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 ↓ 100bp ⇒ extra 4.8% capital growth after 8Q in model (8.4% in data).

▶ **Main Finding #2**: Combination of interest coverage + other cov. ⇒ 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: ↓ 100bp ⇒ 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 $\Rightarrow$ 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 $\theta^{IC}$ of earnings (EBITDA).
  2. **Debt/Earnings**: restrict stock of debt $\leq$ fraction $\theta^{DE}$ of earnings (EBITDA).
  3. **Leverage**: restrict stock of debt $\leq$ fraction $\theta^{LEV}$ 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.

(a) Min Interest Cov. Ratio
(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.

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.

<table>
<thead>
<tr>
<th>Year</th>
<th>Min. Interest Cov.</th>
<th>Corp NF Profit / Pay</th>
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(a) Min Interest Cov. Ratio

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<th>Year</th>
<th>Max. Debt/EBITDA</th>
<th>Corp NF Debt/Profit</th>
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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

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

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:

\[
\log \beta_t = (1 - \rho_\beta) \log \bar{\beta} + \rho \beta_{t-1} + \epsilon_{\beta,t}.
\]

- Representative firm owns capital and pays dividends to household.

▶ Productive technology:

\[
f(K_{t-1}, N_t) = Z_t K_t^\alpha N_t^{1-\alpha}
\]

▶ 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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- Flexible prices and wages, monetary authority targets (and achieves) constant inflation.
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, $\Lambda_{t+1}$ is the household SDF, subject to the budget constraint

$$D_t = (1 - \tau)\left(f(K_{t-1}, N_t) - w_tN_t\right) + \tau\delta K_{t-1} - i_tK_{t-1}$$

\[
\begin{array}{c}
\text{after-tax profit} \\
\text{depreciation credit} \\
\text{investment} \\
\text{interest payment} \\
\text{net principal}
\end{array}
\]

and the borrowing constraint (debt covenants).

Household’s Problem
Covenant Implementations

- Denote EBITDA by \( X_t = f(K_{t-1}, N_t) - w_tN_t \).

- 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 \( \bar{B}_{t}^{IC} \) to rates is \( \sim 10 \).

- Overall debt limit is smoothed to allow for e.g., annual financial statistics:
  \[
  B_t \leq \rho \bar{B}_t + (1 - \rho)\pi^{-1}B_{t-1}
  \]
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 $\implies$ capital, EBITDA growth $\implies$ 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: \( y_{i,t+h} = \alpha_i + \phi_t + \sum_{cov} I_{cov,t} \cdot (\beta_{0,cov} + \beta_{1,cov} \Delta r_t) + \gamma' X_{t-1} + \delta' (X_{t-1} \cdot \Delta r_t) + \varepsilon_{i,t}. \)

Source: DealScan, Compustat. The sample spans 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.

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

- 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 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

- 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.

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.
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 $\theta^{DE}$, but each firm $i$ faces idiosyncratic IC limit:

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

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

- Calibrate $\sigma_e$ to match IQR of $\theta^{DE}_{i,t} / \theta^{IC}_{i,t}$ 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 \( r_t \geq i^*_t \equiv \theta_{i,t}^{IC} / \theta^{DE} \)

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.
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:

\[ y_{i,t+h} = \alpha_i + \phi_t + \sum_{s \in \{hi, low\}} I_{s,t} \left\{ \sum_{cov} I_{cov,t} \cdot \left( \beta^s_{0,cov} + \beta^s_{1,cov} \Delta r_t \right) + \gamma'_{s} X_{t-1} + \delta'_{s} (X_{t-1} \cdot \Delta r_t) \right\} + \epsilon_{i,t} \]

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

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

subject to the budget constraint

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