Taxes Depress Corporate Borrowing: Evidence from Private Firms

Federal Reserve Board  U.S. Senate  Michigan & NBER

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*The views stated herein are those of the authors and are not necessarily the views of the Federal Reserve Board or the Federal Reserve System.
Outline

1 Motivation
2 Data
3 Diff-in-diff methodology
4 Results
5 Model
6 Conclusion
An **old** question – **new** data – a **new** result – a **newish** explanation

- How do taxes affect capital structure?
- New data on private firms in the United States
The first part of the paper is empirical

- Use comprehensive samples of U.S. privately-held firms
- Use simple event study techniques around changes in state corporate income taxes since the late 1980s
- Distinguish between enactment and effective dates of tax changes
The main findings contradict the importance of the tax benefit of debt

- Corporate leverage increases after tax cuts and decreases after tax hikes.

- Strong results for small private firms.

- Weak results for all public firms.

- Zero sensitivity for large private firms.
The second part of the paper is structural

- We estimate a dynamic equilibrium model of an economy

- Firms are financed by internal profits and external risky debt

- They hire, invest, and adjust debt in anticipation of future tax changes

- Interest expense is tax deductible
We show that a tax-sensitive cost can offset the tax benefit of debt

- Tax shields make leverage more attractive
- Taxes make firms less profitable and less valuable
- They move default thresholds and credit spreads
- In the model, the **quantitative** effect of taxes on default thresholds and credit spreads can be larger
Evidence has mostly supported the interest tax shield.

- Nearly all empirical evidence based on samples of large publicly-traded companies (Fleckenstein, Longstaff, and Strebulaev 2019)

- Taxes increase corporate borrowing (Heider and Ljungqvist 2015; Faccio and Xu 2015)
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Corporate loan and financial statement data

- Firm financial statements from the Federal Reserve’s Y-14 Collection:
  - **Borrower** financials from the loan portfolios of the 37 largest banks in the U.S. since 2011
  - Screen for pass-through entities
  - 38,221 firm-years, 2011–2017

- Financials data on public firms comes from the CRSP-Compustat database
  - 2011–2017 with historical information on firm location
Y14 firms are small, use more debt, and are more profitable

<table>
<thead>
<tr>
<th></th>
<th>Panel A: Y-14 Data</th>
<th></th>
<th>Panel B: Compustat Data</th>
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<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>St. Dev.</td>
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<td>Book Assets, $m</td>
<td>2,224</td>
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<td>EBITDA</td>
<td>0.14</td>
<td>0.14</td>
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<td>Long Term Debt</td>
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<td>0.25</td>
<td>0</td>
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<tr>
<td>Book Assets, $m</td>
<td>4,452</td>
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<tr>
<td>EBITDA</td>
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<td>0.28</td>
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<td>Long Term Debt</td>
<td>0.22</td>
<td>0.25</td>
<td>0.00</td>
</tr>
</tbody>
</table>
Data on state corporate taxation


- Hand collect all corresponding tax enactment dates.
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We start with a simple event study†

Our base event year is $t - 3$.

$$y_{it} = \bar{\alpha_i} + \bar{\beta_t} + \sum_{t=-3}^{t=+4} \bar{\lambda}_k 1\{K_{it} = k\} + \delta X_{it} + \varepsilon_{it}$$

- $y_{it}$ is an outcome
- firm fixed effects
- time fixed effects
- $K_{it}$ is the number of periods relative to the event
- $k < 0$ correspond to pre-trends
- $k \geq 0$ correspond to dynamic effects relative to the event
- $X$ contains state tax base rules/credits and local economy/firm controls

†I will talk about the recent diff-in-diff literature later
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Tax Cuts, Y-14 Data, Enactment Dates, Small firms

Significant rise in year zero that persists until year four

Ivanov, Petitt, Whited Taxes Depress Corporate Borrowing
Tax Cuts, Y14-Data, Enactment Dates, Large firms

Nothing to see here
Tax Cuts, Compustat, Enactment Dates
Almost nothing happens!

![Graph showing the effect of tax cuts on corporate leverage](image-url)

- Leverage treatment effect: \[-0.04, -0.02, 0, 0.02, 0.04\]
- Event time - effective dates: \[-3, -2, -1, 0, 1, 2, 3, 4, 5\]
Stuff folks worry about . . .

► Question: but aren’t these just credit supply effects?

► But then why would we see effects at the enactment date?

► Question: but aren’t the effects at the enactment date just evidence for the tax shield?

► But then why do they persist?
Stuff folks worry about . . .

- Question: but aren’t tax cuts endogenous?
  - We use a Giroud and Rauh (2019)-esque narrative approach.
  - The results for small firms at enactment dates are slightly larger.
Question: but aren't these treatment effects heterogeneous?

For the small firms at the enactment dates:
- de Chaisemartin and D'Haultfoeuille (2020) offer an estimator for a single ATT:
  - $\sim 1.9\%$ effect at time 0

- Sun and Abraham (2021) offer an estimator for a dynamic specification:
  - Significant positive effects at dates 0–4, slightly larger than our baseline.
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Equilibrium model of heterogeneous firms and a consumer

- Discrete time, infinite horizon

- A representative consumer supplies labor and consumes, maximizing expect utility, with one-period utility function

\[ \ln c + \varphi (1 - n_s) \]

- Each firm maximizes the expected present value of distributions to the consumer

- The interest and wage rates adjust to clear the labor and goods markets.
Technology is standard

- Output is a decreasing returns function of a shock, capital, and labor:

\[ y = z^n \left( k^\alpha n^{1-\alpha} \right)^\theta, \quad \theta < 1 \]

- The shock follows an AR(1) in logs

\[ \ln(z') = \rho \ln(z) + \sigma_z \varepsilon' \]

- Firms invest, \( I \), and capital accumulates

\[ k' = (1 - \delta)k + I \]

- Capital adjustment costs

\[ \psi(k, k') = \frac{\psi(k' - (1 - \delta)k)^2}{2k} \]
There are three sources of financing for investment

- profits are output minus payments to labor minus fixed operating costs

- cash (negative debt in the model)
  \[ p < 0 \]

- one-period risky debt
  \[ p > 0 \]

- No external equity issuance
  \[ \text{‡This is not a big deal.} \]

‡Ivanov, Petitt, Whited Taxes Depress Corporate Borrowing
Debt is risky

- Need not be fully collateralized

- Default occurs if debt repayment exceeds after-tax profit plus the fraction of capital, $1 - \xi$, that can be recovered in default

- The risky interest rate on debt is determined by a zero-profit condition for the financial intermediaries.

\[
\text{expected payoff discounted at the risk free rate} = \text{promised payoff discounted at the risky rate}
\]
Firm profits are taxed

- Tax rate follows a persistent Markov process:

\[ \tau' = \rho_\tau \tau + \sigma_\tau u', \quad u' \sim \mathcal{N}(0, 1). \]

- Interest tax deduction is baked into the model

- Government gives tax revenue to the consumer as a lump sum.

- Firms make decisions in anticipation of future tax changes.

- Estimate this process separately with a mini-SMM
Cash flows to shareholders are inflows minus outflows

\[
e(k, p, n, k', p', z, \tau) = (1 - \tau) \left( z^\nu \left( k^\alpha n^{1-\alpha}\right)^\theta - wn - f \right) \quad \text{after tax profits}
\]
\[
- (k' - (1 - \delta)k) - \psi(k, k') \quad \text{investment and adjustment costs}
\]
\[
+ \frac{p'}{1 + r(k', n', b', z, \tau)(1 - \tau)} - p, \quad \text{net debt issuance}
\]

where \( w \) is the wage rate, which is determined in equilibrium.
The Bellman equation is

\[
\pi(k, p, z, \tau) = \max_{k', n, p'} \left\{ e(k, p, n, k', p', z, \tau) + \frac{1}{1 + r} \mathbb{E}_\pi(k', p', z', \tau') \right\}
\]

\[
e(k, p, n, k', p', z, \tau) \geq 0
\]
We estimate the model and test for external validity

- Data and model moments mostly in line
- Parameter estimates standard
- Compare the estimated elasticity of leverage to staggered tax changes
- In the simulated and real data (de Chaisemartin and D'Haultfoeuille 2020)
- 0.014 versus 0.019
Optimal leverage declines with the tax rate for small/medium firms
Ambiguous relationship for large firms

![Graph showing the relationship between Log Productivity Shock and Optimal Leverage for low, medium, and high tax regimes.](image)

Ivanov, Petitt, Whited: Taxes Depress Corporate Borrowing
Taxes affect risky and safe debt differently

Ivanov, Petitt, Whited
Taxes affect risky and safe debt differently

![Graph showing the relationship between leverage and after-tax equilibrium interest rate for different tax levels (low, medium, high) and small firms.]
Taxes affect risky and safe debt differently
Stuff folks worry about . . .

- Question: but haven’t we been doing dynamic capital structure since the late 80s?

- Why didn’t anybody point this out before?
  - Yes, but those models do not have endogenous investment.
  - Firms never actively choose to be close to default thresholds.
Question: But do you really need this model?
Isn’t it already in the limited commitment model of Rampini and Viswanathan (2013)

But the quantitative effect is tiny — WHY?

The cost of debt is lost financial flexibility – not very tax sensitive
Question: But isn’t the default condition too stringent?
But the same thing happens in a model with endogenous (value = 0) default
Stuff folks worry about . . .

▶ Question: But what if firms can issue costly equity?
Question: But do you have any evidence that debt costs change with taxes?

Yes!

- Interest-rate data too sparsely populated.
- Y-14 data: loan maturity and collateral requirements rise with tax cuts.
- SNC data: internal bank credit ratings fall after tax cut enactments.
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Conclusion

▶ Revisit the relation between taxes and corporate leverage

▶ New data!

▶ Taxes have a *negative* effect on leverage

▶ Develop and quantify the intuition in a model

▶ Direct-tax benefits exist

▶ Can be small compared with the effect of taxes on credit spreads


