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 general equilibrium 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 4.8% capital growth after 8Q in model (8.4% in data).
- **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 (+3ppt) vs. low (-3ppt) rate regime: $\downarrow$ 100bp $\implies$ extra 2.5% capital after 8Q in model.

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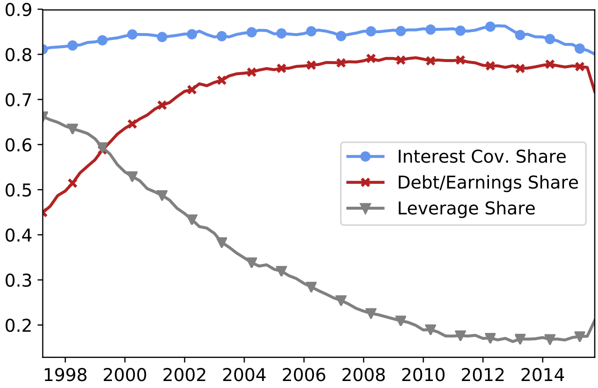
Background: Debt Covenants

- 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

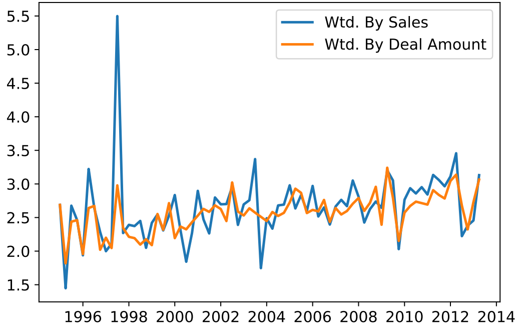
- Plot: share with each covenant type for firms with at least one DealScan covenant.
- Share with Interest Coverage high and stable over time.



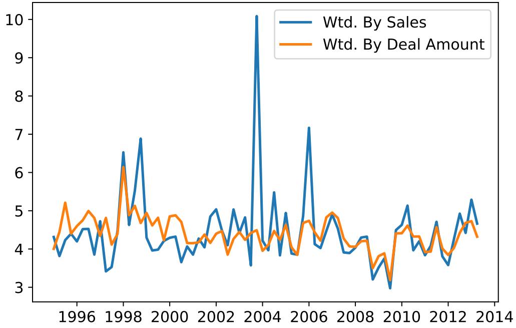
Source: DealScan. Shares are equally weighted among DealScan firms with at least one covenant.

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

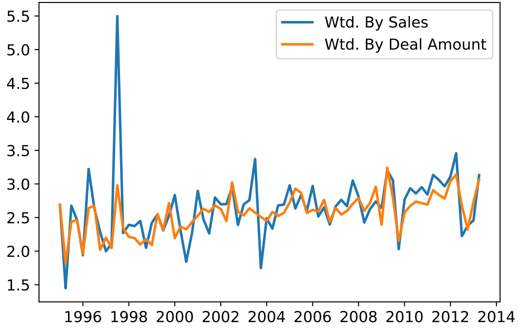


(b) Max Debt/Earnings Ratio

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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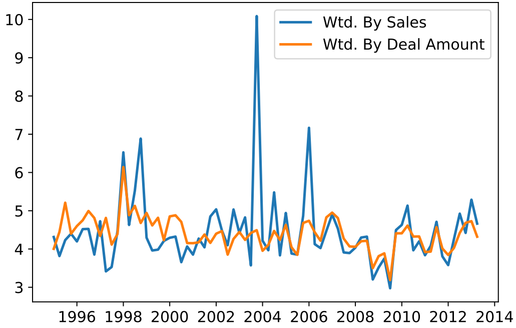
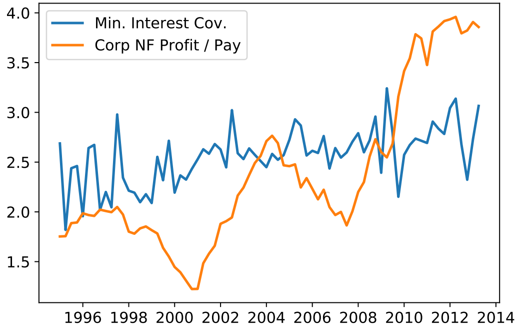


(b) Max Debt/Earnings Ratio

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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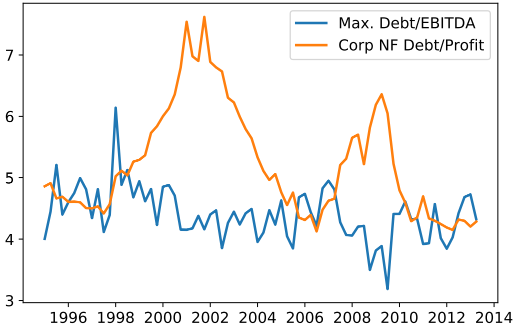
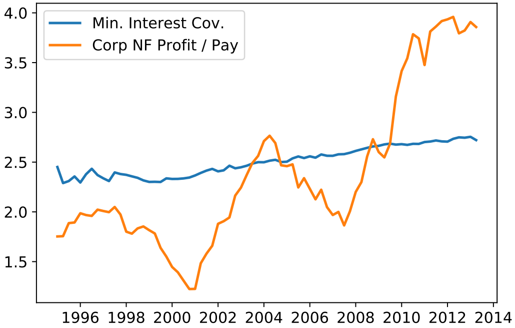


(b) Max Debt/Earnings Ratio

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.

Covenant Ratios Over Time

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



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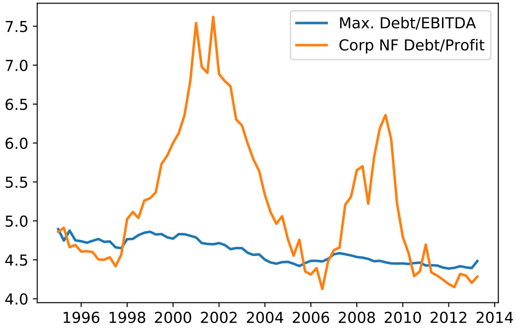

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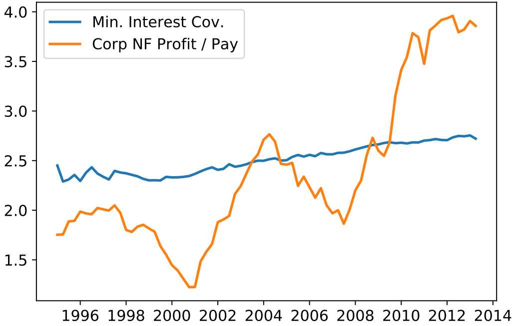
Covenant Ratios Over Time

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



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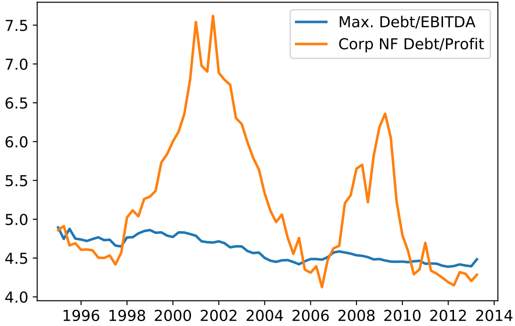

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Model

Model Overview

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

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

  - 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

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

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

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

and the borrowing constraint (debt covenants).

Household's Problem

Covenant Implementations

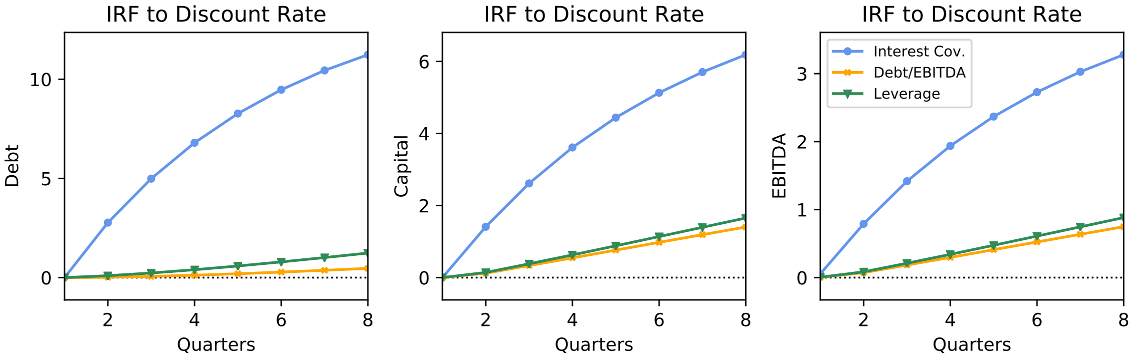
- Denote EBITDA by $X_t = f(K_{t-1}, N_t) - w_t N_t$.
- Covenant types:
  1. **Interest Coverage:** $\bar{B}_t^{IC} = \dfrac{\theta^{IC} X_t}{r_t + \omega}$.
  2. **Debt/Earnings:** $\bar{B}_t^{DE} = \theta^{DE} X_t$.
  3. **Leverage:** $\bar{B}_t^{LEV} = \theta^{LEV} K_{t-1}$.
- Only interest coverage **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

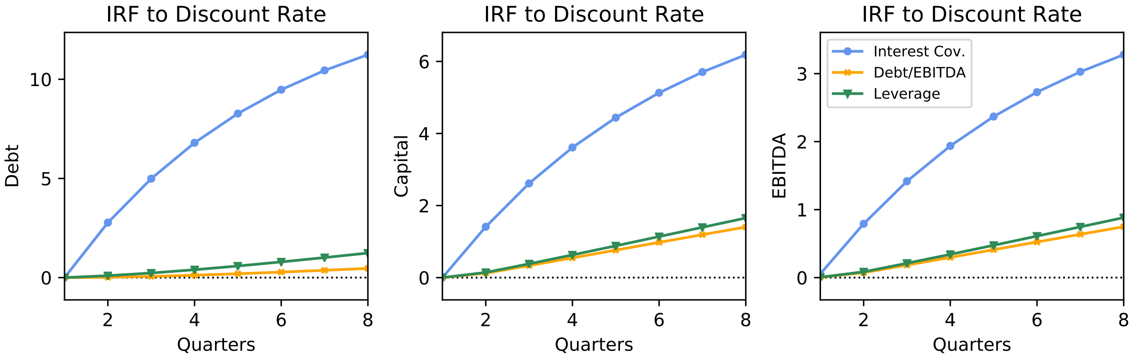
Comparison: Covenant Types

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



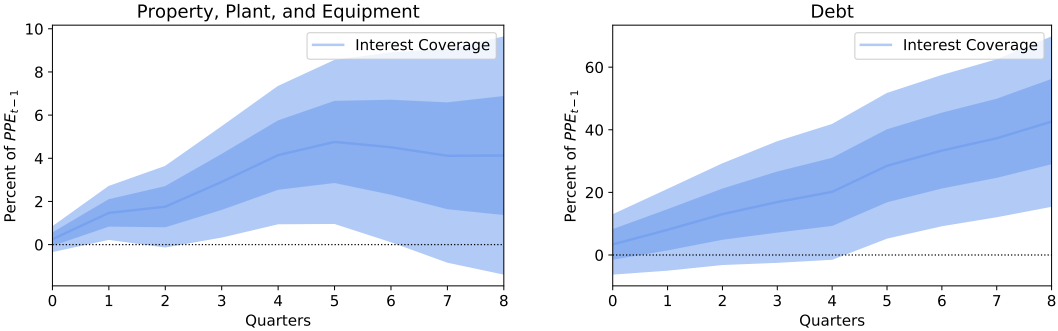
Comparison: Covenant Types

- IC economy: large relaxation of debt limits $\Longrightarrow$ capital, EBITDA growth $\Longrightarrow$ feedback.
- Additional 8Q growth of debt (10.7%), capital (4.8%), output (2.5%) relative to DE economy.



Empirical Evidence: Covenant Types

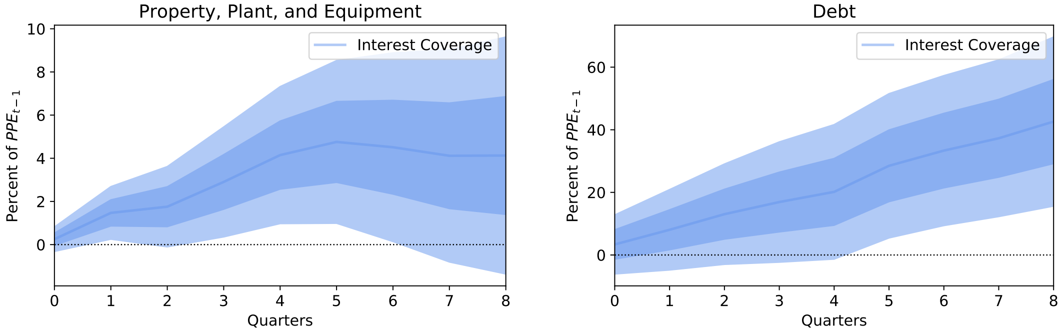
- Data: merged Compustat (investment, debt) + DealScan (loan covenants).
- Regression: $$y_{i,t+h} = \alpha_i + \phi_t + \sum_{\text{cov}} \mathbb{I}_{\text{cov},t} \cdot (\beta_{0,\text{cov}} + \beta_{1,\text{cov}} \Delta r_t) + \gamma' X_{t-1} + \delta'(X_{t-1} \cdot \Delta r_t) + \varepsilon_{i,t}.$$



Source: DealScan, Compustat. The sample spans 1994Q1 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

- Time effects control for endogeneity of interest rate.
- Larger responses to rates ↓ 100bp for firms with Interest Coverage covenants.



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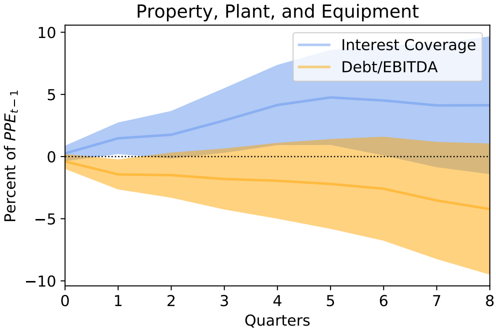
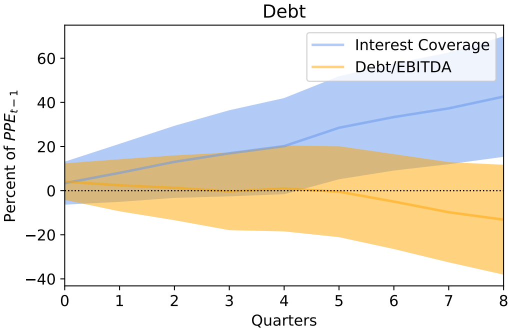
Empirical Evidence: Covenant Types

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





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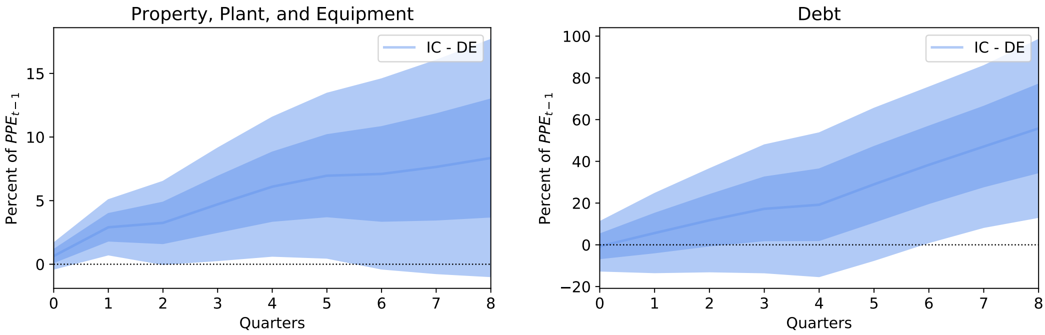
Empirical Evidence: Covenant Types

- Formal comparison: estimate $\beta_{1,IC} - \beta_{1,DE}$.
- Estimate: 8Q PPE growth 8.4% higher for IC relative to DE covenant after 100bp rate drop.



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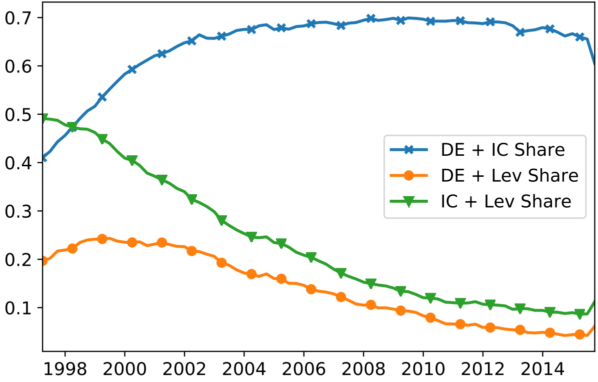
Multiple Covenants

- 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

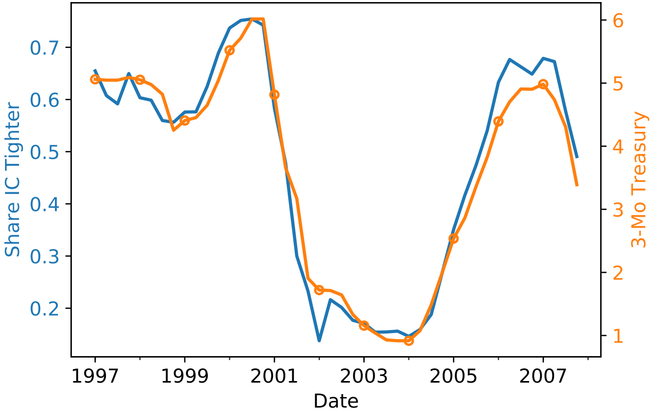
- Assume common Debt/Earnings limit $\bar{\theta}^{DE}$, but each firm i faces idiosyncratic IC limit:

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

- 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: $\bar{B}_{i,t} = \min\left(\bar{B}_{i,t}^{IC}, \bar{B}_{i,t}^{DE}\right)$.
- 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

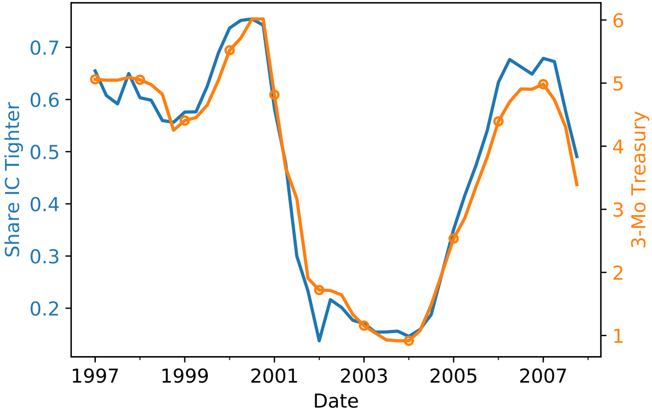
- Whether Interest Coverage vs. Debt/Earnings is tighter uniquely determined by rates.
  - IC binds $\iff r_t \geq r^*_{i,t} \equiv \theta^{IC}_{i,t} / \bar{\theta}^{DE}$



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

State Dependence

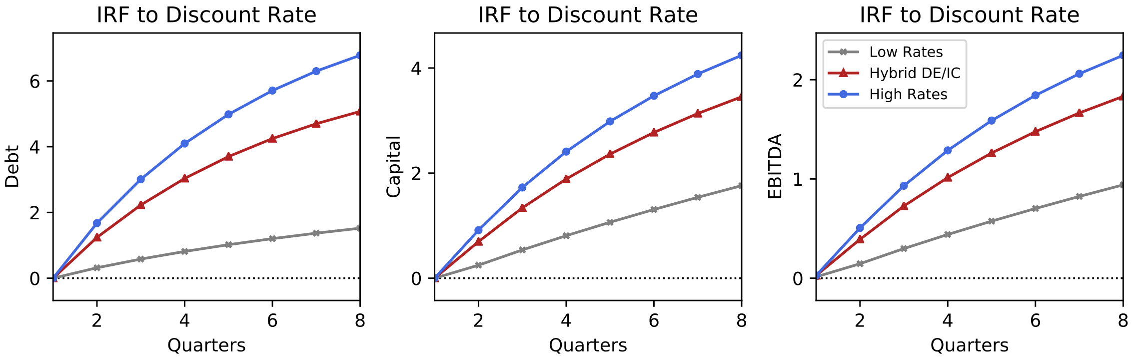
- DealScan data: substantial variation in implied fraction with IC as tighter covenant.



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

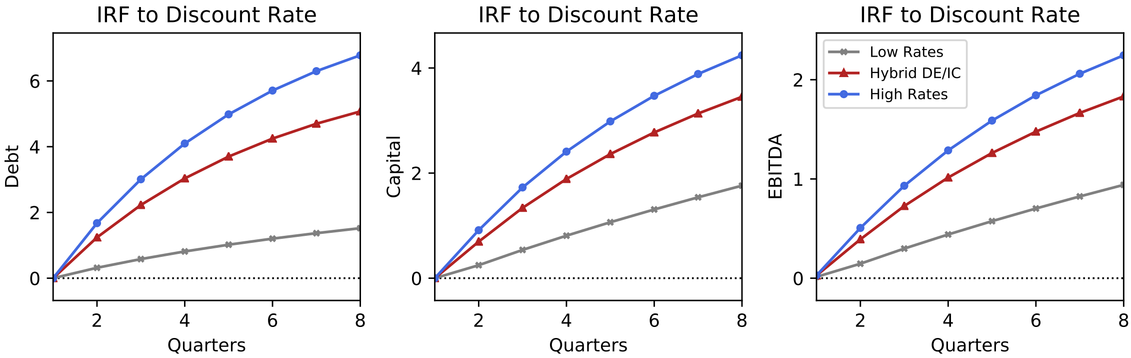
State Dependence: DE + IC Covenants

- **Main Result #2:** Combining IC + DE covs $\implies$ **state dependent** interest rate transmission.
- Alternative regimes with SS interest (discount) rate high (+3ppt) vs. low (-3ppt).



State Dependence: DE + IC Covenants

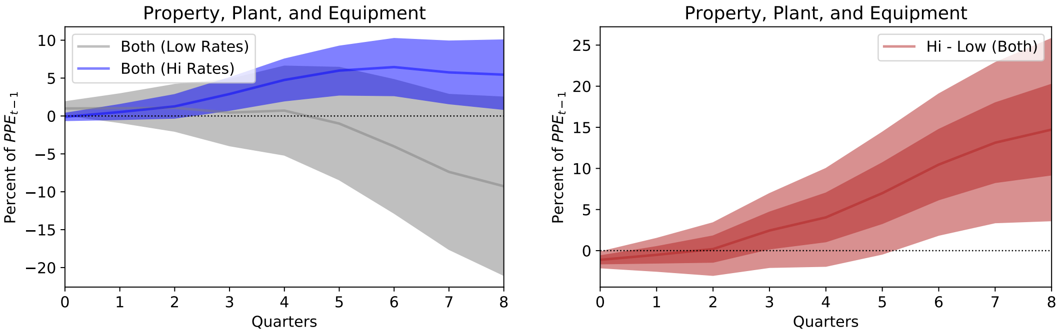
- Stronger transmission when rates are high (82% IC binds) vs. low (93% DE binds).
- Additional 8Q growth in debt (5.3%), capital (2.5%), output (1.3%) in high vs. low regime.



Empirics: State Dependence

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

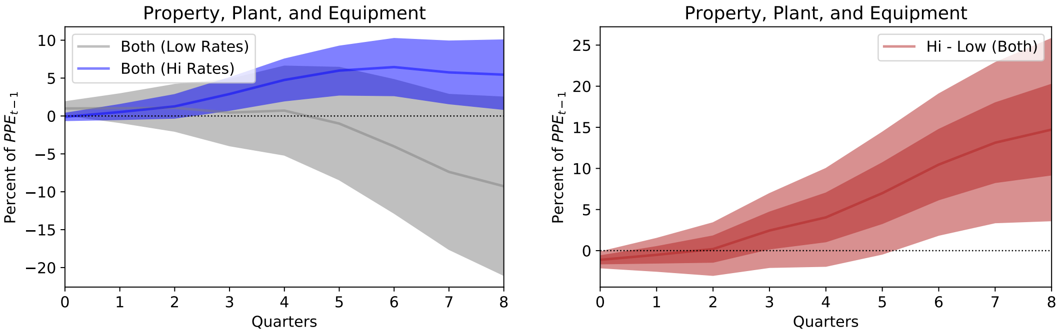
$$y_{i,t+h} = \alpha_i + \phi_t + \sum_{s \in \{hi,low\}} \mathbb{I}_{s,t} \left\{ \sum_{\text{cov}} \mathbb{I}_{\text{cov},t} \cdot \left(\beta^s_{0,\text{cov}} + \beta^s_{1,\text{cov}} \Delta r_t \right) + \gamma'_s X_{t-1} + \delta'_s (X_{t-1} \cdot \Delta r_t) \right\} + \varepsilon_{i,t}$$



Source: DealScan, Compustat. The sample spans 1994Q1 to 2007Q4.

Empirics: State Dependence

- Increased investment entirely driven by high rate ($r > 3.5\%$) environment.
  - Additional 14.7% PPE growth in high vs. low rate regime.
- Empirical state dependence only significant for firms with IC + Other covenant.



Source: DealScan, Compustat. The sample spans 1994Q1 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.
  - Scraping EDGAR data.

Representative Household's Problem

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

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

subject to the budget constraint

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

Back