Taxes Depress Corporate Borrowing: Evidence from Private Firms

Ivan T. Ivanov*
Federal Reserve Board

Luke Pettit
U.S. Senate

Toni M. Whited
Michigan & NBER

October 13, 2022

*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

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)

Outline

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

	Mean	*St. Dev.*	*p10*	*p25*	*p50*	*p75*	*p90*
			Panel A: Y-14 Data				
Book Assets, $m	2,224	21,292	118	152	**265**	653	2,083
EBITDA	0.14	0.14	0.02	0.06	0.11	0.17	0.26
Long Term Debt	0.27	0.25	0	0.05	0.21	0.42	0.63
			Panel B: Compustat Data				
Book Assets, $m	4,452	12,715	35	139	**647**	2,682	9,147
EBITDA	0.03	0.28	-0.26	0.03	0.10	0.16	0.22
Long Term Debt	0.22	0.25	0.00	0.00	0.16	0.34	0.54

Data on state corporate taxation

- Annual data on the top statutory corporate income tax rates since 1987 from Suárez Serrato and Zidar (2018). Hand collected after 2010.
- Hand collect all corresponding tax enactment dates.

Outline

We start with a simple event study†

- Our base event year is $t-3$.

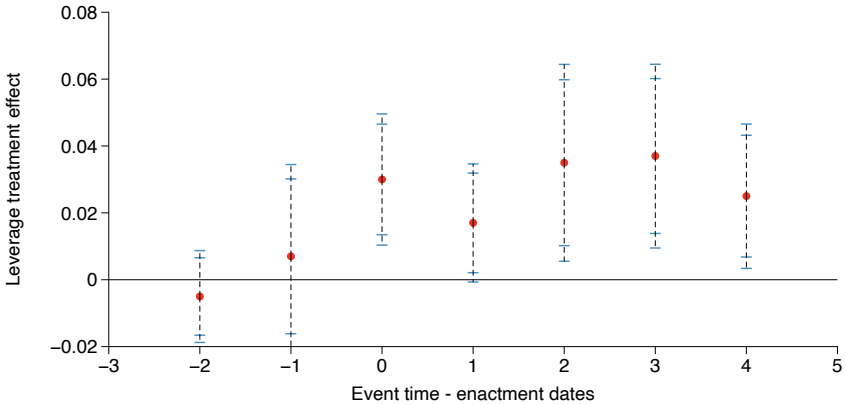
$$y_{it} = \bar{\alpha}_i + \bar{\beta}_t + \sum_{t=-2}^{t=+4} \bar{\lambda}_k \mathbf{1}\{K_{it} = k\} + \boldsymbol{\delta} \boldsymbol{X_{it}} + \varepsilon_{it}$$

  - 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

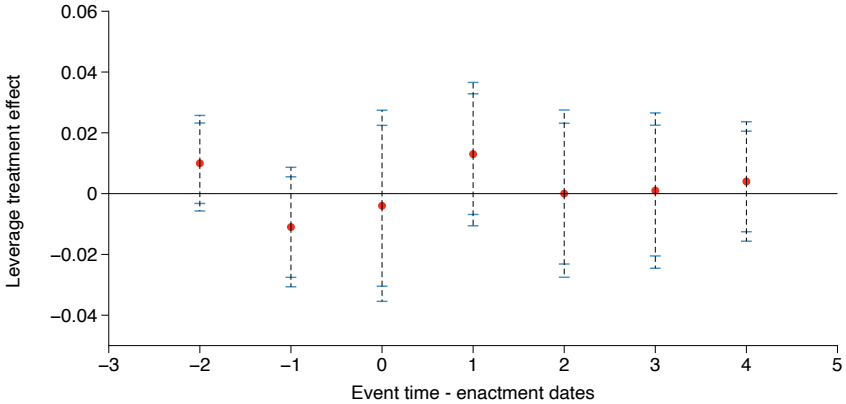
†**I will talk about the recent diff-in-diff literature later**

Outline

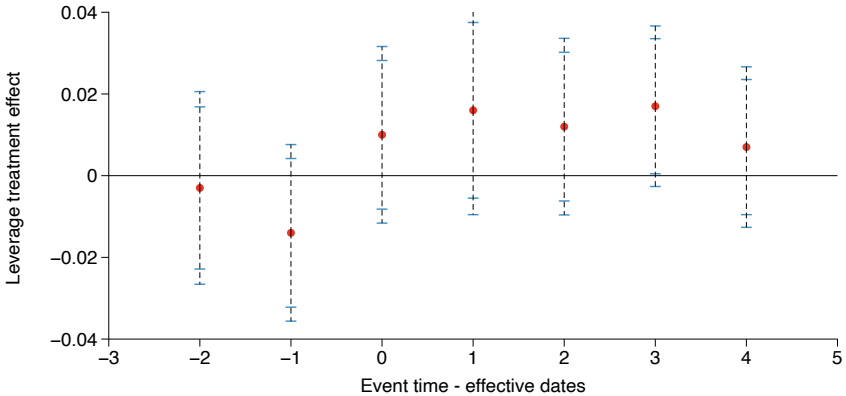
Tax Cuts, Y-14 Data, Enactment Dates, Small firms
Significant rise in year zero that persists until year four



Tax Cuts, Y14-Data, Enactment Dates, Large firms
Nothing to see here



Tax Cuts, Compustat, Enactment Dates
Almost nothing happens!



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)-esqe narrative approach.
  - The results for small firms at enactment dates are slightly larger.

Stuff folks worry about . . .

- 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.

Outline

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:

$$y = z^{\nu} \left(k^{\alpha} n^{1-\alpha}\right)^{\theta}, \qquad \theta < 1$$

- 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‡

‡**This is not a big deal.**

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.

$$\begin{array}{rcl} \text{expected payoff discounted} & = & \text{promised payoff discounted} \\ \text{at the risk free rate} & & \text{at the risky rate} \end{array}$$

Firm profits are taxed

- Tax rate follows a persistent Markov process:

$$\tau' = \rho_\tau \tau + \sigma_\tau u', \qquad u' \sim \mathcal{N}(0,1).$$

- 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

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

where w is the wage rate,
which is determined in equilibrium.

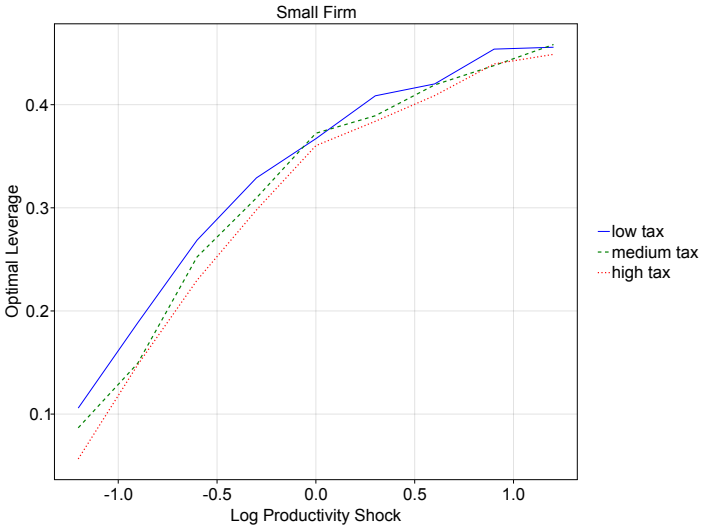
The Bellman equation is

$$\begin{aligned} \pi(k,p,z,\tau) &= \max_{k',n,p'} \left\{ e(k,p,n,k',p',z,\tau) + \frac{1}{1+r}\mathbb{E}\pi\left(k',p',z',\tau'\right) \right\} \\ e(k,p,n,k',p',z,\tau) &\geq 0 \end{aligned}$$

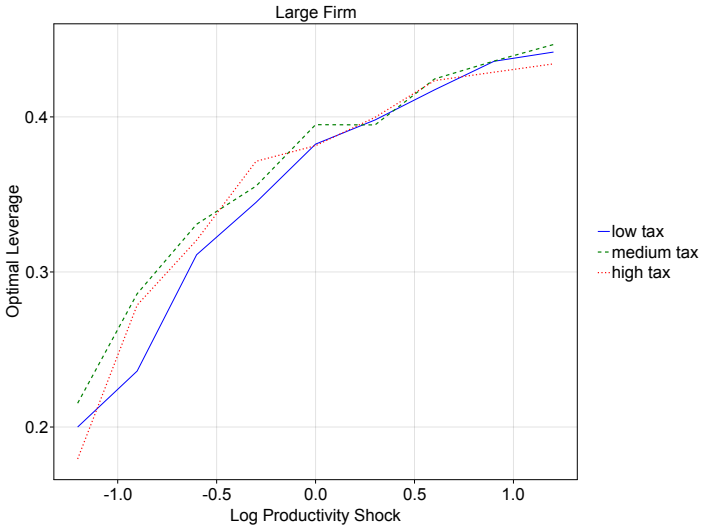
We estimate the model and test for external validity

- 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

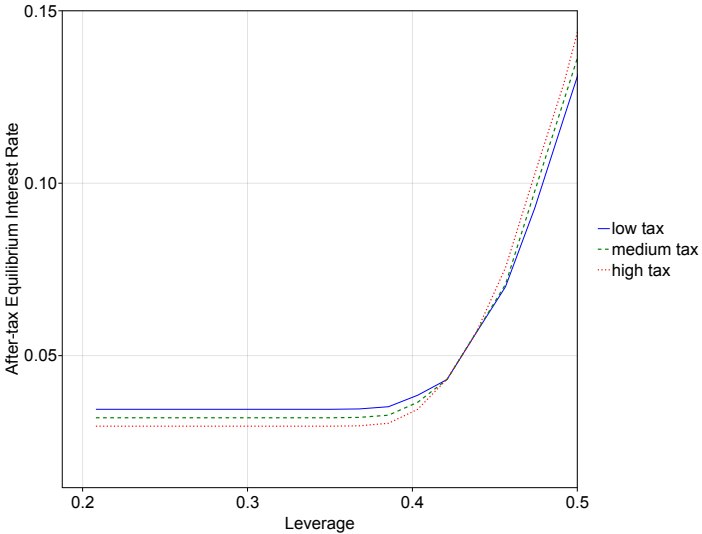
Optimal leverage declines with the tax rate for small/medium firms



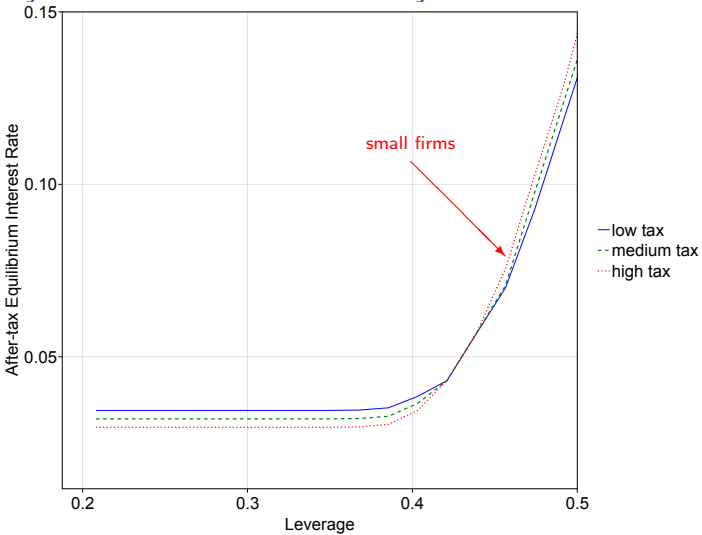
Ambiguous relationship for large firms



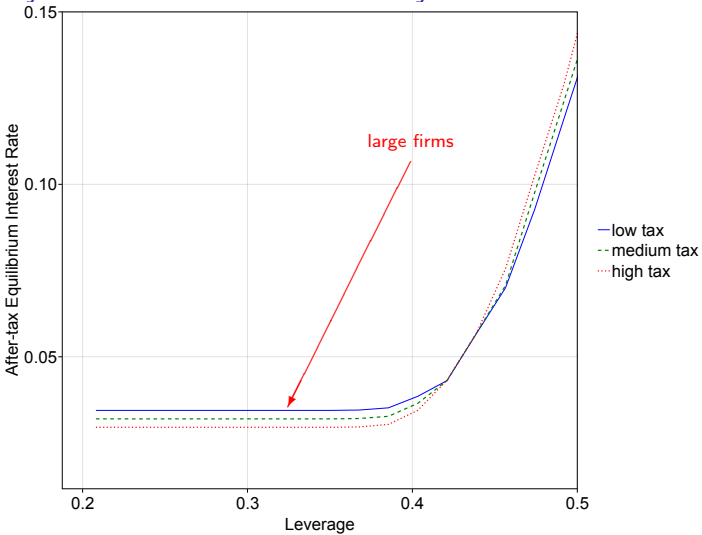
Taxes affect risky and safe debt differently



Taxes affect risky and safe debt differently



Taxes affect risky and safe debt differently

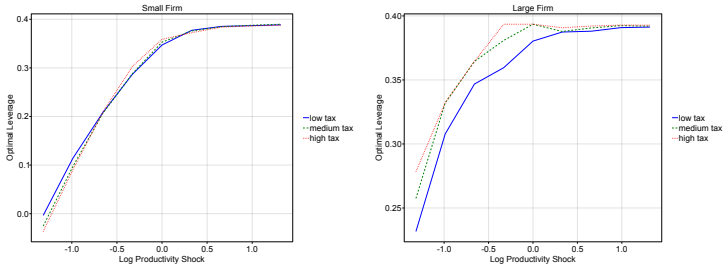


Stuff folks worry about . . .

- 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.

Stuff folks worry about . . .

- Question: But do you really need this model?
  Isn't it already in the limited commitment model of Rampini and Viswanathan (2013)

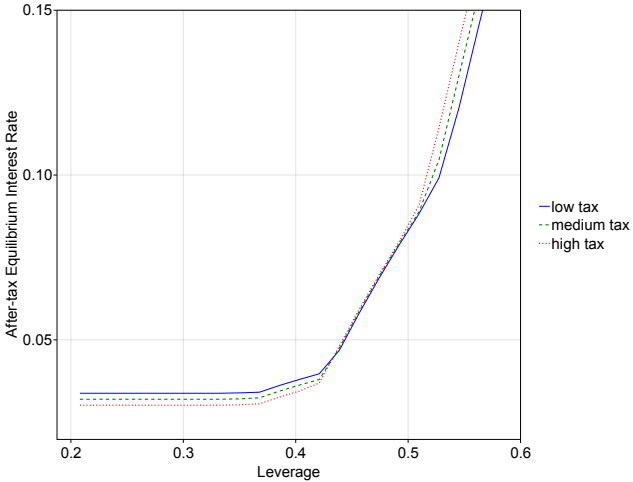


- But the quantitative effect is tiny — WHY?

- The cost of debt is lost financial flexibility – not very tax sensitive

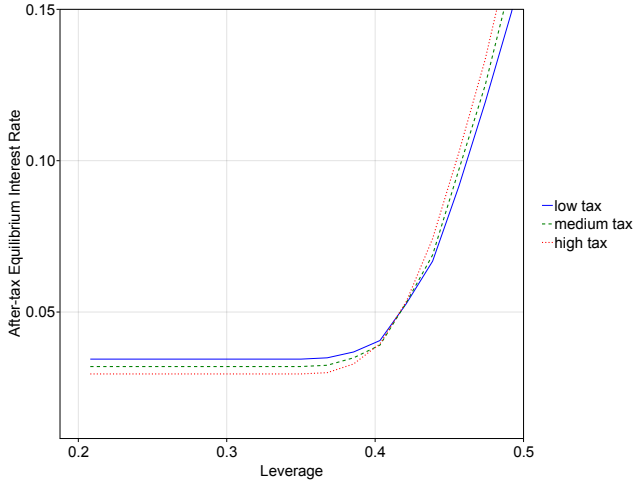
Stuff folks worry about . . .

- 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?



Stuff folks worry about . . .

- 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.

Outline

Conlusion

- 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

de Chaisemartin, Clement, and Xavier D'Haultfoeuille, 2020, Two-way fixed effects estimators with heterogeneous treatment effects, *American Economic Review* 9, 2964–2996.

Faccio, Mara, and Jin Xu, 2015, Taxes and capital structure, *Journal of Financial and Quantitative Analysis* 50, 277–300.

Fleckenstein, Matthias, Francis A. Longstaff, and Ilya A. Strebulaev, 2019, Corporate taxes and capital structure: A long-term historical perspective, *Critical Finance Review* 8, 1–28.

Giroud, Xavier, and Joshua Rauh, 2019, State taxation and the reallocation of business activity: Evidence from establishment-level data, *Journal of Political Economy* 127, 1262–1316.

Heider, Florian, and Alexander Ljungqvist, 2015, As certain as debt and taxes: Estimating the tax sensitivity of leverage from state tax changes, *Journal of Financial Economics* 118, 684–712.

Rampini, Adriano A., and S. Viswanathan, 2013, Collateral and capital structure, *Journal of Financial Economics* 109, 466–492.

Suárez Serrato, Juan Carlos, and Owen Zidar, 2018, The structure of corporate taxation and its impact on state tax revenues and economic activity, *Journal of Public Economics* 167, 158–176.

Sun, Liyang, and Sarah Abraham, 2021, Estimating dynamic treatment effects in event studies with heterogeneous treatment effects, *Journal of Econometrics* 225, 175–199.