Financial Covenants, Firm Financing, and Investment

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Abstract

Firms reduce investment to avoid costly violations of financial covenants, most of which are based on earnings. Empirically, I show that a 25% drop in earnings implies a 15% decrease in investment for the median listed US firm due to the reduced distance to the covenant threshold. To quantify this precautionary effect of covenants in the aggregate, I incorporate earnings covenants into a heterogeneous firm model with a financial sector. Firms in the model are uncertain about the bank's reaction to a covenant breach and therefore reduce debt issuance and investment when approaching the covenant threshold. In the model, covenants reduce aggregate investment by 14% relative to a benchmark economy without limits on borrowing, where the precautionary effect of covenants accounts for most of the decrease.

Keywords: Financial Constraints, Covenants, Investment, Heterogeneous Firms
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1 Introduction

Financial covenants are conditions present in almost all bank loan contracts because they mitigate agency frictions between creditors and shareholders. Yet they come at a cost: a covenant breach gives banks the right to accelerate the repayment of a loan, and banks often use this threat in the renegotiation after a covenant breach to tighten credit supply (Roberts and Sufi, 2009). Because of the potentially negative consequences of a covenant breach, firms try to avoid breaching a covenant. Figure 1 shows the distribution of the distance to the covenant threshold across firms. The relatively large number of firms just above zero, those firms are close to the threshold but still in compliance with the covenant, and the relatively small number of firms below zero, i.e., firms breaching a covenant, are in line with firms actively trying to avoid a covenant breach. Firms can avoid covenant breaches by reducing debt issuance, but this often comes at the cost of reduced investment, which is a sizable expenditure for most firms and usually financed by debt.[1]

While the impact of loan volumes and collateral constraints on investment has been established and quantified (Catherine et al., 2018), the effect of financial covenants on investment outside covenant breaches has received less attention. In this paper, I quantify the aggregate costs that arise from firms' precautionary behavior to avoid covenant breaches on investment. In the first part of the paper, I use firm-level data matched with loan contract data and information extracted from SEC-filings to estimate the direct and precautionary cost of covenants. I find a large reduction in debt issuance and investment after covenant breaches, in line with the previous literature. This direct cost gives rise to the precautionary cost of covenants as firms want to stay clear of the covenant threshold.[2] I find that firms issue less debt and lower their investment rate, the closer they get to the covenant threshold. To address endogeneity problems, I use different sources of variation in the strength of the precautionary motive. In the second part of the paper, I introduce earnings covenants into a heterogeneous firm model to quantify the aggregate effect of covenants on investment. Relative to a model without restrictions on borrowing, earnings covenants reduce aggregate investment by 14%, mainly due to firms' precaution. I also find that the total cost of earnings covenants on investment is similar to the cost of collateral constraints and earnings *constraints*.

In the empirical part, I focus on debt to earnings covenants, the most frequent type of covenants.[3] I find that a one standard deviation increase in the log distance to the covenant threshold increases debt issuance by 0.71 percentage points and the investment rate by 0.2 percentage points. For

[1] For the median firm in my sample, annual investment expenditures represent 15% of its stock of outstanding debt. Ajello (2016) finds 35% of US public firms investment is financed by external funds.

[2] Apart from reductions in credit supply and additional fees, firm managers might also want to avoid covenant breaches because they dislike the bank's interference after a covenant breach. Dichev and Skinner (2002), for example, write: "Any review of the firm's operations by outsiders is likely to be costly–in terms of managerial time, the need to generate updated financial reports, and the need for management to explain and justify its forecasts and strategy–and something managers prefer to avoid."

[3] I find a similar precautionary effect for interest coverage covenants, the second most frequent type of covenants.

the median firm, a 25% decrease in earnings implies a 15% drop in the investment rate due to the precautionary effect of covenants. The baseline results are robust to changes in the specification[4] and excluding firms in breach of their covenant from the sample.

The precautionary effect in the baseline regression is estimated based on variation in a firm's debt to earnings ratio.[5] A drop in a firm's earnings decreases the distance to the covenant threshold, but it also lowers internal financial resources and changes investment opportunities. I include cash flow and the stock of cash to control for changes in internal funds and Tobin's Q as a proxy for investment opportunities. While firms reduce debt issuance when getting closer to the covenant threshold, I also find that they are more likely to issue equity and tap into their cash holdings. This substitution pattern is a first indication that even firms close to the threshold have valuable investment opportunities but change the source of financing to avoid a covenant breach. To address the endogeneity of earnings, I run additional tests using three different sources of variation to identify the precautionary effect of covenants.

In the first test, I focus on cross-sectional variation in firms' exposure to a covenant breach. I find a stronger precautionary effect for firms without a credit rating and firms who do not have an established relationship with their lenders. Firms expecting a worse outcome after a covenant breach seem to be more precautious ex-ante. In a further cross-sectional test, I find a weaker precautionary effect for firms likely to manipulate their accounting. These firms are less concerned about a covenant breach as they can, at least temporarily, increase the distance to the covenant threshold using creative accounting. Although the sub-samples are not random, the findings are in line with a causal interpretation of my baseline result.

In the second test, I study the precautionary effect when a firm's loan contract changes from containing net worth covenants only to a contract, which includes at least one earnings covenant. For the years before the contract change, I compute a hypothetical distance to the earnings covenant threshold and then compare the effect of the distance to the earnings covenant on investment before and after the contract change. I find no significant effect of the distance to the earnings covenant threshold before the contract change, but a significant, positive effect on investment after the contract change. Although the contract changes themselves are potentially endogenous,[6] it is unlikely that the relationship between earnings and investment opportunities changed at the same time as the loan contract.

For the third test, I use the introduction of the Basel II regulatory framework for banks as a source of plausibly exogenous variation in the strength of the precautionary motive of covenants.

[4] Using the level distance instead of the log, including industry-year fixed effects and replacing firm fixed effects by lags yields very similar coefficients.

[5] Firms' thresholds very rarely change in my sample. To account for the potential endogeneity of the covenant thresholds, I re-run the baseline regressions with firm-threshold fixed effects and find very similar coefficients.

[6] Most of the contract changes in my sample occur between 1997 and 2002, at the same time as the use of net worth covenants declined overall. The timing points to changes in accounting rules (Demerjian, 2011) rather than firm-specific explanations as the main reason for the contract changes.

Basel II, unlike its predecessor Basel I, linked the amount of capital banks have to set aside for corporate loans to a firms' credit risk. With Basel II in place, banks might use covenant breaches to reduce their exposure to firms that have become riskier because these firms tie up more bank capital. This, in turn, makes riskier firms more precautious about breaching a covenant. I compare the impact of credit rating downgrades, an indicator for a change in a firm's risk, on precaution before and after the introduction of Basel II. The key identifying assumption is that the relationship between investment opportunities and the distance to the covenant threshold has not changed over time for downgraded firms. While I find no significant impact of credit rating downgrades on precaution before Basel II, I find a statistically significant increase in precaution due to credit rating downgrades after the introduction of Basel II. The effect is also economically large: after the introduction of Basel II, a firm at the 10^{th} percentile of the distance to the covenant threshold has a 30% lower investment rate after a credit rating downgrade compared to a firm at the 90^{th} percentile, while there is almost no difference before. The results are robust to the inclusion of rating as well as rating-year fixed effects.

While each of the approaches has its shortcomings, all the findings together are difficult to account for based on endogeneity concerns and support a causal interpretation.[7] Before turning to the model, I compute aggregate in-sample investment without the direct effect of covenant breaches and aggregate investment without the precautionary cost, assuming that all firms are "far" away from their covenant threshold. I find that, overall, covenants reduce aggregate annual investment by 4% and that 80% of the reduction is due to the precautionary motive.

I then build a heterogeneous firm model in which earnings covenants play a key role. The model allows me to compute the aggregate cost of covenants without auxiliary assumptions and to compare the cost of covenants to the cost of other types of financial frictions. In the model, firms differ in their productivity, debt, and capital and operate a decreasing returns to scale technology. An exogenous exit shock combined with low initial capital of newborn firms creates a borrowing need as firms want to attain their optimal scale. Firms finance investment using retained earnings and debt. Different from a standard model, firms have to satisfy an earnings covenant, a maximal debt to earnings ratio, to keep unlimited access to bank debt.[8] When firms' debt to earnings ratio exceeds the threshold, i.e., the covenant is breached, access to credit becomes restricted in a fraction of breaches. As a consequence, firms reduce their borrowing and investment when the risk of a covenant breach increases.

I calibrate the model to the US public firms sector, and I find an aggregate cost of covenants of 14% of aggregate annual investment relative to a benchmark model without limits on borrowing, and the precautionary effect of covenants accounting for most of the cost. Although not targeted in

[7] I also use the accounting rule change re-defining a firm's earnings as in Lian and Ma (2020) to instrument the distance to the covenant threshold. I find a significant positive impact of the distance to the covenant threshold on investment but the sample is very small and I cannot include all firm-level controls.

[8] I do not explicitly micro-found the earnings covenant, but in an incomplete contract framework (Aghion and Bolton, 1992) covenants arise naturally as part of the optimal contract.

the calibration, the model reproduces several features of the data: the split-up of the precautionary and the direct cost is similar to the one found in the data, firms in the model bunch at the covenant threshold as in the data, and firm-level variables show similar patterns around covenant breaches. When I run the baseline regressions on model-generated firm-level data, a covenant breach reduces the investment rate by 14% in the model-generated data (11% in the data), and a one standard deviation increase in the log distance to the covenant threshold increases investment rate by 3% in the model-generated data (3% in the data).

My paper contributes to the empirical literature about financial covenants. While the effects of covenant breaches on different firm-level outcomes are well documented (Chava and Roberts (2008), Roberts and Sufi (2009), Nini et al. (2012), Falato and Liang (2016), Freudenberg et al. (2017), Chodorow-Reich and Falato (2017) and Ersahin et al. (2020)), the impact of covenants on firm behavior outside covenant breaches has attracted less attention. This paper establishes and quantifies the precautionary cost of covenants on investment at the firm-level and in the aggregate. The paper closest to mine is Lian and Ma (2020), who find a positive impact of current earnings on debt issuance and investment for firms subject to earnings-based constraints. I control for earnings in my regressions and find an additional effect of a firm's distance to the covenant threshold on debt issuance and investment, suggesting that the precautionary motive of covenants matters for firms in addition to other earnings-based constraints.[9]

My paper also contributes to the macroeconomics literature on the aggregate effects of financial frictions. While most of the literature has focused on collateral/net worth constraints (Jermann and Quadrini (2012), Khan and Thomas (2013), Midrigan and Xu (2014), Catherine et al. (2018)), I study covenants. I explore the differences between the earnings covenant model and a model with a net worth *constraint*. In the net worth *constraint* model, all firms are permanently restricted in how much they can borrow, whereas, in the earnings covenant model, borrowing is only restricted after a covenant breach and a credit cut by the bank. Although I find the cost of covenants on aggregate investment to be similar to the cost of net worth constraints, the incidence of the cost differs. When firms are subject to net worth constraints, precaution matters less for the overall cost than with earnings covenants because a larger share of firms is directly restricted in the quantity of borrowing.

Finally, this paper is also related to the recent macro literature studying macro models with earnings-based *constraints* (Drechsel (2019) and Greenwald (2019)).[10] In my model, heterogeneous firms are subject to earnings *covenants*, which, if breached by the firm, give the bank the possibility to tighten a firm's net worth constraint, but, different from an earnings *constraint*, do not directly

[9] A related accounting literature documents other strategies of firms to avoid covenant breaches: the use of accounting tricks to increase earnings (Sweeney (1994), DeFond and Jiambalvo (1994), Dichev and Skinner (2002)), real earnings management (Roychowdhury (2006), Franz et al. (2014)) and reshuffling of tax liabilities over time to increase current earnings (Dyreng, 2009). I view these findings as complementary to mine, supporting the view that firms actively try to avoid covenant breaches by different means.

[10] In household finance Greenwald (2016) and Ingholt (2020) study the effect of income-based constraints.

restrict the quantity of credit. A comparison of earnings *covenants* against earnings *constraints* shows that, first, the earnings *constraint* needs to be set much looser than the earnings *covenant* to attain the same aggregate leverage, and, second, aggregate TFP is less affected under earnings *constraints* than earnings *covenant*. These differences suggest that the precise nature of the borrowing restriction matters for aggregate outcomes.

2 The Impact of Covenants on Investment

This section analyzes the impact of covenants on investment empirically. I use annual and quarterly US public firm data from 1997 until 2014. Accounting data are from Compustat and loan contract data from DealScan. Because DealScan only reports the covenant threshold at loan initiation and often does not include changes to covenant thresholds made by amendments, the threshold is likely to be mismeasured. I therefore also use a text-based measure of covenant violations, directly based on SEC-filings, described in more detail in Appendix A.1. I exclude financial firms and firms with missing information on loan covenants from the sample. Appendix A.2 provides more general information about covenants.

2.1 Baseline Regressions

I start by running two firm-level regressions to document the direct and precautionary effect of financial covenants on debt issuance and investment:

$$Y_{i,t+1} = \alpha_i + \gamma_t + \beta_1 \text{First Breach}_{i,t} + \beta X_{i,t} + \epsilon_{i,t}$$
$$Y_{i,t+1} = \alpha_i + \gamma_t + \beta_1 \text{Log Distance to Threshold}_{i,t} + \beta_2 \text{Distance to Threshold}{<}0_{i,t} + \beta X_{i,t} + \epsilon_{i,t}$$

The main outcome variables are next year's investment and the change in book value of debt, both normalized by total assets. The construction of all variables is explained in Appendix A.3.

To measure the direct effect of a covenant breach, I use a dummy variable indicating a text-based measure of covenant breach. Following Nini et al. (2012) I focus on first breaches after a firm has not breached a covenant for at least one year.[11]

The precautionary effect of covenants is measured by the log distance to the debt to EBITDA covenant. A dummy variable controls for firm-years, where the distance to the covenant threshold is negative. I focus on debt to EBITDA covenants because they are the most frequent type of

[11] This restriction allows for a more precise measurement of the effect of a covenant breach because firms often remain in breach for some time.

covenant, included in 51% of loan contracts.[12] In Appendix Table A2 I show that the results are similar with interest coverage covenants, the second most frequent type of covenant. Although most contracts contain several covenants focusing on one covenant type avoids complications from comparing different types of covenants (Murfin, 2012). I take the log distance instead of the simple difference because I expect the precautionary effect to increase non-linearly when a firm approaches the covenant threshold. But the baseline results are unchanged when using the plain distance instead (Appendix Table A2). In the regression, I use the minimum quarterly distance over a year between a firm's total debt divided by EBITDA. EBITDA is the four-quarter average of sales minus operating expenses.[13] The quarterly variables are closer to the definitions used in the loan contracts (Demerjian and Owens, 2014) than the annual variables.

The identification of the precautionary effect in the baseline regressions comes mainly from variation in firms' debt to earnings because covenant thresholds rarely change over time.[14] I include threshold fixed effects in Columns (11) and (12) of Appendix Table A2 and the baseline coefficients are almost unchanged. Additional variation comes from firms switching between negative and positive distance to covenant threshold and firms who become subject to a debt to EBITDA covenant over time and vice-versa. Columns (15) and (16) in Appendix Table A2 show that the coefficients remain similar when excluding firm-years with negative distance to the covenant threshold and firm-years without debt to EBITDA covenant from the sample.

An increase in sales increases a firm's internal funds and decreases the distance to the covenant threshold. I include cash flows and the stock of cash to control for the change in internal funds, as discussed in detail in Lian and Ma (2020). I also control for firm's leverage ratio, i.e. debt to assets, and earnings divided by lagged assets to capture changes in firm policy associated with different levels of earnings and debt.[15] Including EBITDA to assets as a control variable also controls for other constraints based on earnings (Lian and Ma, 2020). Further control variables include firms' market to book value as a proxy for investment opportunities and other firm characteristics (log size, the share of tangible assets, acquisitions to assets) which might be correlated both with the time-varying component of investment and the distance to the covenant threshold. All baseline regressions include year and firm fixed effects, but the results remain largely unchanged with industry-year fixed effects or lagged dependent variables instead of firm fixed effects (Appendix Table A2).

Table 1 provides summary statistics. The median investment rate and median leverage are similar for firms in compliance with their covenant, 4.27% and 25%, and firms without a debt to

[12] Followed by Interest Coverage (included in 37% of contracts), Fixed Charge Coverage (33%) and Tangible Net Worth Covenants (21%).

[13] Operating expenses include, among other items: cost for material, labor, and overhead as well as expenses not related to production, including R&D expenditures, and advertisement costs.

[14] The debt to earnings threshold changes only in 3.4% of firm-years in the baseline regression

[15] Because there are only very few within-firm changes of the covenant threshold the debt to earnings ratio is almost co-linear with the distance to threshold in levels.

EBITDA covenant, 4.29% and 25%. The median firm with a negative distance to the covenant threshold has a lower investment rate, 3.49% and has a much higher leverage of 45%. Appendix A.2 provides more detailed descriptive statistics about the DealScan database.

Results Table 2 reports the baseline regression results. A covenant breach has a significant negative effect on a firm's debt issuance (column 1) and investment rate (column 2). A covenant breach reduces the investment rate by 0.6 percentage points. The magnitude is similar to what previous studies have found[16] and corresponds to 11% of the standard deviation of investment.

Columns (3) and (4) of Table 2 show the precautionary effect of covenants on firm-level outcomes. An increase in the log distance to the covenant threshold has a significant positive impact on a firm's debt issuance and the investment rate. Importantly, because the control variables include earnings to assets, the distance to the covenant threshold matters in addition to the earnings constraints reported by Lian and Ma (2020).

A one standard deviation increase in the log distance to the covenant threshold increases investment by 0.9*0.2, which corresponds to 3% of the standard deviation of the investment rate. How does this number translate into dollars? Consider a typical firm with total debt of 260 million, earnings of about 100 million, and a debt to earnings covenant threshold of 3.5. Each of these values corresponds to the median in my sample. Suppose the firm's earnings decrease by 25%, a decrease that is common in my sample,[17] while debt and the covenant threshold stay the same. The coefficient in column four in Table 2 implies that a 25% drop in the firm's earnings leads to a 0.66 percentage points decrease in investment. This is a 15% decrease due to the precautionary effect of covenants if the firm started with a median investment rate of 4.3%.[18]

The precautionary effect of covenants is stronger for debt issuance than for investment because firms can substitute debt financing by equity and internal funding to some extent. Columns (5) to (8) of Table 2 provide evidence for this substitution. The closer firms are to the threshold, the more likely they are to issue equity (column 5) and the more they reduce their cash holdings (column 6). Firms' use of alternative sources of financing when they get closer to the covenant threshold suggests that firms are, to some extent, constrained by the covenant threshold. The decrease in debt and investment is not just due to lower credit demand or a lack of investment opportunities.

In addition to debt and investment, firms can try to avoid a covenant breach by cutting back other expenditures. Column (7) of Table 2 shows that firms close to the threshold are less likely to pay dividends or repurchase shares. Firms also reduce employment when they get closer to the threshold (column 8). While dividends are not affecting EBITDA, reducing labor has a direct effect

[16] Using quarterly data Chava and Roberts (2008) find a 1.5 percentage points reduction in investment after a covenant breach.

[17] About 25% of firms have negative earnings growth, and among those, a 25% decrease in earnings corresponds to the 55% percentile.

[18] $\Delta inv = \hat{\beta}_{precaution} log\left(1 + \frac{\left(3.5 - \frac{260}{75}\right) - \left(3.5 - \frac{260}{100}\right)}{3.5 - \frac{260}{100}}\right)$

on EBITDA by reducing production costs.

I now examine at which distance firms reduce investment and debt. I sort firm-years into bins depending on their distance to the covenant threshold and regress debt issuance and investment on these dummies, including the same control variables as in the baseline regression. Figure 4 shows a non-linear relationship between the distance to the covenant threshold and debt[19] and investment, supporting the log transformation in the baseline regressions. Firms start reducing debt issuance and investment when their distance is less than one, even though the difference to the reference group of firms far away from the covenant threshold is not statistically significant. Firms with a distance below 0.25 from the covenant threshold reduce investment and debt issuance the most. For those firms, the effect is also statistically significant. The precautionary effect is mainly driven by firms very close to the threshold.

Firm fixed effects and the time-varying firm-level controls might not capture all changes of a firm's investment opportunities after an earnings drop. In particular, the market to book ratio might mismeasure the change in investment opportunities. A decrease in investment after a fall in earnings could then be falsely attributed to the precautionary effect of covenants. I now use variation in the cross-section of firms that is, first, unlikely to be related to mismeasurement in investment opportunities and, second, likely to affect the strength of the precautionary motive.

Cross-Sectional Variation in the Exposure to Covenant Breach I re-run the baseline regression interacting all independent variables with different indicator measures for how exposed firms are to a covenant breach.[20] Table 3 presents the results. When approaching the covenant threshold firms without an existing lending relationship to any one of the banks in their syndicate reduce debt and investment much more than firms who have borrowed from a bank in their syndicate before (columns 1 and 2). Firms repeatedly borrowing from the same bank acquire reputational capital (Diamond, 1989) and their banks have acquired more information about these long-time borrowers over time. Both factors lower the expected cost of a covenant breach to the firm and therefore also the firm's precaution to avoid a covenant breach. Columns (3) and (4) show the interaction between the distance to the covenant threshold and an indicator of whether a firm has a credit rating. The precautionary effect on debt issuance and investment is larger for firms without a credit rating. Firms without a credit rating are more opaque to lenders and have more difficulty to access alternative sources of funding after a covenant breach, both factors making unrated firms more precautious.

The results in columns (5) and (6) of Table 3 indicate that firms with lower cash holdings have a stronger precautionary motive. Firms with lots of cash can turn to internal financing of investment projects in case of a covenant breach. Finally, I also interact the distance to the covenant threshold with an indicator for firms in the lowest (unconstrained) and top tercile (constrained)

[19] Similar to the graph in Lian and Ma (2020).

[20] Results are similar when running separate regression on subsamples.

of the Whited and Wu (2006) Index. Constrained firms reduce investment when approaching the covenant threshold (column 7), but not debt (column 8). The precautionary effect of covenants on debt is only significant for unconstrained firms. Financially constrained firms might be unable to use alternative sources of financing and have to reduce investment, whereas financially unconstrained firms adjust debt, but not investment.

Firms more exposed to covenant breaches are more precautious when they get closer to the threshold. The cross-sectional results support a causal interpretation that firms try to avoid covenant breaches by reducing debt and investment because unobservable changes in investment opportunities, the main alternative explanation, are unlikely to be perfectly correlated with the different proxies measuring firms' exposure to covenant breaches. Next, I run an event study around changes in firms' loan contracts.

Event Study around Contract Changes I focus on the introduction of earnings covenants into loan contracts that previously contained only net worth covenants. The precautionary effect in this event study is identified using variation in the type of covenant included in the loan contract and, different from the baseline regression, not based on changes in the firm's debt to earnings ratio. In this setting, the endogeneity of a firm's earnings is unlikely to drive the precautionary effect. Although the contract changes are also potentially endogenous, most of the changes in the sample occur between 1997 and 2002, coinciding with the accelerated overall decline of net worth covenants in new loan contracts, see Appendix Figure A2. The timing of contract changes suggests that economy-wide changes, for example in accounting standards,[21] rather than firm-specific characteristics led to the contract changes.

In the data, I identify episodes where, initially, a firm's loan contract includes only net worth covenants and then, in a new contract, at least one earnings covenant is added. To increase the number of episodes I include all types of earnings covenants[22] and normalize the distance to the covenant threshold by the firm-level standard deviation of the accounting ratio to make distances comparable across different covenants. I focus on a three-year window before and after the contract change. For the years before the contract change, I compute a hypothetical distance to the earnings covenant using the future earnings covenant threshold. I then run the following regression:

$$Y_{t_0+i} = \gamma_{t_0,i} + \gamma_{t_0,i} \cdot \frac{\text{Distance to Threshold}}{\text{SD(Covenant Variable)}}_{t_0,i} + \beta \text{Distance to Threshold} < 0_{t_0,i} + \epsilon_{t_0,i}$$

with t_0 the year of the contract change and $i = -3, -2, -1, 0, 1, 2, 3$ indicating the year relative

[21] Demerjian (2011) relates the decline in net worth covenants to changes in accounting practices towards the "balance sheet approach", for example, the adoption of fair value accounting, making balance sheet items less informative for banks.

[22] Debt to EBITDA, interest coverage, fixed charge coverage, debt service coverage and minimum EBITDA covenants.

to the contract change.

Figure 5 shows $\gamma_{t_0,i}$, the interaction coefficients between the distance to the covenant threshold and dummies indicating the year relative to the contract change from a regression on investment.[23] The distance to the covenant threshold does not have a significant impact on firms' investment before the contract change. After the contract change, there is a positive effect of the distance to covenant on investment, although, given the small sample, the coefficients are not very precisely estimated.

When their contract contains only net worth covenants, firms do not pay attention to the earnings covenant threshold, but, as soon as an earnings covenant is included in their loan contract, firms try to avoid a covenant breach.

Aggregate Effect of Covenants In Sample Before discussing alternative interpretations of the results above, I compute the direct and precautionary effect of covenants on aggregate investment in my sample as in Chodorow-Reich (2014). To obtain counterfactual investment without the direct cost from covenant breaches, I add back the coefficient on the text-based covenant breach variable to firms investment predicted in the baseline regression. Counterfactual investment without the precautionary cost from covenants is calculated by assuming that all firms are as far from their covenant threshold as the firms with the largest difference to the threshold in the sample which is 2.9. Therefore I set the log distance to one. I then multiply the investment rate by firms' total assets and sum investment over firms.

Figure 6 shows the percentage difference between the two counterfactuals and the baseline predicted aggregate investment over time. The direct cost and the precautionary cost evolve differently over the business cycles. The cost from precaution peaks in 2001 and 2006, whereas the direct cost is highest in 2003 and 2009. Firms reduce investment the most during and before the two recessions in my sample, while the direct cost from covenant breaches is peaks towards the end or after the recessions.

The precautionary cost is larger than the direct cost every year. Furthermore, there is a downward trend in the direct cost over the sample period due to the downward trend in covenant violations.[24] In the baseline sample, covenants on average decrease investment by 4.2% with the precautionary cost accounting for most of the cost. The share of the investment reduction due to the precautionary effect is 78% of the total cost on average and varies between 55 and 93% during the sample period. This is surprising because the corporate finance literature on covenants has almost exclusively focused on the direct effect of covenant breaches on investment.

[23] I did not find a similar effect for debt issuance. This may be because the other earnings covenants do not include debt.

[24] Griffin et al. (2019) argue the downward trend in covenant violation is due to banks becoming better at setting covenants. Covenants are not triggered as often as they used to, but they are better targeted to capture relevant changes in firm financial health.

Additional Checks for Alternative Explanations In addition to the alternative explanations for the precautionary effect of covenants already explored, I now discuss accounting manipulation and other potential endogeneity problems.

Accounting Manipulation Firms can manipulate their accounting to avoid getting too close to the covenant threshold,[25] but accounting manipulation is unlikely to overturn the baseline regression results for several reasons. First, accounting manipulation weakens the precautionary motive because firms with the ability to manipulate their accounting are less concerned about getting closer to the threshold. Those firms can increase the distance to the threshold with accounting tricks if needed, thus avoiding a covenant breach. I use abnormal operating accruals, a measure of unusually large differences between a firm's cash flow and earnings, as a proxy for a firm's ability to manipulate accounting (Bharath et al., 2008). Appendix Figure A4 shows the marginal effect of the distance to the covenant threshold on investment and debt issuance for firm-years at different percentiles of abnormal operating accruals. Higher abnormal operating accruals indicate a larger potential to manipulate a firm's accounting. The precautionary effect is weaker for firms with higher abnormal operating accruals and becomes statistically insignificant for firms with the highest abnormal operating accruals. Firms with the largest potential to manipulate their accounting indeed seem to be the least concerned about a potential covenant breach.

Second, it is unlikely that firms can manipulate earnings for a long time without banks noticing.[26] Finally, accounting manipulation has become more difficult over time. Franz et al. (2014), for example, find firms switching from accounting to real earnings management after the introduction of the Sarbanes-Oxley Act in 2002.

More Endogeneity Concerns In the following I discuss, whether the presence of covenants in loan contracts or the covenant thresholds are endogenous.

Are covenants only included in loan contracts for specific firms? The answer is no. Roberts and Sufi (2009), for example, find covenants in 97% of loan contracts examined. Therefore the potential endogeneity of the presence of covenants in the loan contract is unlikely to affect my results. Covenants are included in almost all loan contracts.

The tightness of the covenant threshold, however, is negotiated by the bank and the firm at contract initiation and might depend on unobservable information correlated with a firm's subsequent financial health. Demiroglu and James (2010) show that firms with a strong growth potential accept tighter covenant threshold in return for a lower interest rate, thus weakening the precautionary

[25] DeFond and Jiambalvo (1994) find that firms manipulate accruals to avoid covenant breaches, Sweeney (1994) provide evidence for accounting changes increasing earnings before covenant breaches.

[26] Roberts and Sufi (2009) write: "CFOs are required to submit periodic covenant compliance reports that discuss in great detail the computation of and adherence to each financial covenant. Additionally, creditors have significant experience in originating and monitoring loans and are well aware of possible accounting manipulations."

effect.[27] On the other hand, firms in bad financial health might have to accept tight covenants for the bank to be willing to extend credit. To control for unobservable information at loan initiation I re-run the baseline regressions replacing firm with covenant threshold fixed effects. Threshold fixed effects control for any variable remaining constant until the maturity of the loan, including any unobservable information about the firm's future performance at loan initiation. The precautionary effect on debt issuance and investment shown in columns (11) and (12) of Appendix Table A2 remain significant and the coefficient on investment is even larger than the baseline coefficient.[28]

Taken together, the results above point to a causal interpretation of the precautionary effect of covenants on debt and investment. In the next section, I try to address endogeneity concerns by using plausibly exogenous variation in how strongly firms try to avoid covenant breaches.

2.2 Exogenous Variation

In this subsection, I use the introduction of the Basel II regulatory framework (Basel Committee on Banking Supervision, 2006) for banks as a source of variation for how strongly firms try to avoid a covenant breach that is plausibly exogenous to firms' earnings and investment opportunities.[29]

Basel II Under Basel I, the predecessor regulation, banks had to retain 8% of corporate loans as a capital buffer irrespective of the firm's credit risk, i.e. all firms had a 100% risk weight. Basel II changed this: banks have to set aside more capital for riskier firms. Basel II contains two different methods to calculate risk weights: First, for banks using the so-called "Standardized Approach", the risk weight directly follows from a firm's credit rating. Second, banks can use their own models to compute a firm's risk weight under the "Internal Ratings-Based Approach" (IRB). Although banks using IRB have some discretion in how exactly the risk weight is calculated, both approaches make it more expensive for banks to retain loans of riskier firms.

As a side-effect, Basel II introduced variation in the strength of the precautionary motive because firms who become riskier after loan initiation might try harder not to breach a covenant to avoid a renegotiation of their loan. In a renegotiation, a bank subject to Basel II rules is more likely to reduce credit supply to a risky firm because a reduction allows the bank to save capital.[30]

Most developed countries, except for the United States, adopted some version of Basel II in early 2007. In the United States, Basel II rules initially applied only to the largest and most international banks, but those banks account for the majority of loans in my sample.[31] The Dodd-Frank Act of

[27] Matvos (2013) and Green (2018) estimate the benefit of covenants at loan initiation and find that covenants significantly reduce the cost of debt at the firm-level.

[28] The sample size is smaller because only firms with non-missing information on threshold are included.

[29] Thanks to Raffael Auer for suggesting the use of risk weights.

[30] Banks could also increase their capital, but there is evidence that banks prefer to reduce risk-weighted assets (Gropp et al., 2018).

[31] See U.S. Implementation of the Basel Accords. The largest and most international banks had to complete parallel runs starting in 2008, during which they had to calculate regulatory capital using old and new rules. The first banks exited the parallel run in 2014.

2010 required the removal of references to credit ratings to, among other things, calculate bank's capital requirements. This provision was, however, only implemented with Basel III, which took effect in 2014, and my sample ends in 2015.

Empirical Strategy I use a difference in difference strategy comparing the effect of credit rating changes before and after the introduction of Basel II. I expect credit rating downgrades to increase the precautionary effect of covenants more after 2006 because firms know banks might have to set more capital aside to back up their loan. As in the baseline regression, I include firm fixed effects to control for time-invariant unobservables, year fixed effects to control for factors affecting all firms simultaneously, and fixed effects for credit ratings. The main identifying assumption is then that there is no other time-varying factor affecting the precaution of the subset of firms downgraded after 2006 than the change in the banking regulation.

Credit rating changes for firms borrowing from banks using the "Standardized Approach" would provide an ideal setting because some rating changes lead to changes in capital requirements, whereas other rating changes leave capital requirements unaffected (Hasan et al. (2020)).[32] Unfortunately, there are only very few credit rating changes implying changes of capital requirements in my sample to begin with[33] and even fewer when limiting the sample to firms borrowing mainly from non-US banks, i.e. banks using the "Standardized Approach". Instead, I compare the impact of *all* credit rating changes on the precautionary effect on firms, because changes in credit ratings are also likely to be correlated with banks' internal risk measures under the IRB approach and most of the US banks in my sample started implementing IRB in 2008. Because a precise timing of the downgrade is crucial, I use quarterly data and run the following regression:

$$\begin{aligned} Y_{i,t+1} = \alpha_i + \gamma_t + \phi_r + \beta_1(\text{Log Distance to Threshold} \cdot \text{Rating Change} \cdot \text{Post}) + \\ \beta_2(\text{Rating Change} \cdot \text{Post}) + \beta_3(\text{Log Distance to Threshold} \cdot \text{Post}) + \\ \beta_4 \text{Distance to Threshold} < 0 + \beta X_{i,t} + \epsilon_{i,t} \end{aligned}$$

with α_i a firm fixed effect, γ_t a quarter fixed effect, ϕ_r a ratings fixed effect, *Post* a dummy indicating quarters after 2006 and *Rating Change* indicating the quarter of, and two quarters after a credit rating up- or downgrade. Both before after 2006 more than 80% of the rating changes in my sample are down- or upgrades by only one notch, therefore I do not use the variation in the severity of the downgrades.

[32] Under the "Standardized Approach" a credit rating downgrade from AA to AA-, for example, does not change a firm's risk weight, whereas a downgrade from AA- to A+ does increase the risk weight from 20 to 50%.

[33] For US-firms with non-missing distance to covenant threshold and control variables there are 23 credit rating downgrades leading to higher capital requirements under the "Standardized Approach" before 2007 and 7 after 2007 in the sample. For non-US firms, data on covenant threshold is mostly missing in DealScan.

Results Table 4 presents the results. In columns (1) and (2) I find that the log distance to the covenant threshold has a significant positive impact on debt issuance and investment. The effect of a credit rating downgrade on precaution before the introduction of Basel II, i.e. *Downgrade· Log Distance to Threshold*, is not statistically significant. This changes once Basel II is introduced: the coefficient of interest, *Downgrade· Log Distance to Threshold ·Post*, is positive and significant. A downgrade makes firms precautious about breaching a covenant. In columns (3)-(6) of Table 4 I keep only rated firms in the sample to allow for different slopes of the control variables of rated firms compared to unrated firms. The log distance to the covenant threshold is no longer significant when restricting the sample to rated firms. This is not surprising as the sample split in Table 3 indicated that rated firms are generally less concerned about breaching a covenant. The coefficient of interest, however, remains significant and increases slightly in magnitude, even when I include year-rating fixed effects in columns (5) and (6). Rating-year fixed effects control for ratings-specific changes in firm-policy over time, for example, if the Great Recession made debt issuance disproportionately more difficult for low-rated firms. When I exclude the Great Recession from the sample, results I do not report due to space considerations, the coefficient of interest for both investment and debt remain positive and significant. To get a sense of the magnitude implied by the coefficients in column (4) of Table 4 consider a firm at the 10^{th} ("close") and the 90^{th} percentile ("far") of the distance to the covenant threshold distribution. A downgrade has no differential effect before the introduction of Basel II. After 2006, predicted investment of a firm close to the threshold drops to 80% of the sample mean after a downgrade, whereas predicted investment of the firm far away from the threshold is 10% above the sample mean.

Are "rating triggers" in bonds and loan contracts a possible alternative explanation for my findings? These clauses force firms to repay part of their debt or specify an increased interest rate in case their credit rating is downgraded Bhanot and Mello (2006). Because these triggers have been present before the introduction of Basel II and I have not found a change in the regulation concerning these clauses, it seems unlikely that they can explain my findings.

The change in bank capital regulation introduced by Basel II is unlikely to have directly affected firms' investment opportunities. Instead, it changed the sensitivity of bank credit supply with respect to firm risk. Riskier firms, therefore, have a stronger incentive to avoid a covenant breach once Basel II was introduced and this is what I find.

Accounting Rule Change As a final check I use the change in the SFAS 123(r) accounting rule, which forced firms to include option compensation expenses in operating expenses which lowers a firms EBITDA as in Lian and Ma (2020).[34] Appendix Table A3 shows that the distance to the

[34]Using an accounting change in December 2008, which increased the net worth of some firms without affecting their fundamentals, Cohen et al. (2019) find that firms with a net worth covenant increase their leverage, but not their investment. The authors acknowledge that their results about investment might not generalize to other periods, because of the special time the accounting change occurred.

covenant threshold has a positive significant impact on investment even when instrumented with the average option compensation expenses before the accounting rule was issued.

Overall, the results confirm the strong precautionary motive of firms trying to avoid a covenant breach found in the baseline regressions. I now build a quantitative model which allows me to compute the aggregate impact of earnings covenants and the comparison of earnings covenants to alternative models with collateral and earnings *constraints*.

3 Quantitative Model

In this section, I add an earnings covenant to an otherwise standard dynamic heterogeneous firms model with financial frictions. Consider a small open economy with a large number of competitive entrepreneurs[35] and banks. Entrepreneurs are subject to an earnings covenant, which give the bank the right to tighten credit supply whenever a firm exceeds the threshold.

3.1 The Entrepreneur's Problem

Entrepreneurs have access to a decreasing returns to scale production function with capital as input: $y_{it} = z_{it}k_{it}^{\alpha}$ with z_{it} a persistent firm-specific productivity shock and k_{it} the capital stock the firm owns. Entrepreneurs can save and borrow using uncontingent one-period debt b, which yields an exogenous interest rate r, but they cannot issue equity.

As in most of the literature, every year, a fraction γ of entrepreneurs is forced to consume all their assets and is re-born the next period with a low stock of capital and savings otherwise all entrepreneurs could save enough to finance investment only through internal finance. Absent borrowing constraints, newborn firms would be able to borrow enough to reach the efficient capital stock level. But entrepreneurs' borrowing is limited to a fraction θ of their capital stock. In addition to the net worth constraint, there are convex investment adjustment costs and a time to build assumption for capital, all of which combined slow down the accumulation of capital. These additional frictions are standard in the literature and needed to generate realistic investment behavior. To separate the effect of the limits on borrowing from the convex investment adjustment costs and time to build, I will compare models with and without limits on borrowing while keeping the other frictions in place.

The novel part of the model is the earnings covenant. The earnings covenant determines the tightness of the net worth constraint θ. In this model, θ can be either loose or tight. I will discuss the determination of θ and the probability of next period's θ, $\pi_{\theta'}$, in detail below. For now, with θ and $\pi_{\theta'}$ given, the entrepreneur's problem is standard. Entrepreneurs who know they will

[35] In the empirical part, I am using data from publicly traded firms which are quite different from entrepreneurs. Unfortunately, there is no loan contract data available for private firms, and even credit registry data usually have no information about covenants. Appendix A.4 shows some anecdotal evidence that loans for small firms do contain covenants.

not exit this period maximize their flow utility and expected continuation value with respect to consumption, next period capital, and next period debt:

$$V(k,b,z,\theta) = \max_{c,k',b'} \frac{c^{1-\sigma}}{1-\sigma} + \beta \sum_{\theta'} \pi_{\theta'} \sum_{z'} \pi_{z'|z} V(k',b',z',\theta')$$

subject to:

$$c + i \leq zk^{\alpha} + \frac{1}{1+r} b' - b - \Phi(i)$$

$$i = k' - (1-\delta)k$$

$$b' \leq \theta k,$$

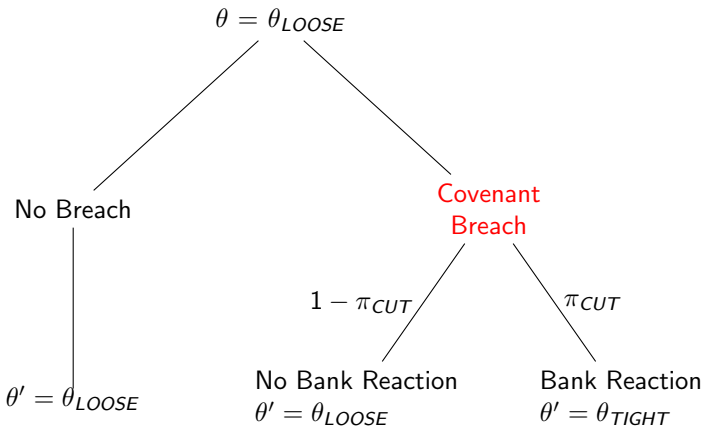
where β denotes the discount factor. Entrepreneurs finance their consumption and investment using the output from production and net borrowing. Investment is subject to an adjustment cost $\Phi(i)$ that has to be paid in period t, while capital can only be used next period.[36] Next period borrowing b' is limited to a fraction θ of the firm's current capital stock. Even though default is technically possible in the model, in equilibrium entrepreneurs do not default on their debt. Without an earnings covenant, the net worth constraint θ remains constant over time, and the model corresponds to a standard model.

The Earnings Covenant Entrepreneurs in this model are subject to an earnings covenant in addition to the net worth constraint. The earnings covenant specifies a maximal ratio of debt to earnings $\widehat{\frac{b}{y}}$, the most common type of covenant in the data. When an entrepreneur's debt to earnings ratio is lower than the threshold, the net worth constraint is loose ($\theta = \theta_{LOOSE}$). This corresponds to the left-hand side branch in Figure 2. When the debt to earnings ratio exceeds the threshold $\widehat{\frac{b}{y}}$ the entrepreneur breaches the covenant. For a given level of productivity and stock of capital, entrepreneurs can influence the probability of a covenant breach by taking on more or less debt.

Once the covenant is breached, the bank has two options to react: it can either reduce the firm's access to credit by tightening the net worth constraint $\theta = \theta_{TIGHT}$ or it can waive the covenant breach and keep $\theta = \theta_{LOOSE}$. Banks tighten a firm's access to credit after a covenant breach with an exogenous probability π_{CUT}, represented by the right-hand side branch of Figure 2. In case of

[36] This time to build assumption is standard in macro, see for example Gopinath et al. (2017) and Khan and Thomas (2013).

Figure 2: Evolution of the Entrepreneur's Net Worth Constraint Tightness θ



a credit cut, the firm's net worth constraint is tight next period and returns to θ_{LOOSE} the period after, unless the firm has breached the covenant again.

While simplistic, this specification of the earnings covenant captures the main features of covenants in microeconomic models:[37] covenants relax borrowing constraints ex-ante, the contract gives control to the firm in case of good performance and to the lender in case of bad performance and, finally, in some cases of lender control, the lender reduces credit supply.[38]

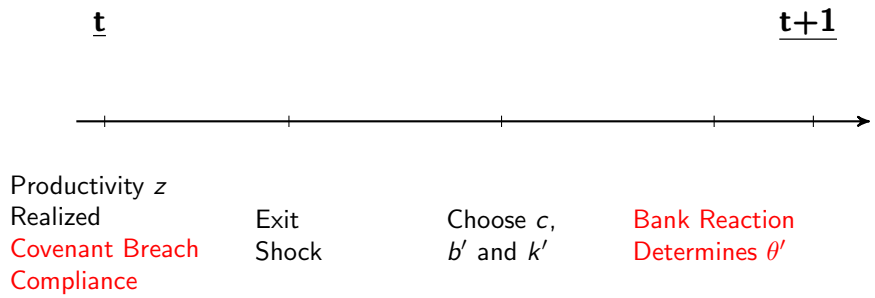
The bank's decision to cut credit supply is random after a covenant breach, which simplifies the solution of the model. Although one might expect banks to cut credit only for the worst firms, there is evidence that shocks to banks' financial health unrelated to borrower characteristics matter for credit supply as well. Chava and Purnanandam (2011), for example, report a decline in investment by bank-dependent firms who borrowed from banks exposed to the Russian sovereign default in 1998. Murfin (2012) finds that banks write stricter covenants after suffering losses unrelated to the borrower's financial health.[39] Using data by Sufi (2009), I compare the characteristics of firms with a large decrease in their credit line against firms with a small or no decrease in their access to credit one year after a covenant breach in Table A4. There is no significant difference in observable characteristics between the two groups of firms, except that firms experiencing a large decrease in their credit line have lower leverage. Table A4 suggests that banks' decision to cut access to credit

[37] Covenants in an incomplete contracts framework: Aghion and Bolton (1992), Garleanu and Zwiebel (2009), covenants in a complete contracts framework: Dewatripont and Tirole (1994), Xiang (2019) provides a micro-foundation based on shareholders' inability to commit to not issuing more debt for covenants in a dynamic setting.

[38] Covenants emerge naturally in an incomplete contract framework where firm productivity is persistent, and debt is used to finance firms. If the firm is in control, it overinvests due to risk-shifting in bad states of the world, whereas if the lender is in control, it might under-invest in good states of the world because of a hold-up problem. An earnings covenant therefore optimally allocates control rights to the firm in good states, and to the lender in bad states of the world.

[39] There is even more evidence for the transmission of bank health shocks to borrowers during recessions. See, for example, Chodorow-Reich and Falato (2017).

Figure 3: Timing



to a firm, while probably not random as in the model, does not directly depend on a firm's financial health.

Timing Figure 3 shows the timing of events in the model: First, firm-specific productivity is realized, which determines whether the entrepreneur breaches the covenant or not. Then the entrepreneur learns whether he will be forced to exit this period. The entrepreneur then decides about consumption, next period debt, and capital. Finally, the bank loss shock is realized: when the entrepreneur has breached a covenant, the bank shock determines if the bank cuts the entrepreneur's next period credit or not.

Entrepreneurs in this model do not know their productivity when taking the borrowing and investment decision. This assumption is important as it makes it more difficult for firms to avoid a covenant breach.

Model Evaluation I compare the earnings covenant model to a model with a net worth constraint only and a model with an earnings constraint. In the net worth constraint model θ is constant, corresponding to how a large part of the existing macro literature has modeled financial frictions (Gopinath et al. (2017), Buera et al. (2015), Buera and Moll (2015), Khan and Thomas (2013), Zetlin-Jones and Shourideh (2017), Midrigan and Xu (2014), Jermann and Quadrini (2012)). The net worth/collateral constraint ties the amount a firm can borrow to the collateral provided, as in the real world (Flannery and Wang, 2011). Different from the covenant model, the bank does not have the right to call back the loan.

Second, I replace the net worth constraint by an earnings constraint as in Drechsel (2019) and motivated by Lian and Ma (2020). Figure 7 summarizes the borrowing restrictions of the three models. A model without any restriction on borrowing serves as a common benchmark.

3.2 Parametrization

The parameters of the model are either set to values commonly used in the literature, directly taken from the data, or set to match a moment in the data. Table 5 shows all parameter values.

Set Parameters I set the discount factor β, the depreciation rate δ, and relative risk aversion σ to values commonly used in the literature. Returns to scale α are set to 0.62 as estimated by Hennessy and Whited (2007) using US public firms data. The exit rate γ is set to 5%. This value is roughly in the middle between Khan and Thomas (2013), who use establishment-level data and set the exit rate to 10% and Begenau and Salomao (2018), who use firm-level data and find an exit rate of 1.7%. The investment adjustment cost parameter ϕ is set to 3 as in Gopinath et al. (2017).

The parameters guiding the firm-level productivity process, ρ_z and σ_z are estimated. I compute Solow residuals by running the following regression on the entire[40] Compustat sample:

$$log(y_{ist}) = \alpha_i + \beta_s^k log(k_{ist}) + \beta_s^l log(l_{ist}) + z_{ist}$$

with y_{ist} sales deflated by a GDP deflator, k_{ist} the capital stock computed using the perpetual inventory method and l_{ist} the number of employees. The input elasticities are allowed to vary across 30 Fama-French industries indexed by s. To keep the model as close as possible to the data, I then restrict the sample to firms included in the baseline regression above. I also winsorize the Solow residuals $\hat{z}_{ist}$ at 5% before estimating the following AR1 process:

$$log(\hat{z}_{ist}) = \rho_z log(\hat{z}_{ist-1}) + \epsilon_{ist}.$$

I find a persistence parameter ρ_z of 0.7 and a standard deviation of productivity shock σ_z of 0.23.[41] Hennessy and Whited (2007) find a similar persistence parameter ρ_z of 0.68 and a lower σ_z of 0.12. I discretize the estimated productivity process to a six-state Markov chain using the Tauchen (1986) method.

I set the earnings covenant threshold, the maximal allowed ratio of debt to earnings without breaching the covenant, $\widehat{\frac{b}{y}}$ to 3, the most frequent covenant threshold in my regression sample, see Appendix Figure A3.

I use data on credit lines and covenant breaches provided Sufi (2009) to determine the probability of credit line cut π_{CUT} and the tightness of the loose net worth constraint θ_{LOOSE}. Sufi (2009) provides information about the used and unused portion of credit lines and whether or not a firm is breaching a covenant for 300 randomly chosen firms between 1996 and 2003. I compute the change in the size of a firm's credit line between the year of the covenant breach and the next year. I find

[40] I exclude financial firms and utilities as well as firms with negative sales or assets or firms which report an acquisition larger than 5% of their assets.

[41] The sample size is 21250 firm-years and the R^2 is 0.48

a credit line decrease of more than 25%[42] after 29% of covenant breaches in the sample, close to the 30% probability of a credit supply tightening reported by Roberts and Sufi (2009). Therefore I set π_{CUT} to 0.29.

To determine θ_{LOOSE}, the tightness of the loose net worth constraint, I compute the unused portion relative to the total size of a credit line in years without a covenant breach. Appendix Figure A6 shows that only 3% of firms use the total amount of their credit line. Most firms do not appear to be directly constrained in the quantity of borrowing therefore I set θ_{LOOSE} to infinity. Allowing firms to borrow unlimited amounts in case of no covenant breach also simplifies the decomposition between the precautionary and direct cost on investment below. With θ_{LOOSE} never binding all differences in investment relative to the model without borrowing constraints can be attributed to the precautionary effect of covenants.

Calibrated Parameters The tightness of the net worth constraint after a bank cuts the firm's access to credit, θ_{TIGHT}, is set to match aggregate leverage in the data. I find $\theta_{TIGHT} = 0.65$. For the net worth constraint model and the earnings *constraint* model, θ is also set to match aggregate leverage. For the net worth constraint model I find $\theta_{\frac{b}{k}} = 0.82$. θ_{TIGHT} in the earnings covenant model is more restrictive than $\theta_{\frac{b}{k}}$ found for the net worth constraint model. This is not surprising as θ_{TIGHT} affects only the subset of firms who breach a covenant *and* have their credit cut, whereas, in the net worth constraint model, the amount of borrowing of all firms is restricted by $\theta_{\frac{b}{k}}$ at all times. Therefore θ_{TIGHT} has to be stricter to attain the same aggregate leverage. For the earnings constraint model, I find $\theta_{\frac{b}{y}} = 4.66$, close to the average reference level of debt to EBITDA in Lian and Ma (2020). The debt to EBITDA *constraint* is much looser than the debt to EBITDA *covenant* although both models have the same aggregate leverage.

4 Results

This section presents steady-state results of the earnings covenant model and compares them to the net worth and earnings constraint models.[43] First, I compare the aggregate cost of earnings covenants on investment to the cost of the other two financial frictions and then I decompose the cost into a direct and an indirect, precautionary cost. Then I use simulated model data to study the implications of earnings covenants at the firm-level and compare firm-level data across models.

[42] Changing the cut-off value does not change the probability by a lot. The probability of a 20% or a 40% credit line decrease after a covenant breach is 0.37 and 0.23 respectively.

[43] I use standard value function iteration to solve the models. Firms' capital, debt holdings, and productivity can take values on grids with 155, 365, and 6 points respectively. Given entrepreneurs' optimal decision rules, the productivity process, and an initial guess for the distribution of entrepreneurs, I iterate on the firm distribution until convergence.

4.1 Aggregate Results

Table 7 presents the aggregate results. Each column corresponds to a different model. Panel A of Table 7 reports the main aggregate variables relative to the benchmark model without limits on borrowing. Investment in the earnings covenant model is 14% below aggregate investment in the benchmark model (column 1).[44] Average firm value in the earnings covenant model is 4.7% lower than in the benchmark economy. As a comparison, earnings covenants are costlier than short-term income targets in Terry (2017), who finds a 1% decrease in average firm value, but less costly than agency frictions related to firm manager's diversion of cash resources in Nikolov and Whited (2014), who finds a 6% decrease in average firm value. The cost of earnings covenants is sizable, especially because firms in the earnings covenant model face no limitations on borrowing unless their access to credit is cut after a covenant breach and even then borrowing is limited only for one period.

How costly are earnings covenants relative to net worth/collateral constraints? Column (2) in Table 7 shows that the cost of net worth constraints on aggregate investment is also 14%. Therefore earnings covenants have a quantitatively similar impact on aggregate investment as the well-studied net worth/collateral constraints. Turning to the earnings *constraint* model, shown in column (3) of Table 7, aggregate investment 17% is below the benchmark economy, making earnings constraints the costliest restriction on borrowing studied.

The ranking of the costs is similar for investment, output, and the capital stock, with earnings covenant being the least, and earnings constraints the costliest restriction on borrowing. The ranking is different for aggregate TFP and average firm value, which is lower in the earnings *covenant* model than in the earnings *constraint* model, with the net worth constraint model having the highest decrease in TFP and average firm value. Why are earnings *constraints* so costly for investment, capital, and output, but not TFP and average firm value? Earnings depend on random productivity shocks and therefore fluctuate a lot. Firms subject to an earnings *constraint* try to avoid default by issuing less debt and investing less, but they do so proportionally to debt issuance and investment in the benchmark model. This proportional decrease lowers investment, the stock of capital and output but not does not lower aggregate TFP and firm value to the same extent. In contrast, in the earnings *covenant* model and the net worth constraint model, the net worth constraint distorts debt issuance and investment relative to the benchmark economy, thus reducing aggregate TFP and firm value.

Turning to output, the difference relative to the model without borrowing constraints can be due to lower use of capital or a worse allocation of capital among firms. Similar to Catherine et al. (2018)[45] I find that across all models, the decrease in the use of capital is much larger than the

[44] This model-based cost estimate is larger than the in-sample estimate of 4.2% found in Section 2.1. On one hand, the empirical estimate might understate the actual cost, because even firms at a large distance to the covenant threshold might still be precautious, on the other hand, the model might overstate the actual cost, because firms in the model have fewer alternative sources of funding and cannot, for example, use accounting tricks to avoid a covenant breach.

[45] Catherine et al. (2018) find that removing collateral constraints increases output by 7.2%.

decrease in aggregate TFP.

Panel B of Table 7 shows aggregate moments. The share of firms breaching an earnings covenant each year is 6%, close to the 10% in my data. The share of firms borrowing as much as allowed by their constraint is 1.4% earnings *covenant* model. These firms have breached a covenant, had their credit supply cut, and have a high demand for borrowing. In the earnings *constraint* model about 2% of firms are borrowing as much as allowed by the constraint. Turning to the net worth constraint model, more than a third of firms face a binding net worth constraint.[46] Comparing the models to the data, Hoberg and Maksimovic (2014) find a share of 5.7% financially constrained firm-years based on a text analysis of firms' annual reports. Therefore the earnings covenant and earnings constraint model seem to generate a more realistic share of directly financially constrained firms than the net worth covenant model.

A comparison of the share of constrained firms across models in Panel B and the cost on investment in Panel A of Table 7 makes clear that there is no direct relation between the two. To better understand the difference in the cost on investment across models, I decompose the difference in aggregate investment relative to the benchmark model into a direct effect, i.e. lower investment of firms facing a binding constraint, and a precautionary effect. The precautionary effect comes from firms lowering investment *before* hitting the constraint. I compute the shares of the difference in investment as follows:

$$\text{Direct Share} = \frac{\sum_{k,b,z} \left(i_{k,b,z} - i^{\text{Benchmark}}_{k,b,z} \right) \mathbb{1}[b_{k,b,z} = \theta k_{k,b,z}] f_{k,b,z}}{I^{\text{Benchmark}}}$$

$$\text{Precautionary Share} = \frac{\sum_{k,b,z} \left(i_{k,b,z} - i^{\text{Benchmark}}_{k,b,z} \right) \mathbb{1}[b_{k,b,z} < \theta k_{k,b,z}] f_{k,b,z}}{I^{\text{Benchmark}}}$$

with $i_{k,b,z}$ firm-level investment, $I^{\text{Benchmark}}$ aggregate investment in the benchmark economy and $f_{k,b,z}$ the firm-size distribution.

Panel C of Table 7 shows the results of the decomposition. More than 95% of the cost on aggregate investment in the earnings covenant model is due to the precautionary motive. This model-based share is close to the 78% in-sample estimate in Section 2.1. The precautionary cost in the earnings covenant model is large because 44% of firms with positive debt in the model, have more debt outstanding than what the tight debt to capital ratio θ_{TIGHT}, the maximum debt to capital ratio in case of a credit cut after a covenant breach, would allow. When these firms

[46] Similar to the share of 17% of firms with a binding borrowing limit at steady-state found by Khan and Thomas (2013)

are hit by bad productivity shocks they reduce debt issuance and investment to avoid a covenant breach and a possible default in case the bank lowers their access to credit to θ_{TIGHT}. Figure 8 illustrates this mechanism by comparing the policy functions of the earnings covenant model against the benchmark economy. Holding productivity fixed, firms in both models reduce investment the higher their debt holdings. But once debt to capital exceeds θ_{TIGHT}, the first vertical line in the graph, firms in the earnings covenant model reduce investment by more than firms in the benchmark economy. This continues up to the point of the covenant breach, marked by the second solid line in the graph.

Turning to the other models, Panel C of Table 7 shows that the precautionary share for the earnings *constraint* model is almost the same as in the earnings covenant model. For the net worth constraint model, only 75% of the total cost is due to the precautionary effect. In the earnings covenant and the earnings constraint model, firms reduce debt issuance and investment even they may appear financially unconstrained, whereas, in the net worth covenant model, firms have to reduce investment when they are at the borrowing limit.

Discussion of Modeling Assumptions I now discuss how the modeling assumptions in the earnings covenant model might affect the aggregate results.

Modeling the restriction in credit supply after a covenant breach as a tight net worth constraint is likely to underestimate the precautionary cost of earnings covenants for two reasons. First, the net worth constraint is tight only for one year. This is short because, after a covenant breach, it takes firms more than two years on average to obtain a new loan (Freudenberg et al., 2017). Second, instead of imposing a tight net worth constraint, banks in the model could impose a tight debt to earnings constraint after a covenant breach. Because firms' debt to earnings are more volatile than net worth, this alternative restriction of credit supply is likely to increase the precautionary cost of covenants.

The decision to cut credit after a covenant breach in the model is random, while in reality, banks might only cut credit to firms in bad financial health. In the data, however, I find no statistical difference between the financial health of firms who experienced a credit cut after a covenant breach and those firms who kept access to their credit (Appendix Table A4). Furthermore, in the model, firms with high debt to capital ratios before a covenant breach, i.e. financially unhealthy firms, reduce their investment more than financially healthy firms with low debt to capital ratios, even when the bank cuts their access to credit.[47] Firms in financial distress, therefore endogenously react more to the random credit cut in the model.

The decreasing returns to scale assumption creates a size effect. Firms closer to their optimal level of capital are more likely to breach the covenant. But because the only possible bank reaction in the model is a tightening of the firm's maximal debt to capital ratio, which is linear in capital,

[47] See Figure 11 discussed below.

larger firms are less concerned about a covenant breach because they have a lower debt to capital ratio relative to a small firm holding debt to earnings constant.

The aggregate numbers in this section are not informative about whether the models can generate realistic firm behavior. Therefore I use simulated firm-level data in the next section to compare the different models to actual data.

4.2 Firm-Level Results

In this section, I use simulated firm-level data to evaluate the earnings covenant model and for further comparisons to the earnings constraint and net worth constraint models. First, I compare different moments and distributions to the data, then, I re-run the same regressions as in the empirical part, and finally, I compare firms in the model to actual firms around covenant breaches.

Distributions and Moments I start by comparing the distribution of the distance to the covenant threshold of the simulated data against the actual data in Figure 1. The two distributions are very similar. The earnings covenant model can reproduce this important feature of the data.

To evaluate the fit of the models, I compare the distribution of debt to earnings and debt to capital to the data. I restrict the baseline sample to firms with a debt to earnings covenant threshold of 3, as in the earnings covenant model. The top row of Figure 9 shows that the earnings *covenant* and the earnings *constraint* model have a similar debt to earnings distribution, even though the covenant threshold is much tighter than the earnings constraint. The net worth constraint model generates a more realistic debt to earnings distribution than the earnings covenant and the earnings constraint models. Turning to the debt to capital distribution in the bottom row of Figure 9 the picture is different: the net worth constraint truncates the debt to capital ratio distribution for the net worth constraint model, whereas the earnings *covenant* and the earnings *constraint* model generate distributions somewhat closer to the data.

I now compare characteristics of credit-constrained and precautious firms across the three models. Table 9 provides firm-level characteristics for all three models. Panel A shows that the average firm in all three models have similar debt to earnings ratios, whereas firms in the earnings *constraint* model have much higher debt to capital ratios on average. In the other two models debt to capital is either restricted for all firms, in the net worth constraint model, or for firms after a credit cut, in the earnings covenant model.

Panel B of Table 9 limits the sample to credit-constrained firms, who account for the direct cost. These firms differ markedly across the three models: In the earnings *constraint* model, debt to EBITDA of constrained firms is above four, in the earnings covenant model, it is above three and above one in the net worth constraint model. In the net worth constraint model, young, small, and relatively productive firms are credit-constrained, whereas, in the other two models,

credit-constrained firms are older, less productive, and larger.

Characteristics for firms responsible for the precautionary cost are shown in Panels C of Table 9. In the earnings covenant model, the average firm in the highest precaution tercile has a debt to earnings ratio of about 2. The corresponding number in the earnings *constraint* model is 2.5, even though the earnings constraint is at 4.4. Firms are similar among most other dimensions.

A more direct test of the earnings *covenant* against the earnings *constraint* model using firm-level data would be preferable. Unfortunately, there is no firm-level data on earnings constraints. Lian and Ma (2020) motivate the use of earnings constraints mostly by empirical evidence on earnings *covenants*.[48] The lack of firm-level data about earnings constraints make further tests between earnings constraints and earnings covenants against actual data challenging.

Before turning to the regressions, I investigate whether the earnings covenant model reproduces the most important cross-sectional and within-firm moments. Panel A of Table 8 compares cross-sectional moments. The standard deviations of investment and the log distance to the covenant threshold are similar, but the firm size distribution is more spread out in the data than the model. The model under-predicts the share of firms breaching a covenant, but the share of first-time breaches after one year of no breach is almost the same. In Panel B of Table 8 I compare regression coefficients to examine differences in the time-series properties. The auto-correlation coefficients of productivity and EBITDA are similar, but the autocorrelation coefficient of the log distance to the covenant threshold is larger in the model than in the data. Finally, firms in the model are more likely to repeatedly breach a covenant compared to actual firms. Because I use the text-based measure of covenant breaches for the actual firms, measurement error might explain this difference. Overall, key moments of the model data are similar to moments based on actual data.

Regression I re-run the same regression as in Section 2 on simulated earnings covenant model data. Table 10 presents the results. A covenant breach has a significant negative impact on debt issuance (column 1) and investment (column 2). The economic size is larger in the model than the data for debt issuance and investment. Different from the model, banks in the real world can tighten credit supply in many different ways, which might not affect debt issuance or investment, i.e. require more collateral, limit capital expenditures directly or ask for cost-cutting measures. In the model, on the other hand, banks can only directly restrict the quantity of credit available to the firm.

As in the actual data, I use the log difference to the covenant threshold as a measure of the precautionary motive. Columns (3) and (4) of Table 10 show an increase in the log distance to the covenant threshold has a significant positive impact on debt issuance and investment. A one

[48] Lian and Ma (2020) do mention "reference levels" of debt to EBITDA used by lenders as an example of debt to earnings *constraints* that are not covenants, but the authors also note that these "reference levels" are not legally binding and only indirectly observable. Furthermore, "reference levels" only matter when a firm wants to issue new debt, whereas most covenants matter during the lifetime of the loan.

standard deviation increase in the log distance to the covenant threshold increases the investment rate by 0.29 percentage points, which corresponds to 3% of the standard deviation of the investment rate. The economic size of the coefficients is again similar to the ones found using actual data. Because the coefficients have not been targeted in the calibration, this suggests that the model can generate realistic firm behavior.

I now examine the relationship between the earnings covenant and the net worth constraint in the model. Appendix Figure A5 shows the marginal effect of the distance to the covenant threshold for different distances to the tight net worth constraint, θ_{TIGHT}. The marginal effect is highest for firms borrowing more than what would be admissible under θ_{TIGHT} and decreases as the distance to θ_{TIGHT} becomes positive and larger. The precautionary effect of earnings covenants in the model is driven by the firms most exposed to a decrease in credit supply.

Covenant Breach As a final check for how well the earnings covenant model fits the data, I turn to firm variables around covenant breaches.

I select three-year windows around covenant breaches in the simulated and the actual data and take the median across episodes. Firm variables around covenant breaches, as shown in Figure 10, evolve similarly both in the model and the data. In both the model and the data, firms breaching a covenant experience a steep drop in TFP that leads to the covenant breach and a sharp recovery after the breach. The pre-breach decrease in TFP is reflected in the debt to earnings ratio, which increases strongly before the covenant breach. Firms' distance to the covenant threshold falls from around 0.5 in the data and 1 in the model three years before the breach to about -1 and -0.5 when the covenant breach occurs. Investment falls already falls two years before the covenant breach and then stabilizes. As firms get closer to the threshold, they reduce investment and shareholder payouts to avoid breaching the covenant. Qualitatively the patterns in Figure 10 are remarkably similar in the model generated data compared to the actual data.

The simulated data allows to separate episodes with and without bank reaction, something that is difficult to do in the data, as well as episodes, where the firm has borrowed more than the tight debt to capital ratio θ_{TIGHT}. Firms with a higher debt to capital ratio than θ_{TIGHT} before the breach are the firms most exposed to a credit cut. Figure 11 shows the evolution of firm variables for the four groups of firms separately. Firms borrowing more than θ_{TIGHT} before the breach *and* experiencing a credit cut have to lower their stock of debt to attain a debt to capital ratio of $\theta_{TIGHT} = 1.2$ one year after the covenant breach. These firms cut investment sharply, whereas investment of the other firms remains relatively stable.

5 Conclusion

This paper quantifies the cost of financial covenants on investment. In addition to the well-documented direct effect of covenants from covenant breaches, I provide empirical evidence for

an indirect, precautionary cost of covenants. Firms reduce debt issuance and investment when they approach the covenant threshold to avoid a potentially costly covenant breach. I use the introduction of the Basel II regulatory framework for banks, which lead to an increase in firms' precautionary motive, which is plausibly exogenous to firms' investment opportunities. I find no significant impact of a credit rating downgrade, a measure for a change in a firm's risk, on precaution before, but a significant positive impact on precaution after the introduction of Basel II, supporting a causal interpretation of my baseline results.

I then incorporate earnings covenants into an otherwise standard model with heterogeneous firms to quantify the aggregate cost of covenants. The earnings covenant in the model determines the tightness of a firm's net worth constraint. In a calibrated version of the model, earnings covenants reduce aggregate investment by 14% relative to a model without borrowing constraints. I also find that precaution accounts for 95% of the overall cost of covenants.

My findings suggest taking a broader view of financial frictions when studying firms' financing and investment decisions. First, I find that firms restrict their debt issuance and investment because of covenants, even though they do not appear financially constrained by conventional measures. Second, I document that financial covenants are a quantitatively important source of financial frictions. This second result is in line with the new macro literature highlighting the importance of earnings-based constraints.

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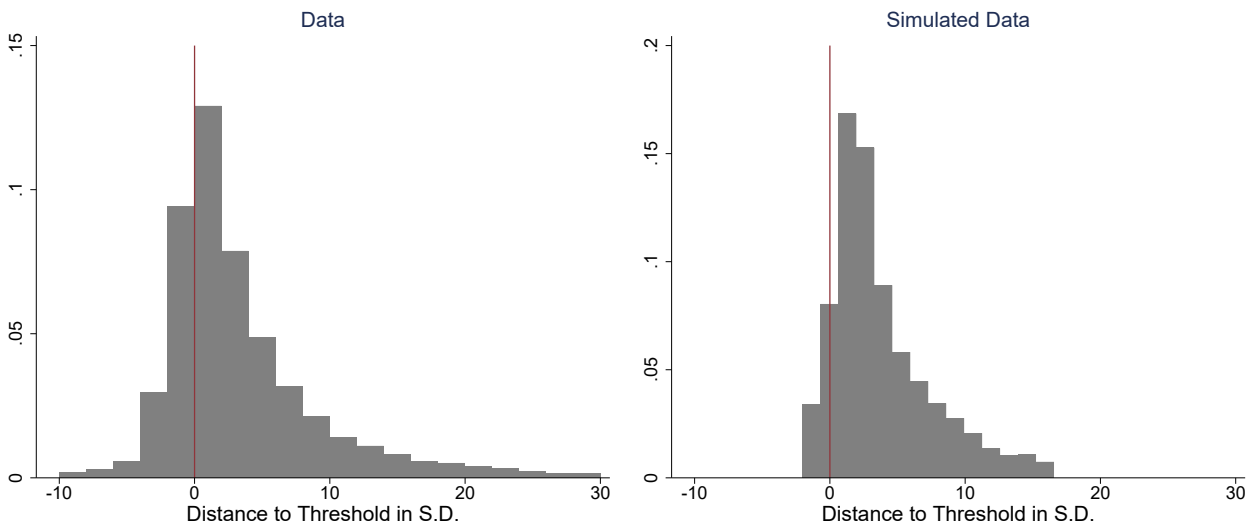
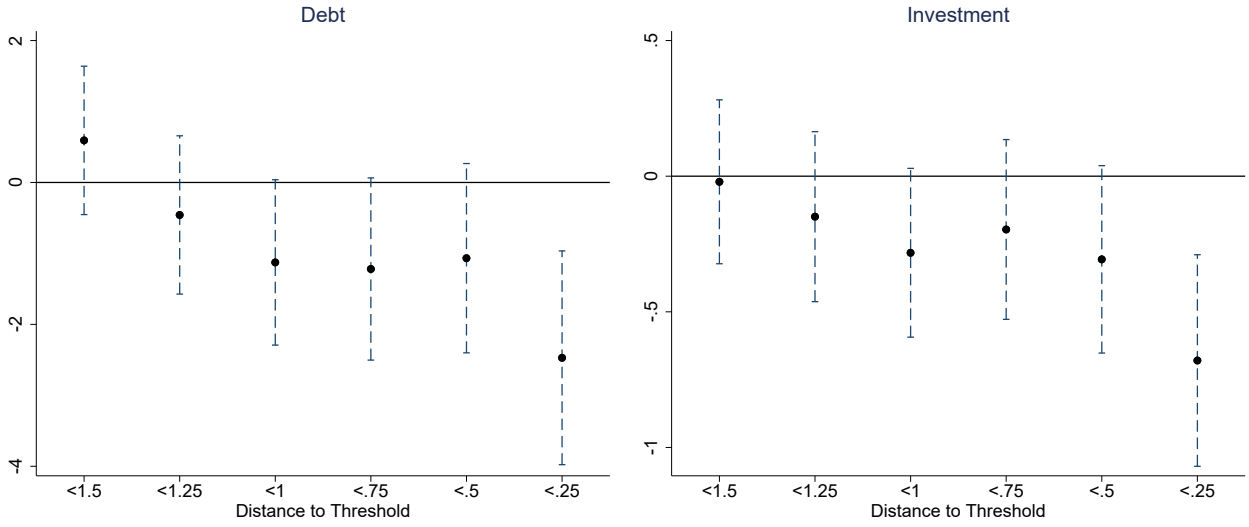
Figures and Tables

Figure 1: Distribution Distance to Threshold



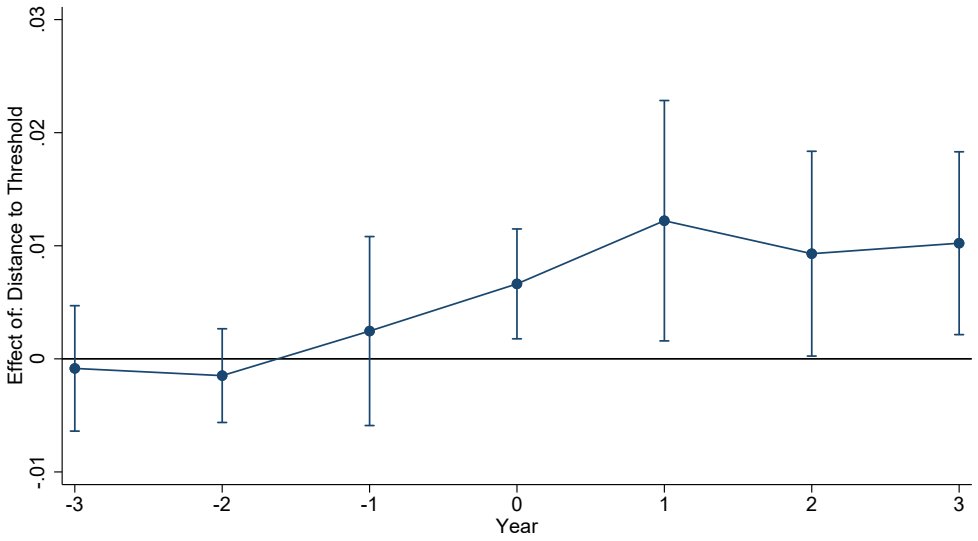
Distribution of the distance between a firm's debt to EBITDA ratio and the debt to EBITDA covenant threshold divided by the standard deviation of debt to EBITDA. Firms to the left of the zero line breach their covenant. Simulated data are from the earnings covenant model. Firms younger than 4 years are excluded from the simulated data.

Figure 4: Distance to Covenant Threshold



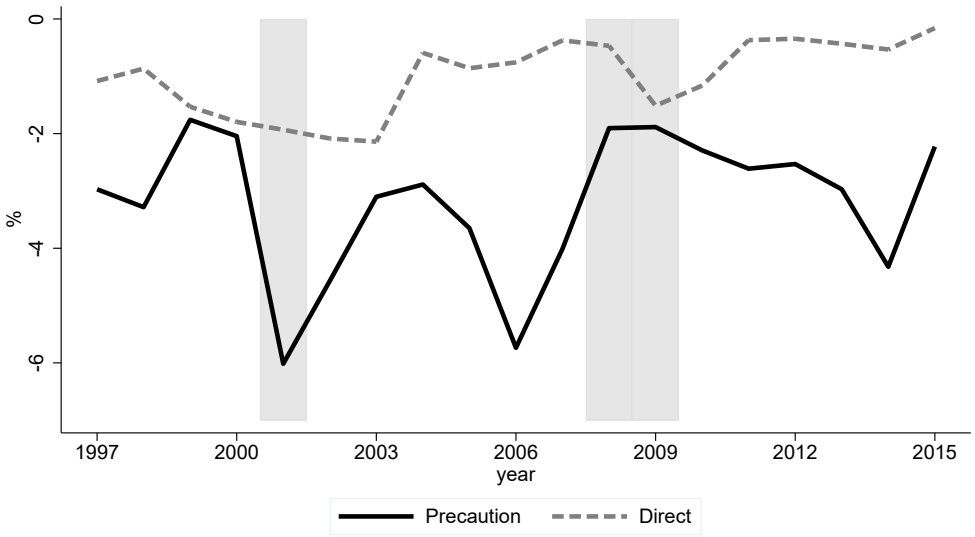
Regression with dummy coefficients indicating a distance of 1.5, 1.25,... 0.25 between the firm's debt to EBITDA ratio and the debt to EBITDA covenant threshold. The reference group are firms with a distance larger than 1.5 to their covenant threshold. The dependent variables are the change in total debt between t+1 and t scaled by total assets in t and investment in t+1 scaled by total assets in t. Control variables are the same as in the baseline regression. Lines indicate 95% confidence intervals.

Figure 5: Event Study around Contract Changes



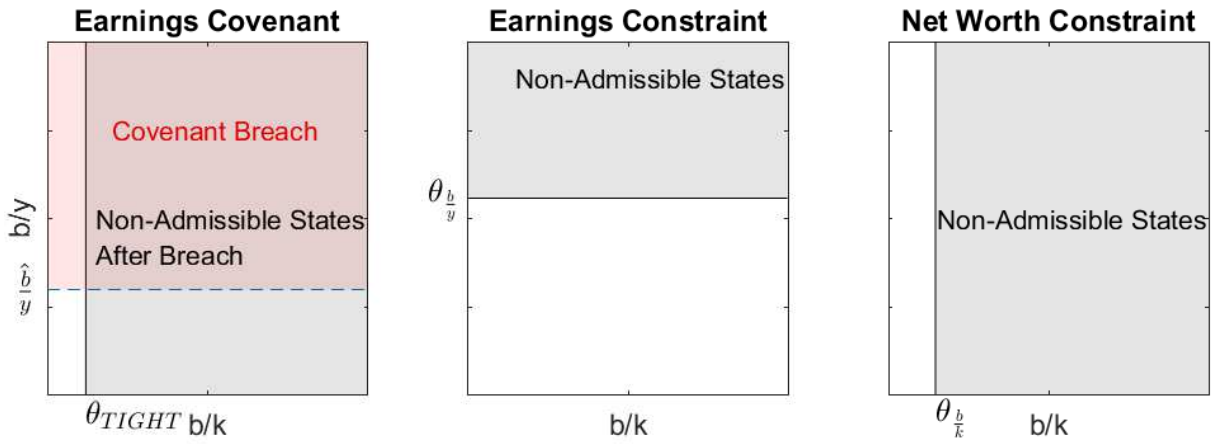
The graph shows the interaction coefficient of the distance to the earnings covenant threshold and dummies, indicating the year relative to the introduction of an earnings covenant in the loan contract in year 0. Vertical lines indicate 90% confidence intervals. The dependent variable is capital expenditures in t+1 scaled by total assets in t. The sample is restricted to firms with a contract including only net worth covenants from $t = -3$ until $t = 0$ and a contract including at least one earnings covenants from $t = 0$ until $t = 3$. For the period $t = -3$ until $t = 0$. The sample includes 543 firm-years from 100 firms. I compute a hypothetical distance to the threshold based on the $t = 0$ earnings covenant threshold. I exclude firms with more than one contract change in the sample. The distance to the covenant threshold is divided by the standard deviation of the covenant variable. Dummies for the year relative to the contract change are included. Distance to earnings covenant threshold and investment are winsorized at 1%. Standard errors are clustered at the firm-level.

Figure 6: Aggregate Effect in Sample



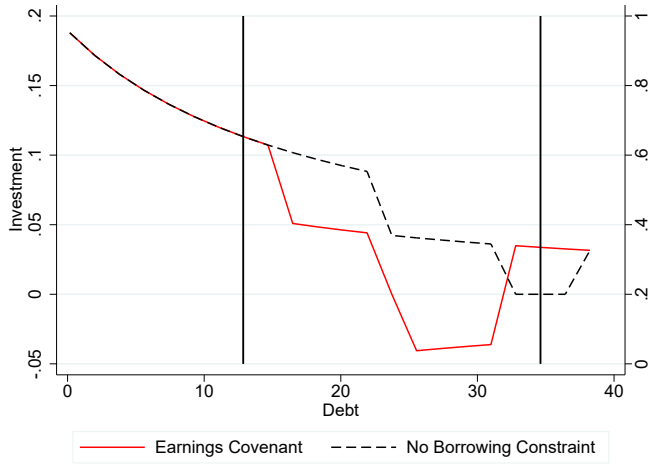
Difference between aggregate in-sample investment and a counterfactual aggregate investment i) without the direct cost of covenant breaches (dashed line) and ii) without the precautionary cost of covenants (solid line). Grey shaded bars indicate NBER recessions. Predicted investment is from the baseline regression. Counterfactual investment without the direct cost is obtained by adding back the decrease in investment due to a covenant breach (text-based measure). The counterfactual investment without the precautionary cost is calculated by assuming that all firms have a log distance of one to their debt to EBITDA covenant threshold. This corresponds approximately to the maximum distance in the sample (2.9).

Figure 7: Borrowing Restrictions



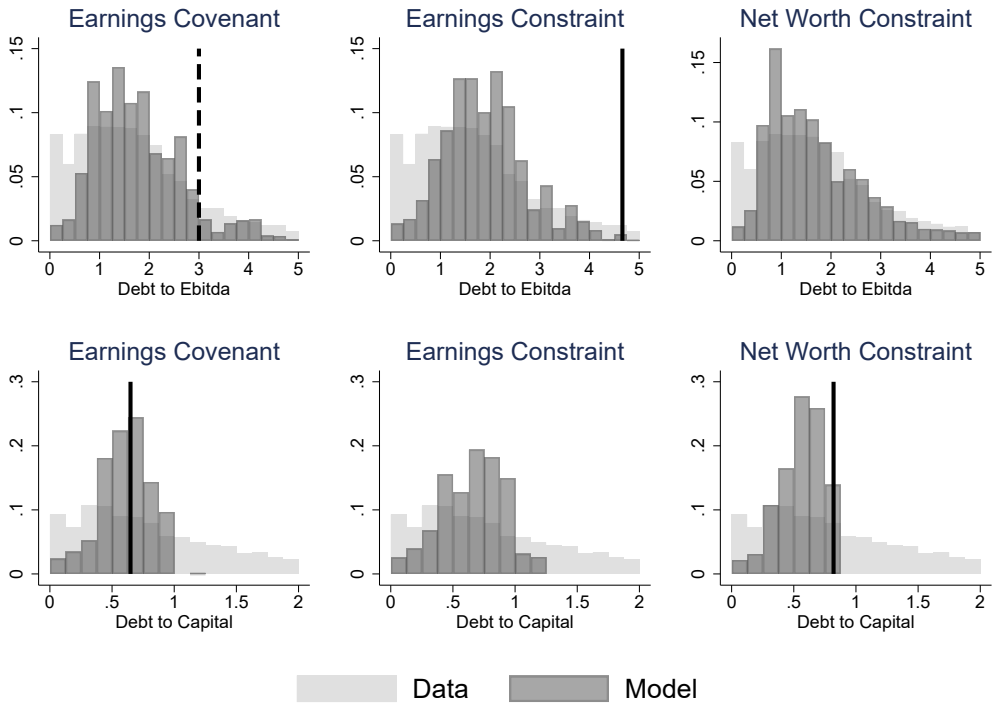
Borrowing restrictions in the three models. The y-axis represents a firm's debt to earnings ratio b/y and the x-axis a firm's debt to capital ratio b/k. In the earnings covenant graph, the dashed line represents the debt to EBITDA *covenant* and the solid line the net worth constraint, that becomes active when a bank cuts a firm's access to credit after a covenant breach. The solid lines in the earnings *constraint* and net worth constraint graphs represent the maximal amount that can be borrowed at any time.

Figure 8: Policy Function



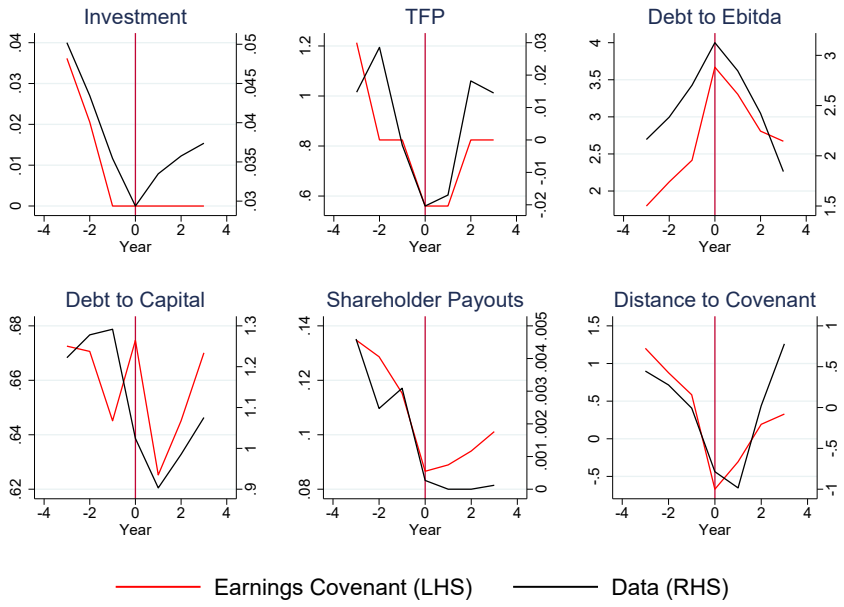
Policy functions for investment (y-axis) in relation to debt (x-axis) in the earnings covenant model (red line, left-hand side scale) and the benchmark economy without borrowing restrictions (dashed line, right-hand side scale). Productivity and capital are held constant. The vertical line on the left indicates θ_{LOOSE}, the maximum debt to capital ratio firms can borrow after a credit cut. Debt holdings to the right of this line are not admissible after a credit cut. The vertical line on the right indicates the debt to EBITDA covenant threshold.

Figure 9: Debt to Earnings and Debt to Capital Distributions



Distribution of debt to earnings (top row) and debt to capital (bottom row). Dark shaded bars are simulated model data and light-shaded bars US public firms data 1995-2014, including only firms with a debt to earnings covenant threshold of 3. The distributions are truncated at a debt to earnings ratio of five and a debt to capital ratio of 2. The dashed vertical line indicates the earnings covenant threshold. The solid vertical lines indicate net worth and earnings *constraints*. Firms younger than 4 years are excluded from the simulated model data sample.

Figure 10: Simulated Data vs Data around Covenant Breach



Median over three-year covenant breach episodes in the data (black line) and simulated earnings covenant model data (red line). The covenant breach is in year 0. Only firms with a debt to earnings covenant are included. Episodes of repeated breaches are excluded. Due to missing data, the number of observations varies across panels. Variables: TFP is firm-level productivity z_t (simulated data) and the Solow residual (data). The other variables are as in the baseline regressions.

Figure 11: Simulated Data around Covenant Breach

Median over three-year covenant breach episodes with simulated earnings covenant model data. The dashed line is the median for firm with $\frac{b}{k} > \theta_{TIGHT}$ (Excess Borrowing) before the breach and $\theta = \theta_{TIGHT}$ (Bank Reaction) after the breach. The dotted line is the median for firms with $\frac{b}{k} > \theta_{TIGHT}$ before the breach, but no bank reaction, i.e. $\theta = \theta_{LOOSE}$ after the breach. The solid lines represent the other two combinations. The covenant breach is in year 0. Variables: TFP is firm-level productivity z_t. The other variables are defined as in the regressions.

Table 1: Descriptive Statistics

	No Covenant Breach		*Covenant Breach*		*No Debt to EBITDA Covenant*	
	Mean	Median	Mean	Median	Mean	Median
Panel A:						
Firm Characteristics						
Investment to Assets	5.8	4.3	4.9	3.3	6.2	4.5
Debt Issuance	3.3	0.0	2.7	−0.2	2.8	0.0
Debt to EBITDA	197.1	182.9	416.0	464.4	274.5	180.1
Leverage	30.1	26.4	50.5	46.0	28.8	26.5
Log Assets	6.8	6.8	6.6	6.6	6.2	6.1
EBITDA to Assets	18.7	16.4	11.2	10.6	39.4	12.0
Cash Flow to Assets	11.1	10.4	4.8	5.3	5.0	7.0
Market to Book Value	180.5	149.9	135.0	117.2	182.7	130.5
Cash to Assets	8.7	4.8	6.3	2.9	11.4	4.7
Log Net Worth	6.5	6.4	5.9	5.9	5.9	5.7
Acquisitions to Assets	6.7	0.3	28.6	0.1	231.2	0.0
Share of Tangible Assets	30.5	23.5	32.8	26.0	34.1	27.0
Sales Growth	15.6	7.8	284.9	8.1	33.1	7.7
Panel B:						
Firm-Bank Relationship						
Distance to Threshold	1.3	1.3	−21.9	−2.1		
Covenant Breach (Text-Based)	4.3	0.0	18.2	0.0	13.2	0.0
Loan Size	981.4	395.8	1334.3	450.0	766.7	148.3
Number of Lenders	11.1	9.0	12.0	8.0	8.0	4.0
Number of Loan Contracts	2.2	2.0	3.0	2.5	2.1	1.5
Firm-Years	7740		5259		13882	

Summary statistics for the baseline regression sample. All ratios, shares, and growth rates are multiplied by 100. Annual data from 3310 US public firms with non-missing information about the covenant threshold between 1995 and 2014. No covenant breach are firms currently not in breach of their debt to earnings covenant. Covenant breach means firms with a negative distance to their debt to earnings covenant threshold. No debt to EBITDA covenant are firms with a loan contract that does not include a debt to EBITDA covenant.

Table 2: Baseline Regressions

	(1) Δ Debt	(2) Investment	(3) Δ Debt	(4) Investment
First Breach	−1.35***	−0.62***		
	(0.38)	(0.11)		
Log Distance to Threshold			0.71***	0.20***
			(0.23)	(0.06)
Standardized Coefficients	-11%	-11%	5%	3%
Controls	✓	✓	✓	✓
R^2	0.32	0.68	0.32	0.68
Observations	19460	19496	19460	19496

	(5) Equity Issuance	(6) Cash/Assets	(7) Shareholder Payout	(8) Employment
Log Distance to Threshold	−0.02***	0.27***	0.01**	0.01**
	(0.01)	(0.10)	(0.01)	(0.01)
Controls	✓	✓	✓	✓
R^2	0.45	0.80	0.58	0.97
Observations	20438	19398	20438	18161

Firm-level regression results with the change in total debt between t and t+1 scaled by total assets in t in columns (1) and (3), capital expenditures in t+1 scaled by total assets in t in columns (2) and (4), an indicator for net equity issuance higher than 5% of lagged total assets in t+1 in column (5), cash to assets in t+1 in column (6), a dummy for dividend payer or share repurchases in column (7) and log employment in column (8) as dependent variables. First Breach is a text-based indicator for the first covenant breach after at least one year of no covenant breach. Log distance to Threshold is the log distance between a firm's debt to earnings and the covenant threshold if the distance is positive. Control variables: Log Assets, Leverage, EBITDA to Assets, Market to Book Value, Share of Tangible Assets, Sales Growth, Cash Flow to Assets, Cash to Assets, and Acquisitions to Assets. Additional controls in columns (2)-(8): threshold-based indicators for covenant breach and a dummy variable for firm-years without debt to EBITDA covenant. Data are from US public firms 1995-2014. All regressions include year and firm fixed effects. The continuous dependent variables and the distance to the covenant threshold are winsorized at 5%. Standard errors clustered at the firm-level in parentheses.

Table 3: Variation in Exposure to Covenant Breach

	(1)	(2)		(3)	(4)
Lending Relations	Δ Debt	Investment	Credit Rating	Δ Debt	Investment
None	1.09**	0.33**	No	0.74**	0.20**
	(0.50)	(0.15)		(0.35)	(0.09)
Many	0.43*	0.11*	Yes	0.48	0.14**
	(0.25)	(0.06)		(0.31)	(0.07)
R^2	0.33	0.69		0.33	0.68
Observations	19474	19509		19473	19511
	(5)	(6)		(7)	(8)
Cash Holdings	Δ Debt	Investment	WW Index	Δ Debt	Investment
Low	1.05***	0.19**	Unconstrained	0.65**	0.07
	(0.32)	(0.07)		(0.32)	(0.07)
High	−0.69	−0.09	Constrained	0.19	0.26*
	(0.82)	(0.18)		(0.48)	(0.15)
R^2	0.39	0.72		0.33	0.71
Observations	11353	11387		15195	15262

Interaction coefficients between log distance to covenant threshold and variables measuring the exposure of firms to a covenant breach. I interact all independent variables with the dummy variables measuring the exposure using the baseline specification. The dependent variables are the change in total debt between t and t+1 scaled by total assets in t and capital expenditures in t+1 scaled by total assets in t. Lending Relations is a dummy indicating firms with at least one previous loan from one of the banks in their lending syndicate. Rating equals one for firms with at least one credit rating during the sample period. Firms with high cash holdings are in the upper, firms with low cash holdings are in the lower tercile of the distribution. Constrained firms are in the upper, unconstrained firms are in the lower tercile of the Whited and Wu (2006) Index distribution. Data are from US public firms 1995-2014. All regressions include year and firm fixed effects. The dependent variables and the distance to the covenant threshold are winsorized at 5%. Standard errors clustered at the firm-level in parentheses.

Table 4: Basel II Implementation

Sample	(1) Δ Debt Full	(2) Investment Full	(3) Δ Debt Rated Firms	(4) Investment Rated Firms	(5) Δ Debt Rated Firms	(6) Investment Rated Firms
Downgrade · Log Distance to Threshold · Post	0.55**	0.20**	0.64***	0.23**	0.67***	0.23**
	(0.22)	(0.10)	(0.24)	(0.09)	(0.23)	(0.09)
Downgrade · Log Distance to Threshold	−0.19	−0.04	−0.16	0.00	−0.15	0.01
	(0.13)	(0.04)	(0.14)	(0.04)	(0.13)	(0.04)
Downgrade · Post	0.22*	0.08*	0.24*	0.02	0.36***	0.02
	(0.13)	(0.05)	(0.13)	(0.05)	(0.13)	(0.05)
Downgrade	−0.19**	−0.17***	−0.13*	−0.10***	−0.18**	−0.12***
	(0.08)	(0.03)	(0.08)	(0.03)	(0.08)	(0.03)
Log Distance to Threshold · Post	0.02	−0.02	0.03	−0.02	0.02	−0.02
	(0.05)	(0.02)	(0.07)	(0.03)	(0.07)	(0.03)
Log Distance to Threshold	0.11***	0.05***	0.01	−0.00	0.03	−0.01
	(0.04)	(0.01)	(0.06)	(0.02)	(0.06)	(0.02)
Rating FE	✓	✓	✓	✓	✓	✓
Rating x Year FE					✓	✓
R^2	0.18	0.59	0.19	0.67	0.24	0.69
Observations	67022	67559	24406	24608	24221	24433

Difference in difference regression estimates with the change in total debt between t and t+1 scaled by total assets in t in columns (2), (4) and (6) and capital expenditures in t+1 scaled by total assets in t in columns (1), (3) and (5) as dependent variables. Post indicates quarters after 2006. Downgrade indicates the quarter of and the two following quarters after a credit rating downgrade. Coefficients for credit rating upgrades and interactions are included in the regression, but none is statistically significant at 10%. Control variables are defined as in the baseline regression. Quarterly data from US public firms 1995-2014. All regressions include firm, year, and rating or year-rating fixed effects. The continuous dependent variables and the distance to the covenant threshold are winsorized at 5%. Standard errors clustered at the firm-level in parentheses.

Table 5: Parametrization

Set Parameters

Model	Parameter	Value	Source
All Models	Discount factor	$\beta = 0.96$	Literature
All Models	Depreciation	$\delta = 0.06$	Literature
All Models	Relative risk aversion	$\sigma = 2.00$	Literature
All Models	Returns to scale	$\alpha = 0.62$	Literature
All Models	Exit rate	$\gamma = 0.05$	Literature
All Models	Investment adjustment cost	$\phi = 3.00$	Literature
	Productivity process		
All Models	Persistence	$\rho_z = 0.70$	Compustat
All Models	Standard deviation	$\sigma_z = 0.23$	Compustat
Earnings Covenant	Covenant threshold	$\widehat{\frac{b}{y}} = 3.00$	DealScan
Earnings Covenant	Probability of credit cut	$\pi_{CREDIT\ CUT} = 0.29$	Sufi (2009)
Earnings Covenant	Loose net worth constraint	$\theta_{LOOSE} = \infty$	Sufi (2009)

Calibrated Parameters

Model	Parameter	Value	Debt to Assets	
			Data	Model
Earnings Covenant	Tight net worth constraint	$\theta_{TIGHT} = 0.65$	32	32
Earnings Constraint	Debt to earnings constraint	$\theta_{\frac{b}{y}} = 4.66$	32	32
Net worth Constraint	Net worth constraint	$\theta_{\frac{b}{k}} = 0.82$	32	32

Set parameters: The first group of parameters is set to values commonly used in the literature. The productivity parameters are estimated on the same sample of US public firms 1995-2014 as in the baseline investment regression. The debt to EBITDA covenant threshold $\widehat{\frac{y}{b}}$ is the mode of the distribution of debt to EBITDA covenant thresholds the baseline sample. The probability of a credit cut after a covenant breach, $\pi_{CREDIT\ CUT}$, and the tightness of the net worth constraint when loose, θ_{LOOSE} are set using data by Sufi (2009). Calibrated Parameters: The tightness of the debt to capital constraint after a credit cut θ_{TIGHT}, and the tightness of the debt to income constraint,$\theta_{\frac{b}{y}}$ and of the debt to capital, $\theta_{\frac{b}{k}}$, are set to match aggregate debt to assets in the data.

Table 7: Aggregate Variables at Steady State

Model	(1) **Earnings Covenant**	(2) **Earnings Constraint**	(3) **Net Worth Constraint**
Debt to earnings covenant	✓		
Debt to earnings constraint		✓	
Debt to capital constraint	✓ After credit cut		✓
Panel A:			
Relative to No Borrowing Constraint			
Δlog(Investment)	−14.1	−17.2	−14.2
Δlog(Output)	−9.4	−10.6	−10.1
Δlog(K)	−13.4	−16.3	−13.5
Δlog(TFP)	−1.1	−0.5	−1.7
Average Δ Firm Value	−4.7	−4.1	−4.9
Panel B:			
Aggregate Moments			
Share of firms in breach	6.4		
Share of firms with binding constraint	1.4	2.2	34.6
Panel C:			
Decomposition of Δ Investment			
Share Precautionary	94.6	95.2	76.2
Share Direct Effect	5.4	4.8	23.8

Panel A: Steady-state comparison across models. Investment, Output, TFP, and Capital are log differences relative to the benchmark economy without borrowing constraints. TFP is computed as Y/K^{α}. Panel B: The share of firms breaching a covenant and the share of firms with a binding constraint are in percent. Panel C: Decomposition of the difference in aggregate investment relative to the model without borrowing constraints into a direct and a precautionary effect. The aggregate loss is computed using the firm size distribution of the corresponding model with financial friction:

$$\text{Direct Share} = \frac{\sum_{k,b,z} \left(i_{k,b,z} - i^{\text{Benchmark}}_{k,b,z}\right) \mathbb{1}[b_{k,b,z} = \theta k_{k,b,z}] f_{k,b,z}}{I^{\text{Benchmark}}}$$

$$\text{Precautionary Share} = \frac{\sum_{k,b,z} \left(i_{k,b,z} - i^{\text{Benchmark}}_{k,b,z}\right) \mathbb{1}[b_{k,b,z} < \theta k_{k,b,z}] f_{k,b,z}}{I^{\text{Benchmark}}}$$

The direct effect is the loss in terms of investment of firms facing a binding constraint. The precautionary effect is the aggregate difference compared to the investment in the model without borrowing constraint of firms not facing a binding constraint.

Table 8: Model vs Data

	Data	Earnings Covenant Model
Panel A:		
Distributional Moments		
Standard Deviation of Investment Rate	6.29	5.95
Standard Deviation of Log Distance to Threshold	0.90	0.71
Standard Deviation of Log Assets	2.73	0.73
Share of Firms Breaching a Covenant	0.09	0.06
Share of First-Time Breaches	0.04	0.03
Panel A:		
Within-Firm Moments		
Coefficient of log(z) on its Lag	0.51	0.66
Coefficient of EBITDA on its Lag	0.43	0.79
Coefficient of Log Distance to Threshold on its Lag	0.11	0.61
Coefficient of Breach on its Lag	0.46	0.40

Comparison of simulated earnings covenant model data against actual data. Data are as they enter the baseline regressions. Investment is defined as capital expenditures divided by lagged total assets. Distance to Threshold is the log difference between a firm's debt to earnings ratio and the covenant threshold when this distance is positive. Covenant breaches in the data are the text-based measure. First breaches are firms breaching covenant after being in compliance with their covenants for at least one year. All regressions coefficients are significant at 1%. The EBITDA and distance to threshold regressions include firm fixed effects.

Table 9: Averages of Simulated Firm Data

Panel A: *All Firms*	Earnings Covenant	Earnings Constraint	Net Worth Constraint
Debt to EBITDA	137	151	132
Debt to Capital	55	63	51
Panel B: *Constrained Firms*			
	1	2	3
Debt to EBITDA	345	403	136
Debt to Capital	61	84	72
TFP	26	19	40
Age	24	16	11
Size Percentile	56	36	31
Panel C: *Precautionary Firms*			
	1	2	3
Debt to EBITDA	206	253	157
Debt to Capital	58	72	44
TFP	28	29	30
Age	15	19	14
Size Percentile	34	43	30

Averages of simulated firm data. Ratios are multiplied by 100. Panel A includes all firms, Panel B only firms borrowing the maximal amount under their credit constraint, and Panel C are firms in the highest tercile of the distance in investment to the benchmark model. Variables: TFP is the firm's current productivity level relative to maximum TFP. Size Percentile is the firm's position in the cross-sectional distribution of capital.

Table 10: Regressions with Simulated Model Data

	(1) Δ Debt	(2) Investment	(3) Δ Debt	(4) Investment
First Breach	−1.59***	−0.84***		
	(0.04)	(0.03)		
Log Distance to Threshold			0.22***	0.29***
			(0.02)	(0.02)
Standardized Coefficients				
Simulated Data	-28%	-14%	3%	3%
Data	-11%	-11%	5%	3%
Controls	✓	✓	✓	✓
R^2	0.27	0.64	0.30	0.62
Observations	359573	359573	363134	362991

Firm-level regression on simulated earnings covenants model data with the change in debt between t and t+1 in columns (1) and (3) and the change in capital stock between t and t+1 in columns (2) and (4) as dependent variables. Both variables are scaled by total assets in t. First breach is an indicator for the first covenant breach after at least one year of no covenant breach as of t-1. Log distance to the threshold is the log distance between a firm's debt to EBITDA ratio and the covenant threshold if the distance is positive. Controls: productivity, log net worth, log capital stock. Additional controls: A dummy variable indicating a covenant breach in columns (3) and (4). All regressions include firm fixed effects. The dependent variables and the distance to the covenant are winsorized at 5%. Firms younger than 4 years and firms without debt are excluded from the sample. Standard errors clustered at the firm-level in parentheses.

A Appendix

A.1 Hand-Collected Data on Covenant Breaches

The covenant breach data are based on SEC filings. The quarterly SEC filings are downloaded from EDGAR. For reports filed 1996-2008 I use the Compustat-SEC link provided by Nini et al. (2009). For the period 2009-2015 I follow their procedure and build a bridge.

I have extended the search algorithm for covenant breaches by Nini et al. (2012) to include the type of covenant breached and changed the search terms to reduce the number of false positives. I start by extracting all text parts in quarterly and annual filings containing the word "covenant". My search algorithm has three steps:

1. Filter out conditional statements, for example: "in the event of a covenant violation", "would have been in violation" , "whether or not in compliance" etc[49]
2. Check if the firm reports being in compliance: "in [a-z] compliance", "the company is presently in complicance" etc.
3. Check if the firms is in breach of a covenant: "failed to meet", "in technical violation", "out of compliance" etc.

When the code finds a covenant violation then, only within the same sentence, I look for an indication of the date, because firms often report covenant breaches that have happened in the past. Also within the same sentence I search for the type of covenant breached.

A.2 Covenants: Institutional Framework and Data

This section presents additional information about covenants and the DealScan data.

Institutional Framework I start by providing an example of a financial covenant[50] and detail the steps of how a covenant breach can lead to a reduction of a firm's access to credit. Although public debt often also contains covenants I focus on private debt in this paper.[51]

Figure A1 shows a typical firm-bank relationship and a typical loan contract. The loan contract specifies the different terms of the loan: interest rate, maturity and financial covenants. The firm must have a debt to earnings ratio below 4. Earnings in covenants are usually earnings before interest, taxes, depreciation and amortization (EBITDA). I use this definition of earnings in this paper. Additionally the firm in this example contract must have a minimal amount of net worth

[49] Full regular expressions are available upon request

[50] In addition to *financial* covenants there exist also informational covenants and negative covenants. Informational covenants require the borrower to provide detailed financial reports to the lender. Negative covenants prohibit the borrower from selling assets, for example. In this paper I focus on financial covenants.

[51] Chava and Roberts (2008) write that covenant violation "occur almost exclusively in private debt issues."

of 70 million. Net worth in covenants is defined as the book value of assets minus the book value of liabilities. I use this accounting definition of net worth in the paper.

As long as the firm satisfies the covenants, the bank provides the firm with funding under a term loan and a credit line limit. The credit line limit specifies the maximal amount a firm can borrow using the credit line. A credit line, unlike a term loan, can be used and repaid several times until maturity. To maintain a credit line firms usually pay a fixed fee and variable interest depending on their usage. Now, I will discuss the steps of how a covenant breach might lead to a cut in available credit for a firm.

I. Suppose a negative demand shock lowers the firm's earnings, i.e. because of lower sales, such that given its level of debt the debt to earnings ratio exceeds 4.

II. The firm reports the covenant breach to the bank.

III. At this stage the bank has the right to immediately call back the loan. In practice this extreme outcome rarely happens and the loan is renegotiated.[52] Banks do however frequently tighten different terms of the loan. They increase interest rates, shorten the maturity or lower the credit line limit (Roberts and Sufi, 2009). Banks will take into account the borrower's financial health, but, as shown in the diagram, banks' reaction also depends on their own financial health.[53] Dichev and Skinner (2002) argue that even managers of financially healthy firms have incentives to avoid covenant breaches, because they do not like the increased scrutiny by banks after covenant breaches.

IV. The firm's access to credit might change depending on the bank's reaction.

Prevalence of Covenants in the Data: Covenants are very common: 81% of firm-years in the dataset by Sufi (2009) covering all US public firms have a credit line and almost all credit line contracts contain covenants. Even so called "covenant-lite" loans are subject to financial covenants.[54]

Covenant Breaches in the Data: How frequent are covenant breaches? On average about 10% of firms in my sample are breaching a covenant in a given year. Because the search algorithm I use is conservative the actual number is likely to be higher. This makes covenant breaches a much more frequent event than actual default. Roberts and Sufi (2009), for example, find a termination of the credit agreement in only 4% of covenant breaches

[52] Roberts (2015) finds that 75% of covenant violations lead to a renegotiation.

[53] See Chodorow-Reich and Falato (2017) and Murfin (2012) for how factors on the bank side unrelated to a borrower's financial health affect credit supply.

[54] Wang and Xia (2014) document that banks sell a large portion of loans as collateralized loan obligations to other lenders, thus weakening the incentive to monitor borrowers. Berlin et al. (2020), however, take the entire loan structure into account and find that "[...] bank lenders retain significant control rights and agent banks retain significant exposure to the borrowing firm, inconsistent with the view that the rise of institutional lending or covenant-lite loans has led banks to have less skin in the game."

DealScan Data I use loan data and in particular the covenant thresholds provided by DealScan to compute covenant tightness. DealScan includes information on covenants from more than 15,000 contracts from over 5500 different firms. Information about covenants is at the *Package* level, whereas data about maturity, spreads and the participating banks are at the *Facility* level. Following the literature I merge loan packages with facilities. Then I assume loans are held until maturity and expand all data over the maturity of the facility.[55] This is an important source of measurement error because firms frequently renegotiate loan contracts and DealScan does not provide information about which contract is replaced by a new one. Finally, I merge the DealScan data with Compustat using the bridge provided by Chava and Roberts (2008).

Syndicated Loans: Most loans in my data are syndicated loans, loans where several banks provide a share of the total loan. Usually there is a lead arranger bank, who recruits participant banks, performs due diligence before extending the loan and monitors the borrower. The syndicated loan market accounts for almost half of all commercial and industrial lending in the US (Chodorow-Reich, 2014). The syndicated loan portfolio size of US banks has increased in recent years from around 500 billions in 2013 to about 1 trillion in 2019.[56]

How large are these loans? The median loan size to assets is 21% and the median loan to total debt is 79%. These loans are substantial for the firms obtaining them because they account for a large share of their stock of debt. The median contract package contains one loan facility which typically is a credit line. As for other loan terms, the median spread is 175 basis points, and the median maturity is 47 months or about 4 years.

What are firms using the loans for? Based on DealScan's "Deal Purpose" variable 34% of the loans in the baseline regression sample are for general corporate purposes, 23% are used for debt repayment, 20% as working capital and the remainder for other purposes.

Earnings vs net worth covenants Figure A2 shows the fraction of contracts weighted by loan size containing earnings or net worth covenants over time. The fraction of earnings covenants averages around 80% over the sample period, whereas net worth covenants have become less frequent.[57] In the paper I focus on earnings covenants.

Firm characteristics and covenant type 83% of loan contracts of the firms included in the baseline regression include at least one earnings covenant, 40% of contracts include a net worth covenant. 32% of contracts include both types of covenants. Firms with only earnings covenants in their contract have higher leverage, are larger, have higher cash-flows than firms with net worth covenants (Table A1).

Determinants of inital covenant tightness Table A1 shows median firm characteristics for firms

[55] I want to thank Sebastian Doerr for providing codes for the data treatment

[56] Syndicated Loan Portfolio of Domestic Entities

[57] This fact, while well known in the finance and accounting literature for a long time (Christensen and Nikolaev (2012), Demerjian (2011)), has not been considered in macroeconomics until very recently.

Table A1: Characteristics by Covenant Type and Initial Tightness

	Only Earnings	Only Net Worth	Both	Tight	Loose
Leverage	0.35	0.18	0.29	0.31	0.26
Log Assets	7.02	4.74	5.60	6.26	7.65
EBITDA to Assets	0.14	0.11	0.15	0.15	0.15
Cash Flow to Assets	0.08	0.05	0.07	0.08	0.09
Market to Book Value	1.41	1.45	1.31	1.39	1.43
Cash to Assets	0.04	0.08	0.04	0.04	0.04
Share of Tangible Assets	0.26	0.19	0.25	0.26	0.29
Sales Growth	0.09	0.12	0.15	0.12	0.07

Notes: Median firm characteristics of loan contracts containing only earnings covenants, only net worth covenants and containing both types of covenants as well as median firm characteristics for firms with initially tightly set vs loosely set covenants. The sample includes only contracts of firms in the baseline sample.

with tight and loose initial covenants. Firms with tighly set covenants have higher leverage, are smaller, have lower market to book value, lower net worth, but higher sales growth.

A.3 Variable Definitions

Abnormal Operating Accruals I follow Bharath et al. (2008) and run cross-sectional regressions for each year and Fama-French 48 industry of *total accruals* on lagged total assets, change in sales and the gross value of property plant and equipment. All variables are scaled by lagged total assets. Abnormal accruals are defined as the absolute value of total accruals minus the predicted values from the industry-year regressions. For the precise variable definition see Appendix B of Bharath et al. (2008).

Covenant Variables I use the definitions by Demerjian and Owens (2014) for quarterly data. In the annual regressions I take the minimum quarterly distance to the covenant threshold over the year.

- **Ebitda** $ebitda_t = \sum_{t=-2}^{1} oibdpq_t$
- **Debt to ebitda** (dlttq + dlcq)/EBITDA
- **Interest coverage** ebitda/intexp
- **Fixed charge coverage** ebitda/(intexp + l1.dlcq + xrent)
- **Minimum tangible net worth** atq - intanq - ltq

Net Debt Issuance Change in total debt, scaled by lagged total assets: $((dltt_t+dlc_t)$ - $(dltt_{t-1}+dlc_{t-1}))/at_{t-1}$

No Relation/ Lending Relation The number of previous lending relations is counted as the number of times a bank has already participated in a syndicate to lend to a firm. When there are several facilities with the same start date and bank-firm match I count only one facility as an additional lending relation. I aggregate to the firm-quarter level by taking the largest number of previous lending relations if there are several facilities per firm and quarter. *No Relation* equals one when the firm is borrowing for the first time from the banks of its syndicate, *Lending Relation* equals one when the firm has borrowed at least twice from at least one of the banks in its syndicate.

Rating equals one when a firm has at least one S&P Domestic Long Term Issuer Credit Rating during the sample period. Compustat variable: *SPLTICRM*

Shareholder Payout Dividends plus Purchases of common and preferred stocks: $prstkc + dv$

A.4 Covenants for Small Businesses and Firms Outside the US

Covenants for Small Businesses Niskanen and Niskanen (2004) find covenants in loan contracts of small Finnish firms. For the US, a large number of websites filled with advice for small business owners of how to cope with covenants suggests that covenants are not only used in loans to large firms. Below is an example from a Forbes article titled "Bank loan covenants and clauses entrepreneurs regret most":[58]

"[...] Debt Service Coverage Ratio Bank Loan Covenant: To satisfy the bank's level of risk, the bank will set forth a cash flow requirement such as a ratio of income to debt payments which must be maintained by the business throughout the term of the line of credit or loan. For example, the bank may set a debt service coverage ratio of 1.2 which means that the net operating income for a period must exceed the total debt payments (interest and principal) payable to the bank during the same period by 20%. If the total debt payments for the period were $100,000.00, then the business would need to have income equal to $120,000.00 during the same period in order to maintain the bank's debt service coverage ratio covenant. In many cases, the entrepreneur agrees to this covenant and does not understand its meaning or implications should the business have a year with reduced net profit or a loss."

The Smart Business Website[59] provides the following advice to business owners:

"Sometimes, despite everyone's best intentions, companies fail to meet their bank covenants. When this happens, you should meet the situation head-on. If you are in the middle of the year and believe there is a chance you may not meet a covenant, review current projections to determine what steps can be taken to remedy the situation. If it is a leverage covenant (debt and/or equity),

[58] Bank Loan Covenants And Clauses Entrepreneurs Regret Most visited on 30.08.2018
[59] Your company tripped a bank covenant. Now what do you do? visited on 14.09.2020

consider collecting accounts receivable more quickly, or requesting customer deposits to pay down liabilities. Or you might decide to defer some fixed-asset additions until the following year.

If it is a debt service coverage ratio and you do not expect to meet the projected income, this can be tougher to resolve by year-end. You can consider deferring owner distributions and/or making contributions so the covenant is met. Be sure to read the definition in the loan agreement."

Firms Outside the US Are loan covenants specific to US banking market? Covenants are common also in France as the following information of a French consulting firm[60] shows:

"Dans le contexte économique actuel de dégradation de la situation financière des entreprises, celles-ci éprouvent les plus grandes difficultés à respecter les covenants figurant dans leurs contrats de prêts. Les covenants sont des clauses, insérées dans des contrats de prêts conclus entre une banque et une entreprise, qui imposent au débiteur le respect de certains engagements spécifiques et notamment de ratios financiers. Le remboursement anticipé du prêt pouvant être la conséquence la plus fréquente du non-respect des objectifs fixés contractuellement."

A.5 Additional Tables

[60] Les covenants bancaires ou clauses imposant à l'emprunteur de respecter des ratios financiers visited 30.08.2018

Table A2: Robustness

	Baseline		Interest Coverage Covenant		Level Distance	
	(1)	(2)	(3)	(4)	(5)	(6)
	Δ Debt	Investment	Δ Debt	Investment	Δ Debt	Investment
Log Distance to	0.71***	0.20***	0.62***	0.19***		
Threshold	(0.23)	(0.06)	(0.18)	(0.06)		
Distance to Threshold					1.02***	0.22***
					(0.30)	(0.08)
R^2	0.32	0.68	0.32	0.69	0.32	0.68
Observations	19460	19496	18148	18279	19460	19496

	SIC2 x Year FE		No Firm FE		Firm x Threshold FE	
	(7)	(8)	(9)	(10)	(11)	(12)
	Δ Debt	Investment	Δ Debt	Investment	Δ Debt	Investment
Log Distance to	0.71***	0.20***	0.36*	0.21***	0.58**	0.24***
Threshold	(0.24)	(0.06)	(0.21)	(0.06)	(0.23)	(0.06)
R^2	0.37	0.72	0.05	0.56	0.45	0.77
Observations	19385	19414	14534	15408	9044	9448

	No Controls		Only Positive Distance		Debt to Ebitda	
	(13)	(14)	(15)	(16)	(17)	(18)
	Δ Debt	Investment	Δ Debt	Investment	Δ Debt	Investment
Log Distance to	1.50***	0.45***	0.55**	0.24***	0.46**	0.11**
Threshold	(0.21)	(0.06)	(0.23)	(0.07)	(0.21)	(0.05)
R^2	0.27	0.65	0.39	0.74	0.35	0.70
Observations	22324	22403	6018	6031	9308	9670

Robustness checks with the change in total debt and investment as dependent variables. Columns (1) and (2) are the baseline. Columns (3) and (4) report results using the distance to the interest coverage covenant instead of the debt to earnings covenant. Columns (5) and (6) show the regression in level distance to threshold instead of log distance. Columns (7) and (8) include industry-year FE. Columns (9) and (10) are estimated with lags of the dependent variable and the distance to the covenant threshold instead of firm FE. Columns (11) and (12) include firm-threshold FE. Columns (13) and (14) are estimated without firm-level controls, and columns (15) and (16) report results excluding firms with negative distance to the threshold and firms without debt to EBITDA covenant from the sample. Columns (17) and (18) additionally include the debt to EBITDA ratio as a control variable. The dependent variables and the distance to the covenant threshold are winsorized at 5%. Standard errors clustered at the firm-level in parentheses.

Table A3: Change in Accounting Rules

	(1) OLS	(2) 2SLS
Log Distance to Threshold	0.73**	9.22**
	(0.36)	(3.60)
First Stage F-Stat		13.39
Observations	366	366

Cross-sectional regression with investment to assets in fiscal year 2006 as dependent variable. In column (2) the log distance to the threshold is instrumented with firms' average option compensation expenses divided by total assets 2002-2004 as described in Lian and Ma (2020). Controls: Debt to Earnings Ratio and an indicator for firms breaching a covenant. Robust standard errors in parentheses.

Table A4: Firm Characteristics after Covenant Breach

Variable	Small Decrease	Large Decrease	Diff
Leverage	0.31	0.23	-0.083^{*}
Log Assets	4.90	5.00	0.106
Return on Assets	0.10	0.04	−0.062
Cash Flow to Assets	0.05	0.06	0.004
Market to Book Value	1.21	1.20	−0.012
Cash to Assets	0.09	0.12	0.027
Net Worth	452.94	696.17	243.229
Acquistions to Assets	0.02	0.00	−0.014
Share of Tangible Assets	0.30	0.27	−0.024
Sales Growth	0.09	−0.01	−0.094
Change in Credit Line	0.09	−0.68	-0.774^{***}
N	58	23	81

Comparison of firms with a small (< 25%) against firms with a large decrease (> 25%) in their credit line one year after a covenant breach. Credit line data are from Sufi (2009). Standard errors in parentheses.
Significance levels: $^{*} < 10\%$ $^{**} < 5\%$ $^{***} < 1\%$

A.6 Additional Figures

Figure A1: Firm-Bank Relationship

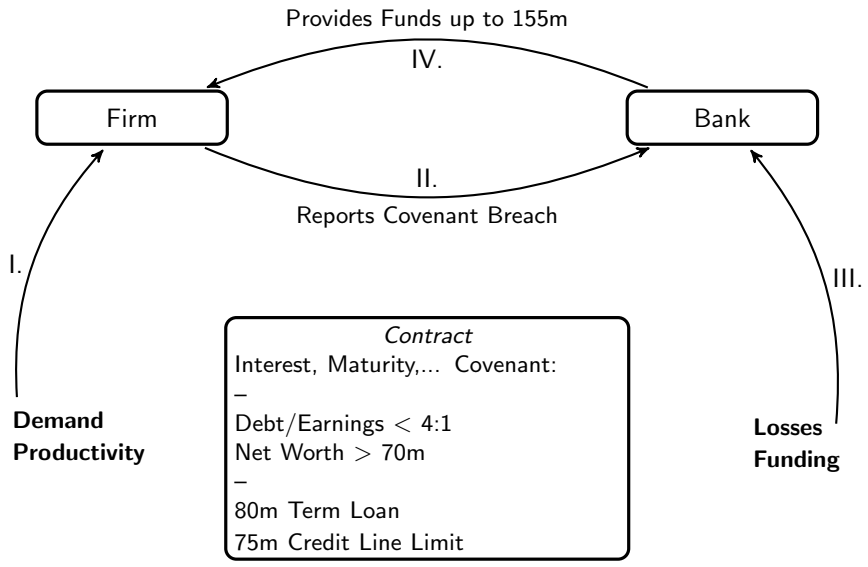
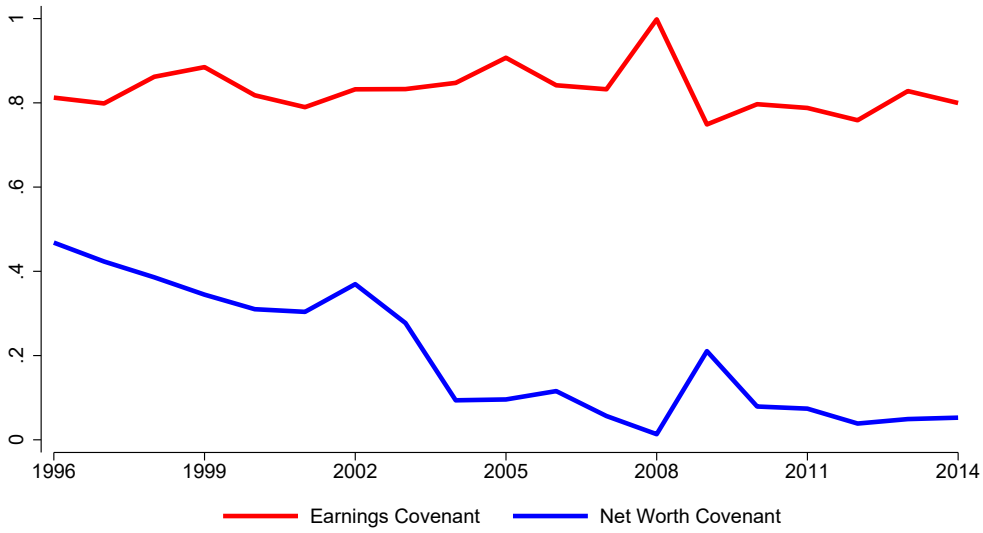
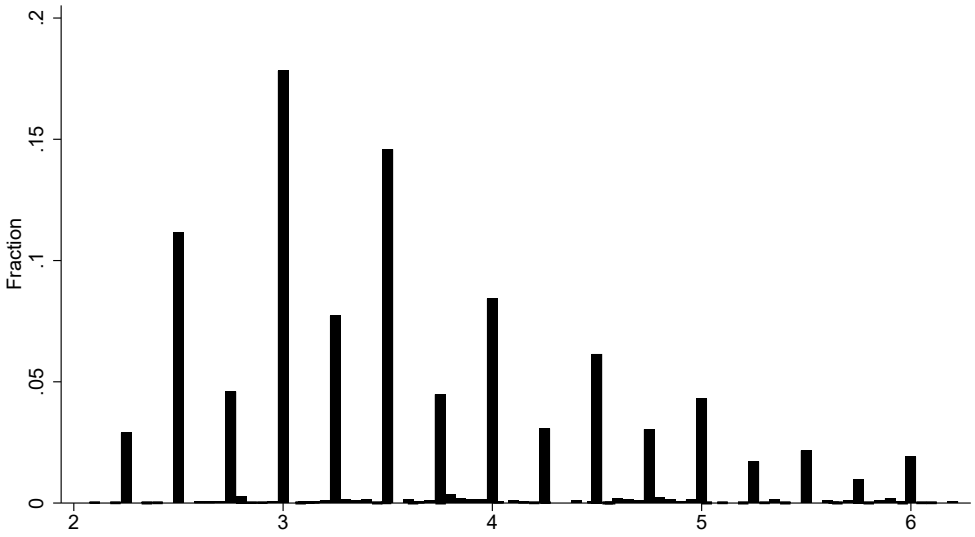


Figure A2: Fraction of New Loan Contracts and Covenant Types



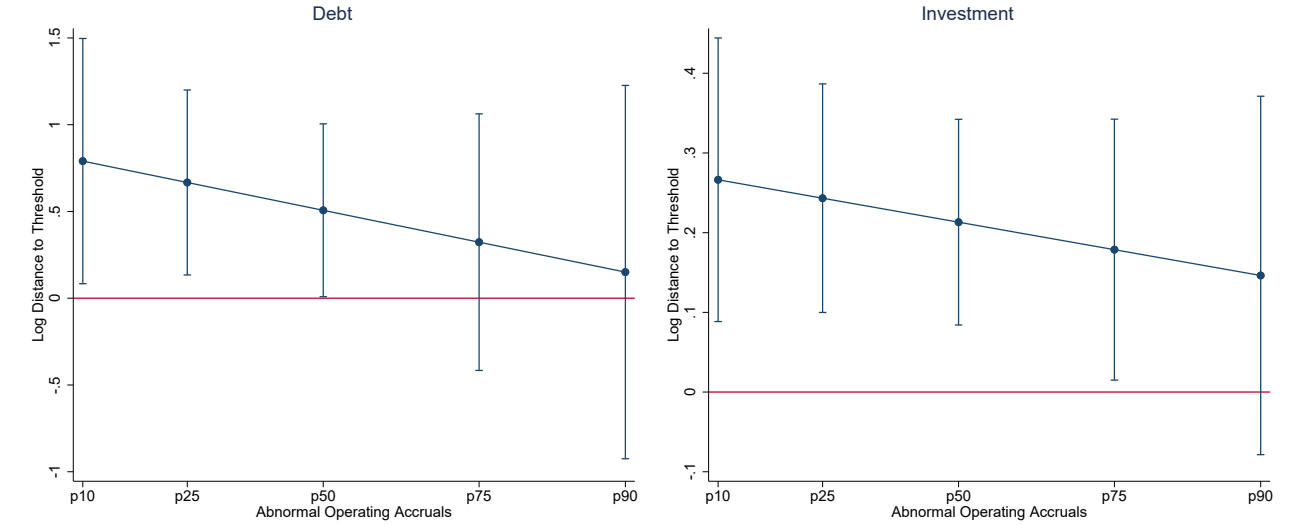
Notes: Fraction of new contracts weighted by loan size containing either an earnings or a net worth covenant in a given year. Some contracts contain both, therefore the fractions do not sum up to one. The sample is limited to firms with non-missing data in both DealScan and Compustat.

Figure A3: Debt to Earnings Covenant Thresholds



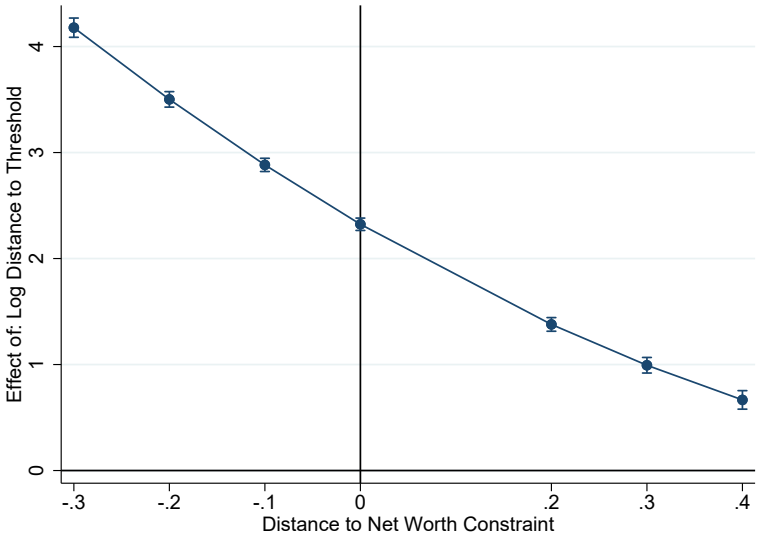
Covenant thresholds of firms in the baseline sample excluding the largest and smallest 5%

Figure A4: Precautionary Effect and Accounting Manipulation



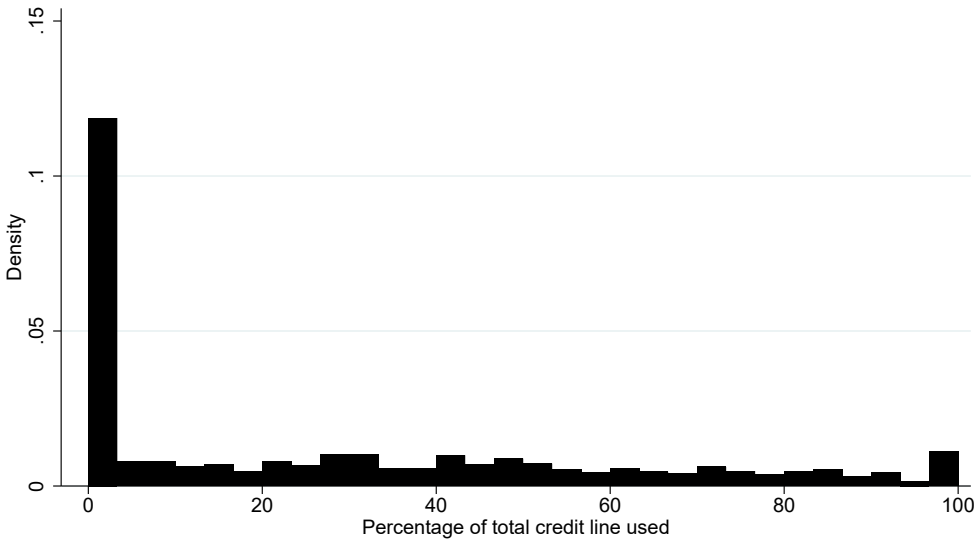
Marginal effect of the log distance to the covenant threshold for different percentiles of abnormal operating accruals. Abnormal operating accruals are the absolute value in logs of the difference between normal accruals and total accruals. Normal accruals are fitted values of industry-year regressions. I drop firms in industry-year cells with fewer than 25 observations. Larger abnormal operating accruals indicate larger deviations between a firm's cash-flows and its earnings. The dependent variables are the change in total debt between t and t+1 scaled by total assets in t and capital expenditures in t+1 scaled by total assets in t. Controls are the same as in the baseline regression. Data are from US public firms 1995-2014. All regressions include year and firm fixed effects. The continuous dependent variables and the distance to the covenant threshold are winsorized at 5%. Lines indicate 95% confidence intervals.

Figure A5: Distance to Covenant Threshold and Distance to Tight Net Worth Constraint



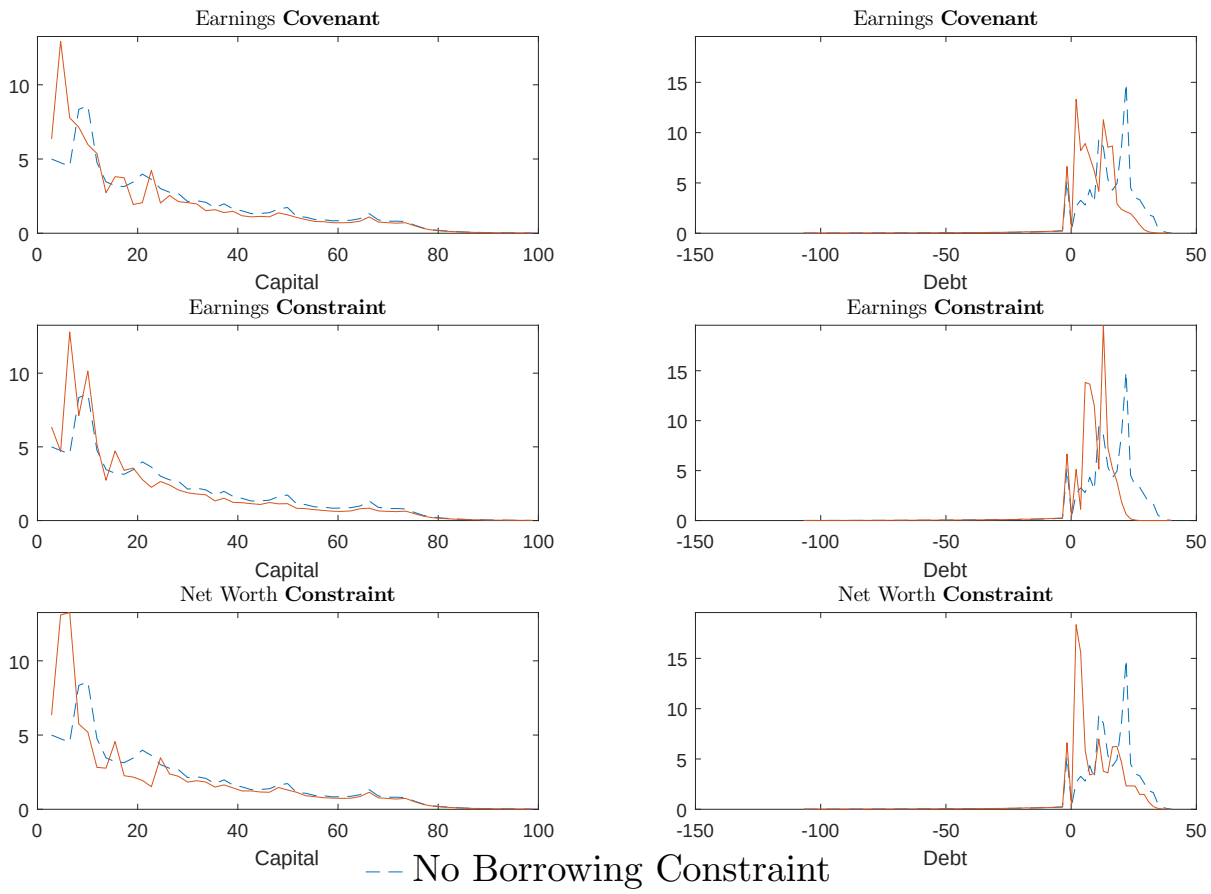
Marginal effect of the log distance to the covenant threshold for different percentiles of the distance to the tight net worth constraint. Firms with negative "distance to net worth constraint" would need to delever in case of a covenant breach. The dots are effect of "distance to covenant threshold", including interactions terms, at the 5, 10, 25, 50, 75, 90, 95 percentiles of the distribution of "distance to net worth constraint" on investment to assets. Firm-level data of the simulated earnings covenant model.

Figure A6: Percentage of Credit Line Used



The graph shows the fraction of the credit line used when there was no covenant breach in the previous year. Data are from Sufi (2009)

Figure A7: Firm Size Distribution



Firm size distribution of capital and debt/savings.