coverage covenant where all variables have been defined in the main text and the notes to Table 5. The baseline specification is estimated only for period post 1994. Columns (2) include in the vector of firm-level controls Z_{jt-1} the interaction between our variable of interest, $x_{jt-1} - E_j[x_{jt}]$, and forecast revisions of output growth in FOMC announcements.

Table 16: Lagged investment

	(1)	(2)
interest coverage × ffr shock	1.99***	2.48***
	(0.49)	(0.48)
Lagged investment	0.20***	0.19***
	(0.01)	(0.01)
Observations	217435	158717
R^2	0.155	0.156
Firm controls	yes	yes
Time sector FE	yes	no
Time clustering	yes	yes

Notes: Results from estimating specification as in Table 5 Column (2) and (3) controlling for lagged investment.

Table 17: Alternative Time Aggregation

	(1)	(2)
interest coverage × ffr shock (sum)	1.52***	1.68***
	(0.45)	(0.59)
ffr shock (sum)		0.82
		(0.49)
Observations	217435	158717
R^2	0.121	0.126
Firm controls	yes	yes
Time sector FE	yes	no
Time clustering	yes	yes

Notes: Results from estimating specification as in Table 5: Column (2) where the monetary shocks are constructed as in Wong (2019)

Table 18: Target versus Path Shock

	(1)	(2)
interest coverage × ffr shock	2.10***	
	(0.50)	
interest coverage × target		3.43***
		(0.84)
interest coverage × path		2.21
		(2.17)
Observations	217435	212070
R^2	0.121	0.121
Firm controls	yes	yes
Time sector FE	yes	yes
Time clustering	yes	yes

Notes: Results from estimating specification as in Table 5: Column (2). The first column is the usual specification whereas the the second column runs separate interactions of financial position x_{jt} with the target and path component of interest rates.