

Debt Covenants and the Macroeconomy: The Interest Coverage Channel

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Introduction

- ▶ Non-residential investment is a key driver of monetary policy response.
 - Natural link: \$6T corporate debt market.
 - Large body of work on transmission through credit limits (“financial accelerator”).
- ▶ Firm credit limits typically modeled as limit on market leverage.
 - Actual debt covenants much more complex, can depend on different variables.
 - Lian and Ma (2017): importance of earnings based constraints.
 - But many covenants depend on more than earnings, firms often have several at once.
- ▶ **Research question:** how does firm credit limit structure influence macro dynamics?
 - Focus on **Interest Coverage (IC)** covenants that cap ratio of interest payments to earnings.

This Paper

- ▶ **Approach:** combine structural model with firm-level empirical evidence.
- ▶ **Stylized Facts:** Interest Coverage covenants extremely common (seen in 84% of firms in DealScan sample with covenants), maximum ratios appear stable over time.
- ▶ **Main Finding #1:** Interest Coverage covenants amplify interest rate transmission.
 - Much stronger responses of debt, investment, output than under alternative covenant types.
 - Reason: directly shifted by interest rates.
 - Rates \downarrow 100bp \implies extra 3.7% 8Q capital growth in data (4.4% in model).
- ▶ **Main Finding #2:** Combination of interest coverage + other cov. \implies state dependence.
 - Whether interest coverage is tightest covenant determined by interest rate.
 - Stronger transmission when rates are already high (and IC covenants likely to bind).
 - High vs. low rates: \downarrow 100bp \implies extra 3.9% 8Q capital growth in data (1.5% in model).

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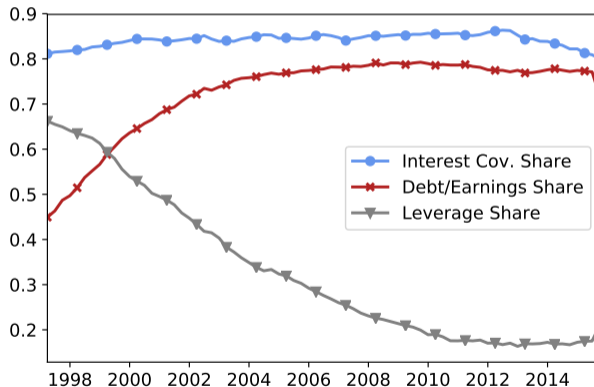
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Background: Debt Covenants

- ▶ Covenants provide conditions that, if violated by the firm, allow lender to demand immediate repayment.
 - Often set thresholds for financial ratios \implies debt limits.
 - Applies to entire firm's statistics, not limited to individual loan.
 - Typically leads to (costly) renegotiation, but for today treat as hard caps.
- ▶ Three main types:
 1. **Interest Coverage:** restrict interest payments \leq fraction θ^{IC} of earnings (EBITDA).
 2. **Debt/Earnings:** restrict stock of debt \leq fraction θ^{DE} of earnings (EBITDA).
 3. **Leverage:** restrict stock of debt \leq fraction θ^{LEV} of firm book value.

Covenant Incidence Over Time

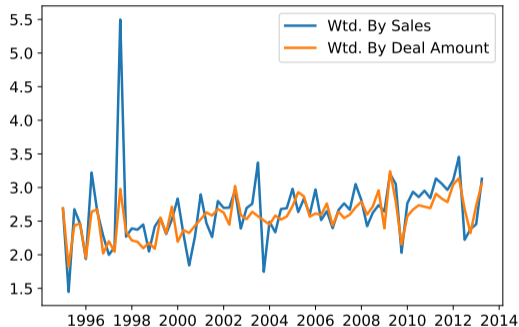
- ▶ Plot: share with each covenant type for firms with at least one DealScan covenant.
- ▶ Share with Interest Coverage high and stable over time.



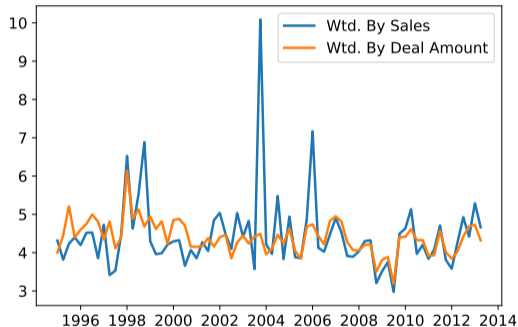
Source: DealScan. Shares are equally weighted among DealScan firms with at least one covenant.

Covenant Ratios Over Time

- Complication: covenant limits are endogenously set. Do lenders dynamically adjust simple covenants to achieve more complex debt policies?



(a) Min Interest Cov. Ratio

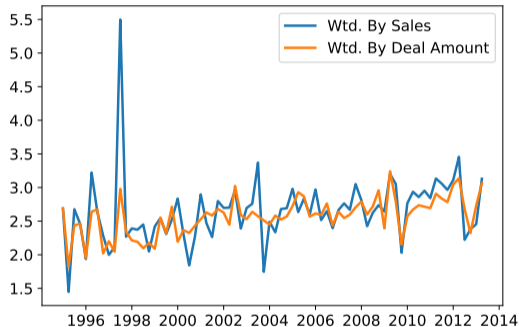


(b) Max Debt/Earnings Ratio

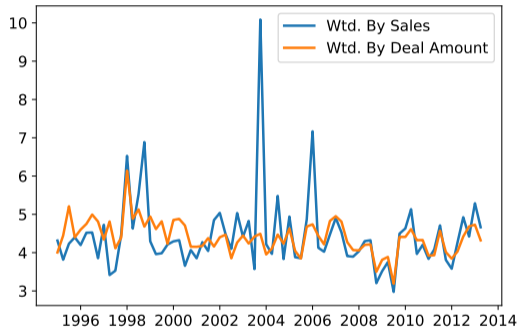
Source: DealScan, Compustat.

Covenant Ratios Over Time

- ▶ Below: initial covenant ratios **at origination** in DealScan. Appear noisy but stable over time.



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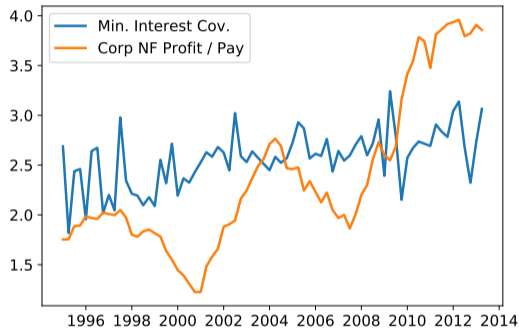


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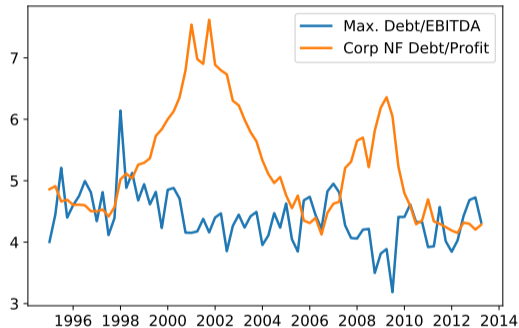
Source: DealScan, Compustat.

Covenant Ratios Over Time

- ▶ Second check: maximum ratios on new loans stable even when underlying aggregate economic ratios move.



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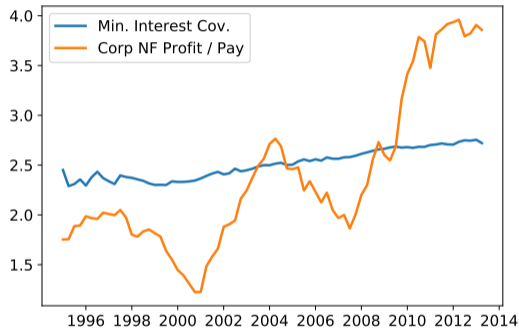


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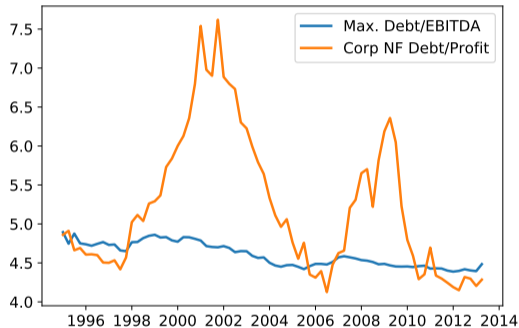
Source: DealScan, Compustat, NIPA, Flow of Funds. Covenant limits are weighted by deal amount. Debt payments assume 600bp spread over 3-Month Treasury. Min. Interest Cov. is the min. allowed Earnings / Interest ratio.

Covenant Ratios Over Time

- ▶ Now look at all **active** covenants. Provide stable constraints even as variables move.



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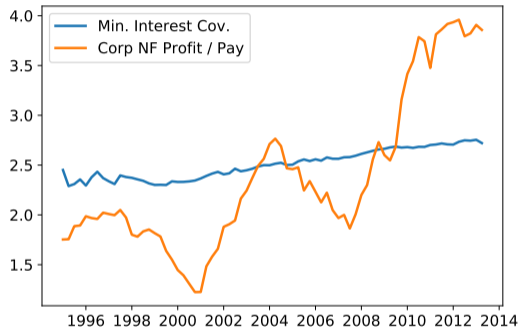


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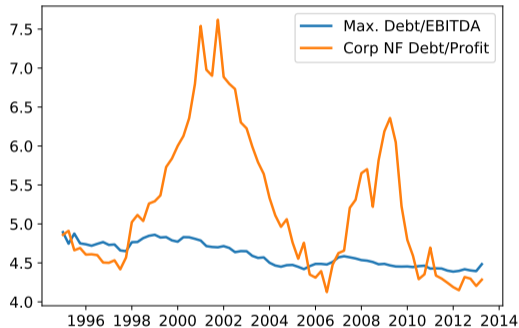
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Covenant Ratios Over Time

- ▶ Takeaway: covenants have structural meaning, reasonable to consider as fixed limits at business cycle frequency.



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(b) Max Debt/Earnings Ratio

Source: DealScan, Compustat, NIPA, Flow of Funds. Covenant limits are weighted by deal amount. Debt payments assume 600bp spread over 3-Month Treasury. Min. Interest Cov. is the min. allowed Earnings / Interest ratio.

Model

Model Overview

▶ Demographics and preferences

- Risk-neutral representative household consumes and provides labor.
- Interest rate variation \implies time varying discount factor:

$$\log \beta_t = (1 - \rho_\beta) \log \bar{\beta} + \rho_\beta \log \beta_{t-1} + \varepsilon_{\beta,t}.$$

- Representative firm owns capital and pays dividends to household.

▶ Productive technology: $f(K_{t-1}, N_t) = Z_t K_{t-1}^\alpha N_t^{1-\alpha}$

▶ Firm capital structure:

- Risk-free floating rate debt at rate r_t , interest is tax deductible (**tax shield**).
- Dividend adjustment costs (**financing frictions**) following Jermann and Quadrini (2012).
- Combined: pathway from debt limits \rightarrow debt \rightarrow investment.

▶ Flexible prices and wages, monetary authority targets (and achieves) constant inflation.

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Representative Firm's Problem

- ▶ Rep. firm chooses dividends D_t , labor demand N_t , new debt B_t and the investment rate i_t to maximize

$$V^F(K_{t-1}, B_{t-1}) = \Psi(D_t) + E_t[\Lambda_{t+1} V^F(K_t, B_t)]$$

where concave $\Psi(D_t)$ represents adjustment costs for dividends, Λ_{t+1} is the household SDF, subject to the budget constraint

$$D_t = \underbrace{(1 - \tau)(f(K_{t-1}, N_t) - w_t N_t)}_{\text{after-tax profit}} + \underbrace{\tau \delta K_{t-1}}_{\text{depreciation credit}} - \underbrace{i_t K_{t-1}}_{\text{investment}} \\ - \underbrace{(1 - \tau)r_t \pi_t^{-1} B_{t-1}}_{\text{interest payment}} + \underbrace{(B_t - \pi_t^{-1} B_{t-1})}_{\text{net principal}}$$

and the borrowing constraint (debt covenants).

Covenant Implementations

▶ Denote EBITDA by $X_t = f(K_{t-1}, N_t) - w_t N_t$.

▶ Covenant types:

1. **Interest Coverage:** $\bar{B}_t^{IC} = \frac{\theta^{IC} X_t}{r_t + \omega}$.

2. **Debt/Earnings:** $\bar{B}_t^{DE} = \theta^{DE} X_t$.

3. **Leverage:** $\bar{B}_t^{LEV} = \theta^{LEV} K_{t-1}$.

▶ Only interest coverage **directly shifted** by interest rates.

- Highly sensitive, elasticity of \bar{B}^{IC} to rates is ~ 10 .

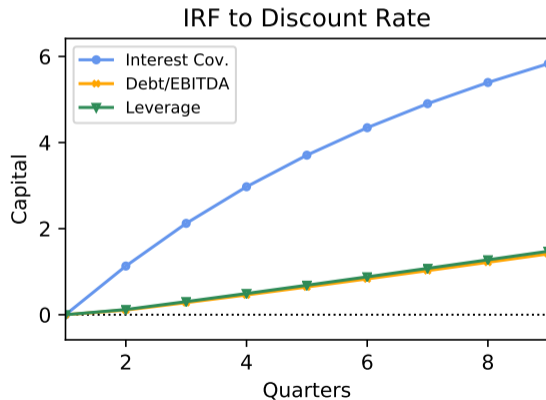
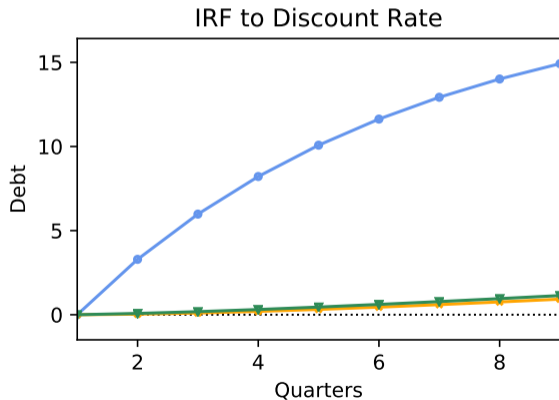
▶ Overall debt limit is smoothed to allow for e.g., annual financial statistics:

$$B_t \leq \rho \bar{B}_t + (1 - \rho) \pi_t^{-1} B_{t-1}$$

Results

Comparison: Covenant Types

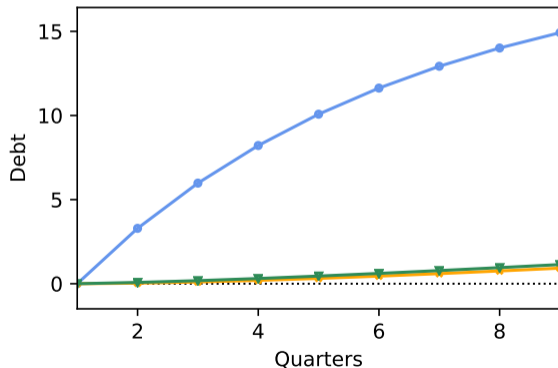
- ▶ **Main Result #1:** Interest Coverage covenants amplify interest rate transmission.
- ▶ Compare linearized IRF to \downarrow 100bp disc. rate shock in economies each with single constraint.



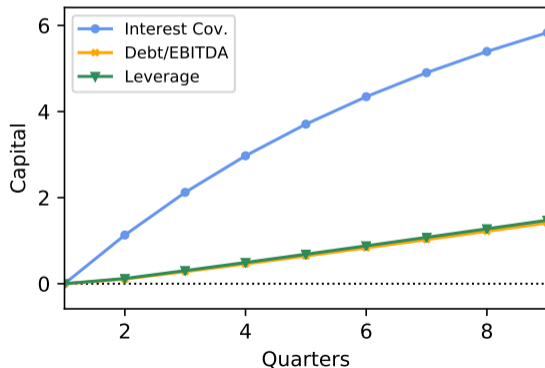
Comparison: Covenant Types

- ▶ IC economy: large relaxation of debt limits \implies capital, EBITDA growth \implies feedback.
- ▶ Additional 8Q growth of debt (14.1%), capital (4.4%), output (4.4%) relative to DE economy.

IRF to Discount Rate



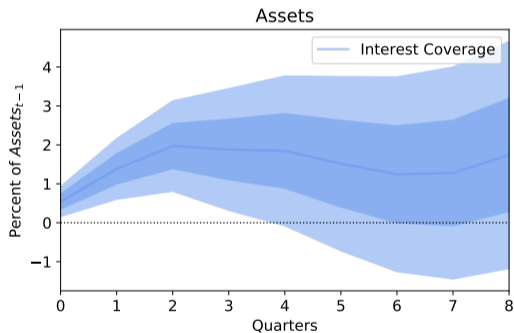
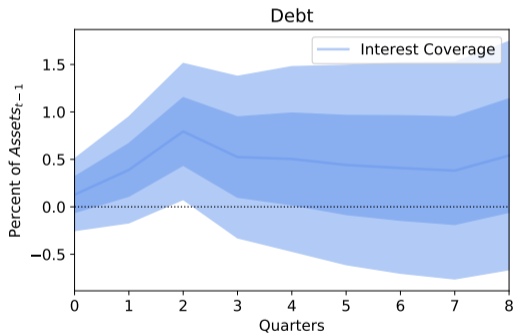
IRF to Discount Rate



Empirical Evidence: Covenant Types

- ▶ Regression on merged Compustat (investment, debt) + DealScan (loan covenants) data:

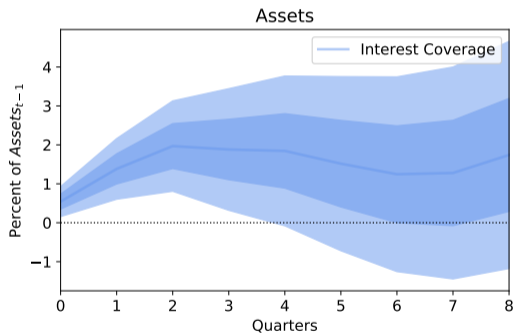
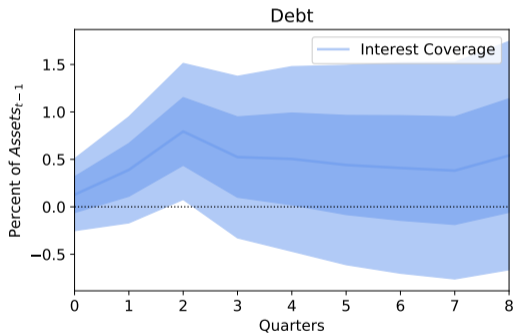
$$y_{i,t+h} = \alpha_i + \phi_{ind,t} + \sum_{cov} \mathbb{I}_{cov,t} \cdot (\beta_{0,cov} + \beta_{1,cov} \Delta r_t) + \gamma' X_{t-1} + \delta' (X_{t-1} \cdot \Delta r_t) + \varepsilon_{i,t}$$



Source: DealScan, Compustat. The sample spans 1997Q1 to 2007Q4. Dark bands indicate 67% confidence bands, while light bands indicate 95% confidence bands. Standard errors are clustered at the firm level.

Empirical Evidence: Covenant Types

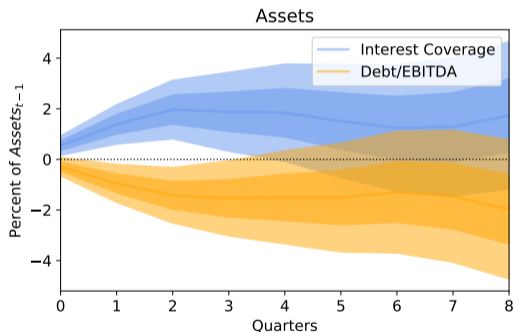
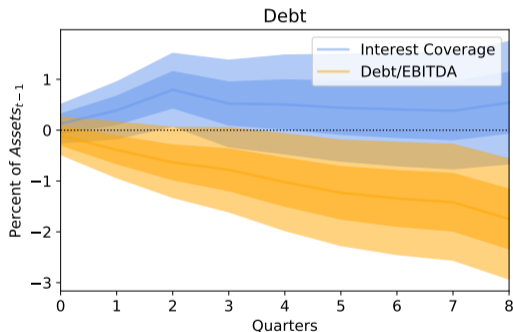
- ▶ Industry-time fixed effects control for endogeneity of interest rate.
- ▶ Larger responses to rates \downarrow 100bp for firms with Interest Coverage covenants.



Source: DealScan, Compustat. The sample spans 1997Q1 to 2007Q4. Dark bands indicate 67% confidence bands, while light bands indicate 95% confidence bands. Standard errors are clustered at the firm level.

Empirical Evidence: Covenant Types

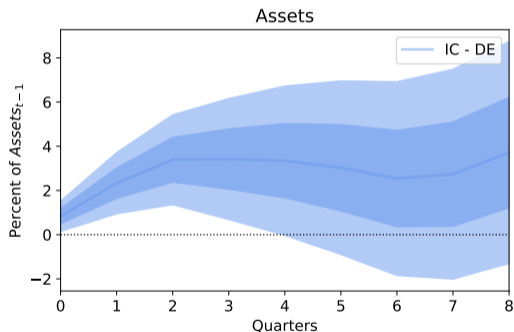
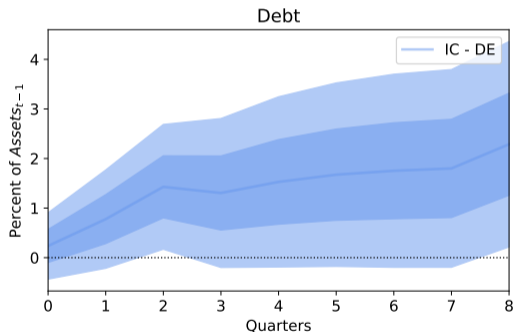
- ▶ Challenge: firms with no covenants differ from IC firms on observables.
- ▶ Better comparison: firms with DE covenants. These show no increased response.



Source: DealScan, Compustat. The sample spans 1997Q1 to 2007Q4. Dark bands indicate 67% confidence bands, while light bands indicate 95% confidence bands. Standard errors are clustered at the firm level.

Empirical Evidence: Covenant Types

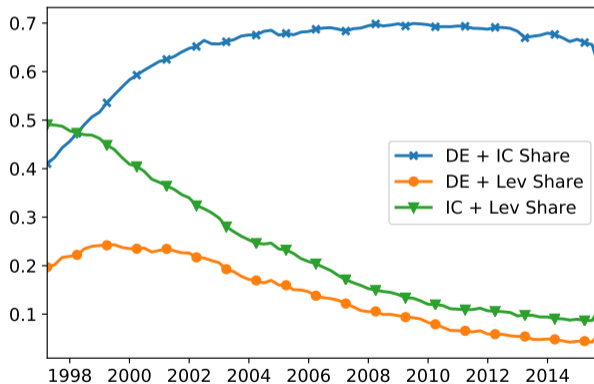
- ▶ Formal comparison: estimate $\beta_{1,IC} - \beta_{1,DE}$.
- ▶ Estimate: higher 8Q debt growth (2.3%), asset growth (3.7%) for IC relative to DE covenant.



Source: DealScan, Compustat. The sample spans 1997Q1 to 2007Q4. Dark bands indicate 67% confidence bands, while light bands indicate 95% confidence bands. Standard errors are clustered at the firm level.

Multiple Covenants

- ▶ Previous analysis considers economies with a single covenant at a time.
- ▶ Data: most firms with any covenants have **both** Interest Coverage + Debt/Earnings.



Source: DealScan. Shares are equally weighted among DealScan firms with at least one covenant.

Implementation: Debt/Earnings + Interest Coverage Covenant

- ▶ Assume common Debt/Earnings limit $\bar{\theta}^{DE}$, but each firm i faces idiosyncratic IC limit:

$$\theta_{i,t}^{IC} = e_{i,t} \bar{\theta}^{IC}, \quad e_{i,t} \stackrel{iid}{\sim} \Gamma_e$$

- ▶ Timing:

- Firm re-draws $e_{i,t}$ each time it takes on new debt.
- Must choose capital before it knows its draw of $e_{i,t}$.

- ▶ Overall debt limit: $\bar{B}_{i,t} = \min(\bar{B}_{i,t}^{IC}, \bar{B}_{i,t}^{DE})$.

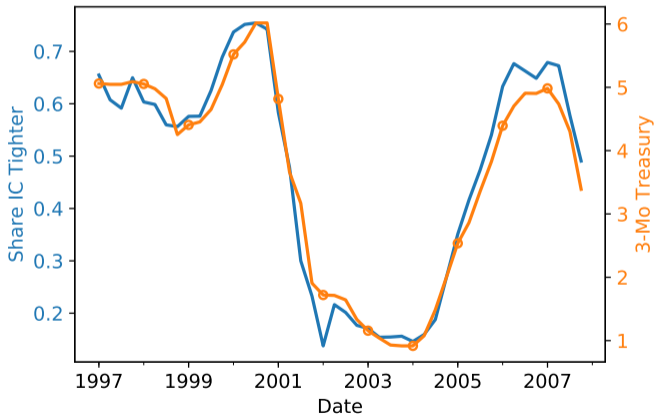
- ▶ Calibrate σ_e to match IQR of $\theta_{i,t}^{DE} / \theta_{i,t}^{IC}$ in DealScan data.

- ▶ Calibrate $\bar{\theta}^{IC}, \bar{\theta}^{DE}$ to match that 47% have tighter IC at steady state.

State Dependence

- ▶ Whether Interest Coverage vs. Debt/Earnings is tighter uniquely determined by rates.

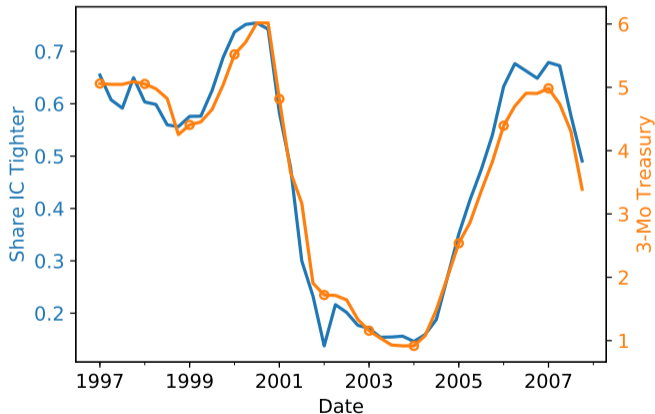
- IC binds $\iff r_t \geq r_{i,t}^* \equiv \theta_{i,t}^{IC} / \bar{\theta}^{DE}$



Source: DealScan, Compustat, equally weighted. Assumed interest rate is 600bp spread over the 3-Month T-Bill.

State Dependence

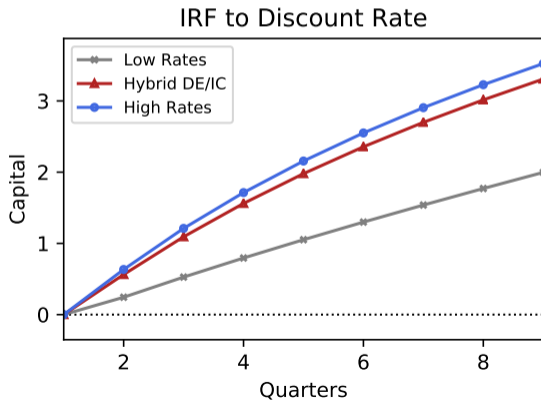
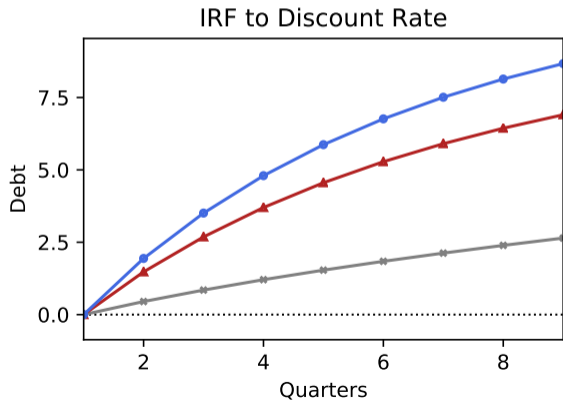
- DealScan data: substantial variation in implied fraction with IC as tighter covenant.



Source: DealScan, Compustat, equally weighted. Assumed interest rate is 600bp spread over the 3-Month T-Bill.

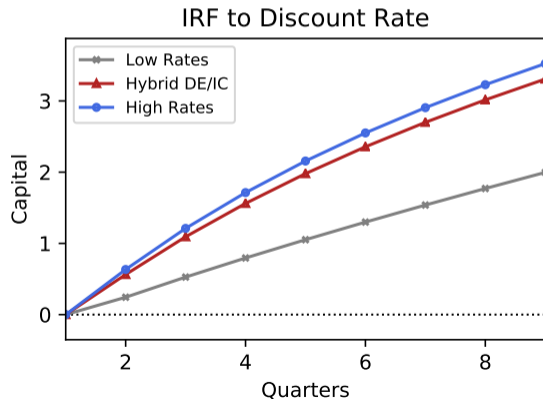
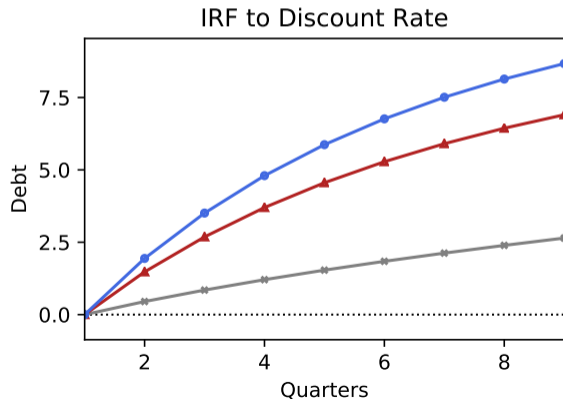
State Dependence: DE + IC Covenants

- ▶ **Main Result #2:** Combining IC + DE covs \implies **state dependent** interest rate transmission.
- ▶ Alternative regimes with SS interest (discount) rate high (+250bp) vs. low (-250bp).



State Dependence: DE + IC Covenants

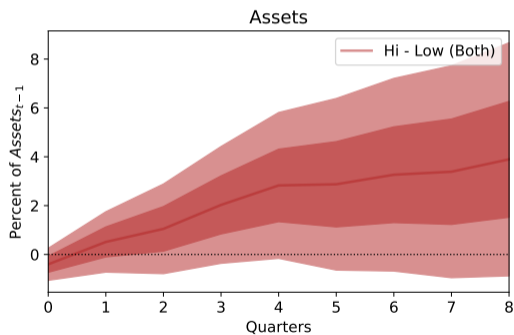
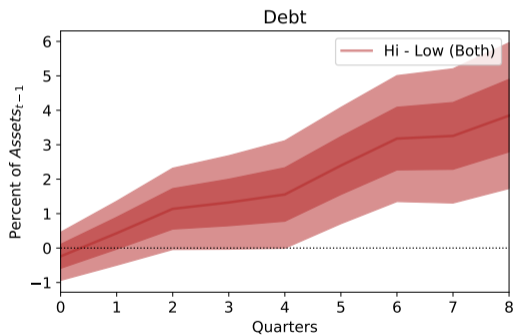
- ▶ Stronger transmission when rates are high (79% IC binds) vs. low (8% IC binds).
- ▶ Additional 8Q growth in debt (6.0%), capital (1.5%) in high vs. low rate regime.



Empirics: State Dependence

- ▶ Augment original regression to allow coefficients to depend on interest rate regime:

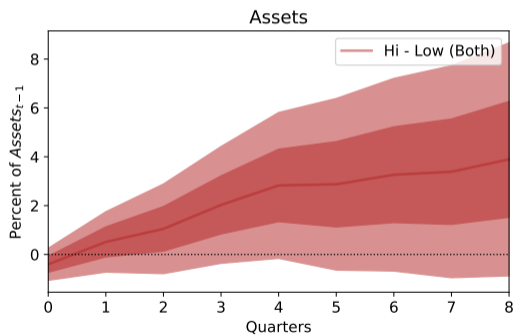
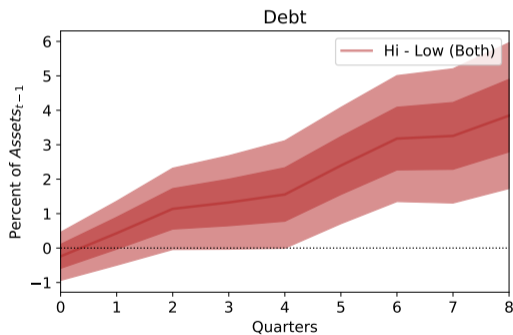
$$y_{i,t+h} = \alpha_i + \phi_{\text{ind},t} + \sum_{s \in \{\text{hi}, \text{low}\}} \mathbb{I}_{s,t} \left\{ \sum_{\text{COV}} \mathbb{I}_{\text{COV},t} \cdot \left(\beta_{0,\text{COV}}^s + \beta_{1,\text{COV}}^s \Delta r_t \right) + \gamma'_s X_{t-1} + \delta'_s (X_{t-1} \cdot \Delta r_t) \right\} + \varepsilon_{i,t}$$



Source: DealScan, Compustat. The sample spans 1997Q1 to 2007Q4.

Empirics: State Dependence

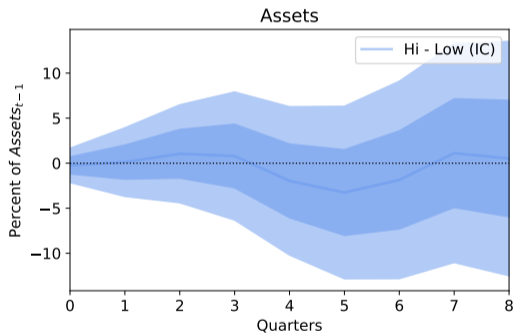
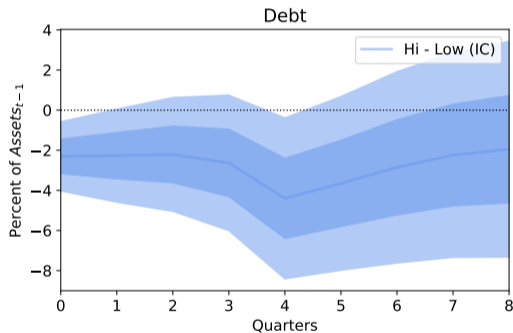
- ▶ Additional 8Q growth in debt (3.8%), assets (3.9%) in high vs. low rate environment.
- ▶ Stronger response in high vs. low rate regime (despite smaller proportional change).



Source: DealScan, Compustat. The sample spans 1997Q1 to 2007Q4.

Empirics: State Dependence

- ▶ No state dependent response for firms with IC covenant only.



Source: DealScan, Compustat. The sample spans 1997Q1 to 2007Q4.

Conclusion

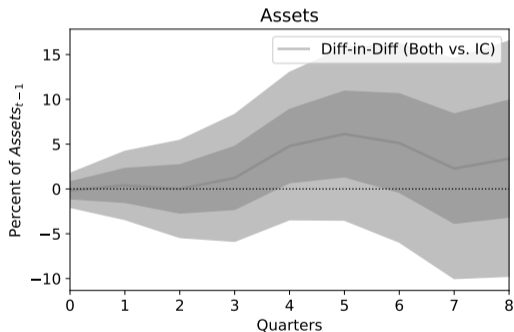
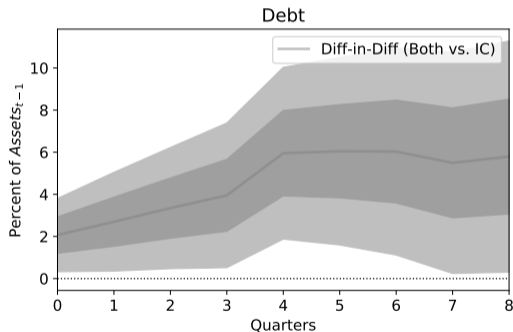
- ▶ Novel model capturing key facts about corporate debt limits.
 - Interest Coverage limits are extremely common, caps stable over time.
 - Typical firm has multiple covenants.

- ▶ Main results:
 - Interest Coverage covenants amplify interest rate transmission.
 - State dependent transmission: stronger when rates are high.
 - Findings supported by firm-level data.

- ▶ Next steps:
 - More realistic firm profile, violation risk instead of hard caps.
 - General equilibrium effects.
 - Scraping EDGAR data.

Empirics: State Dependence

- ▶ Difference in difference (high vs. low, both covenants vs. IC only).
- ▶ Difference in high vs. low regime difference between Both and IC in 8Q growth is 5.8% for debt, 3.4% for assets.



Source: DealScan, Compustat. The sample spans 1997Q1 to 2007Q4.

Representative Household's Problem

- ▶ Rep. household chooses consumption C_t , labor supply N_t and new debt B_t to maximize

$$V^H(B_{t-1}) = u(C_t) - v(N_t) + \beta E_t[V^H(B_t)]$$

subject to the budget constraint

$$C_t = \underbrace{\Psi(D_t)}_{\text{dividends}} + \underbrace{(1 - \tau)w_t N_t}_{\text{labor income}} + \underbrace{r_t \pi_t^{-1} B_{t-1}}_{\text{interest payment}} - \underbrace{(B_t^* - \pi_t^{-1} B_{t-1})}_{\text{net debt issuance}} + \underbrace{T_t^S}_{\text{transfer}}$$

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