NBER Graduate Workshop on Business Taxation

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Princeton and NBER

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Agenda

1. Overview (1-2pm)
   - Introductions
   - Overview of U.S. business tax policy and the TCJA
   - Simple framework and classic research questions
2. Firm location decisions and corporate tax incidence (2:15-3:15pm)
3. User Cost, Impact of TCJA, Open questions (3:30 - 4:15pm)
4. Taxes, Financial Policy, and Investment (**Poterba**, 4:30pm)
5. International taxation (**Hines**, 5 - 630pm)

Introductions: who am I/ who are you?

1. **My background**
   - Ph.D. from UC Berkeley, BA from Dartmouth
   - Staff Economist at Council of Economic Advisers
   - Previously an Assistant Professor at Chicago Booth

2. **Research fiscal policy topics**
   - Incidence and efficiency costs of corporate taxation
   - Economic impacts of taxing high-income earners
   - Effect of state tax system on U.S. economy
   - The structure of state corporate taxation
   - Business taxation and ownership in the U.S.
   - Who profits from patents? Rent sharing at innovative firms
   - Business Income and U.S. income inequality

I. Overview of U.S. Business Taxation

Overview of Business Taxes

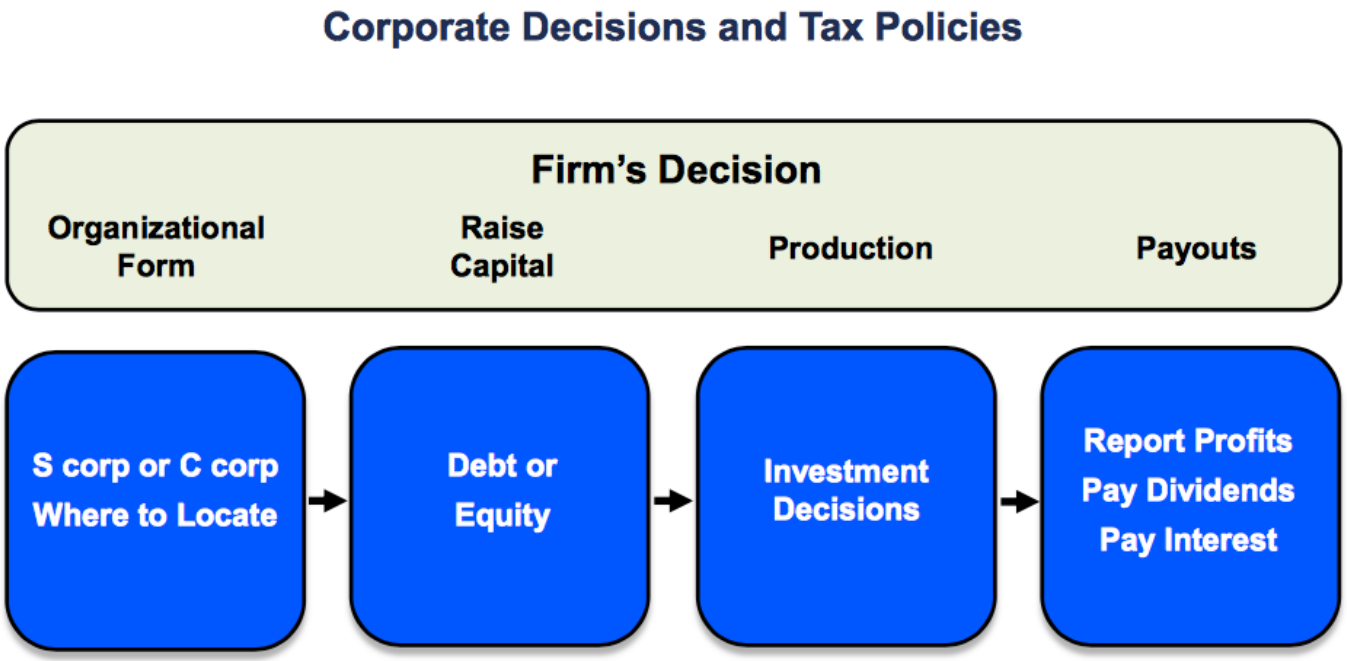
1. Brief overview of firm decisions and tax policies
2. Policy: business tax base (before and after Tax cuts and Jobs Act)
   - Business entity types, tax rates, and context for TCJA
   - Business tax base (before and after TCJA)
     - TCJA Business Tax Reform Summary
     - Key Corporate Deductions before TCJA
     - TCJA: Corporate Tax Base Reforms
     - TCJA: Pass-through Provisions
     - TCJA: International Provisions
   - Fundamental reform and apportionment
     - Tax base: source, residence, destination
     - Apportionment and State Corporate Taxation
3. Economics: Simple Framework and Research Questions
   - Simplest possible framework
   - Research Questions

U.S. Business Tax Structure

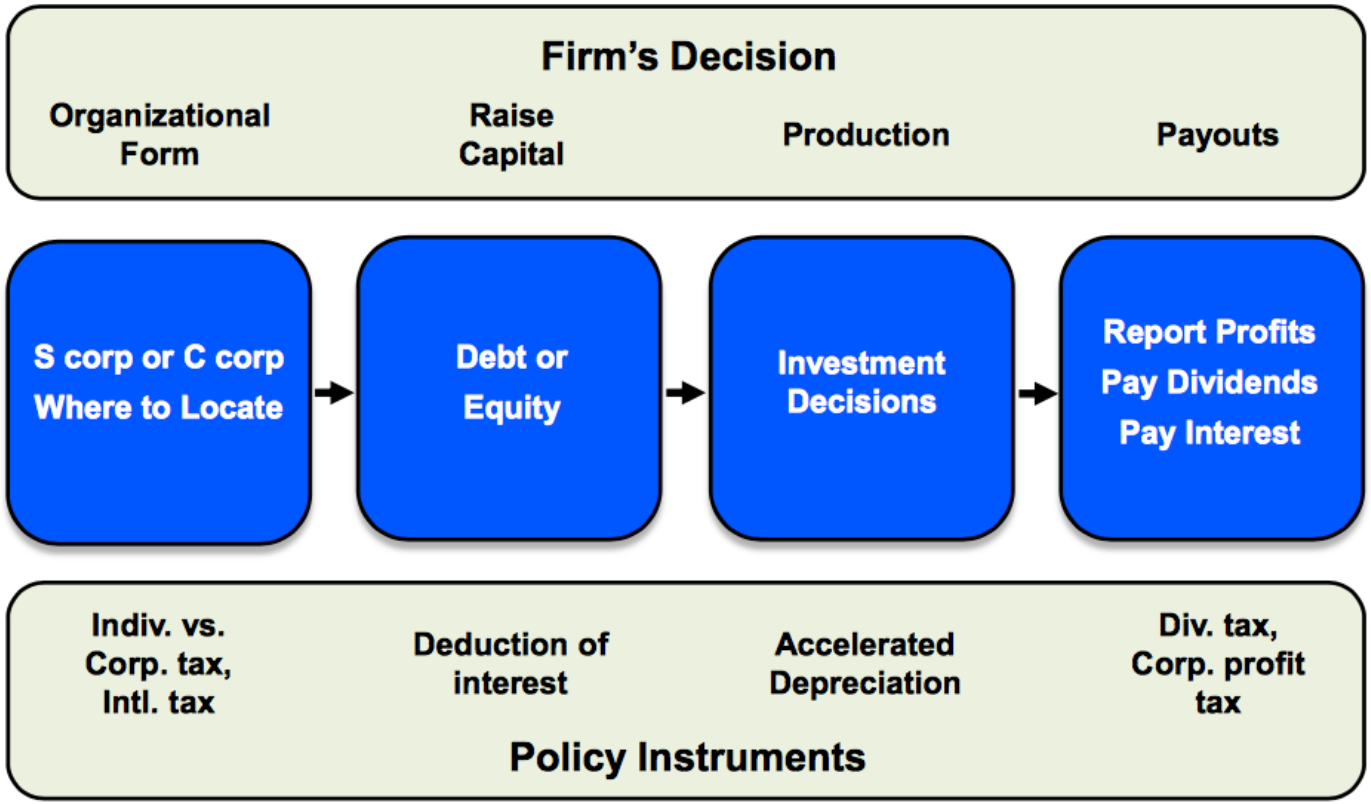
- Taxes on firms in the US consist of several elements
  1. Tax corporate profits (earnings - expenses) at approx flat rate of 21%
     - Expenses include wages+materials, depreciation, and interest payments
     - Acceleration of depreciation used to stimulate investment
  2. Individual-level taxes on payouts (capital gains, dividends, interest income)
  3. International tax provisions (transfer pricing, tax havens, FTC)
  4. Pass-throughs: most privately-owned firms (S corporations and partnerships) subject to individual income tax system

- **Goal**: characterize the consequences of this tax system and optimal design of business taxation

Corporate Decisions and Tax Policies



Corporate Decisions and Tax Policies



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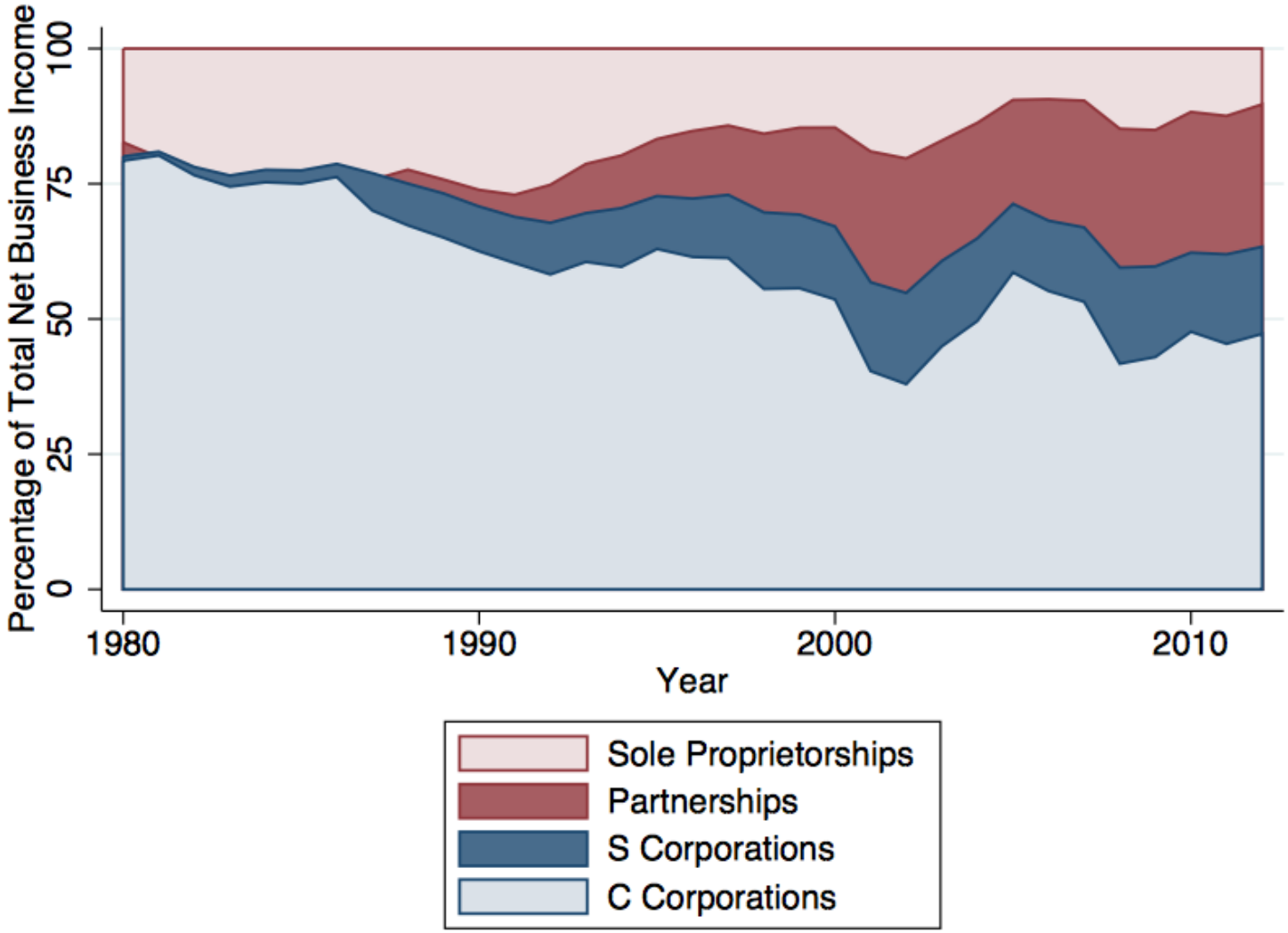
Context for tax reform

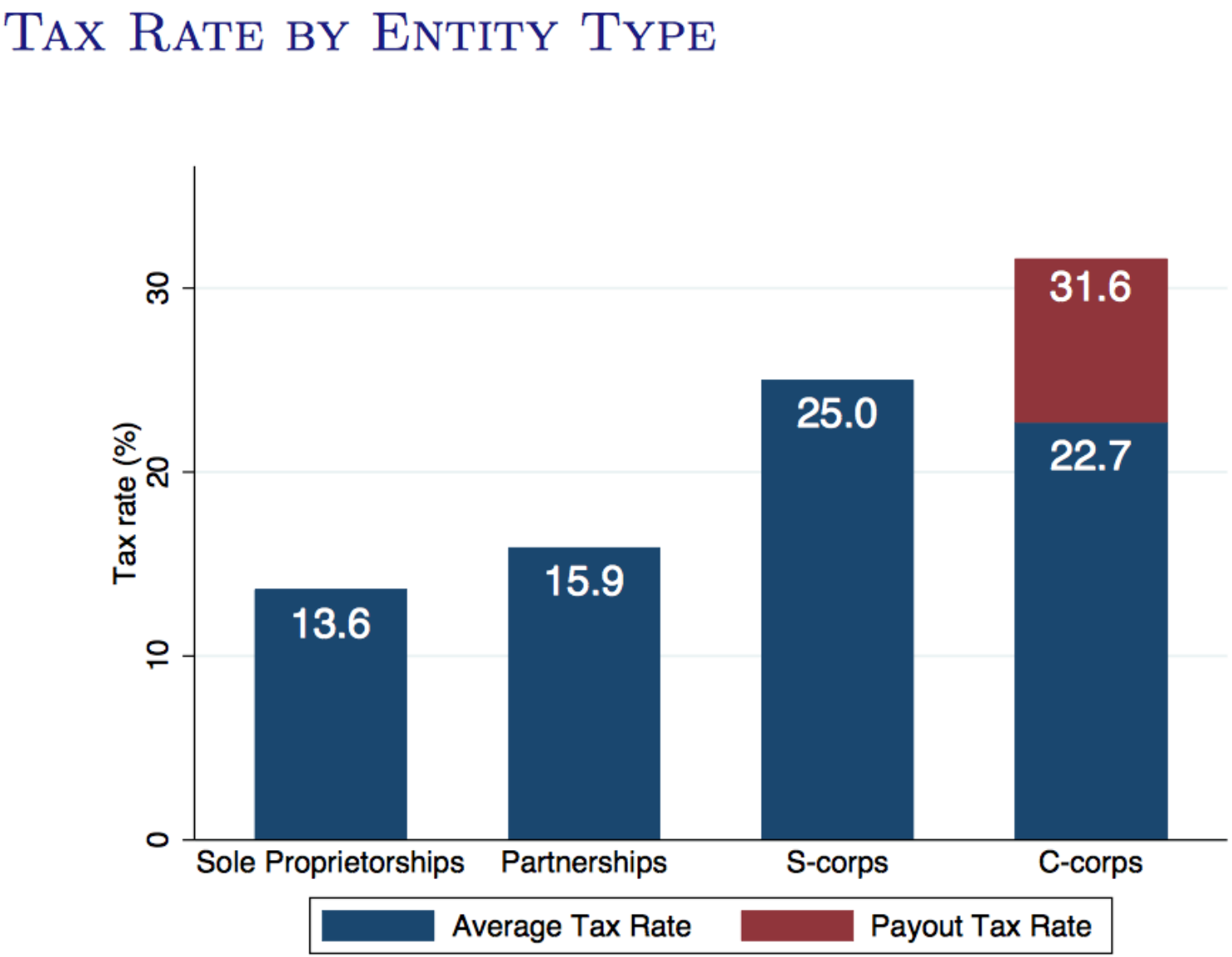
1. Rise of pass-throughs
2. Declining corporate tax revenue
3. Declining corporate tax rates
4. Substantial Tax Avoidance and Evasion

Context #1: The Rise of Pass-throughs



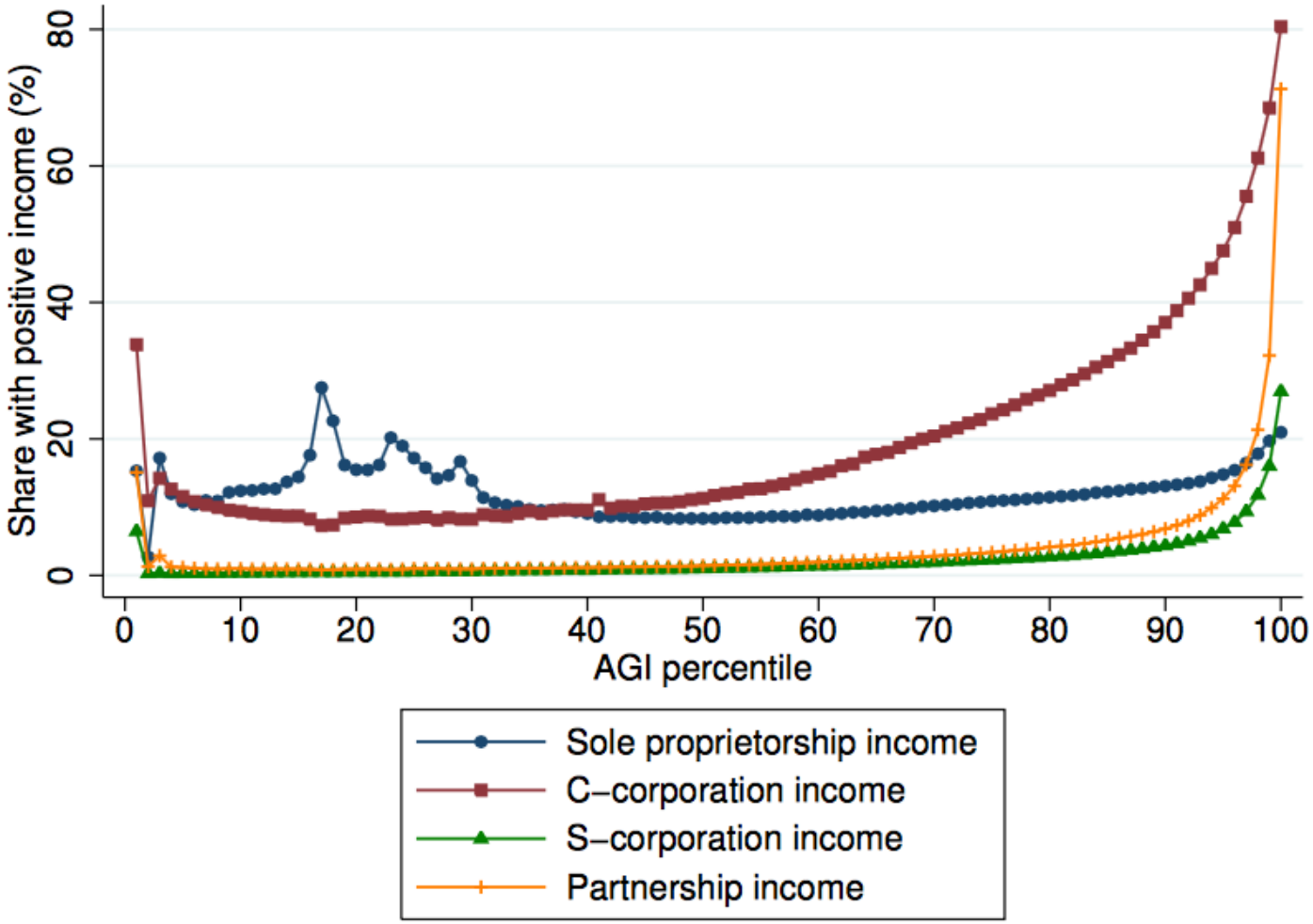
Source: Cooper et al (TPE, 2016).

Business Entity Types and Average Tax Rates in 2011



Source: Cooper et al (TPE, 2016).

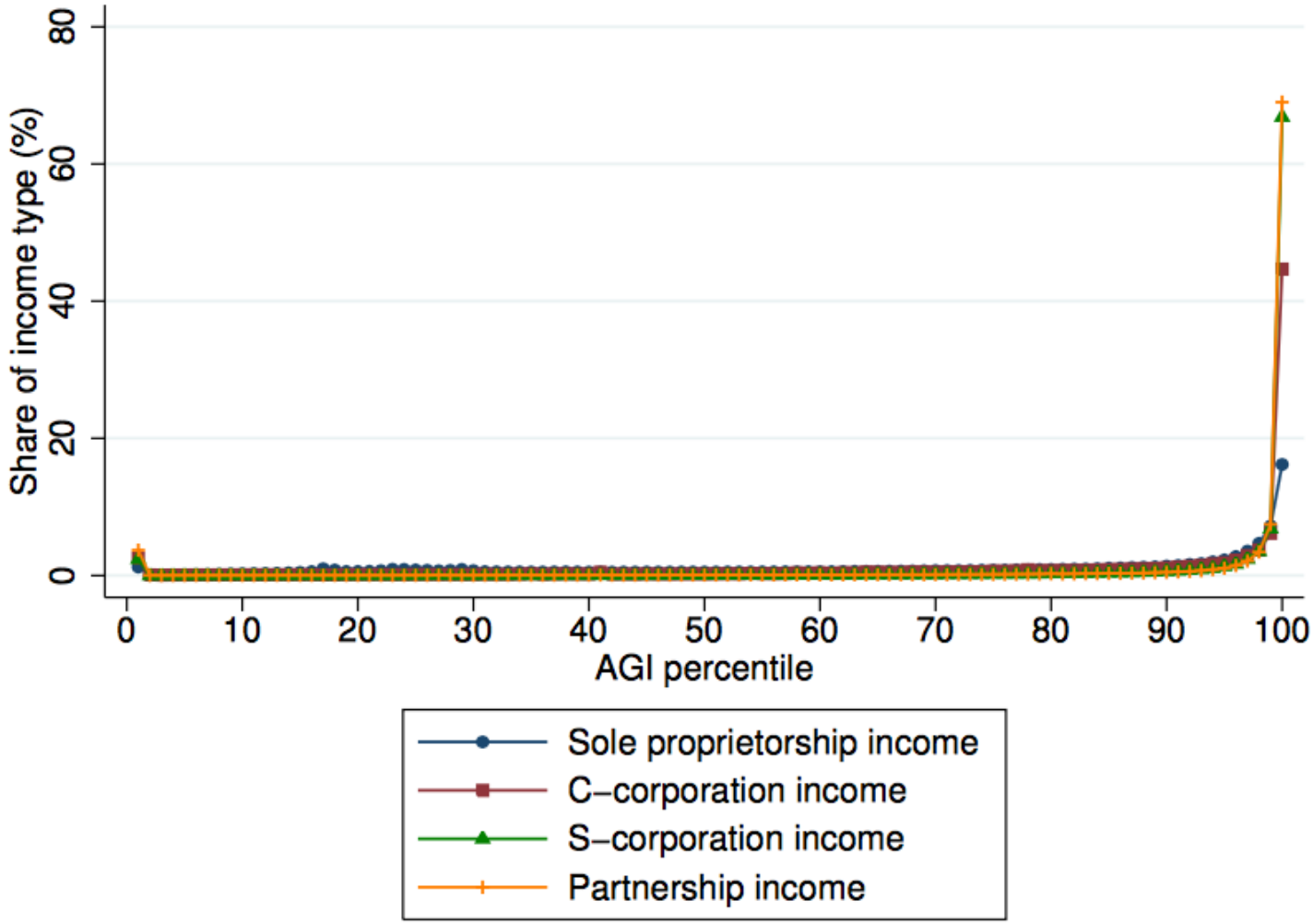
Tax rate depends on ownership, which is concentrated



Source: Cooper et al (TPE, 2016).

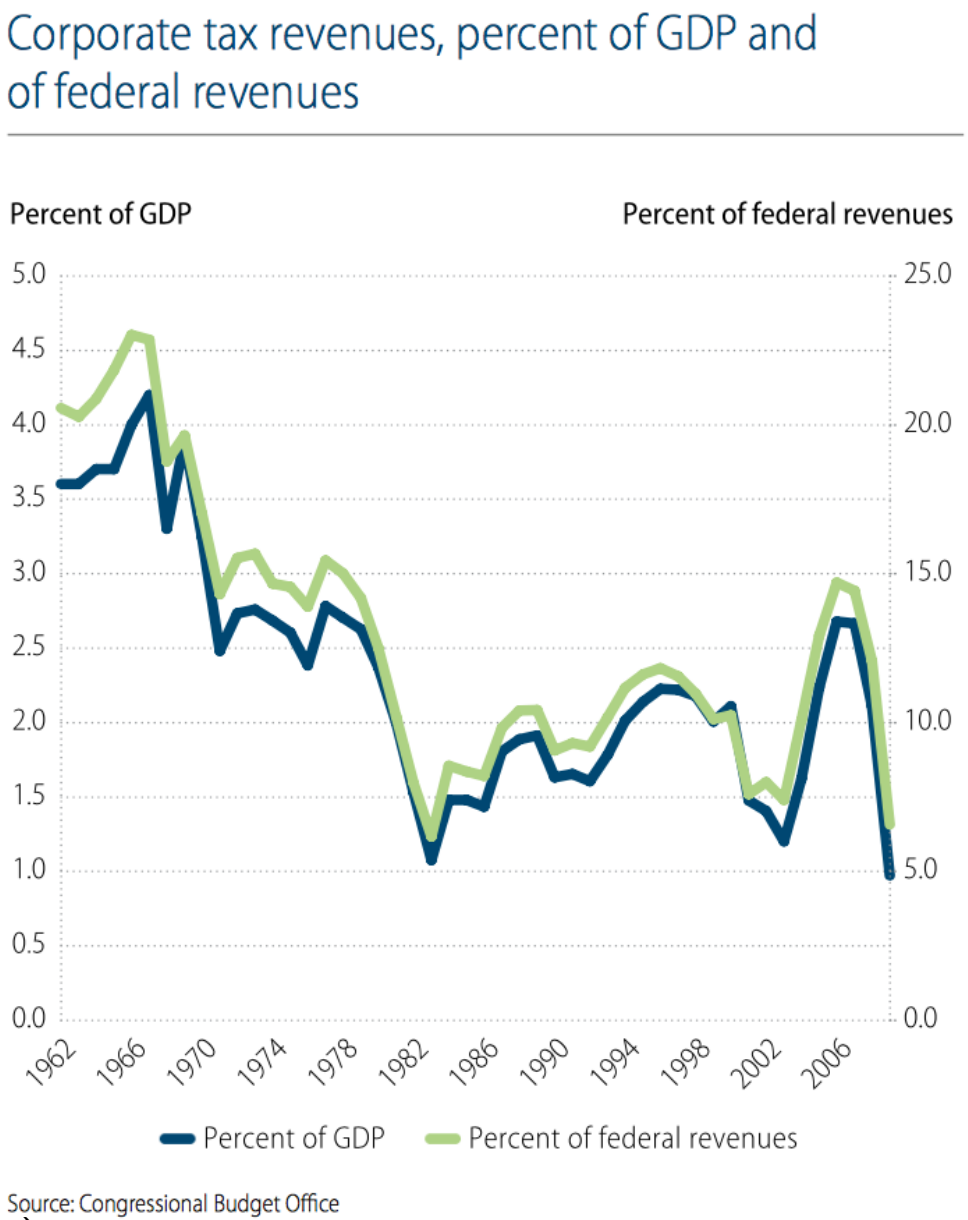
Private business income is very concentrated

Roughly 70% of pass-through income goes to top 1%



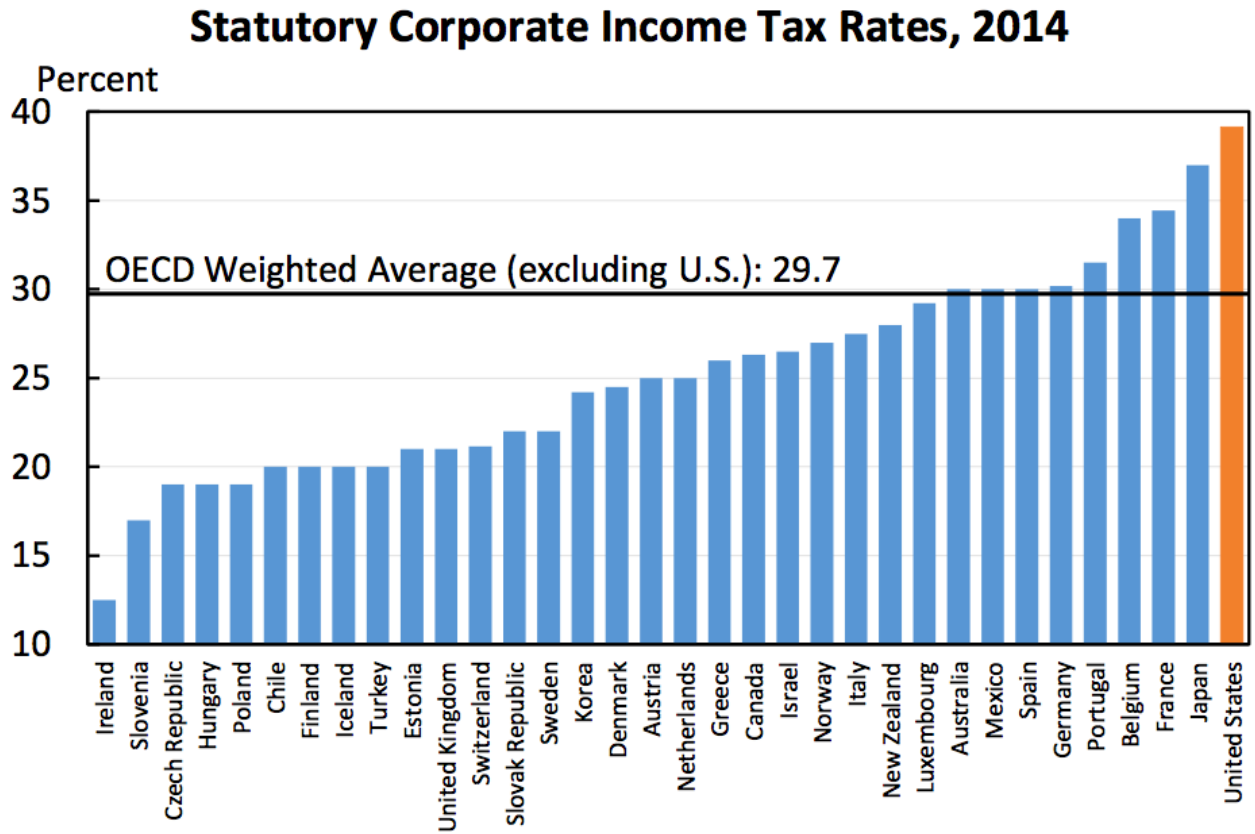
Source: Cooper et al (TPE, 2016).

Context #2: Declining Corporate Tax Revenues



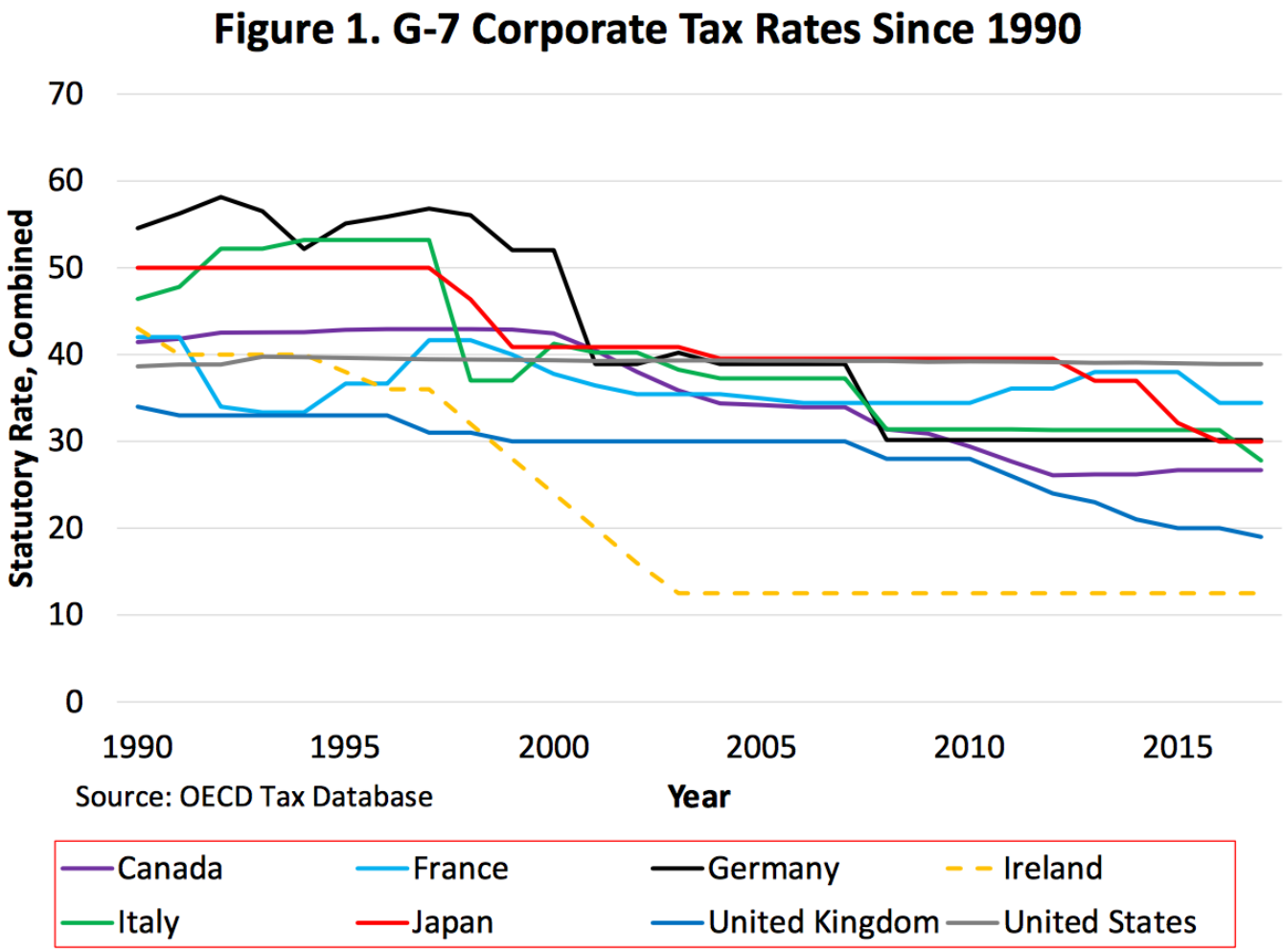
Source: Auerbach (2010).

Context #3: US had highest corp tax rate in the world



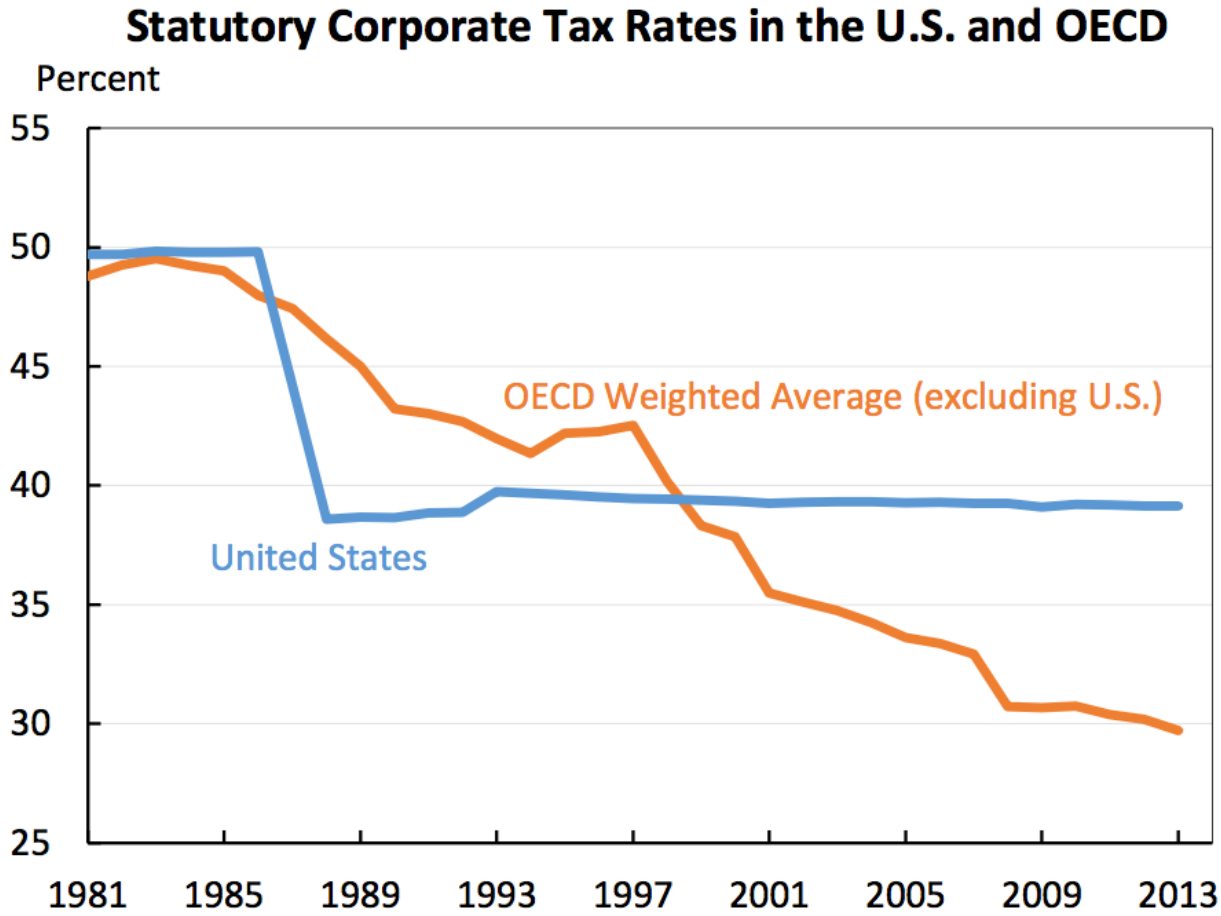
Source: Furman/CEA (2014).

Context #3: Declining Corporate Tax Rates



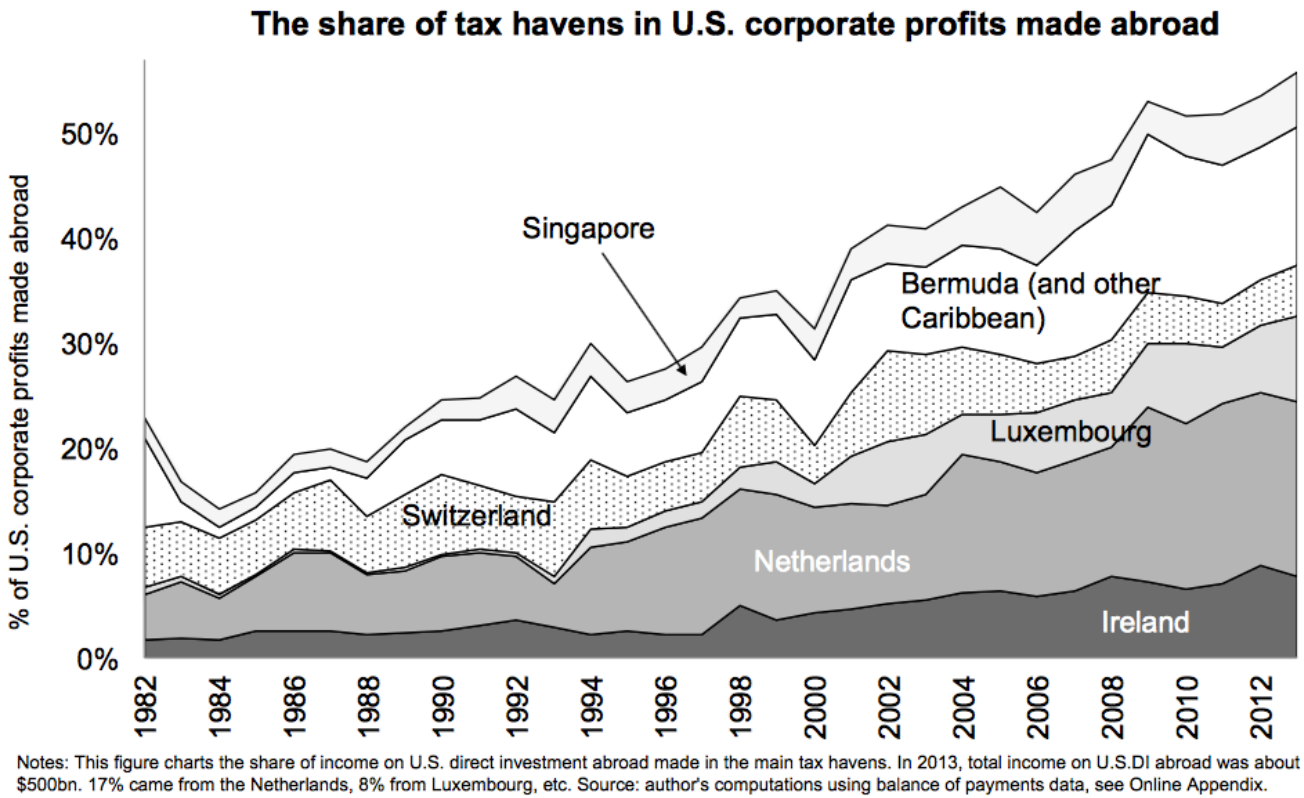
Source: Auerbach (2017 BPEA).

Context #3: Declining Corporate Tax Rates



Source: Furman/CEA (2014).

Context #4: Substantial Tax Avoidance and Evasion



Source: G. Zucman.

Context #4: Substantial Tax Avoidance and Evasion

Source: NYTIMES.

Context #4: Substantial Tax Avoidance and Evasion

Country	U.S. Controlled Foreign Corporation Profits Relative to GDP (2010)
Bahamas	104%
Bermuda	1,578%
British Virgin Islands	1,009%
Cayman Islands	1,430%
Cyprus	13%
Ireland	38%
Luxembourg	103%
Netherlands	15%
Netherlands Antilles	25%

Source: IRS and United Nations; CEA Calculations.

Source: Furman/CEA (2014).

The 2017 Tax Reform (a.k.a., "Tax Cuts and Jobs Act")

1. Summary of TCJA changes to business tax
2. Key base provisions (expensing, interest, DPAD, R&E, losses, etc)
3. Pass-through provisions
4. International provisions

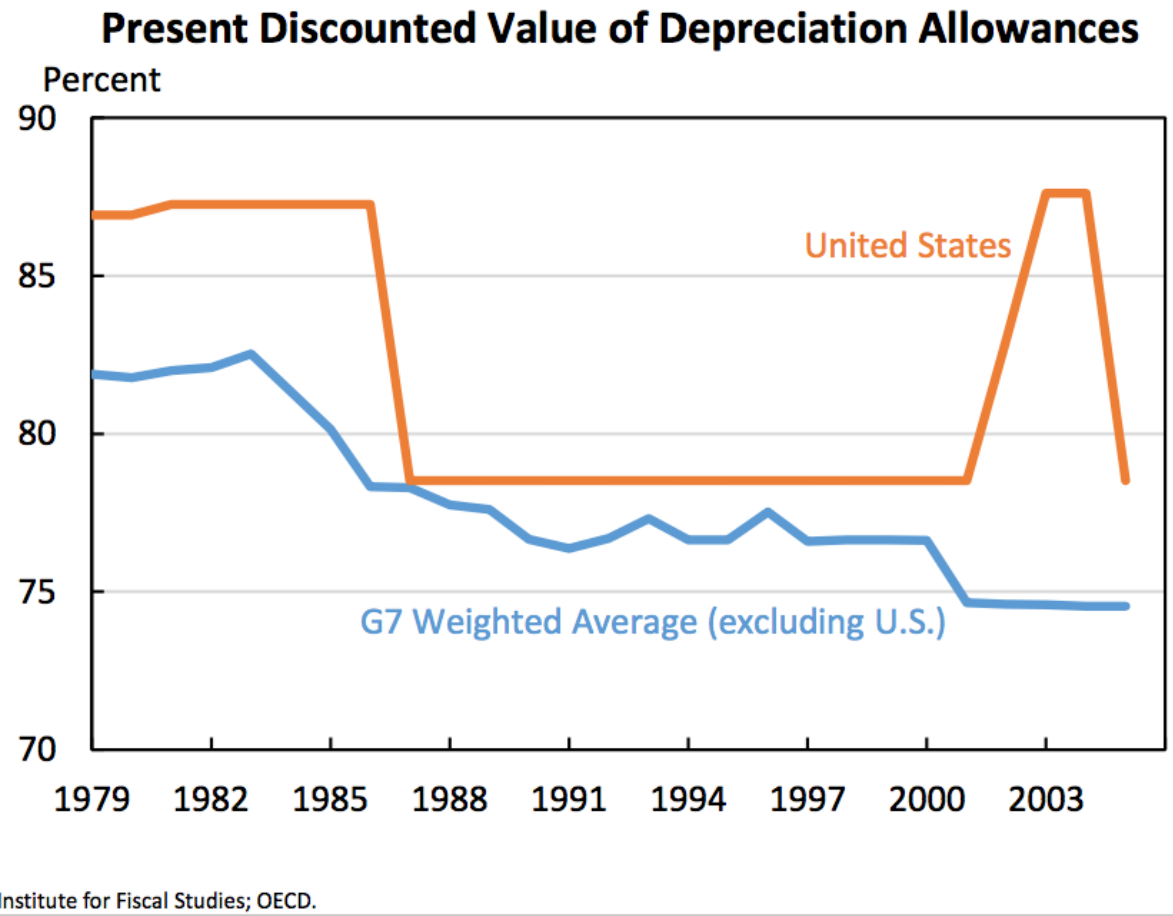
Note: The 2017 Tax Reform is Public Law 115-97, "An Act to provide for reconciliation pursuant to titles II and V of the concurrent resolution on the budget for fiscal year 2018," which was originally named the "Tax Cuts and Jobs Act" before the title had to be changed b/c of procedural rules related to budget reconciliation.

Summary of the 2017 Tax Reform (TCJA)

Overall Revenue Score and Major Business Provisions

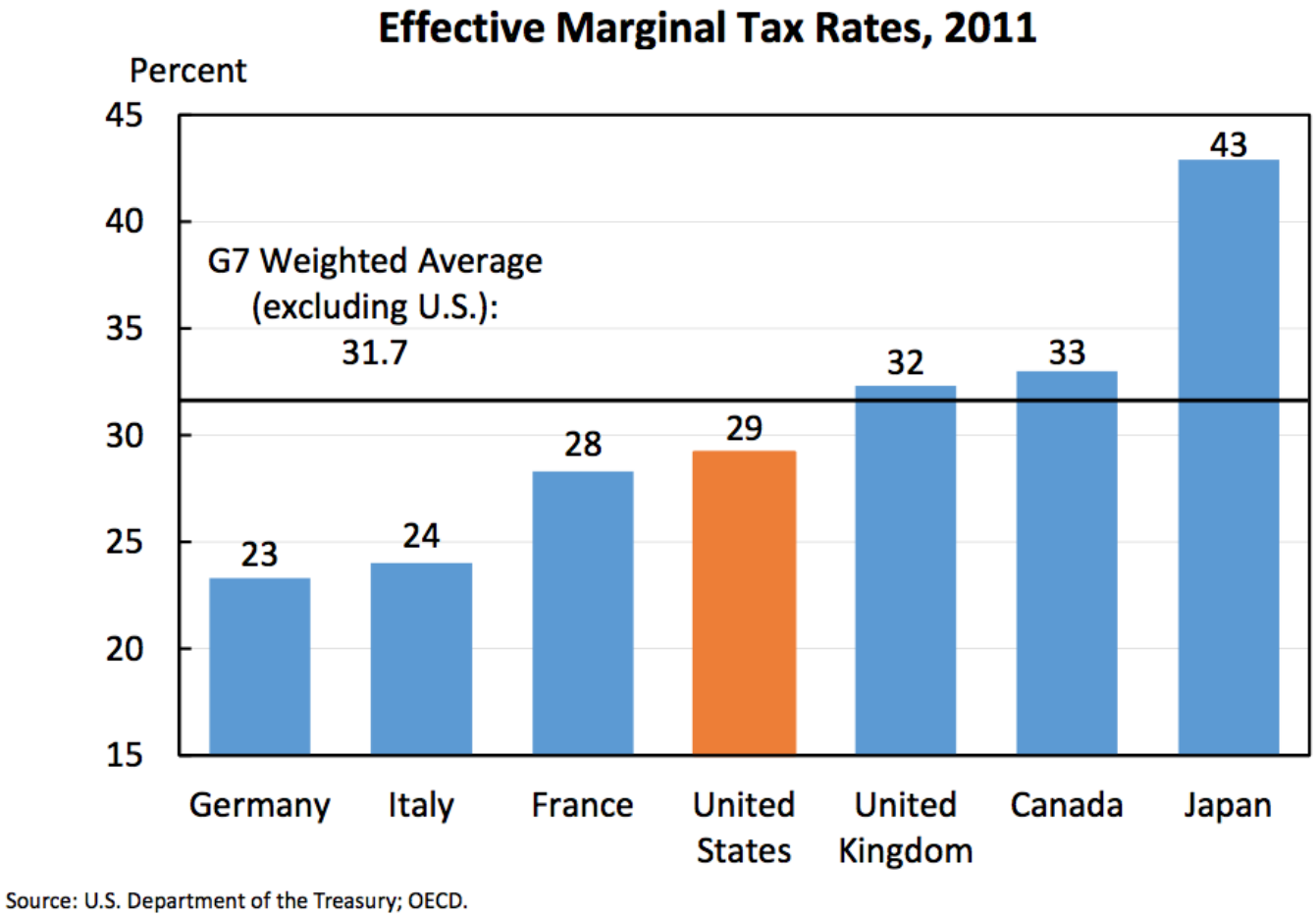
1. Static cost of 1.5T in federal revenue over ten years (JCT 2017)
2. Corporate Tax Changes
   1. Lowered corporate rate from 35% to 21% (-150B/yr, -1.4T 2018-27)
   2. Full expensing for next 5 years (-30B/yr in 2018-20, -86B/yr 2018-27)
   3. To offset, repeal/limit DPAD, interest deductibility, R&E, losses
3. Pass-through provisions (sunset 12/31/2025)
   1. New 20% deduction for certain pass-through income (-45B/yr)
   2. Lowered top rate from 39% to 37%
   3. To offset, disallow active losses in excess of $500K (15B/yr)
4. International provisions
   1. Establish territorial system and reduce rate on foreign intangibles associated with income derived in US
   2. To offset, minimum tax on global intangibles (GILTI) of 10.5% through 2025 and 13.125% thereafter and (BEAT) which is like a minimum tax on inbound investment. Also one-time payment on existing overseas earnings and free repatriation thereafter

Pre TCJA: US had more generous tax base provisions



Source: Furman/CEA (2014).

Effective US rates were thus closer to other G7 countries



Source: Furman/CEA (2014).

Pre TJCA: What are some key tax base provisions?

- **Accelerated depreciation** (House and Shapiro, AER 2008)
- Bonus depreciation and Section 179 (Zwick and Mahon, AER 2017)
- Business net interest deduction
- Loss carry forwards and carrybacks (Zwick and Mahon, AEJ: Policy)
- DPAD (Eric Ohrn, AEJ: Policy 2018 or Rebecca Lester's work)
- R & E credit (Nirupama Rao, JPUBE 2016)
- Many others

Tax Incentives for investment: accelerated depreciation

- Most common policies to directly change level of investment: changes in depreciation rules and tax credits for investment
- Frequently used in recessions to attempt to stimulate investment by firms
- Begin with a simple example to understand why depreciation rules matter
    - Suppose a firm buys a machine for $1000, which wears down by $100 a year

Tax Incentives for investment: accelerated depreciation

- Consider two tax treatments of the machine
  1. Expensing: subtract the full \$1000 from profits in the year you buy machine
  2. Economic depreciation: subtract \$100 per year from your profits
- Expensing reduces effective tax rate for firm given interest rate $r > 0$
- Current policy in U.S.: approximate economic depreciation using linear or exponential rules by asset class

Recovery periods & depreciation methods by type of K

TABLE 2—RECOVERY PERIODS AND DEPRECIATION METHODS BY TYPE OF CAPITAL

Type of capital	Recovery period, R (years)	Tax depreciation rate, $\hat{\delta}$ (percent)	Method
Tractor units for over-the-road use, horses over 12 years of age or racehorses with over 2 years in service	3	66.7	200 DB
Computers and office equipment; light vehicles, buses and trucks	5	40.0	200 DB
Miscellaneous equipment, office furniture, agricultural equiment	7	28.6 or 21.4	200 DB or 150 DB
Water transportation equipment (vessels and barges); single-purpose agricultural structures	10	20.0 or 15.0	200 DB or 150 DB
Radio towers, cable lines, pipelines, electricity generation and distribution systems, "land improvements," e.g., sidewalks, roads, canals, drainage systems, sewers, docks, bridges, engines and turbines	15	10.0	150 DB
Farm buildings (other than single purpose structures), railroad structures, telephone communications, electric utilities, water utilities structures including dams, and canals	20	7.5	150 DB
Nonresidential real property (office buildings, storehouses, warehouses, etc.)	39	2.6	SL

Note: Tax depreciation methods are 200 percent declining balance (200 DB), 150 percent declining balance (150 DB), and straight line (SL).

Source: IRS Publication 946.

Source: House and Shaprio (AER, 2008).

Bonus depreciation

TABLE 1—REGULAR AND BONUS DEPRECIATION SCHEDULES FOR FIVE-YEAR ITEMS

Year:	0	1	2	3	4	5	Total
Normal depreciation							
Deductions (000s)	200	320	192	115	115	58	1,000
Tax benefit ($\tau = 35$ percent)	70	112	67.2	40.3	40.3	20.2	350
Bonus depreciation (50 percent)							
Deductions (000s)	600	160	96	57.5	57.5	29	1,000
Tax benefit ($\tau = 35$ percent)	210	56	33.6	20.2	20.2	10	350

Notes: This table displays year-by-year deductions and tax benefits for a $1 million investment in computers, a five-year item, depreciable according to the Modified Accelerated Cost Recovery System (MACRS). The top schedule applies during normal times. It reflects a half-year convention for the purchase year and a 200 percent declining balance method (2× straight line until straight line is greater). The bottom schedule applies when 50 percent bonus depreciation is available.

Source: Authors' calculations. See IRS publication 946 for the recovery periods and schedules applying to other class lives (https://www.irs.gov/uac/about-publication-946).

Source: Zwick and Mahon (AER, 2017).

Bonus depreciation

- Allows additional first-year deductions for new equipment.
- Bonus I: 30% in 2001, 2002; 50% in 2003, 2004
- Bonus II: 50% in 2008-09, 12-13; 100% in 2010-11

$$\underbrace{z_T^0}_{\substack{\text{PV of \$1} \\ \text{Normal times}}} \equiv \underbrace{D_0}_{\substack{\text{Year 0} \\ \text{Deduction}}} + \underbrace{\sum_{t=1}^{T} \frac{1}{(1+r)^t} D_t}_{\substack{\text{PV of Year 1 to T} \\ \text{Deductions}}} \quad \text{with} \quad \sum D_i = 1$$

$$\underbrace{z_T(\theta)}_{\substack{\text{PV of \$1} \\ \text{Bonus times}}} \equiv \underbrace{\theta}_{\text{Bonus}} + (1-\theta) z_T^0 \quad \text{with} \quad \theta \in (0, 1]$$

Source: Zwick and Mahon (AER, 2017).

Bonus depreciation

$$\underbrace{z_T(\theta)}_{\substack{\text{PV of \$1} \\ \text{Bonus times}}} \equiv \underbrace{\theta}_{\text{Bonus}} + (1-\theta) z_T^0 \quad \text{with} \quad \theta \in (0,1]$$

Normal times:

Year	0	1	2	3	4	5	Total
Deductions	200	320	192	115	115	58	1000
$z_5(0)$							0.890

Bonus times (50%):

Year	0	1	2	3	4	5	Total
Deductions	600	160	96	57.5	57.5	29	1000
$z_5(0.5)$							**0.945**

Source: Zwick and Mahon (AER, 2017).

Bonus depreciation

1. Bonus allowance is more valuable for longer lived items.
2. Industries differ in relative intensity of longer lived investment.

Short Duration (NAICS)	Long Duration (NAICS)
Rental and Leasing (532)	Utilities (221)
Publishing (511)	Pipeline Transport (486)
Data Processing (518)	Railroads (482)
Ground Transit (485)	Accommodations (721)
Professional Services (541)	Food Manufacturing (311)

Source: Zwick and Mahon (AER, 2017).

Bonus depreciation

1. Bonus allowance is more valuable for longer lived items.
2. Industries differ in relative intensity of longer lived investment.
3. Use tax data to compute weighted average present value of deductions, z_N, at four-digit NAICS level
4. Use cross-sectional variation in bonus generosity to identify the effect of bonus (diff-in-diffs)

$$\Delta I_{\text{Rental and Leasing}} \quad \text{vs.} \quad \Delta I_{\text{Utilities}}$$

$$\log(I_{it}) = \alpha_i + \delta_t + \beta z_{N,t} + \gamma X_{it} + \varepsilon_{it}$$

Approach of Cummins, Hassett and Hubbard (1994, 1996), Desai and Goolsbee (2004), Edgerton (2010).

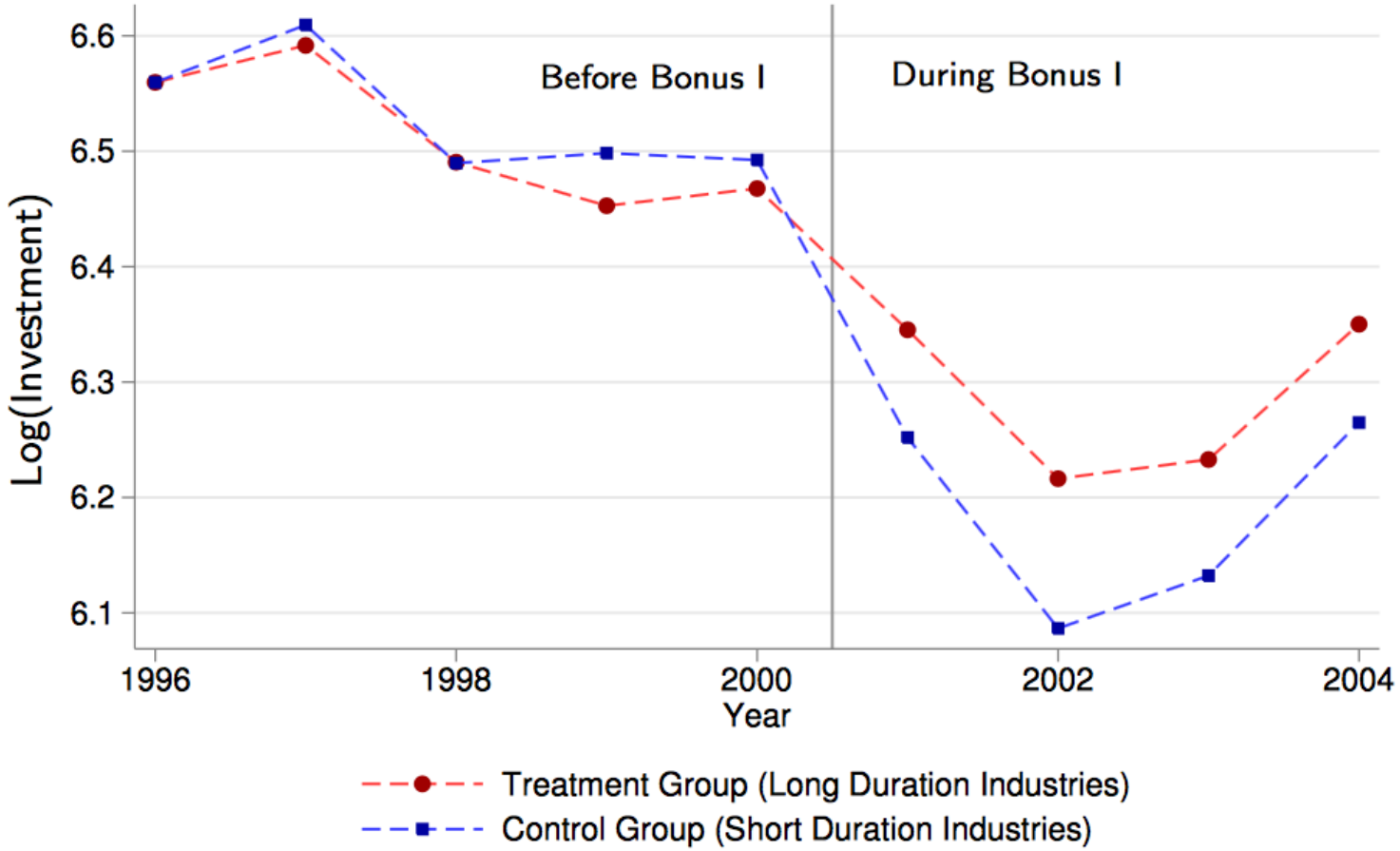
- Larger sample, one policy change

Source: Zwick and Mahon (AER, 2017).

Bonus depreciation

Calendar Diff-in-Diffs: Bonus I

Intensive Margin

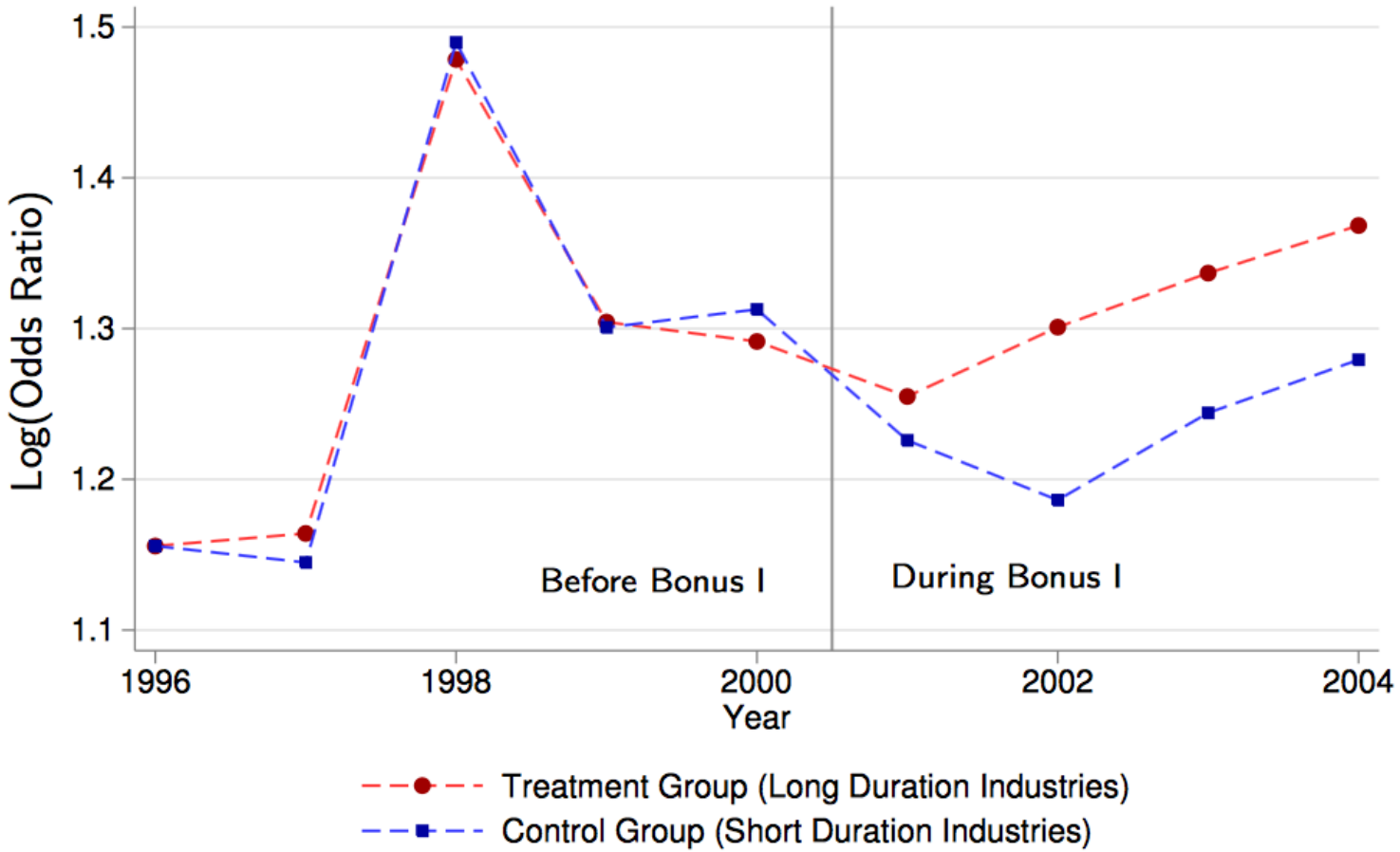


Source: Zwick and Mahon (AER, 2017).

Bonus depreciation

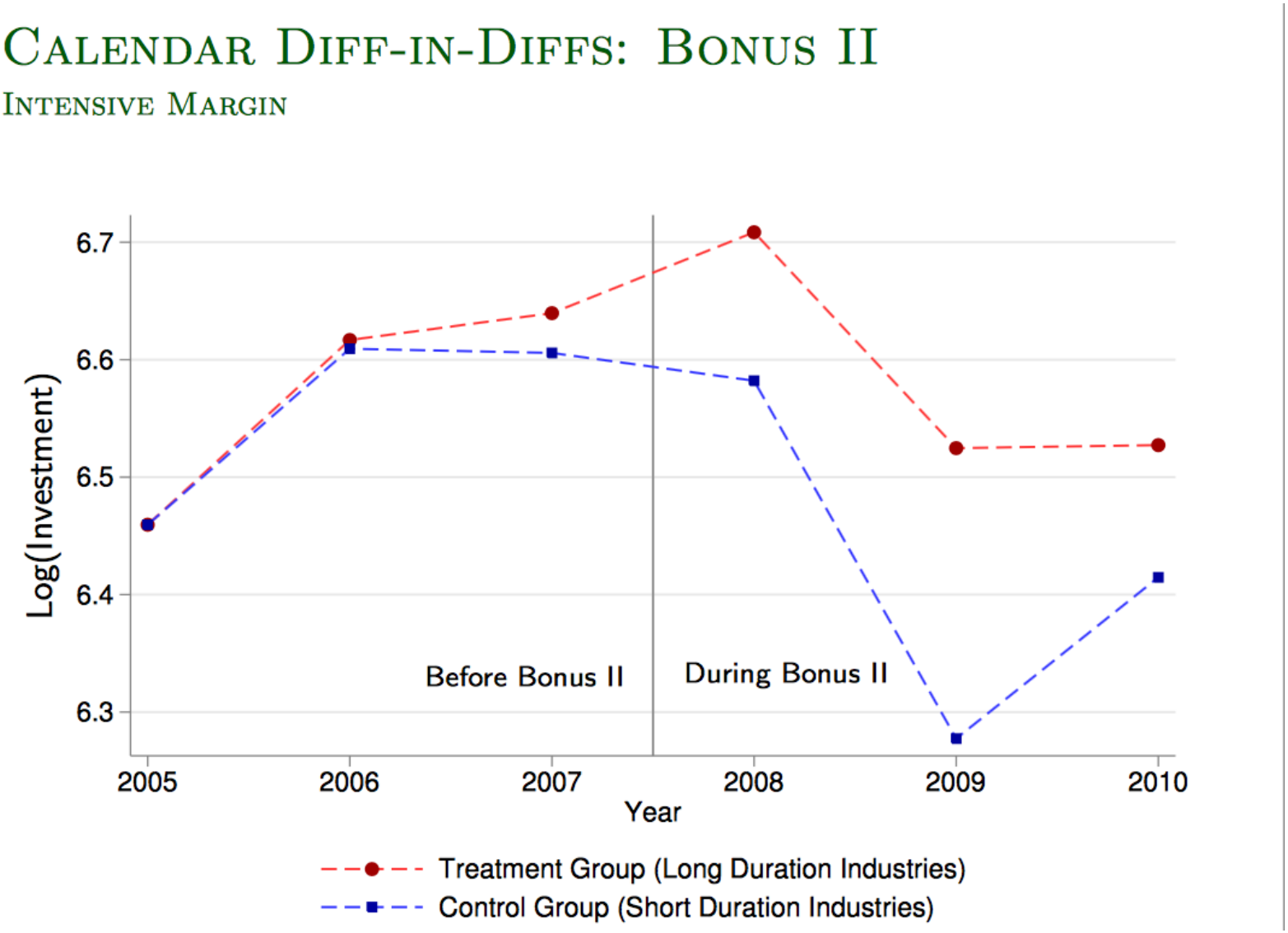
Calendar Diff-in-Diffs: Bonus I

Extensive Margin



Source: Zwick and Mahon (AER, 2017).

Bonus depreciation

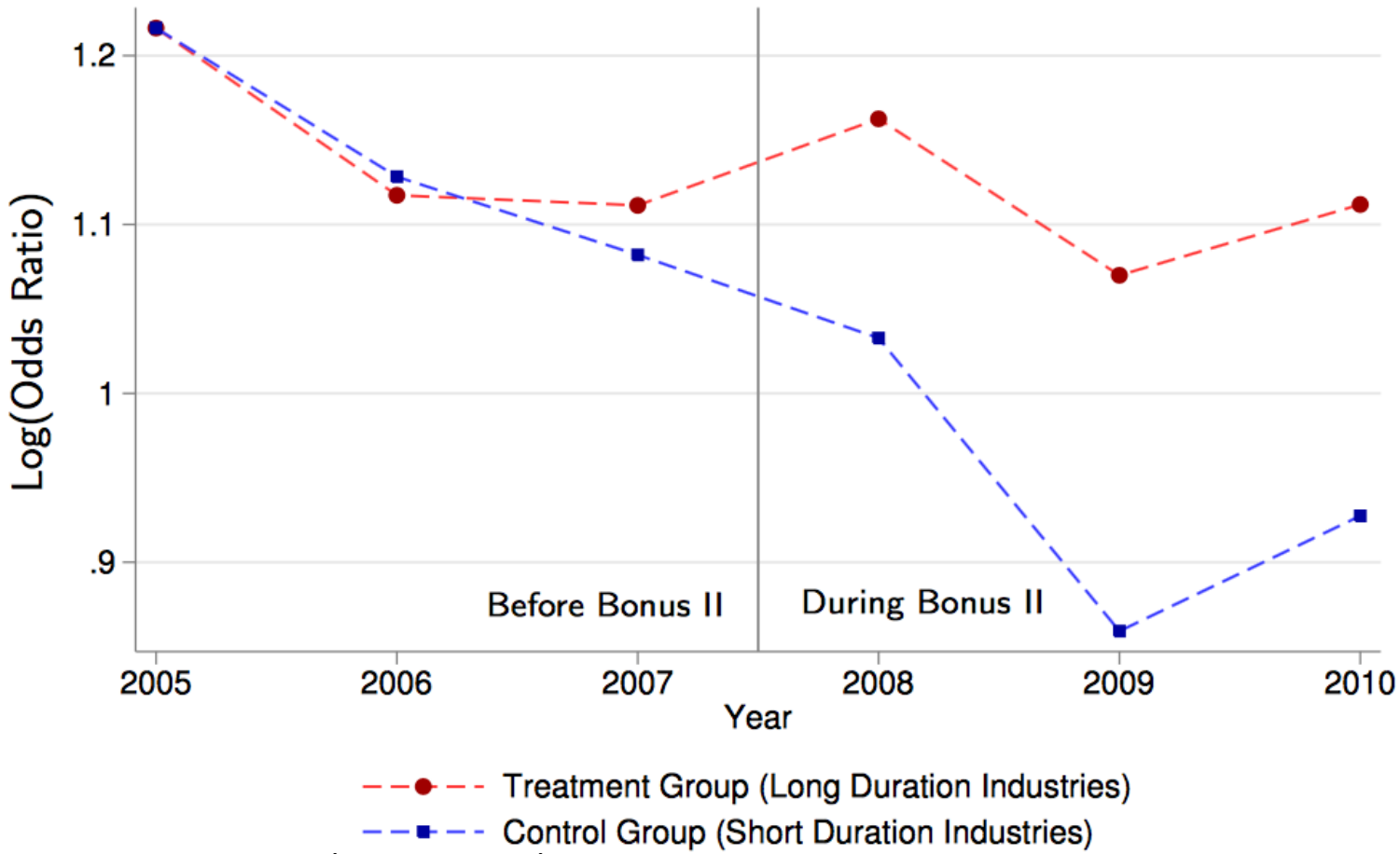


Source: Zwick and Mahon (AER, 2017).

Bonus depreciation

Calendar Diff-in-Diffs: Bonus II

Extensive Margin



Source: Zwick and Mahon (AER, 2017).

What are some key tax base provisions?

- Accelerated depreciation and bonus (House and Shaprio, AER 2008)
- **Section 179**
- Business net interest deduction
- Loss carry forwards and carrybacks (Zwick and Mahon, AEJ: Policy)
- DPAD (Eric Ohrn, AEJ: Policy 2018 or Rebecca Lester's work)
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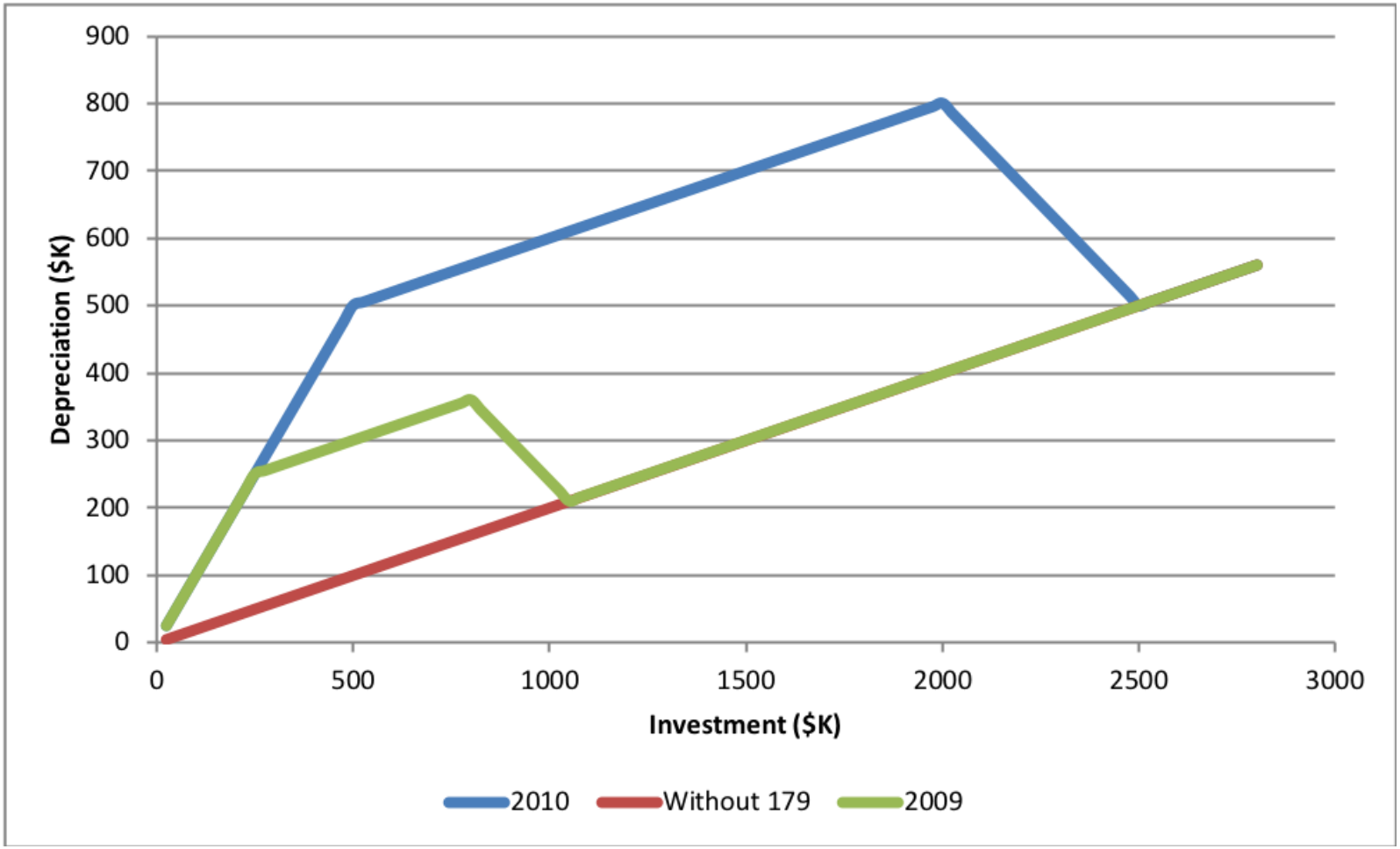
Section 179

- S179 is a component of the depreciation schedule which applies mainly to smaller firms.
- Under Section 179, taxpayers may elect to expense qualifying investment up to a specified limit.
- With the exception of used equipment, all investment eligible for Section 179 expensing is eligible for bonus depreciation.
- Each tax year, there is a maximum deduction and a threshold over which Section 179 expensing is phased out dollar for dollar.
- The kink and phase-out regions have increased incrementally since 1993.
- TCJA raises the top threshold to $2.5 M

Section 179 example



Source: Yagan Zidar Zwick.

Section 179 policy changes

Table 1: Section 179 and Bonus Depreciation Policy Changes

Year	S179 Max Value	S179 Phase-out Region	Bonus
1993-96	$17,500	$200,000-$217,500	
1997	$18,000	$200,000-$218,000	
1998	$18,500	$200,000-$218,500	
1999	$19,000	$200,000-$219,000	
2000	$20,000	$200,000-$220,000	
2001-02	$24,000	$200,000-$224,000	30% Tax years ending after 9/10/01
2003	$100,000	$400,000-$500,000	50% Tax years ending after 5/3/03
2004	$102,000	$410,000-$512,000	50%
2005	$105,000	$420,000-$525,000	
2006	$108,000	$430,000-$538,000	
2007	$125,000	$500,000-$625,000	
2008-09	$250,000	$800,000-$1,050,000	50% Tax years ending after 12/31/07
2010-11	$500,000	$2,000,000-$2,500,000	100% Tax years ending after 9/8/10

a. 2008 was retroactive.

Source: Yagan Zidar Zwick.

Loss provisions

Table 1: Legislative Background on Tax Loss Carrybacks and Carryforwards, 1998-2011

Ending fiscal period[a]	Carryback	Carryforward	Enacting legislation
1998-12 to 2000-12	2 years	20 years	TRA 1997 (permanent)[c]
2001-01 to 2002-12	5 years	20 years	JCWAA 2002 (temporary)[d]
2003-01 to 2007-12	2 years	20 years	TRA 1997 (permanent)
2008-01 to 2010-11	5 years	20 years	ARRA 2009 (temporary)[b,e]
			WHBAA 2009 (temporary)[b,f]
2010-12 to 2012-11	2 years	20 years	TRA 1997 (permanent)

Notes: This table summarizes the statutory window for eligible carrybacks and carryforwards between 1998 and 2011. The policy rules apply to corporate tax returns with ending fiscal periods that fall within the range detailed in the first column of the table. The last column lists the legislation that enacted the policy changes. In this period, the carryback window was twice expanded temporarily as part of fiscal stimulus legislation. The information for this table was pulled from bulletins and revenue procedures released by the Internal Revenue Service.

a. Corporations file income taxes for the fiscal year instead of the calendar year
b. ARRA 2009 and WHBAA 2009 limited deductions against the fifth fiscal year preceding a firm's current tax loss to 50 percent of taxable income
c. TRA: Taxpayer Relief Act of 1997
d. JCWAA: Job Creation and Worker Assistance Act of 2002
e. ARRA: American Recovery and Reinvestment Act of 2009
f. WHBAA: Worker, Homeowner, and Business Assistance Act of 2009

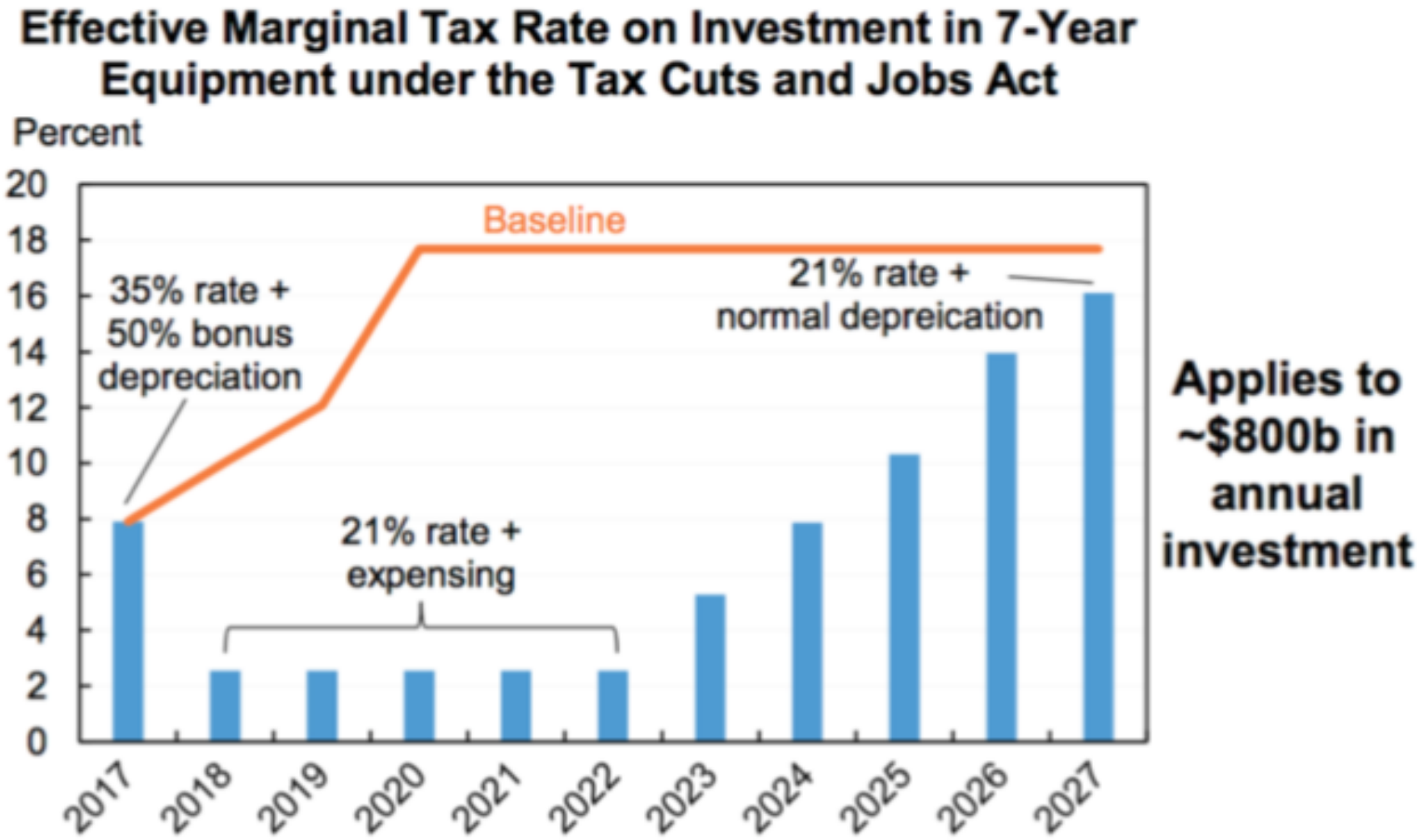
Source: Mahon and Zwick (2017).

TCJA: Corporate Tax Base Reforms

TCJA Bucket 1: Key "old school" Base Provisions

1. **Equipment investment deductions:**
   - Increase section 179 expensing max value to \$1M (with \$2.5M phase-out threshold)
   - Extends bonus depreciation and expands to expensing with phase-out
2. **R&D deductions:** shifts from expensing to amortization in 2022
3. **Interest deductions:**
   - Limit net interest to 30% of adjusted taxable income (EBITDA until 2022 and EBIT after); firms with receipts$<$ \$25M are exempt
   - Does not apply to investment interest/interest income from financials
4. **Net operating losses (NOLs):** Repeals carrybacks. Carryforwards are indefinite, but NOL deduction is capped at 80% of income
5. **Other:** Repeals Corporate AMT and Domestic Production Activities Deduction (DPAD)

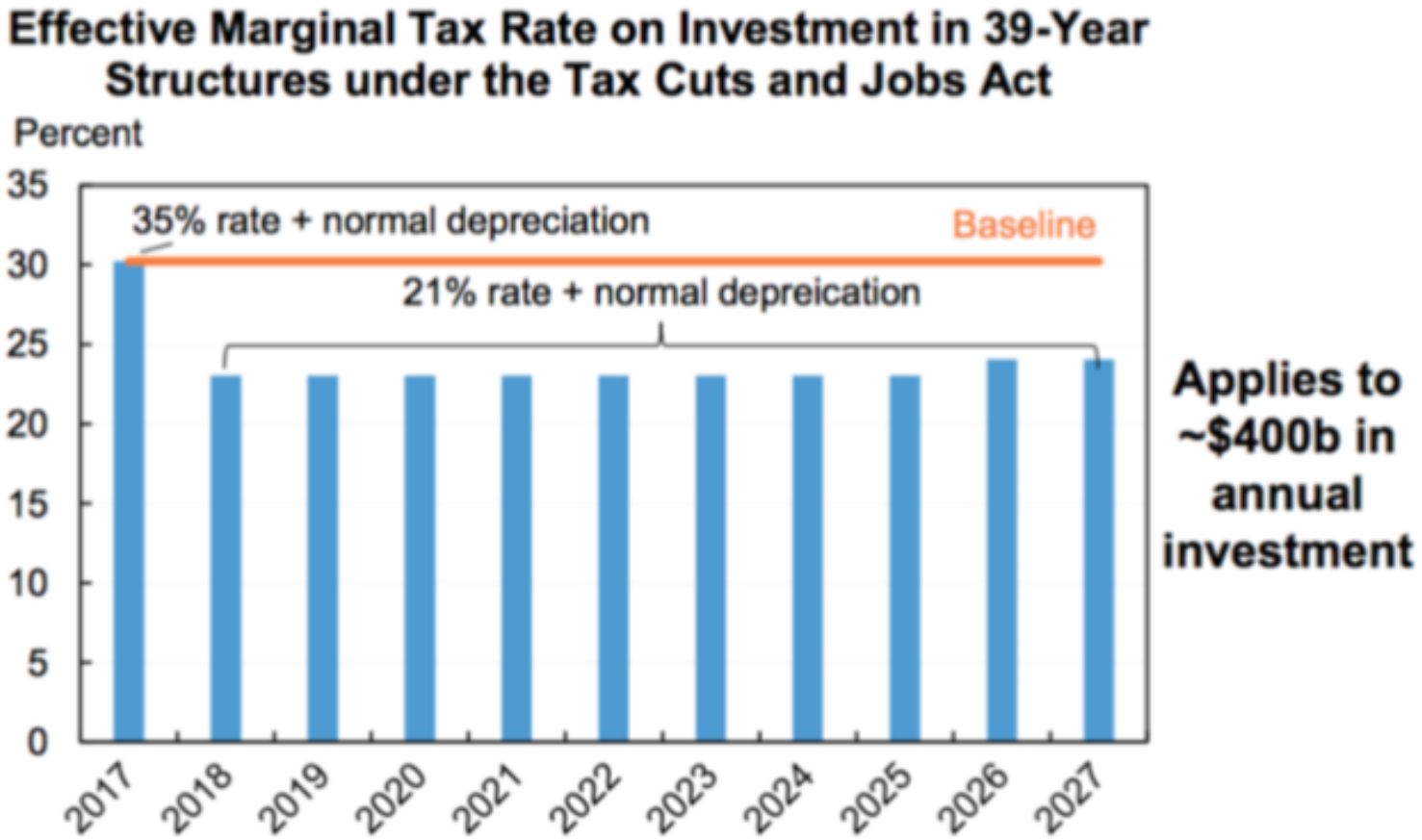
The effective marginal tax rate on equipment investment falls somewhat, then rises sharply



Note: Assumes 32 percent debt financing and 68 percent equity financing. After 2017, assumes that 15 percent of firms are constrained by the interest cap.
Source: Author's calculations based on Mathur and Kallen (2017).

Source: Jason Furman.

The effective marginal tax rate on structures investment falls



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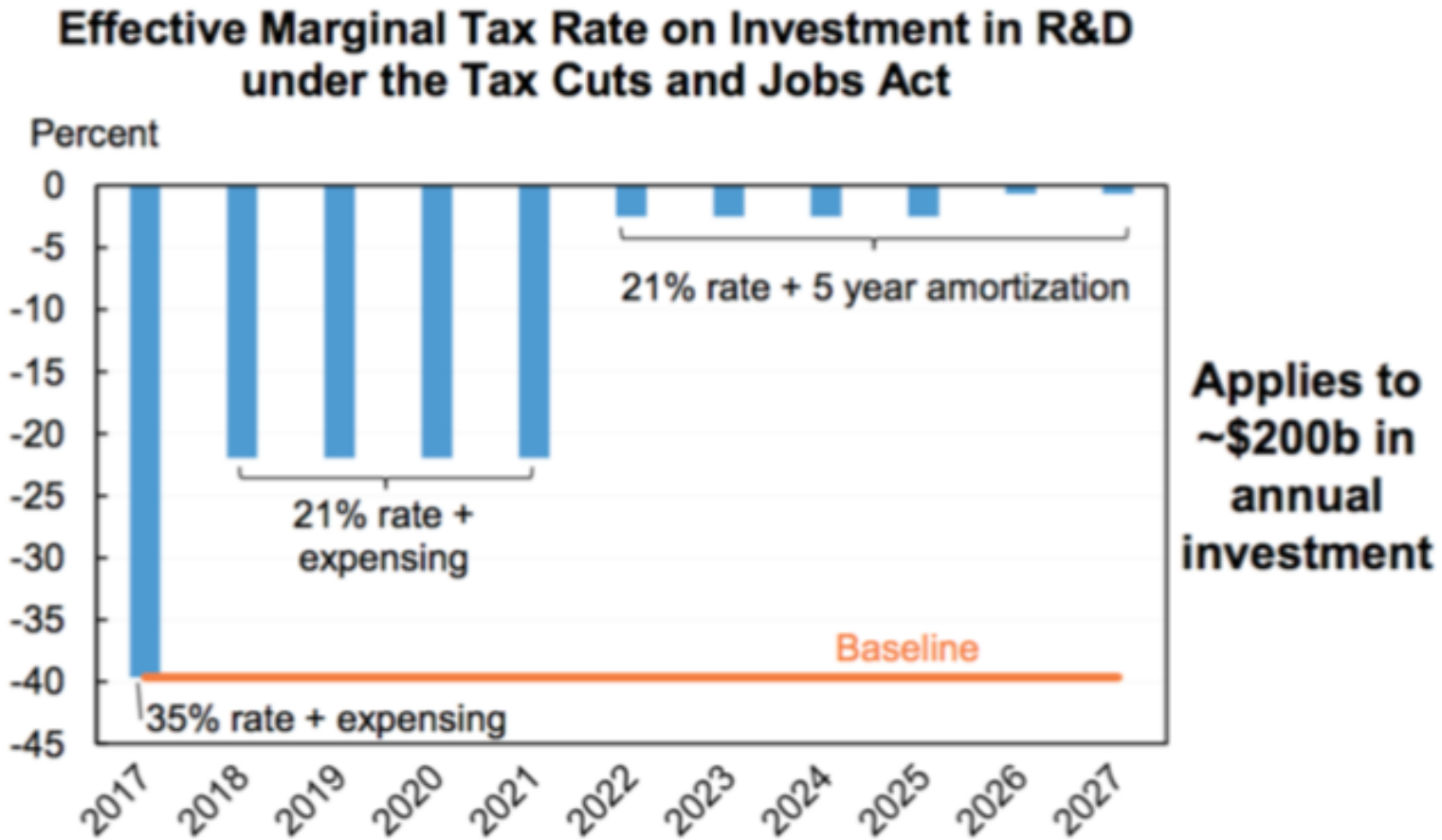
The effective marginal tax rate on R&D investment rises substantially



Note: Assumes 32 percent debt financing and 68 percent equity financing. After 2017, assumes that 15 percent of firms are constrained by the interest cap.
Source: Author's calculations based on Mathur and Kallen (2017) and Bureau of Economic Analysis.

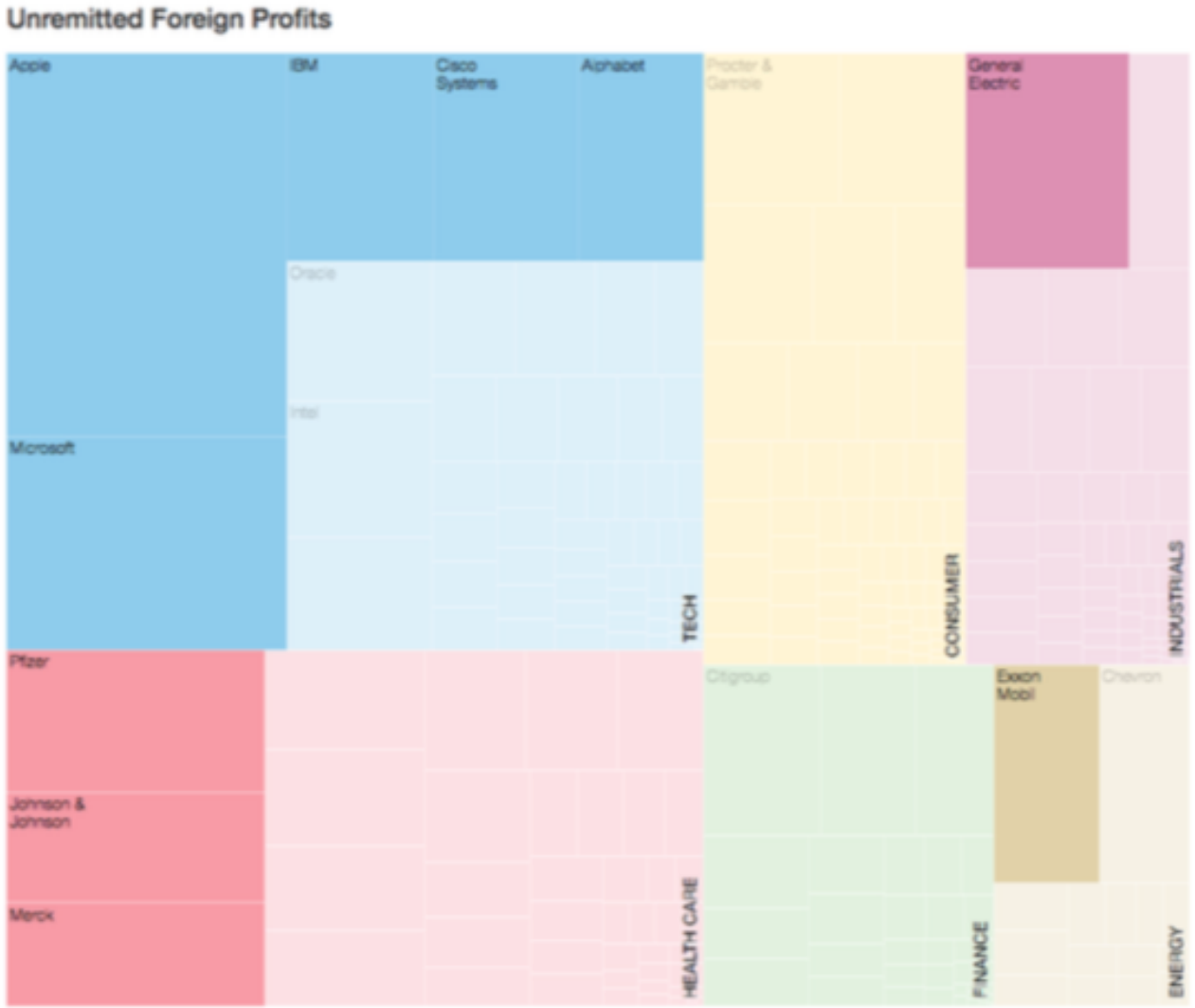
Source: Jason Furman.

TCJA Bucket 2: Pass-through Provisions

1. **Deductions:** Same as pertinent "old school" provisions
2. **Rate cut:**
   - Allows 20% deduction of qualified business income
   - Reduces top rate from 37% to 29.6%
3. **Phase-out of deduction:**
   - Specified service businesses – health, law, consulting, etc.
   - Businesses with low wages AND low capital. Cap on the deduction is greater of (a) 50% of W2 comp or (b) 25% of W2 comp and 2.5% of purchase of tangible assets
   - Phase-out begins at $157,500 for individuals, $315,000 for joint filers

$2.8T in Accumulated Deferred Foreign Income (2017)

Just a handful of the biggest companies are responsible for a disproportionate share of the accumulated foreign profits.

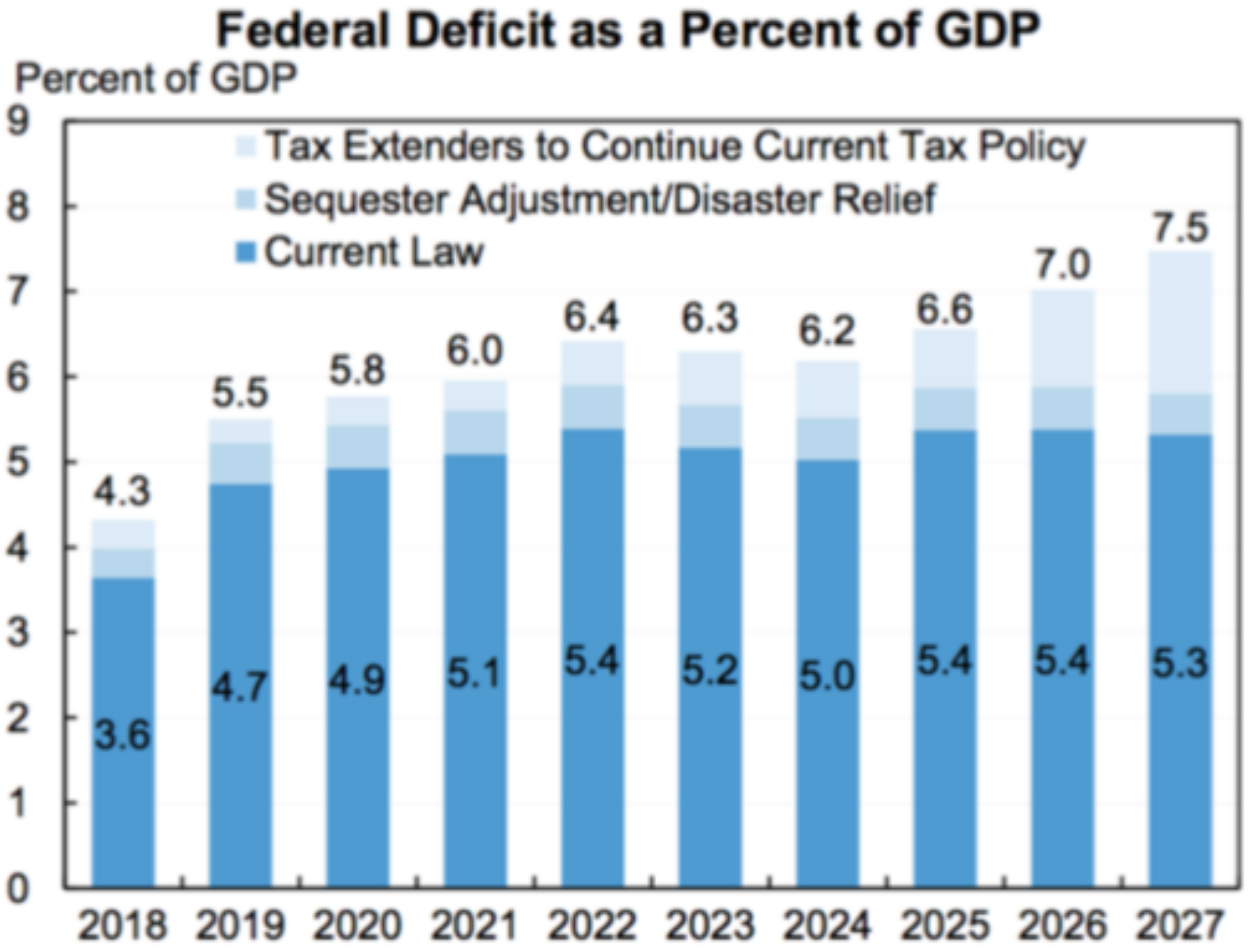


Source: WSJ.

TCJA Bucket 3: International Provisions

1. **Territorial?** territorial with minimum tax on certain foreign income
2. **Toll tax:** One-time tax on past earnings
   - Deemed repatriation of deferred foreign income with 8% rate on illiquid and 15.5% rate on liquid assets, payable over 8 years
   - Deferral system is repealed going forward
3. **Profit shifting with intangibles:**
   - Immediate taxation of global intangible low-taxed income (at least 10.5%) – GILTI provision
   - Deduction for domestic intangible income earned from unrelated foreign parties (implies a rate of at least 13%) – FDII
4. **Inbound profit shifting and anti-inversion measures:**
   - Min tax of 10% on income when payments to foreign related parties occur – BEAT provision
   - Could hit cross-border or sub to branch bank payments, as no netting
5. **Modification to Subpart F:** Broader CFC rules. Foreign corporations may be subject to immediate inclusion of foreign-earned income

Deficits expected to rise to 5%+ of GDP—and much more if major provisions are extended

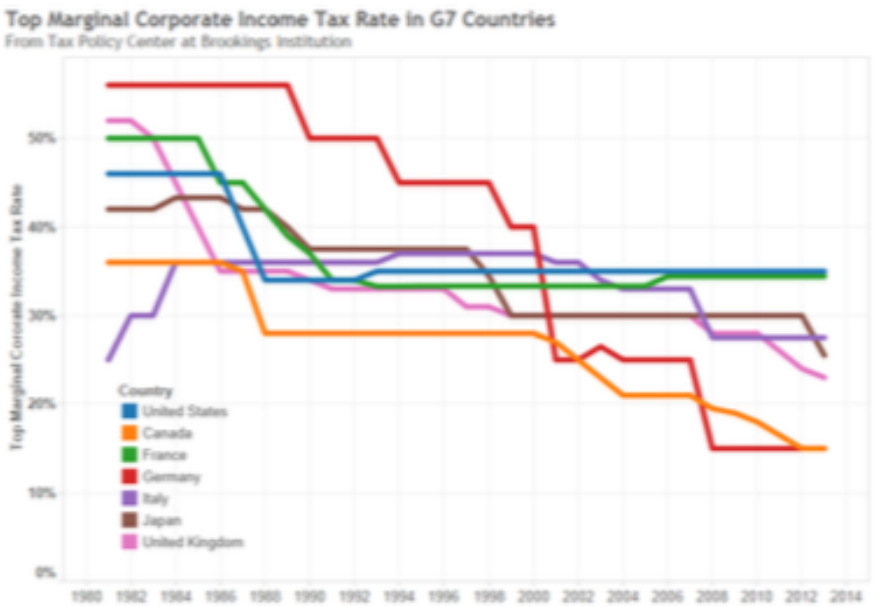


Source: Committee for a Responsible Federal Budget; Congressional Budget Office; author's calculations.

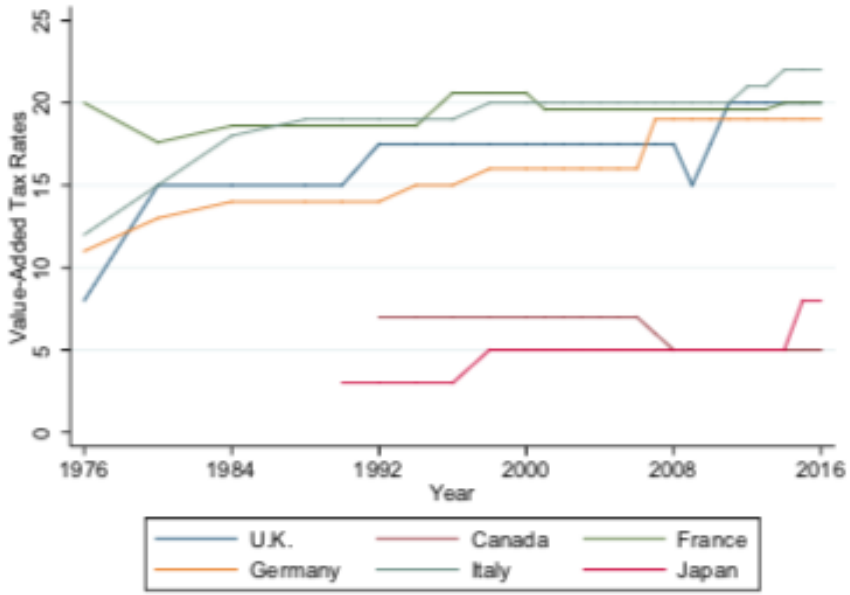
Source: Jason Furman.

Fall in Corporate Tax → Rise in Value-Added Tax

Corporate Rates



Value-Added Tax Rates



Source: Brookings, OECD.

Fundamental reform and apportionment

Reforming how we tax corporate income

Corporate tax base

- Tax base - what do we want to tax?
- Location of the tax base - where do we want income to be taxed?
  - Source-based: where goods or services are produced
  - Residence-based: where shareholders/corporate headquarters are located
  - Destination-based: where final consumers are located

State business taxes: three types of firm taxes

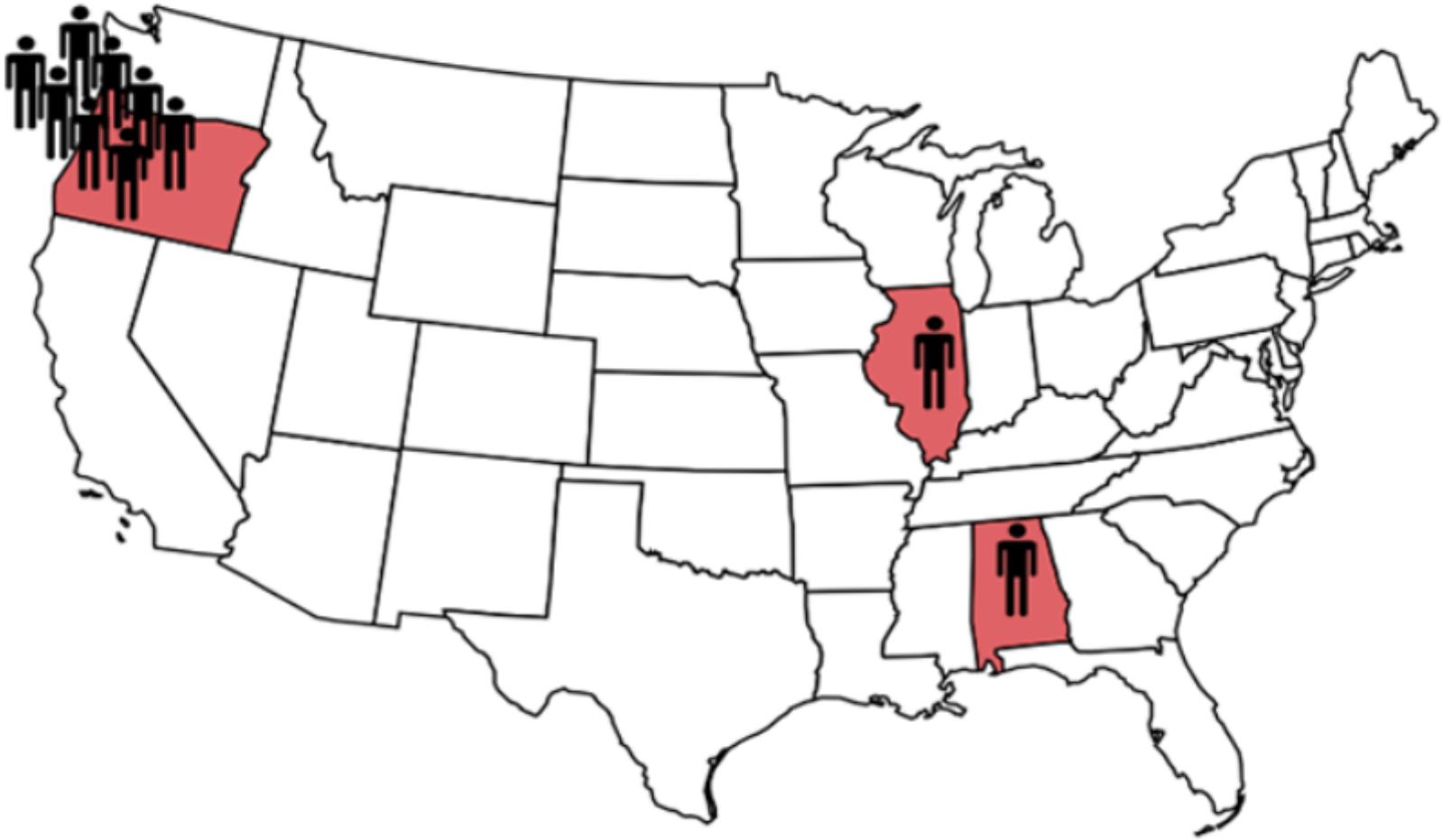
1. Partnership and S-corps: τ^{INC} personal income tax rate
   - Synthetic changes as in Zidar (2013) using NBER's TAXSIM
2. Single-state C-corps: τ^{c} corporate income tax rate
   - Digitized corporate tax rates from "Book of the States"
3. Multi-state C-corps: τ^{A} apportioned corporate income tax rate
   - Depends on corporate rate, apportionment, and activity weights

$$\tau_i^A = \sum_s \tau_s^c \omega_{is}$$

- where $\omega_{is} = \underbrace{\left(\theta_s^w \frac{W_{is}}{W}\right)}_{payroll} + \underbrace{\left(\theta_s^\rho \frac{R_{is}}{R}\right)}_{property} + \underbrace{\left(\theta_s^x \frac{X_{is}}{X}\right)}_{sales}$

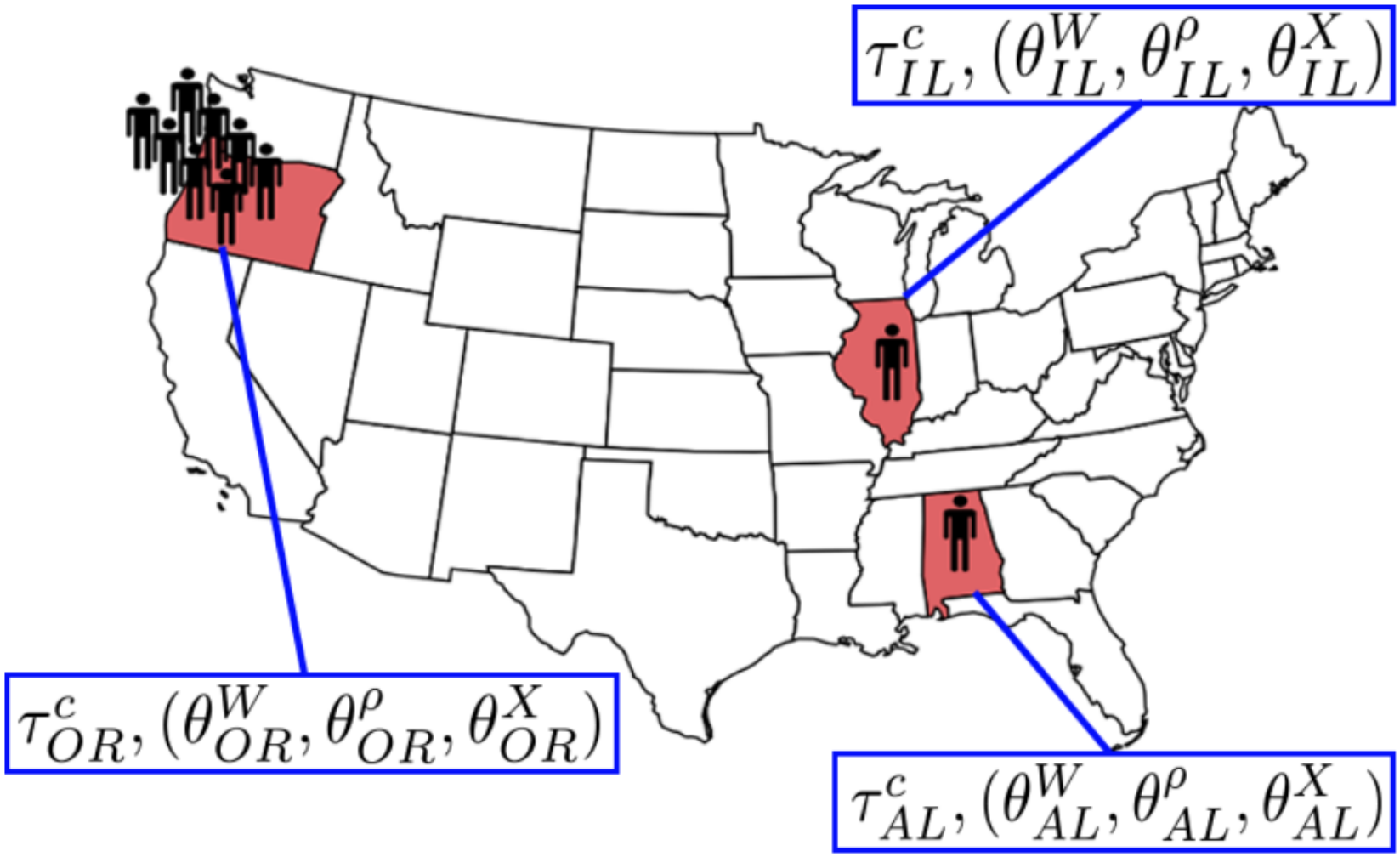
Source: Suárez Serrato and Zidar (AER, 2016).

Nike apportionment example



Source: Suárez Serrato and Zidar (AER, 2016).

Nike apportionment example



Source: Suárez Serrato and Zidar (AER, 2016).

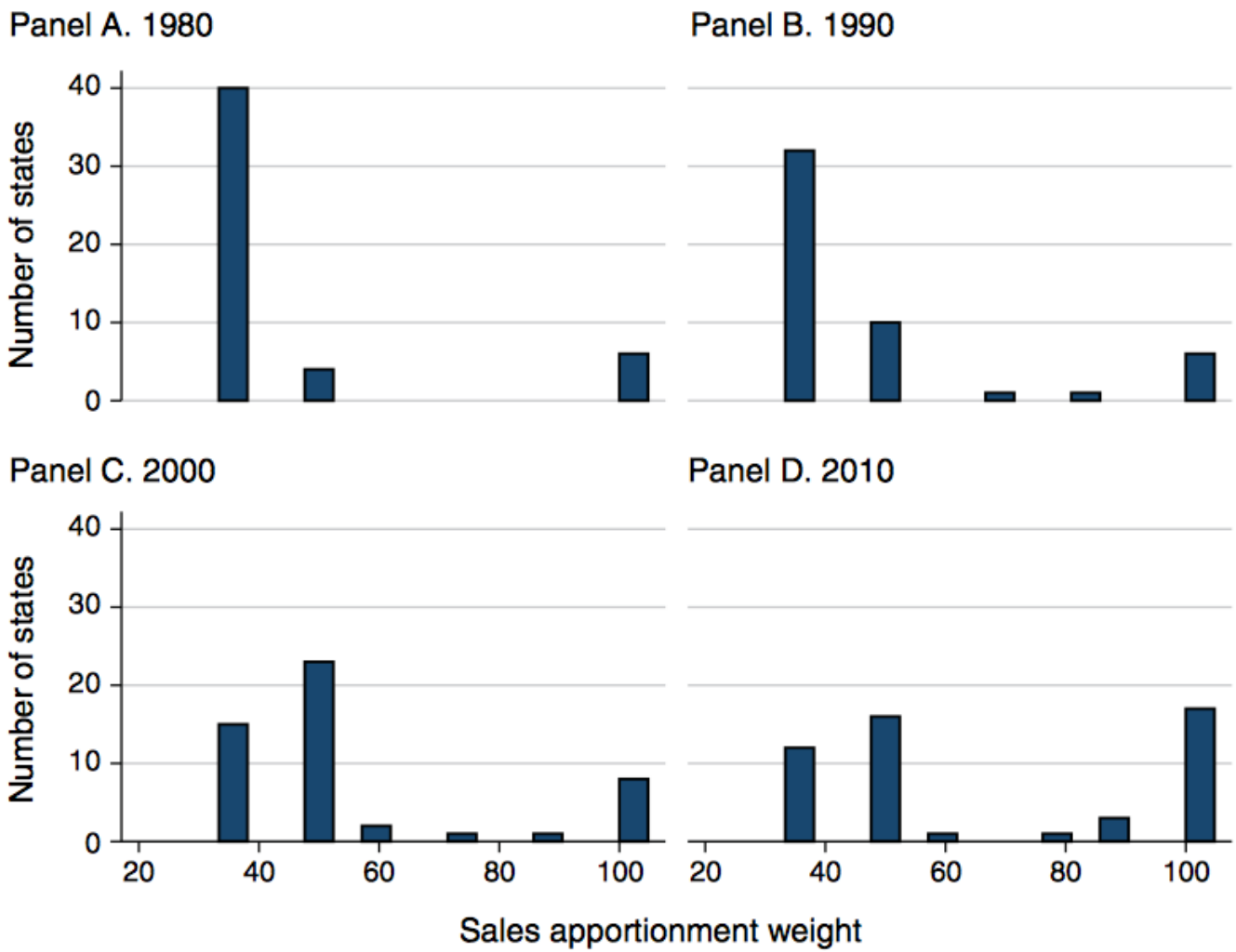
Nike apportionment example

- Suppose Nike earns $2 M of profit in every state
- Their tax liability differs based on how profits are apportioned

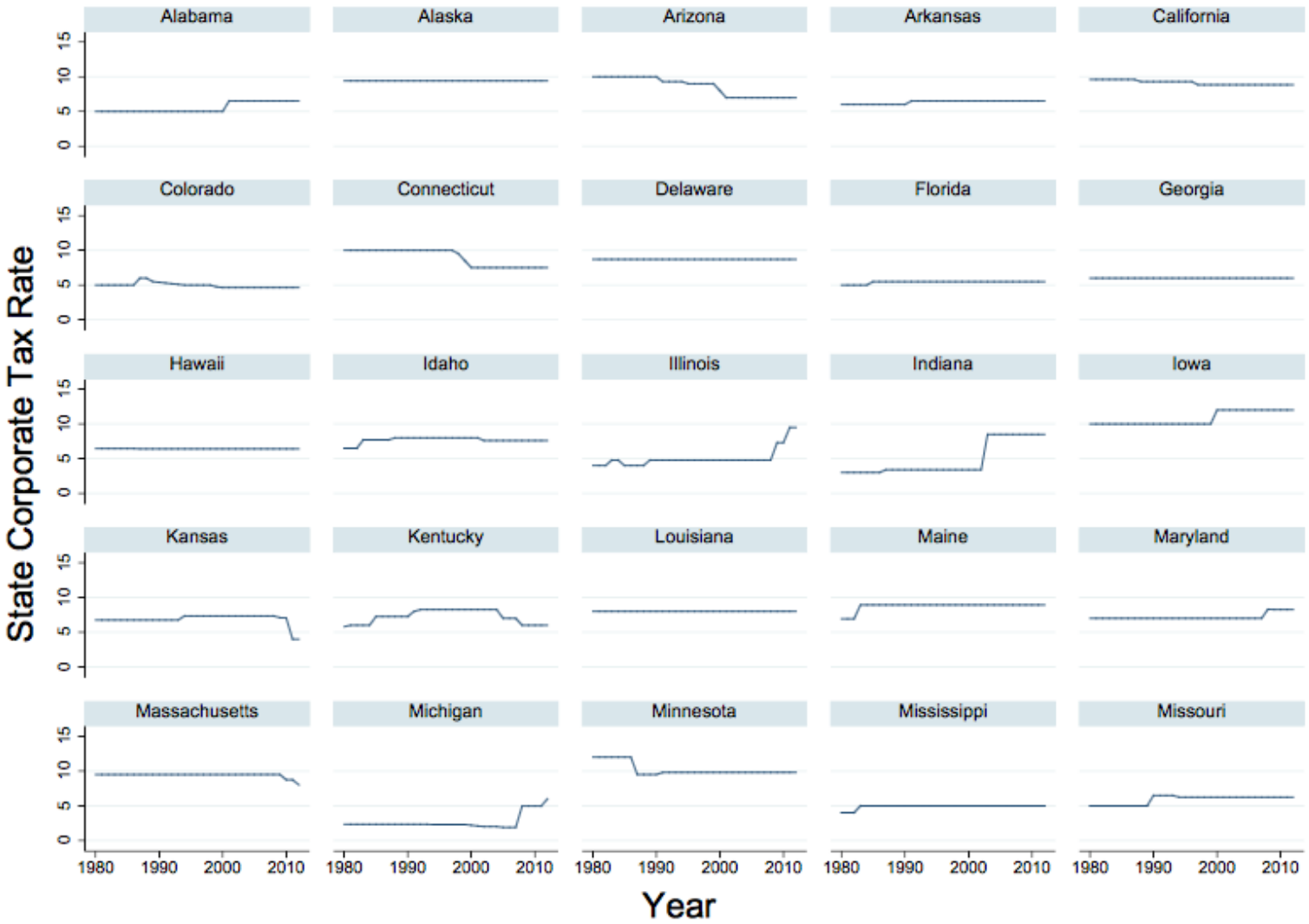
State	I. Using Payroll	II. Using Sales
	Apportioned Profit ($M)	
OR	(80% of 6) = 4.8	2
IL	(10% of 6) = .6	2
AL	(10% of 6) = .6	2
	Corporate Tax Liability ($M)	
OR with $\tau^c_{OR} = 50\%$	2.4	1
IL with $\tau^c_{IL} = 10\%$	.06	0.2
AL with $\tau^c_{AL} = 0\%$	0	0
Total Tax Liability ($M)	3	1.2

Source: Suárez Serrato and Zidar (AER, 2016).

Evolution of apportionment weights

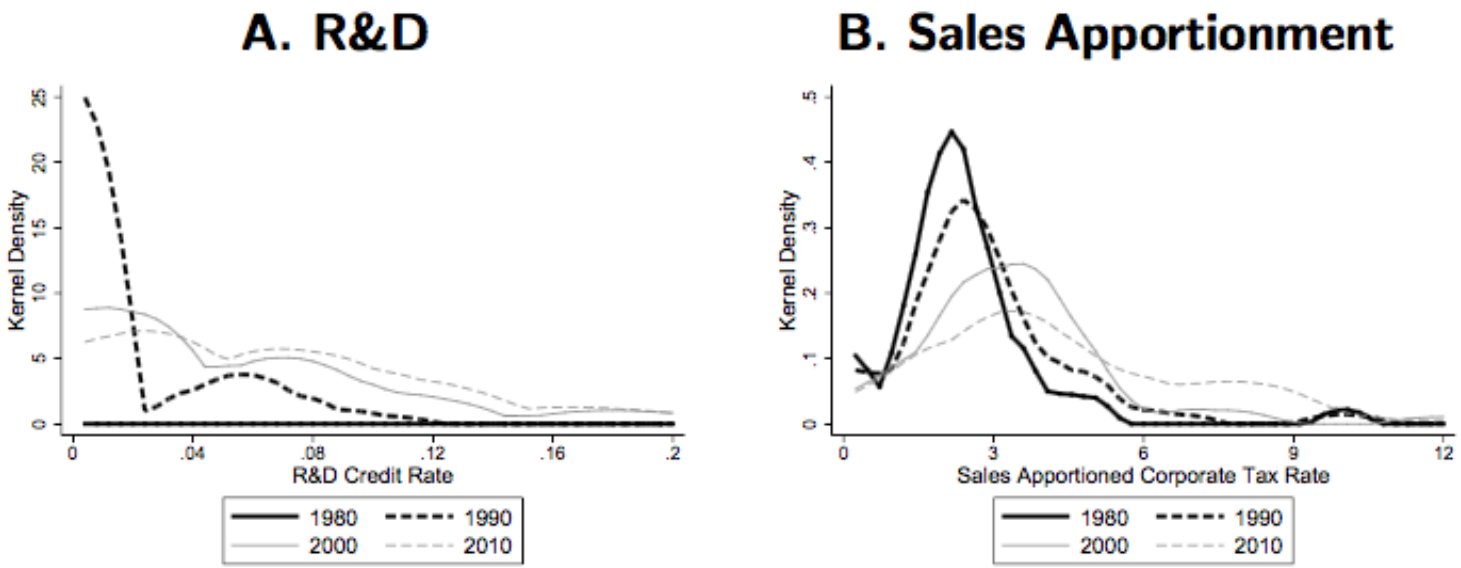


State corporate tax rates



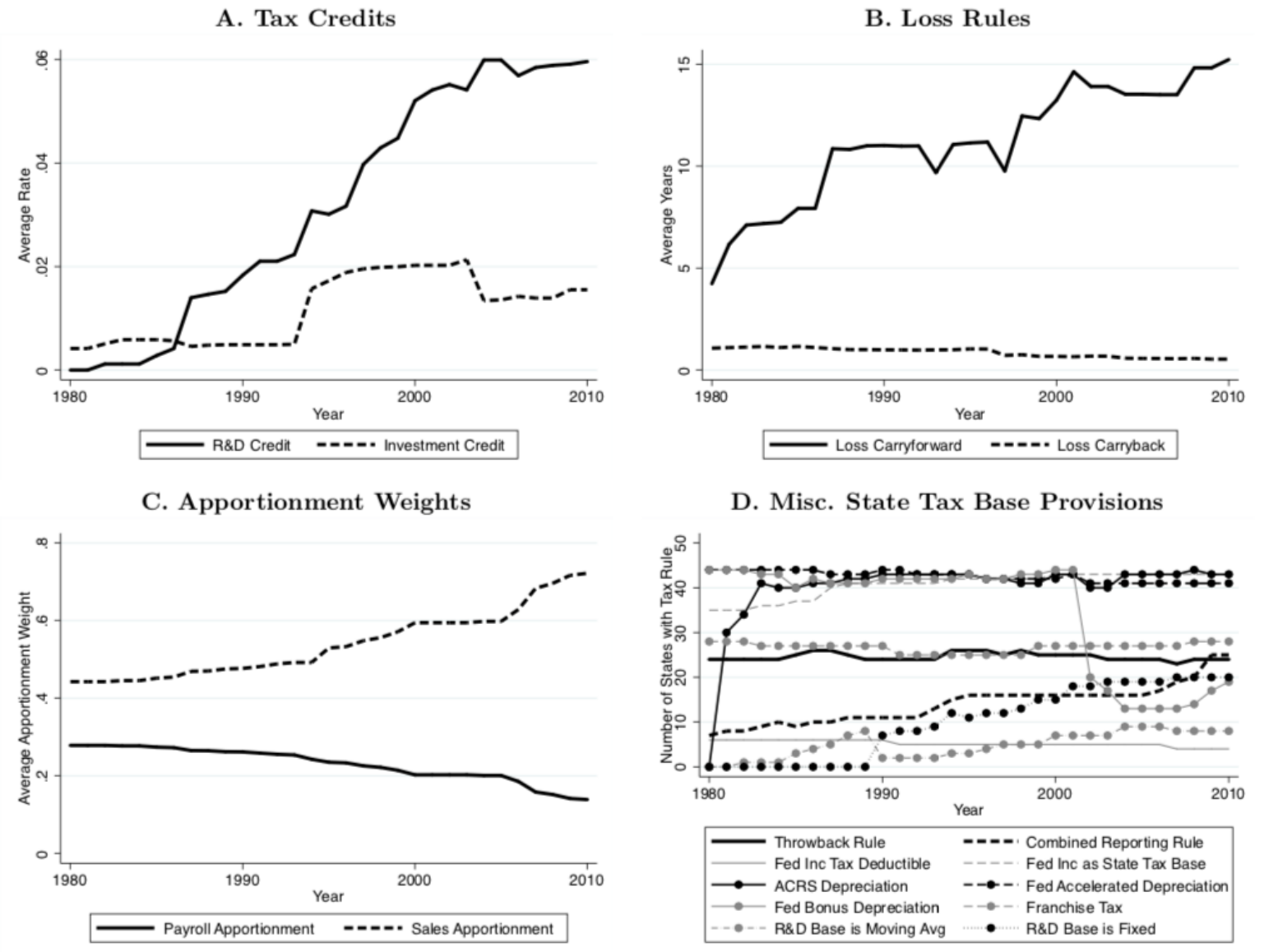
Source: Suárez Serrato and Zidar (JPUBE, 2018).

State corporate tax base



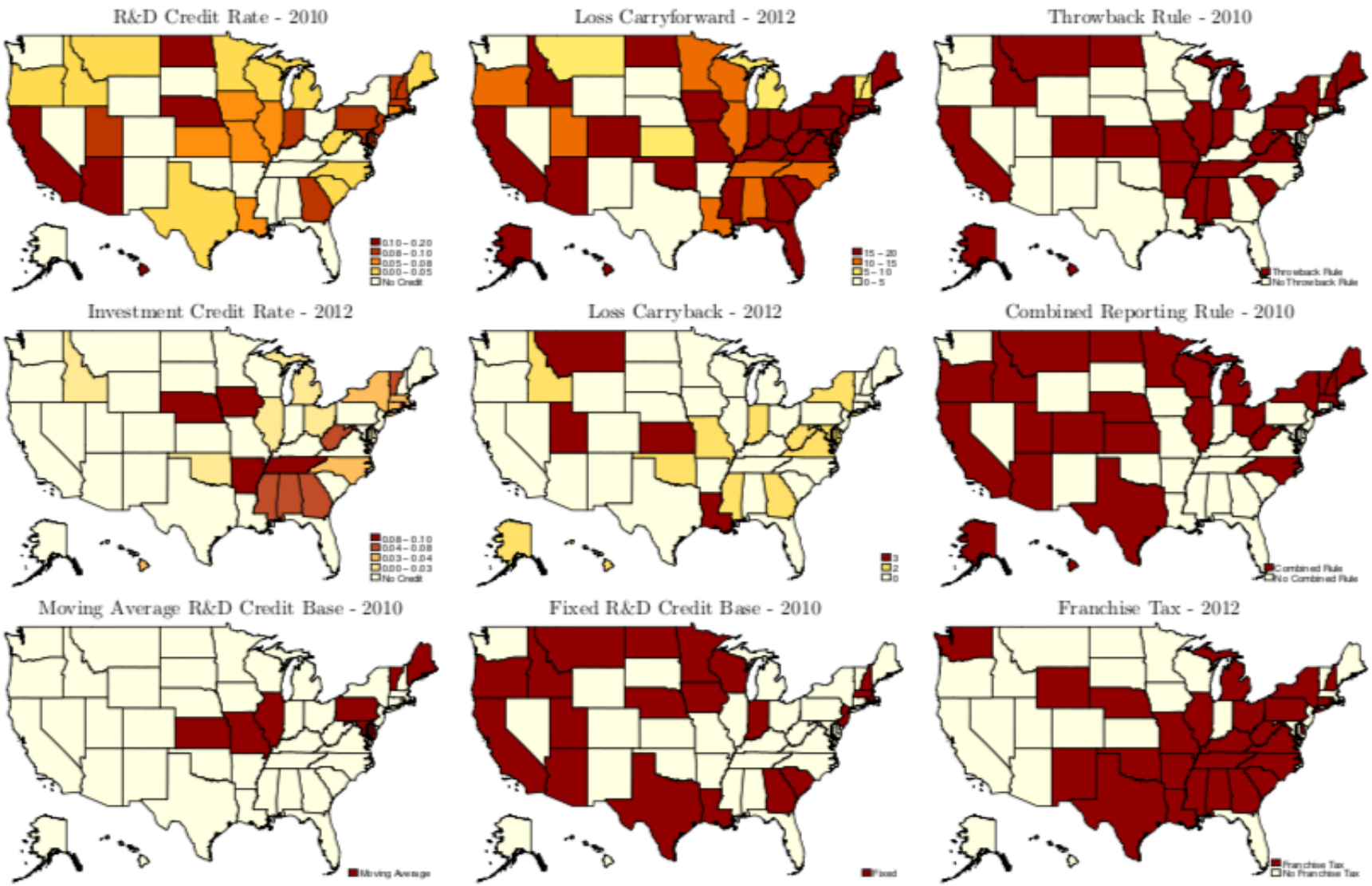
Source: Suárez Serrato and Zidar (JPUBE, 2018).

State corporate tax base



Source: Suárez Serrato and Zidar (JPUBE, 2018).

State corporate tax base



Source: Suárez Serrato and Zidar (JPUBE, 2018).

Variance Decomposition of Tax revenue

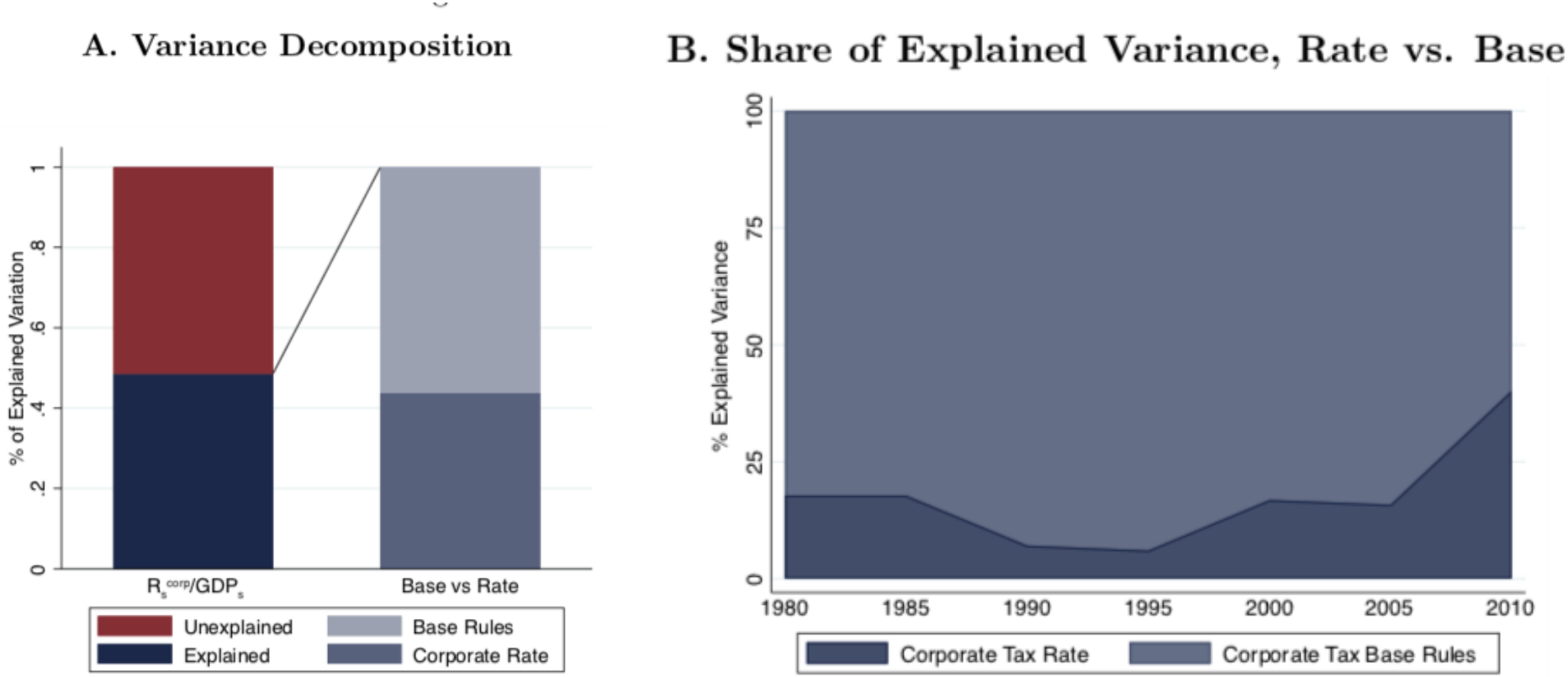
- Base rules change more than taxes, so we want to know if they matter for revenue
- Explore relationship through variance decomposition:

$$Var(R_{st}) = Var(\alpha + \gamma \tau^{c}_{st} + \mathbf{X}'_{st} \mathbf{\Psi}^{BASE}_{st} + u_{st})$$

  - R_{st} = state corporate tax revenue as a share of GDP
  - τ^{c}_{st} = statutory corporate tax rate in state s and year t
  - $\mathbf{X}_{st}$ = vectors of tax base determinants
  - α_s = state fixed effect
  - ε_{it} clustered by state
- Decomposition is performed in 5 year intervals and data is weighted by mean GDP in sample
  - Contribution to variation depends on coefficients (γ, Ψ) and on variation in policies over time

Source: Suárez Serrato and Zidar (JPUBE, 2018).

Tax structure explains ≈ 60% of variance

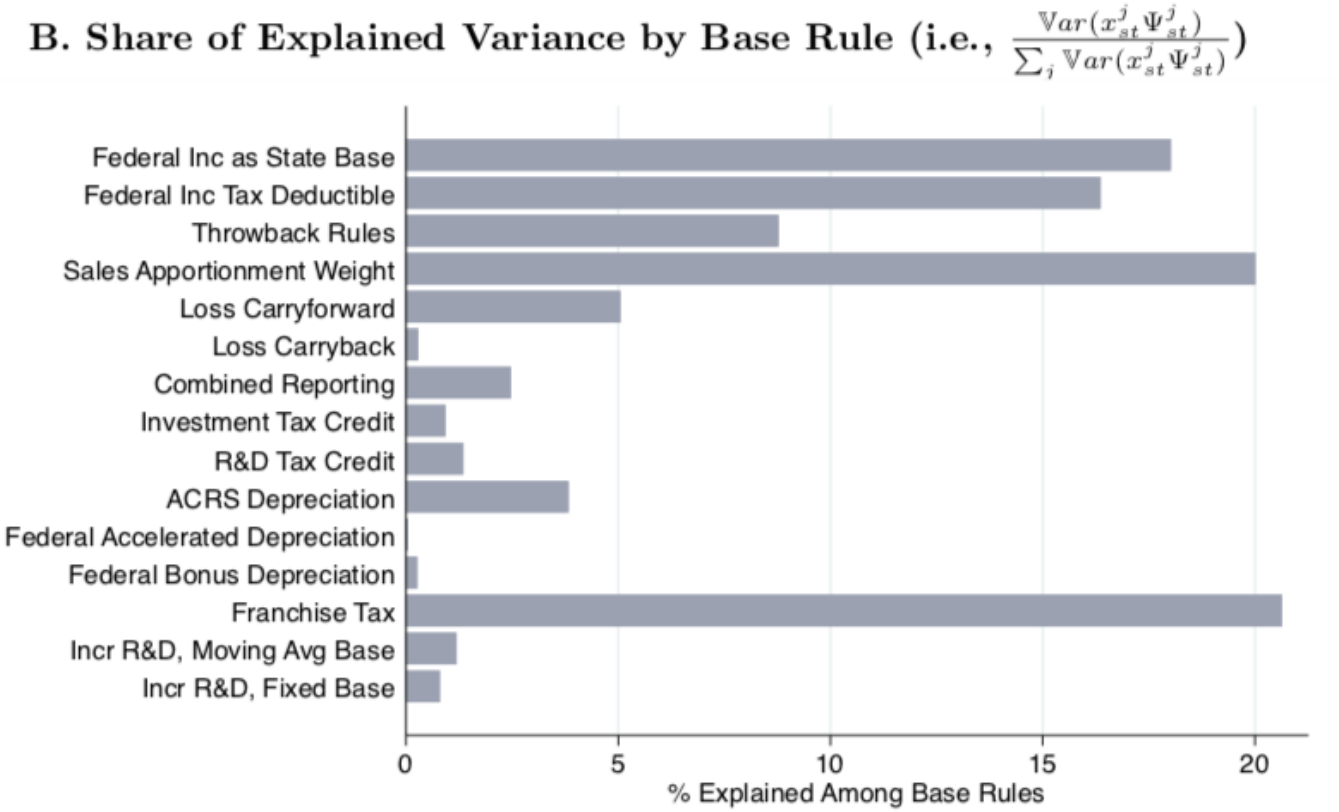


- ≈ 60% of explained variance is due to tax base rules

Source: Suárez Serrato and Zidar (JPubE, 2018).

ANOVA: base and credit rule provisions

- Contribution to the variance from base provision j: $Var(x^j_{st}\Psi^j_{st})$



Source: Suárez Serrato and Zidar (JPUBE, 2018).

Overview of Business Taxes

1. Brief overview of firm decisions and tax policies
2. Policy: business tax base (before and after Tax cuts and Jobs Act)
   - Business entity types, tax rates, and context for TCJA
   - Business tax base (before and after TCJA)
     - TCJA Business Tax Reform Summary
     - Key Corporate Deductions before TCJA
     - TCJA: Corporate Tax Base Reforms
     - TCJA: Pass-through Provisions
     - TCJA: International Provisions
   - Fundamental reform and apportionment
     - Tax base: source, residence, destination
     - Apportionment and State Corporate Taxation
3. Economics: Simple Framework and Research Questions
   - Simplest possible framework
   - Research Questions

Neoclassical Benchmark: corporate tax is a capital tax

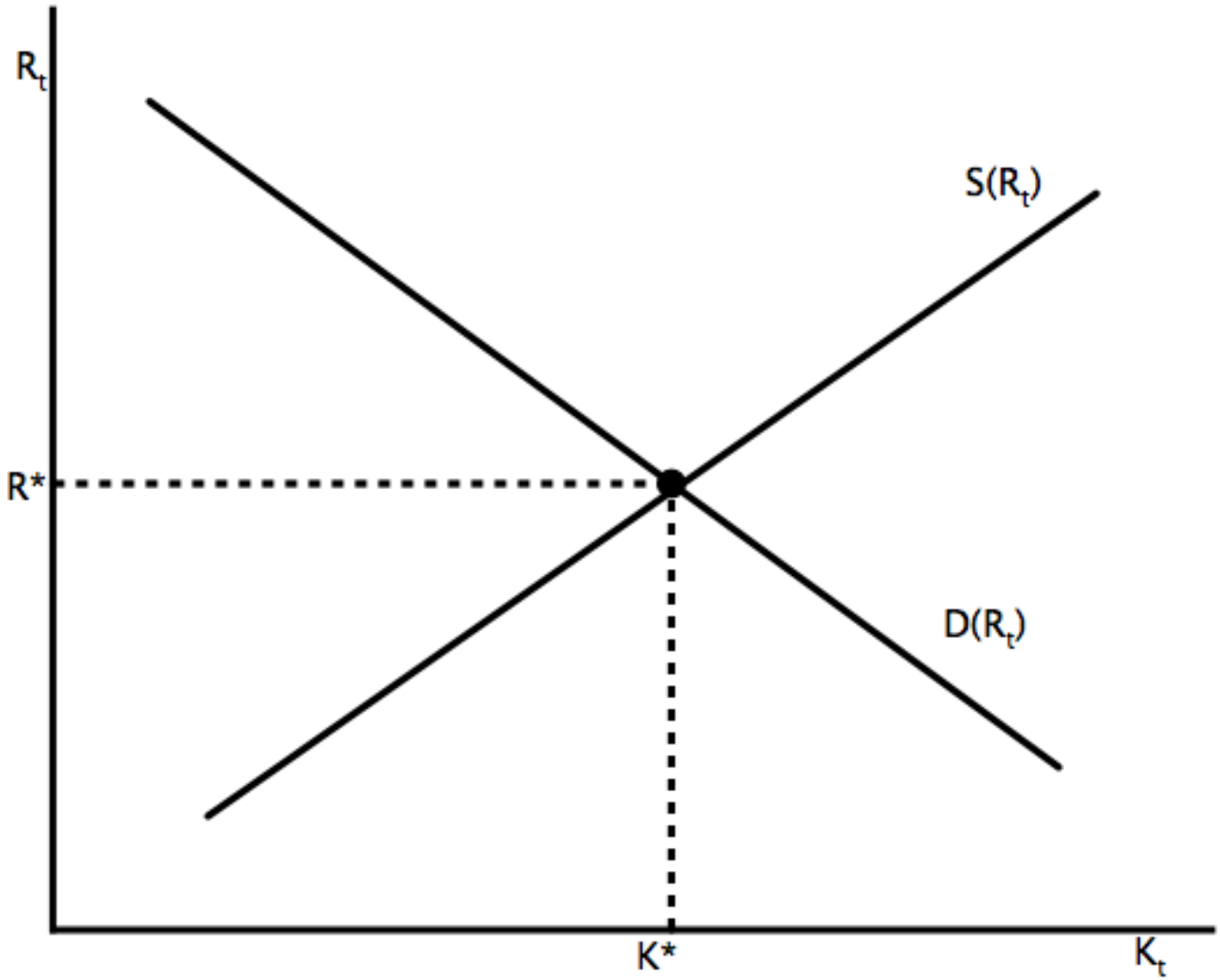
Equity-efficiency tradeoffs of corporate taxation seem especially stark

1. **Efficiency**
   - Capital taxes reduce scale of economic activity
   - Capital accumulation, which may be highly responsive to rates of return, is key driver of economic growth
   - Capital mobility: taxes can lead to misallocation
2. **Equity**
   - Distribution of capital income is much more unequal than labor income
   - Capital mobility: burden may be shifted to labor
3. **Evidence**
   - Empirical evidence/our understanding of capital taxation is less well developed than labor income taxation
4. **Policy Relevance**
   - Future of fiscal policy (taxing robots, driverless cars, corp tax reform)
   - Destination-based cash flow taxes, international reforms

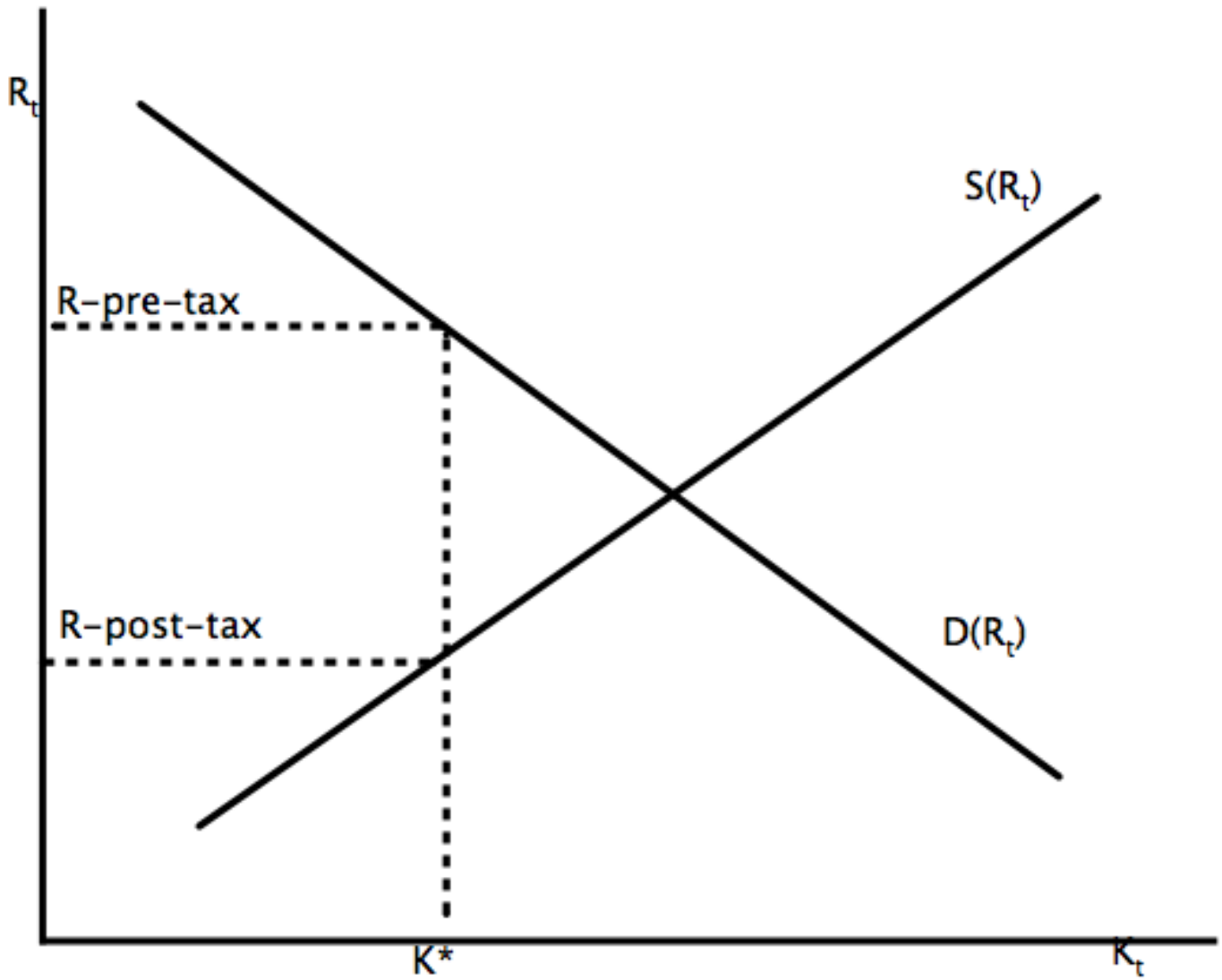
Simplest Possible Framework: Impact of a Capital Tax

- The real price of capital will be determined in the use market
  - Price is the user cost of capital (i.e., the price of using capital services for one period)
  - Quantity is the stock of capital
- A tax on capital will increase the pre-tax return to capital and decrease the after-tax return
- A key question is how the capital tax is split between a decline in the after-tax return and a rise in the pre-tax return
  - Short run: supply of capital is likely to be quite inelastic so that a tax on capital will mostly reduce the after-tax rerun with little increase in the pre-tax return
  - Long run: supply of capital is likely more elastic (net returns tend to be about 6 to 7% and independent of level of capital taxes, but there's little evidence on long-run capital supply elasticities).

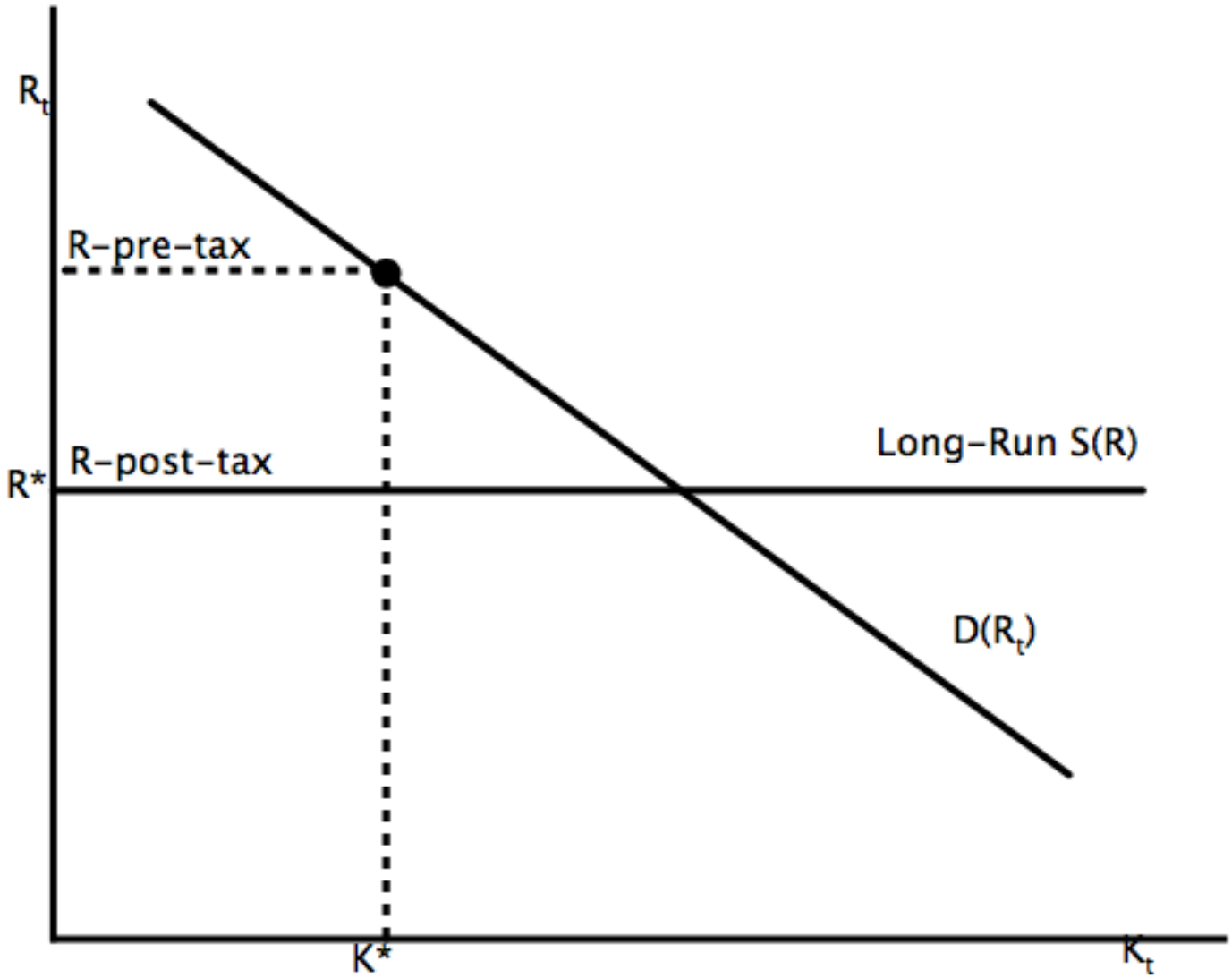
Simple Framework: Impact of a Capital Tax



Simple Framework: Impact of a Capital Tax



Simple Framework: Impact of a Capital Tax (in Long Run)



Simple Framework: Impact of a Capital Tax

Who bears the capital tax in the long run? What are growth and tax revenue effects?

- Who gets the triangle above R-pre-tax (i.e., consumer surplus in the typical S and D graph)?
- If firms don't earn profits, this all goes to workers in terms of higher wages or lower prices
- A key object is the **elasticity of capital supply**, is likely larger (and some think infinite) in the LR
- Note that the distortion in the capital market reduces surplus more than it increases tax revenues (as with most taxes)
- Finally, distortions due to capital taxation are often considered in a dynamic context in which the distortion compounds overtime (See Ivan Werning's recent paper on the classic Chamley-Judd results)

Some Classic Research Questions

What is the effect of cutting τ (or a tax base change) on:

1. **Supply of corporate capital**
   - Extensive margin: firm location, entrepreneurship, innovation
   - Intensive margin: domestic investment, FDI, innovation
2. **Labor market**
   - Wage and employment effects
3. **Product markets**
   - Effects on consumer prices
4. **Tax revenues**
   - Effect on corporate tax revenue
   - Fiscal externalities on personal and sales tax base
5. **Asset markets**
   - Effect on price of investment goods
   - Old versus new capital

What does the classic framework miss?

What is the effect of cutting τ (or a tax base change) on:

1. **Supply of corporate capital**
   - Real versus reporting location responses; firm location shaped by worker pref, productivity, market access, factor prices, etc
   - Decisions of multinationals and multi-product firms are more complex
   - Spillovers of foreign investment on domestic markets
   - Heterogeneous impacts of base and rate provisions across different firms
2. **Labor market**
   - Heterogeneous impacts by skill type
   - When owners also workers; agency issues between owners and managers
3. **Profits/rents/product markets**
   - Marshall's view of corporate tax as falling on pure profits?
4. **Tax revenues**
   - Interactions with other policy (e.g., tariffs and trade policy)
   - Interactions with other distortions (financial frictions, product market and labor market power, etc)
   - Endogenous responses of other locations and tax competition
5. **Asset markets**
   - Expectations, risk, etc. Impacts on other capital markets (e.g., land)

II. Firm Location and Corp Tax Incidence

Firm Location and Corporate Tax Incidence

1. Firm Location Decisions
   - Model of firm location
   - Empirical implementation: taxes and firm location
   - Hines (AER, 1996)
   - Giroud and Rauh (JPE, forthcoming)

2. Corporate Tax Incidence
   - Motivation
   - Local Labor Market Approach of Suárez Serrato and Zidar (AER, 2016)
   - Brief discussion of Local vs National/Global Effects
   - Fuest, Peichl, Siegloch (AER, 2018)

How do taxes affect firm location?

Overview

- **Question** What is the effect of business taxes and location subsidies on firm location and the supply of corporate capital?
- **Motivation:**
  - Capital stock is key for growth
  - At all levels of government, substantial resources deployed with goal of attracting firms
- **Roadmap:**
  - Simple model of firm location Suárez Serrato and Zidar (AER, 2016)
  - Empirical evidence from recent papers

Source: Zidar, in preparation for Journal of Economic Perspectives.

My take on this question

- **Location decisions are multidimensional**
  - Depend on more things than just taxes (e.g., factor prices, productivity, market access, amenities, existing plants and infrastructure)
  - Responsiveness of supply of corporate capital and thus overall economic growth depend on these other factors and how they relate to tax changes
- **Existing empirical estimates:**
  - Can inform some of these things at the state and local level
  - But there is a lot of uncertainty at the federal level or for really big subsides that are beyond what we have seen in the data (in which case we need to rely on models to make predictions)
- **Bottom line:**
  - Thus, in many cases, assessments of the effectiveness of corporate tax cuts depends on our assumptions about the economic environment.

Source: Zidar, in preparation for Journal of Economic Perspectives.

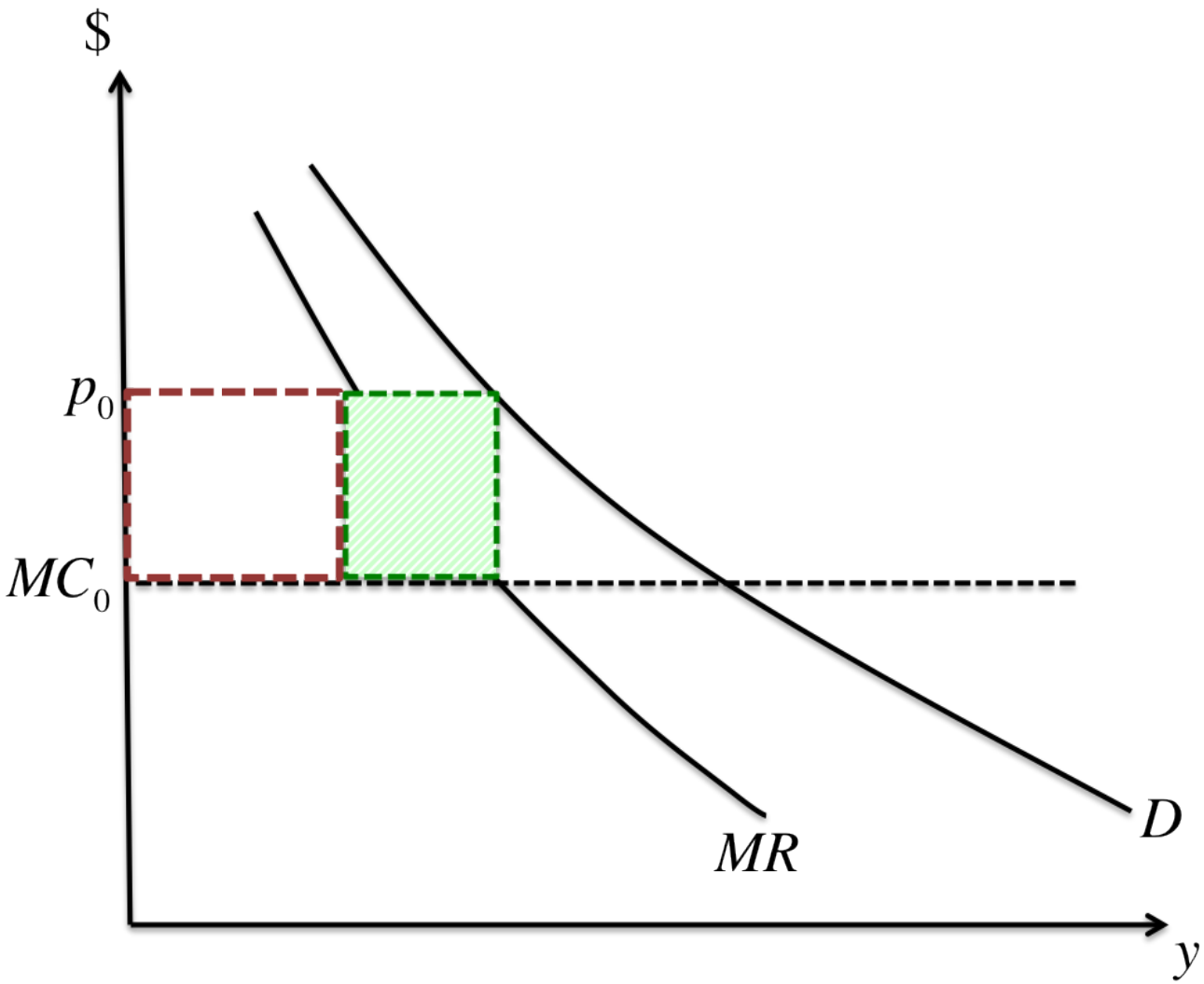
Model of Firm Location

Assumptions and economic environment:

- **Assume** firms make location decision to maximize after-tax profits
- **Geography:** Small open economy $c \in C$
- **Agents:** E_c establishments
- **Market Structure:**
  - Monopolistically competitive traded goods market for each variety j
  - Global capital market
  - Local labor market
  - Local housing market (only used by workers, not firms)

Source: Suárez Serrato and Zidar (AER, 2016)

Establishment Production



Source: Suárez Serrato and Zidar (AER, 2016)

Local Labor Demand: Establishment Production

- Demand for variety j is $y_{jc} = I \left(\frac{p_{jc}}{P}\right)^{\varepsilon^{PD}}$

Local Labor Demand: Establishment Production

- Demand for variety j is $y_{jc} = I \left(\frac{p_{jc}}{P}\right)^{\varepsilon^{PD}}$

- Establishment j produces its variety with the following technology

$$y_{jc} = \underbrace{B_{jc}}_{\equiv \bar{B}_c + \zeta_{jc}} I_{jc}^{\gamma} k_{jc}^{\delta} M_{jc}^{1-\gamma-\delta}$$

Local Labor Demand: Establishment Production

- Demand for variety j is $y_{jc} = I \left(\frac{p_{jc}}{P}\right)^{\varepsilon^{PD}}$
- Establishment j produces its variety with the following technology

$$y_{jc} = \underbrace{B_{jc}}_{\equiv \bar{B}_c + \zeta_{jc}} I_{jc}^{\gamma} k_{jc}^{\delta} M_{jc}^{1-\gamma-\delta}$$

- Firm Value Function

$$V_{jc}^{F} = \underbrace{\overbrace{\frac{\ln(1-\tau_s^b)}{-(\varepsilon^{PD}+1)}}^{\text{Taxes}} - \overbrace{\gamma \ln w_c - \delta \ln \rho}^{\text{Factor Prices}} + \bar{B}_c}_{\equiv v_c} + \zeta_{jc}.$$

Source: Suárez Serrato and Zidar (AER, 2016)

Location Choice & Local Establishment Shares

Fraction of Establishments:

$$E_c = P\left(V_{jc}^F = \max_{c'}\{V_{jc'}^F\}\right) = \frac{\exp\frac{v_c}{\sigma^F}}{\sum_{c'}\exp\frac{v_{c'}}{\sigma^F}}$$

Location Choice & Local Establishment Shares

Fraction of Establishments:

$$E_c = P\left(V_{jc}^F = \max_{c'}\{V_{jc'}^F\}\right) = \frac{\exp\frac{v_c}{\sigma^F}}{\sum_{c'}\exp\frac{v_{c'}}{\sigma^F}}$$

Establishment Growth:

$$\Delta \ln E_{c,t} = \frac{\Delta \ln(1-\tau_{c,t}^b)}{-\sigma^F(\varepsilon^{PD}+1)} - \frac{\gamma}{\sigma^F}\Delta \ln w_{c,t} + \phi_t + \frac{1}{\sigma^F}\Delta \bar{B}_{c,t}$$

Key Parameter:

- Dispersion of idiosyncratic productivity σ^F
- Larger σ^F means lower responsiveness to tax changes

Source: Suárez Serrato and Zidar (AER, 2016)

Empirical Implementation

Estimating Equation:

$$\Delta \ln E_{c,t} = \frac{\Delta \ln(1-\tau^b_{c,t})}{-\sigma^F(\varepsilon^{PD}+1)} - \frac{\gamma}{\sigma^F}\Delta \ln w_{c,t} + \phi_t + \frac{1}{\sigma^F}\Delta \bar{B}_{c,t}$$

Regression

- **LHS:** Log change in the number of establishments $\Delta \ln E_{c,t}$
- **RHS # 1:** Log change in the keep rate $\Delta \ln(1-\tau^b_{c,t})$
- **RHS # 2:** Log change in factor prices $\Delta \ln w_{c,t} + \phi_t$
- **Error term:** TFP shocks $\Delta \bar{B}_{c,t}$ and other factors outside the model

Source: Suárez Serrato and Zidar (AER, 2016)

Empirical Implementation

Reduced Form:

$$\Delta \ln E_{c,t} = \underbrace{\left(\frac{1}{-\sigma^F(\varepsilon^{PD}+1)} - \frac{\gamma}{\sigma^F}\dot{w}(\theta) \right)}_{\beta^E} \Delta \ln(1-\tau^b_{c,t}) + \phi_t + u_{c,t}$$

Regression

- **LHS:** Log change in the number of establishments $\Delta \ln E_{c,t}$
- **RHS:** Log change in the keep rate $\Delta \ln(1-\tau^b_{c,t})$
- **Estimate:** β^E will depend on direct effects plus indirect effects on factor prices (in this case, the incidence on wages)!

Source: Suárez Serrato and Zidar (AER, 2016)

Empirical Implementation

Alternative Estimating Equation (from FMSZ, 2018):

$$\ln E_{nt} = b_0 \ln\left(\left(1 - \bar{t}_n\right) MP_{nt}\right) + b_1 \ln c_{nt} + b_2 \ln \tilde{R}_{nt} + \psi_t^M + \xi_n^M + \nu_{nt}^M$$

where

- $c_{nt} = \left(w_{nt}^{1-\beta} r_{nt}^{\beta}\right)^{\gamma} P_{nt}^{1-\gamma}$ are unit costs
- $\ln \tilde{R}_{nt}$ is government spending
- ψ_t^M is a time effect
- $\xi_n^M + \nu_{nt}^M$ accounts for state effects and deviations from state and year effects in log productivity, $\ln z_{nt}$
- MP_{nt} is the market potential of state n in year t,

$$MP_{nt} = \sum_{n'} E_{n't} \left(\frac{\tau_{n'nt}}{P_{n't}} \frac{\sigma}{\sigma - \tilde{t}_{n'nt}} \frac{\sigma}{\sigma - 1} \right)^{1-\sigma}$$

where $E_{n't} \equiv P_{n't} Q_{n't}$ denotes aggregate expenditures in state n'.

Source: Fajgelbaum, Morales, Suárez Serrato, and Zidar (Restud, 2018)

Empirical evidence on taxation and firm location

Three papers:

- Event study from Suárez Serrato and Zidar (AER, 2016), which uses apportioned tax rate which is approx $\tau^c/3$
- Hines (AER, 1996)
- Giroud and Rauh (JPE, forthcoming)

How do business tax cuts affect firm location?

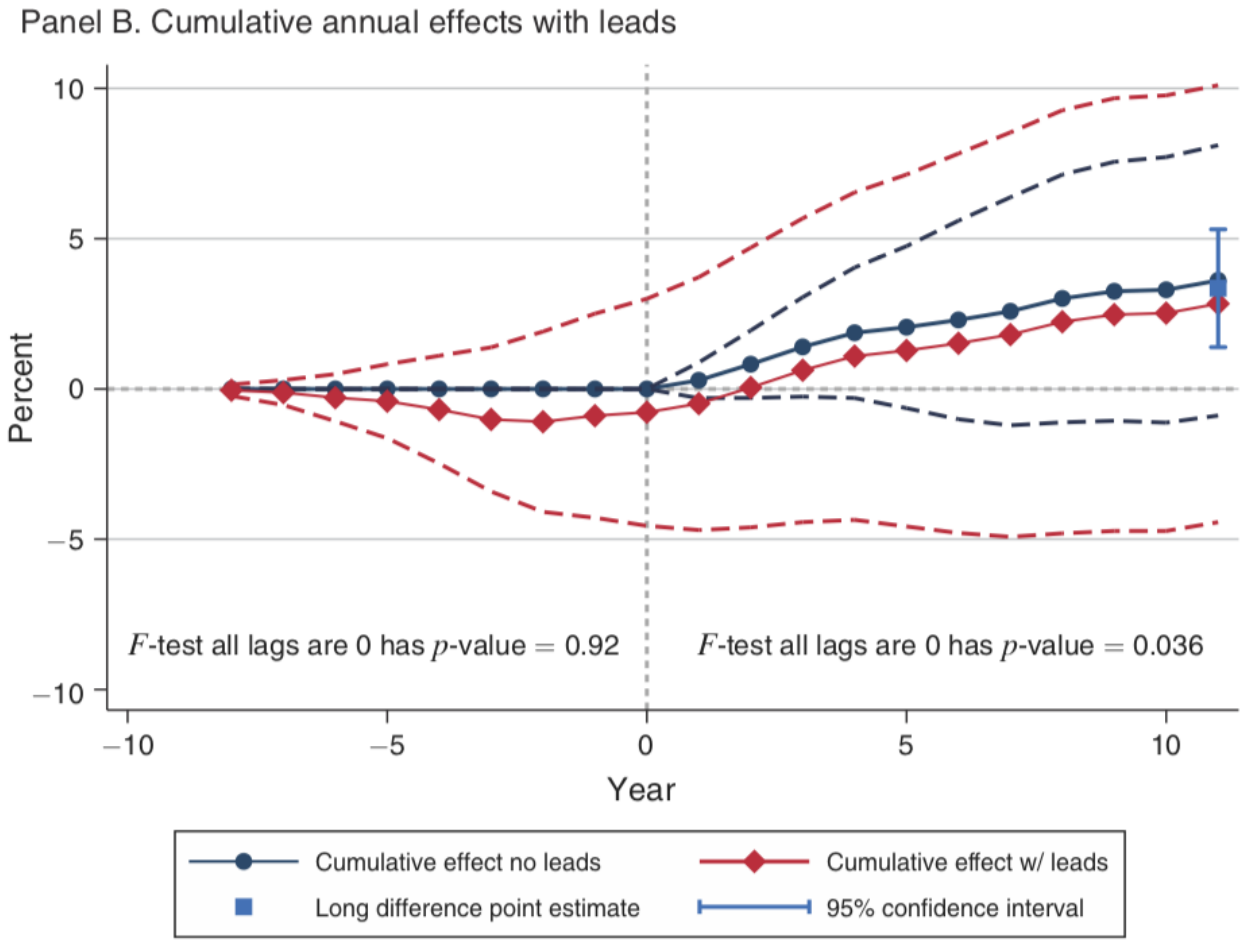


FIGURE 4. CUMULATIVE EFFECTS OF BUSINESS TAX CUTS ON ESTABLISHMENT GROWTH

Source: Suárez Serrato and Zidar (AER, 2016)

Hines (AER, 1996)

- Paper: Hines, James R. "Altered States: Taxes and the Location of Foreign Direct Investment in America." American Economic Review, Vol. 86, No. 5 (1996): 1076-1094.
- Question: How do international taxation on FDI and state taxation interact when affecting business location?
- Motivation: Effect of taxes on investment and firm location are key determinants of the incidence and efficiency consequences of business taxation

Institutional Background

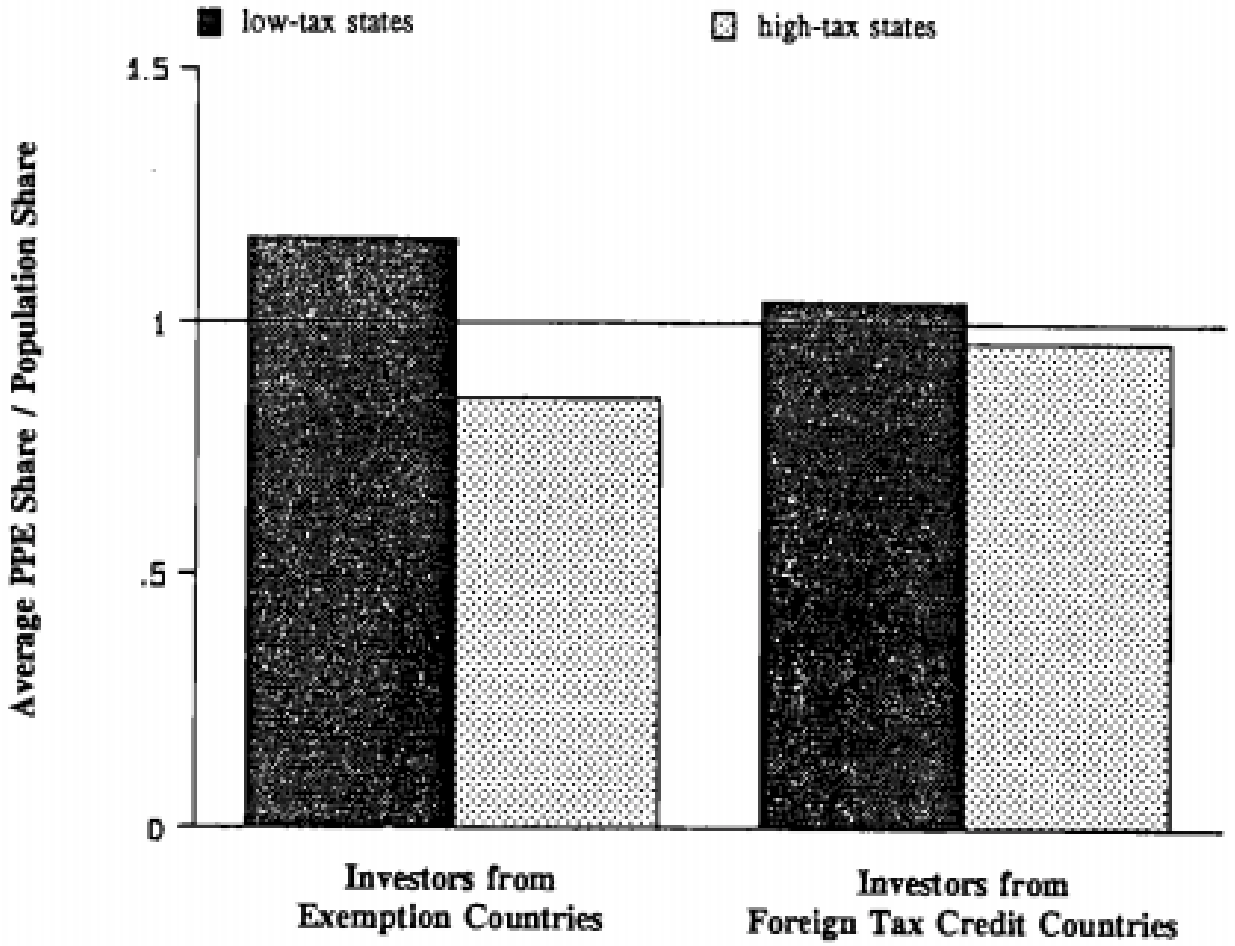
Countries have different policies on taxation of domestic firm income earned abroad.

- Foreign earnings of domestic firms effectively exempt from taxation
  - Ex: Australia, Canada, France, Germany, Switzerland
- Foreign Tax Credits (FTCs): firms pay taxes on profits earned abroad, claim credits against liabilities in the home country
  - Only corporate income taxes can be creditable in countries with FTC policies
  - Ex: United States, the United Kingdom, Japan
- Key idea: countries that can use FTCs are less sensitive to tax differences since they can write them off

Data and Estimation

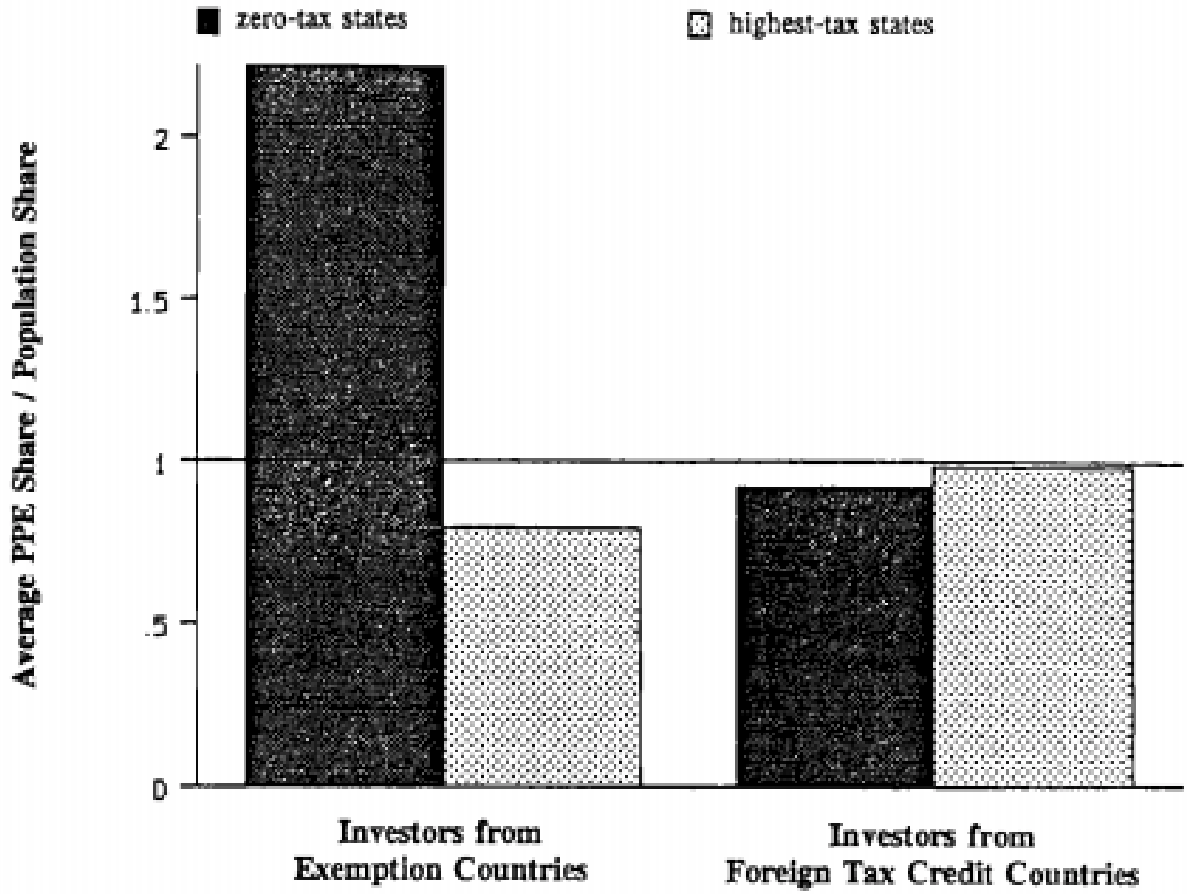
- Investment data: BEA 1987 Census of Manufactures
  - State-by-country FDI data
  - Investing countries: Australia, Canada, France, Germany, Japan, Switzerland, and the United Kingdom $\rightarrow$ "Together, the seven [...] countries account for 78% of the manufacturing PPE controlled by foreign investors in the United States in 1987" (p. 1083)
  - Dataset excludes the Netherlands, because of role of Dutch companies in international tax avoidance
- State corporate income tax rate: top statutory rate, correcting for depreciation rules and federal deductibility

Investors from Exemption Countries Less Likely to Invest in High-Tax States



NOTES: Figure plots investment-to-population ratios in 25 high-tax states and 25 low-tax states. High-tax states have tax rate that is 7% or higher.

Disparity in Investment Even Higher Across Highest- and Zero-Tax States



NOTES: Figure plots investment-to-population ratios in highest-tax states and zero-tax states. Highest-tax states have tax rate that is greater than 8.8%.

State Taxes Influence Allocation of FDI in the US

Main Findings:

- 1% higher state corp tax rate $\leftrightarrow$ 9-11% higher investment shares of firms from FTC countries relative to non-FTC countries
- State tax rate differences of 1% are correlated with diff of 3% in the likelihood of investors to establish affiliates

Key takeaway: results suggest that even small variations in local tax rates may have affect capital flows and on the economy as a whole

Overview of Giroud and Rauh (JPE, forthcoming)

- Paper: Giroud, Xavier and Joshua Rauh. "State Taxation and the Reallocation of Business Activity: Evidence from Establishment-Level Data." NBER Working Paper No. 21534 (2015).
- Question: How does state-level business taxation impact business activity and location decisions?

Data

1. Firm data
   - U.S. Census Bureaus Longitudinal Business Database (LBD) $\rightarrow$ 27.6 million establishment-year observations, or 647,000 firm-year observations observations
   - Sample: All multi-unit U.S. establishments from 1977-2011 belonging to firms with at least 100 employees and having operations in at least two states

2. Tax data
   - Type of state corporate taxation and the corporate tax rates: the University of Michigan Tax Database (1977-2002), the Tax Foundation (2000-2011) and the Book of States
   - Apportionment factors and throwback rules: the Commerce Clearing Houses State Tax Handbooks

Findings:

- For C corporations, employment and the number of establishments have short-run corporate tax elasticities of -0.4 to -0.5, and do not vary with changes in personal tax rates.
- Pass-through entity activities show tax elasticities of -0.2 to -0.4 with respect to personal tax rates, and are invariant with respect to corporate tax rates.
- Capital shows similar patterns.
- Reallocation of productive resources to other states drives around half the effect.
- The responses are strongest for firms in tradable and footloose industries.

Firm Location and Corporate Tax Incidence

1. Firm Location Decisions
   - Model of firm location
   - Empirical implementation: taxes and firm location
   - Hines (AER, 1996)
   - Giroud and Rauh (JPE, forthcoming)

2. Corporate Tax Incidence
   - Motivation
   - Local Labor Market Approach of Suárez Serrato and Zidar (AER, 2016)
   - Brief discussion of Local vs National/Global Effects
   - Fuest, Peichl, Siegloch (AER, 2018)

The Opinion Pages | OP-ED CONTRIBUTOR The New York Times

Abolish the Corporate Income Tax

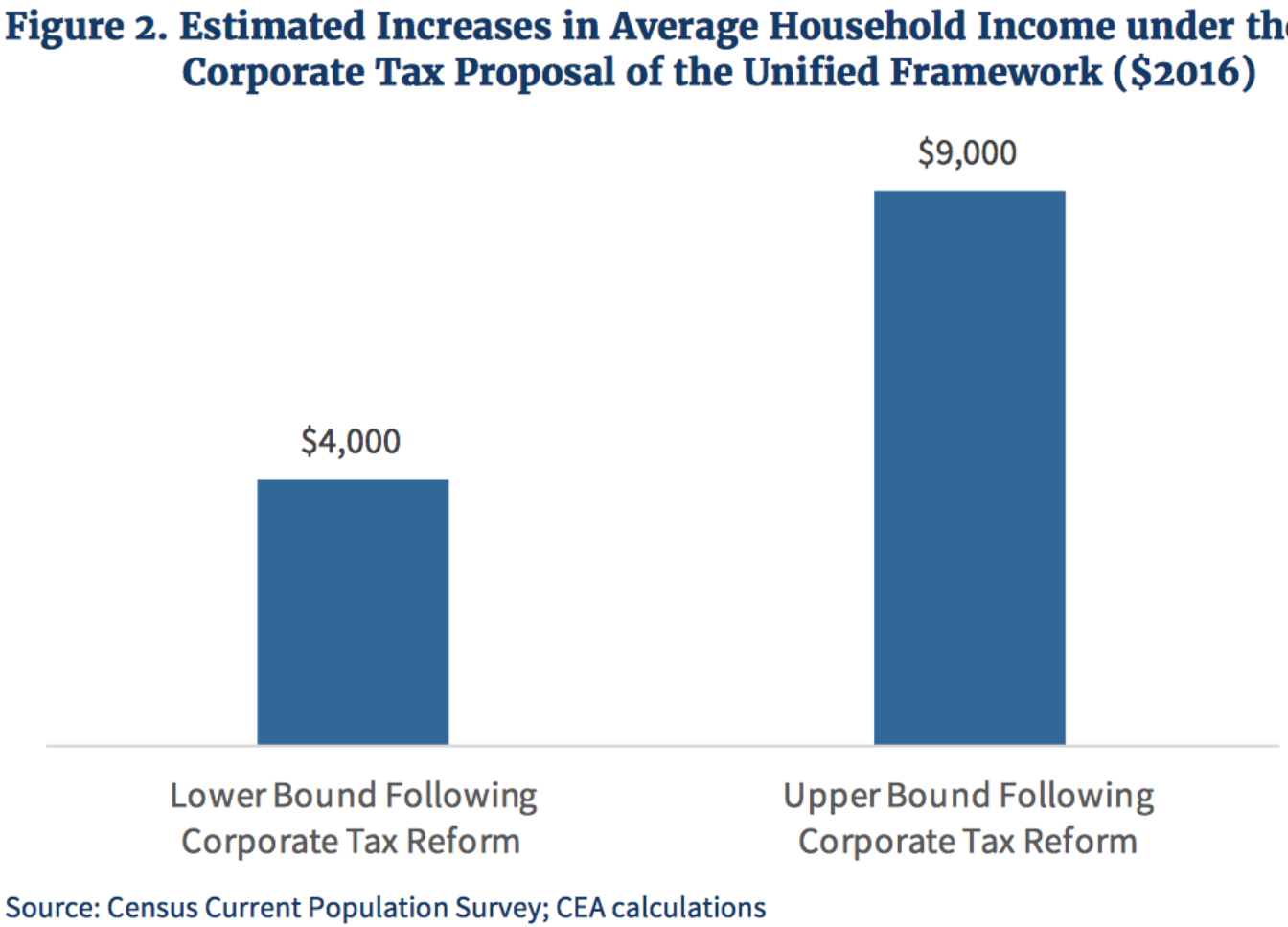
By LAURENCE J. KOTLIKOFF JAN. 5, 2014

I, like many economists, suspect that our corporate income tax is economically self-defeating – hurting workers, not capitalists

What can workers do to mitigate their plight? One useful step would be to lobby to eliminate the corporate income tax. That might sound like a giveaway to the rich. It's not. The rich, including Boeing's stockholders, can take their companies & run

Who will benefit from corporate tax cuts?

Who will benefit from corporate tax cuts?



Source: CEA (2017).

Who will benefit from corporate tax cuts?

THE WALL STREET JOURNAL.

https://www.wsj.com/articles/who-ultimately-pays-for-corporate-taxes-the-answer-may-color-the-republican-overhaul-1502184603

POLITICS

Who Ultimately Pays for Corporate Taxes? The Answer May Color the Republican Overhaul

Investors and workers bear tax burdens, but the politics of tax-code changes hinge on which group carries the heavier load

Lawmakers and Trump administration officials Washington are preparing to mount a business-tax-overhaul campaign this fall, but debate over whether workers or investors bear the brunt of the corporate tax burden may affect the nature of the

Who will benefit from corporate tax cuts?

"This is about creating jobs" Treasury Secretary Steven Mnuchin said on CBS in April, because many surveys show that 70% or more of the tax burden is borne by the American worker. This is about putting money back in the American worker's pocket" Last month, Mr. Mnuchin offered an increased estimate, saying 80% of business taxes are paid by workers.

"There's a pretty wide band of possible outcomes that are plausible," said Alan Auerbach

Source: WSJ (2017).

Agenda

1. **Local Labor Market Approach**
   - Framework from Suárez Serrato and Zidar (AER, 2016)
2. **Brief discussion of Local vs National Effects**
   - State vs federal impacts
   - Harberger-type general equilibrium models
3. **Recent Estimates**
   - Fuest, Peichl, Siegloch (AER, 2018)
   - Other considerations when measuring labor market impacts of corporate tax cuts (e.g., Auerbach, 2005 & forthcoming JEP paper)

Who Benefits from State Corp Tax Cuts (AER, 2016)

- **Question:** What are the welfare effects of cutting **corporate taxes** in an open economy on **workers**, **firm owners**, and **landowners**?

- **Contributions**

  1. New **evidence** on business location
  2. New **framework** for evaluating welfare effects
  3. New **assessment** of corporate taxation in an open economy

Source: Suárez Serrato and Zidar (AER, 2016)

Relax two crucial assumptions

1. Firms are **perfectly competitive**
    - If firm owners earn zero profits, they can not bear incidence
2. Firms are **perfectly mobile**
    - Every firm is marginal in their location decisions

Relax two crucial assumptions

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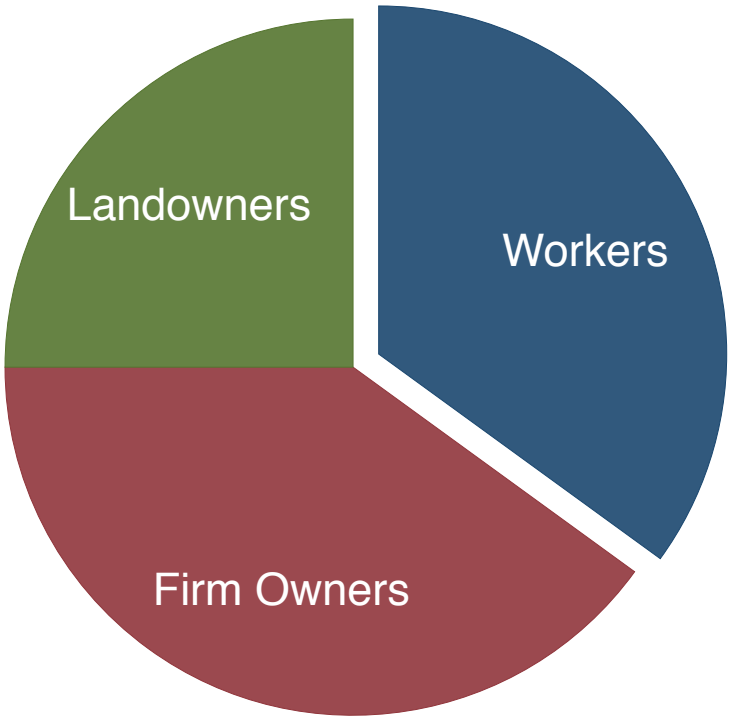
    - If firm owners earn zero profits, they can not bear incidence
2. Firms are **perfectly mobile**
    - Every firm is marginal in their location decisions

Allow for monopolistically competitive & heterogeneously productive firms

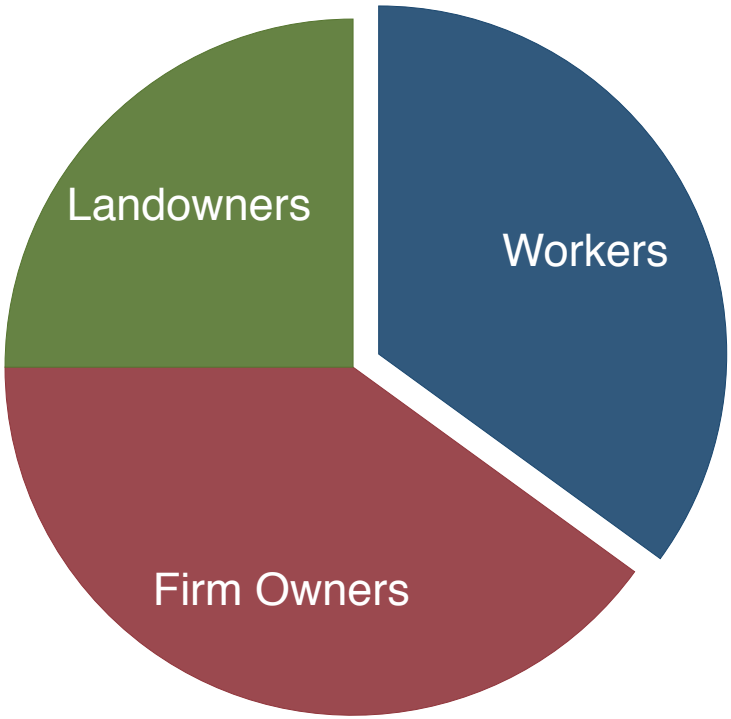
Who Benefits from State Corporate Tax Cuts?

Our Estimate

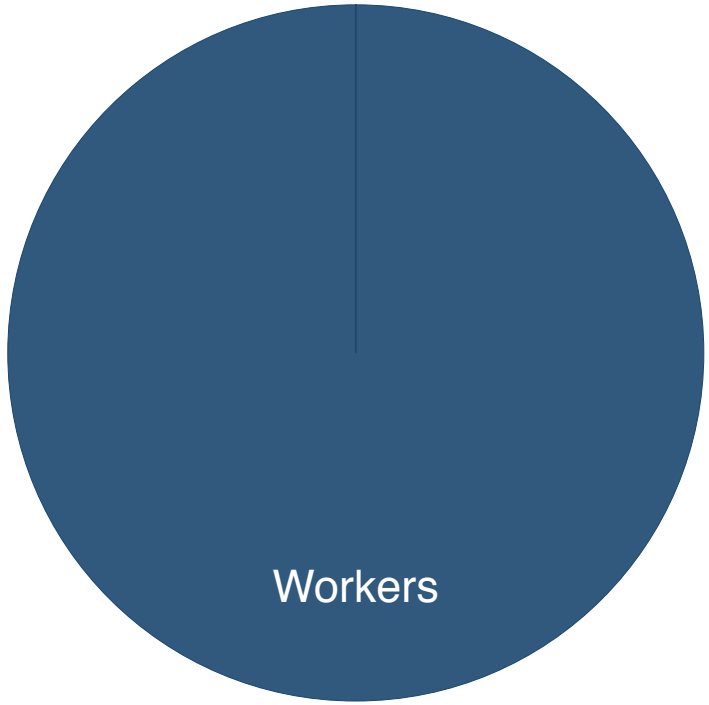


Who Benefits from State Corporate Tax Cuts?

Our Estimate



Standard Model



Context and Challenges

- **Empirical:** Desai et al. 2007, Gravelle 2011, Clausing 2013
  - Insufficient time series variation in US corporate rates
  - Cross-country variation compares countries with dissimilar institutions
- **Theoretical:**
  - Harberger-type general equilibrium with focus on open economy (Gravelle 2010)
  - Computable General Equilibrium Models (Kotlikoff & Summers 1987, Kotlikoff et al. 2013)

Suárez Serrato and Zidar (AER, 2016) Outline: 3 Parts

1. **Develop spatial equilibrium model with firms**
   - Allow workers, firm owners, landowners to bear incidence
   - Map reduced-form effects to parameters governing welfare
2. **Reduced-form effects of corporate tax cuts** (skip for time)
   - Implement state apportionment system using establishment data
   - Number of establishments increases by roughly 3.5% following a 1% corporate tax cut
3. **Estimate incidence and structural elasticities** (skip for time)
   - Implement reduced-form incidence expressions
   - Minimize distance between reduced-form expressions and estimates to estimate structural elasticities
   - Evaluate consequences for equity & efficiency of corporate tax policy

Local Labor Markets Approach

A Spatial Equilibrium Model with Firms

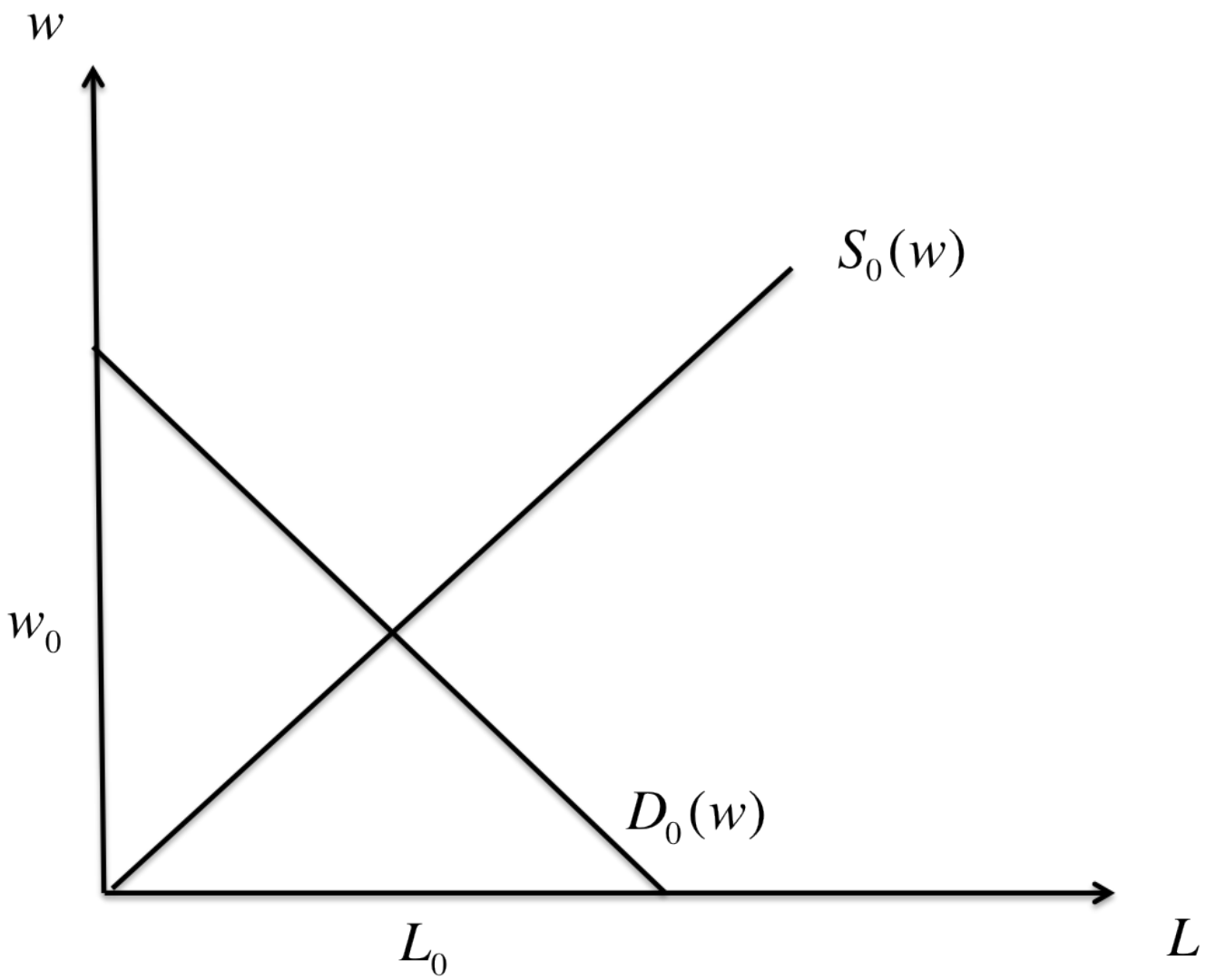
You have to start this conversation with the philosophy that businesses have more choices than they ever have before. And if you don't believe that, you say taxes don't matter. But if you do believe that, which I do, it's one of those things, along with quality of life, quality of education, quality of infrastructure, cost of labor, it's one of those things that matter.

—Delaware Governor Jack Markell (11/3/2013) [1]

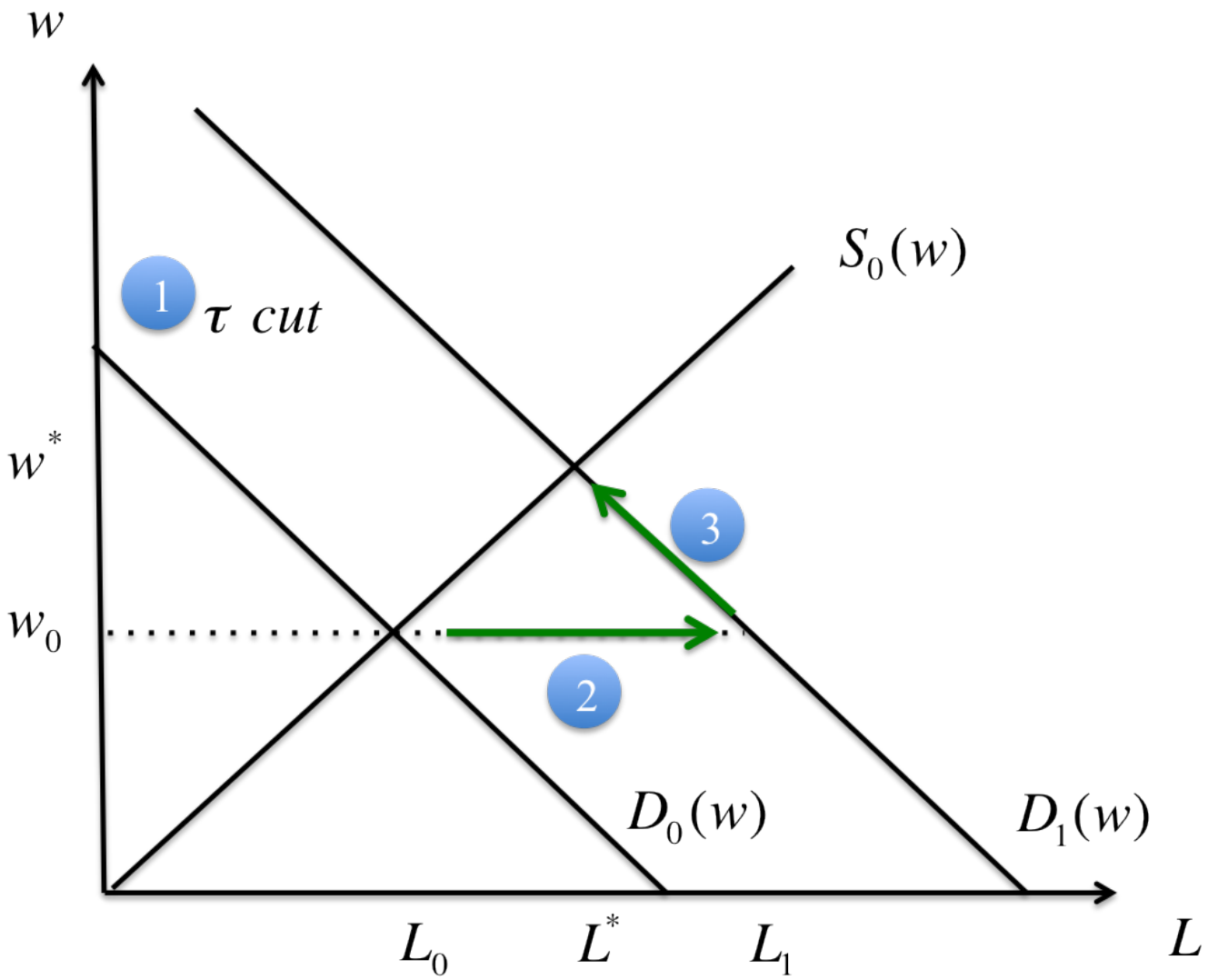
A Spatial Equilibrium Model with Firms: Outline

1. **Setup**
2. **Worker Location, Labor Supply**
   Moretti (2011), Busso et al (2013)
3. **Housing Market**
   Kline (2010), Notowidigdo (2012)
4. **Firm Location and Labor Demand**
   Dixit-Stiglitz (1977), Krugman (1979), Melitz (2003)
5. **Results**: Incidence $\dot{w}(\theta)$, $\dot{\pi}(\theta)$, $\dot{r}(\theta)$
   - $\varepsilon^{LS}(\theta)$ and $\varepsilon^{LD}(\theta)$, and $\mathbf{b}(\theta)$

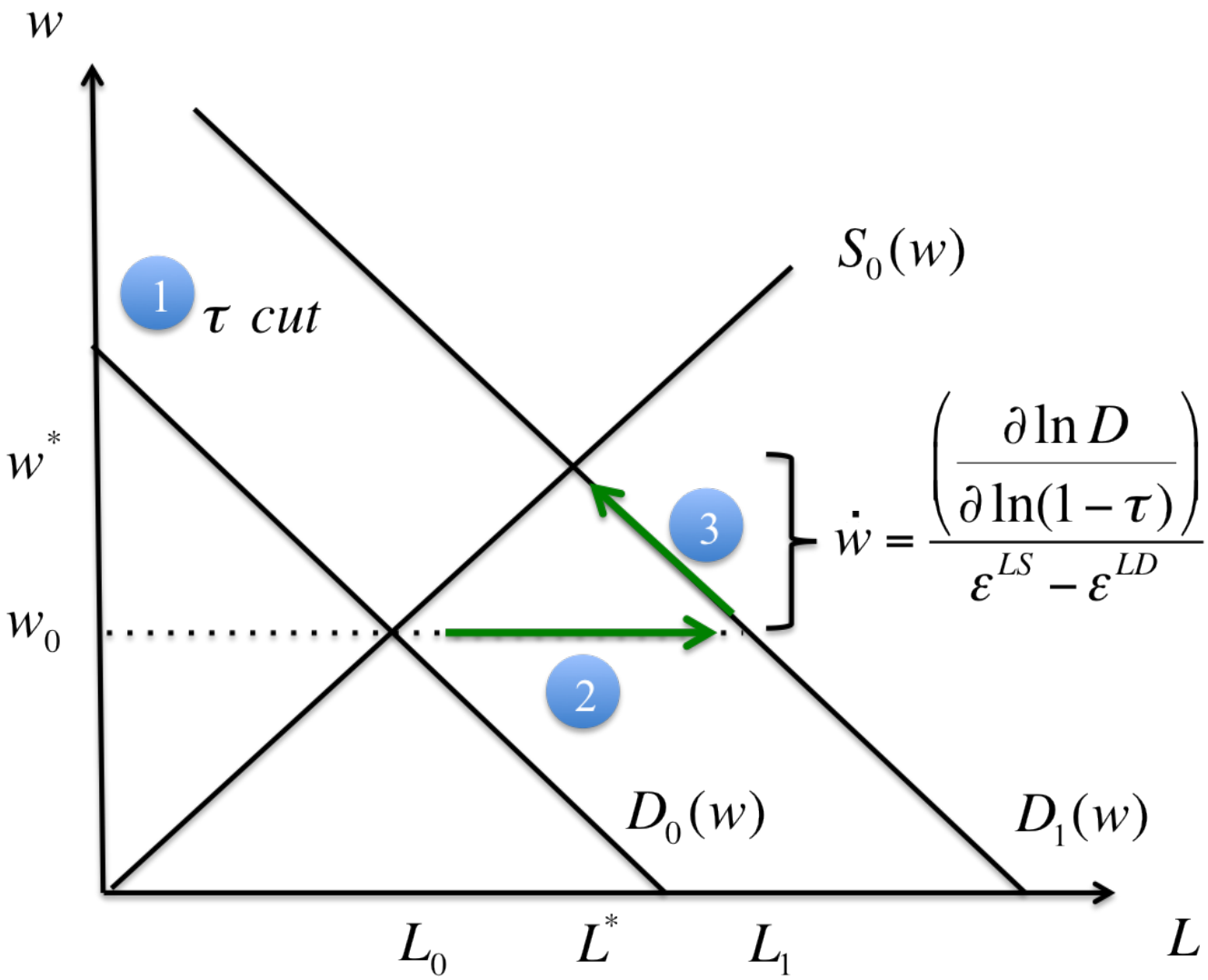
Equilibrium in the Local Labor Market



Equilibrium in the Local Labor Market



Equilibrium in the Local Labor Market



Model Setup

1. **Geography:** Small open economy $c \in C$
2. **Agents:** N_c households, E_c establishments, representative landowner in each location c
3. **Market Structure:**
   - Monopolistically competitive traded goods market for each variety j
   - Global capital market
   - Local labor market
   - Local housing market
4. **Timing:** Steady state, exogenous tax shock, new steady state

Household Problem

$$\max_{h,X} \quad \underbrace{\ln A}_{\text{amenitites}} + \underbrace{\alpha \ln h}_{\text{housing}} + \underbrace{(1-\alpha)\ln X}_{\text{composite good}} \quad s.t. \;\; rh + \int_{j \in J} p_j x_j dj = w$$

- where $X = \left(\int_{j \in J} x_j^{\frac{\varepsilon^{PD}+1}{\varepsilon^{PD}}} dj \right)^{\frac{\varepsilon^{PD}}{\varepsilon^{PD}+1}}$
- rh is housing expenditures
- $p_j x_j$ is expenditure on variety j

Household Problem

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Indirect Utility of a Worker:

$$V_{nc}^W = a_0 + \underbrace{\ln w_c - \alpha \ln r_c}_{\text{Disposable income}} + \underbrace{\ln A_{nc}}_{\text{Amenities } \equiv \bar{A}_c + \xi_{nc}}$$

Local Labor Supply

Location choice: Workers choose location with max utility:

$$\max_c \quad \underbrace{a_0 + \ln w_c - \alpha \ln r_c + \bar{A}_c}_{\equiv u_c} + \xi_{nc}.$$

Local Labor Supply

Location choice: Workers choose location with max utility:

$$\max_c \underbrace{a_0 + \ln w_c - \alpha \ln r_c + \bar{A}_c}_{\equiv u_c} + \xi_{nc}.$$

Local Population:

$$N_c = P\left(V_{nc}^W = \max_{c'}\{V_{nc'}^W\}\right) = \frac{\exp \frac{u_c}{\sigma^W}}{\sum_{c'} \exp \frac{u_{c'}}{\sigma^W}}$$

Local Labor Supply

Location choice: Workers choose location with max utility:

$$\max_c \underbrace{a_0 + \ln w_c - \alpha \ln r_c + \bar{A}_c}_{\equiv u_c} + \xi_{nc}.$$

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(Log) Local Labor Supply:

$$\ln N_c(w_c, r_c; \bar{A}_c) = \frac{1}{\sigma^W}\left(\ln w_c - \alpha \ln r_c + \bar{A}_c\right) + C_0$$

Key Parameter: σ^W, dispersion of idiosyncratic preferences ξ_{nc}

Housing Market

Housing Market: Upward-sloping supply of housing:

$$H_c^S = (B_c^H r_c)^{\eta_c}$$

- B_c^H is housing productivity
- r_c is price of housing

With Cobb-Douglas H_c^D, HM equilibrium given by:

$$\ln r_c = \frac{1}{1+\eta_c} \underbrace{(\ln N_c + \ln w_c)}_{Housing\ Demand} + C_1$$

Key Parameter: η_c elasticity of housing supply

Local Labor Supply: Key points

- People move into a local area when wages increase
- How many people move in depends on:
  1. **Dispersion of Idiosyncratic Preferences** σ^W
     Higher σ^W means smaller inflows of people following wage increases
  2. **Housing Supply Elasticity** η_c
     Lower η_c means rents get bid up more when people move in

Higher σ^W and lower η_c make ε^{LS} smaller, so LS is more vertical

Local Labor Demand

Aggregate labor demand for firms in location c:

$$L_c^D = \underbrace{E_c}_{\text{Extensive margin}} \times \underbrace{\mathbb{E}_\zeta[l^*(\zeta_{jc})|c]}_{\text{Intensive margin}}$$

Elasticity of labor demand:

$$\frac{\partial \ln L_c^D}{\partial \ln w_c} = \underbrace{\gamma - 1}_{\text{Substitution}} + \underbrace{\gamma \varepsilon^{PD}}_{\text{Scale}} - \underbrace{\frac{\gamma}{\sigma^F}}_{\text{Firm-Location}} \equiv \varepsilon^{LD}$$

More elastic ε^{LD} when:

- Higher output elasticity of labor γ
- Higher product demand elasticity ε^{PD}
- Lower productivity dispersion σ^F (i.e. firms more mobile)

Result: Local Incidence of State Corporate Taxes (1/2)

- Let $\dot{w}_c(\theta) \equiv \frac{\partial \ln w_c}{\partial \ln(1-\tau^b)}$. Incidence on wages is:

$$\dot{w}_c(\theta) = \frac{-\frac{1}{(\varepsilon^{PD}+1)\sigma^F}}{\underbrace{\left(\frac{1+\eta_c-\alpha}{\sigma^W(1+\eta_c)+\alpha}\right)}_{\varepsilon^{\mathrm{LS}}} - \underbrace{\gamma\left(\epsilon^{PD}+1-\frac{1}{\sigma^F}\right)}_{\varepsilon^{\mathrm{LD}}}+1}$$

Smaller wage increase if:

1. Productivity Dispersion σ^F is large (i.e. immobile firms)
2. Preferences Dispersion σ^W is small (i.e. mobile people)
3. Any other reason why ε^{LS} and $|\varepsilon^{LD}|$ are large

Result: Local Incidence of State Corporate Taxes (2/2)

Rental Costs: $\dot{r}_c(\theta) = \left(\frac{1+\varepsilon^{LS}}{1+\eta_c}\right)\dot{w}_c$

- Smaller rent increases if housing supply is very elastic

Firm Profits:

$$\dot{\pi}_c(\theta) = 1 \quad \underbrace{-\delta(\varepsilon^{PD}+1)}_{\text{Reducing Capital Wedge}} \quad + \underbrace{\gamma(\varepsilon^{PD}+1)\dot{w}_c}_{\text{Higher Labor Costs}}$$

- Mechanical effects vs. higher production costs

Welfare Effects of Corporate Tax Cut

Stakeholder	Benefit	Statistic
Workers	Disposable Income	$\dot{w}_c - \alpha \dot{r}_c$
Landowners	Housing Costs	$\dot{r}_c$
Firm Owners	After-tax Profit	$1 - \delta(\varepsilon^{PD} + 1) + \gamma(\varepsilon^{PD} + 1)\dot{w}_c$

Welfare Effects of Corporate Tax Cut

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Workers	Disposable Income	$\dot{w}_c - \alpha \dot{r}_c$
Landowners	Housing Costs	$\dot{r}_c$
Firm Owners	After-tax Profit	$1 - \delta(\varepsilon^{PD} + 1) + \gamma(\varepsilon^{PD} + 1)\dot{w}_c$ $= 1 + \underbrace{\gamma(\varepsilon^{PD} + 1)}_{\frac{\text{Labor cost factor}}{\text{Net Markup}}} \times \left(\dot{w}_c - \frac{\delta}{\gamma}\right)$

Empirical Implementation and Identification

Structural Form of the Model

$$\mathbb{A}\mathbf{Y}_{c,t} = \mathbb{B}\mathbf{Z}_{c,t} + \mathbf{e}_{c,t}$$

where

- $\mathbb{A} = \begin{bmatrix} -\frac{1}{\sigma^W} & 1 & \frac{\alpha}{\sigma^W} & 0 \\ 1 & -\frac{1}{\varepsilon^{LD}} & 0 & 0 \\ -\frac{1}{1+\eta} & -\frac{1}{1+\eta} & 1 & 0 \\ \frac{\gamma}{\sigma^F} & 0 & 0 & 1 \end{bmatrix}$, $\mathbb{B} = \begin{bmatrix} 0 \\ \frac{1}{\varepsilon^{LD}\sigma^F(\varepsilon^{PD}+1)} \\ 0 \\ \frac{1}{-\sigma^F(\varepsilon^{PD}+1)} \end{bmatrix}$
- $\mathbf{Y}_{c,t} = \begin{bmatrix} \Delta \ln w_{c,t} & \Delta \ln N_{c,t} & \Delta \ln r_{c,t} & \Delta \ln E_{c,t} \end{bmatrix}'$
- $\mathbf{Z}_{c,t} = \begin{bmatrix} \Delta \ln(1 - \tau^b_{c,t}) \end{bmatrix}$
- $\mathbf{e}_{c,t}$ is a structural error term

Exact Reduced Form of the Model

$$\mathbf{Y}_{c,t} = \underbrace{\mathbb{A}^{-1}\mathbb{B}}_{\equiv \boldsymbol{\beta}^{\text{Business Tax}}} \mathbf{Z}_{c,t} + \mathbb{A}^{-1}\mathbf{e}_{c,t}$$

where $\boldsymbol{\beta}^{\text{Business Tax}}$ is a vector of reduced-form effects of business tax changes:

$$\boldsymbol{\beta}^{\text{Business Tax}} = \begin{bmatrix} \beta^{W} \\ \beta^{N} \\ \beta^{R} \\ \beta^{E} \end{bmatrix} = \begin{bmatrix} \dot{w} \\ \dot{w}\varepsilon^{LS} \\ \frac{1+\varepsilon^{LS}}{1+\eta}\dot{w} \\ \frac{\mu-1}{\sigma^{F}} - \frac{\gamma}{\sigma^{F}}\dot{w} \end{bmatrix}.$$

4 Reduced-Form Equations of the Model

Effects on establishments, pop., wages, & rental cost growth over 10 years

$$\Delta \ln w_{c,t} = \underbrace{\left(\dot{w}(\theta)\right)}_{\beta^W} \Delta \ln(1 - \tau^b_{c,t}) + \phi^1_t + u^1_{c,t}$$

$$\Delta \ln N_{c,t} = \underbrace{\left(\varepsilon^{LS} \dot{w}(\theta)\right)}_{\beta^N} \Delta \ln(1 - \tau^b_{c,t}) + \phi^2_t + u^2_{c,t}$$

$$\Delta \ln r_{c,t} = \underbrace{\left(\frac{1 + \varepsilon^{LS}}{1 + \eta_c} \dot{w}(\theta)\right)}_{\beta^R} \Delta \ln(1 - \tau^b_{c,t}) + \phi^3_t + u^3_{c,t}$$

$$\Delta \ln E_{c,t} = \underbrace{\left(\frac{1}{-\sigma^F(\varepsilon^{PD} + 1)} - \frac{\gamma}{\sigma^F} \dot{w}(\theta)\right)}_{\beta^E} \Delta \ln(1 - \tau^b_{c,t}) + \phi^4_t + u^4_{c,t}$$

Identification of Local Welfare Effects

Stakeholder	Benefit	Statistic
Workers	Disposable Income	$\hat{\beta}^W - \alpha\hat{\beta}^R$
Landowners	Housing Costs	$\hat{\beta}^R$
Firm Owners	After-tax Profit	$1 + \left(\frac{\hat{\beta}^N - \hat{\beta}^E}{\hat{\beta}^W} + 1\right)(\hat{\beta}^W - \frac{\delta}{\gamma})$

Benefits of the incidence formulae

This framework enables us to:

1. Accommodate the conventional view
2. Transparently evaluate the sensitivity of our incidence estimates
3. Use data to govern relative factor mobility
4. Conduct inference and compare results to existing estimates

Brief discussion of Local vs National/Global Effects

Brief discussion of Local vs National/Global Effects

A few considerations:

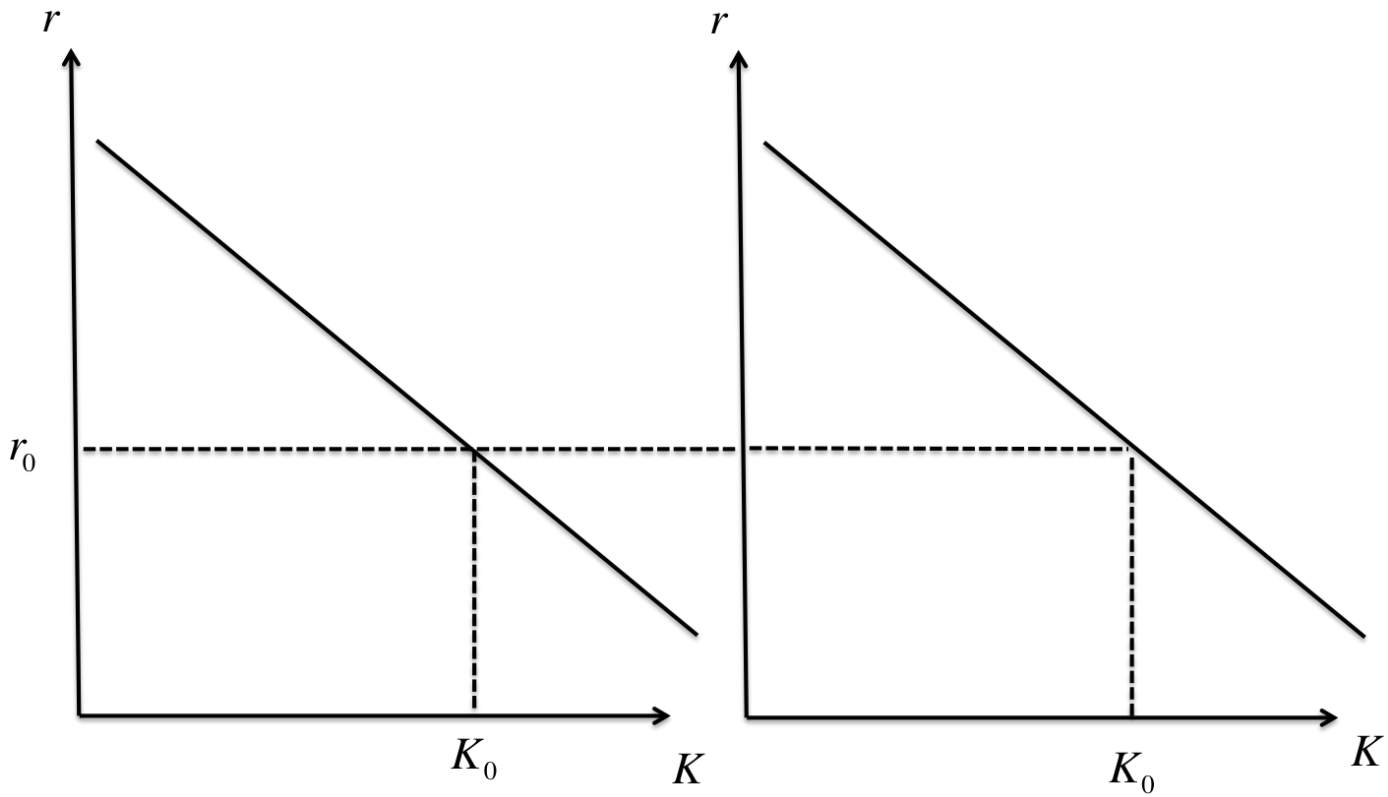
1. Local versus national labor supply and demand are different
2. Key question is how elastic supply of capital is, and how that impacts labor market (both in short and long run)
3. At national level, other issues, like deficit financing's impact on interest rates, and the effects of those higher interest rates on growth, capital accumulation, and labor demand matter more
4. We have more variation and empirical evidence from changes at state and local level. National effects more uncertain

Impact of Capital Tax: One factor, two locations

Setup

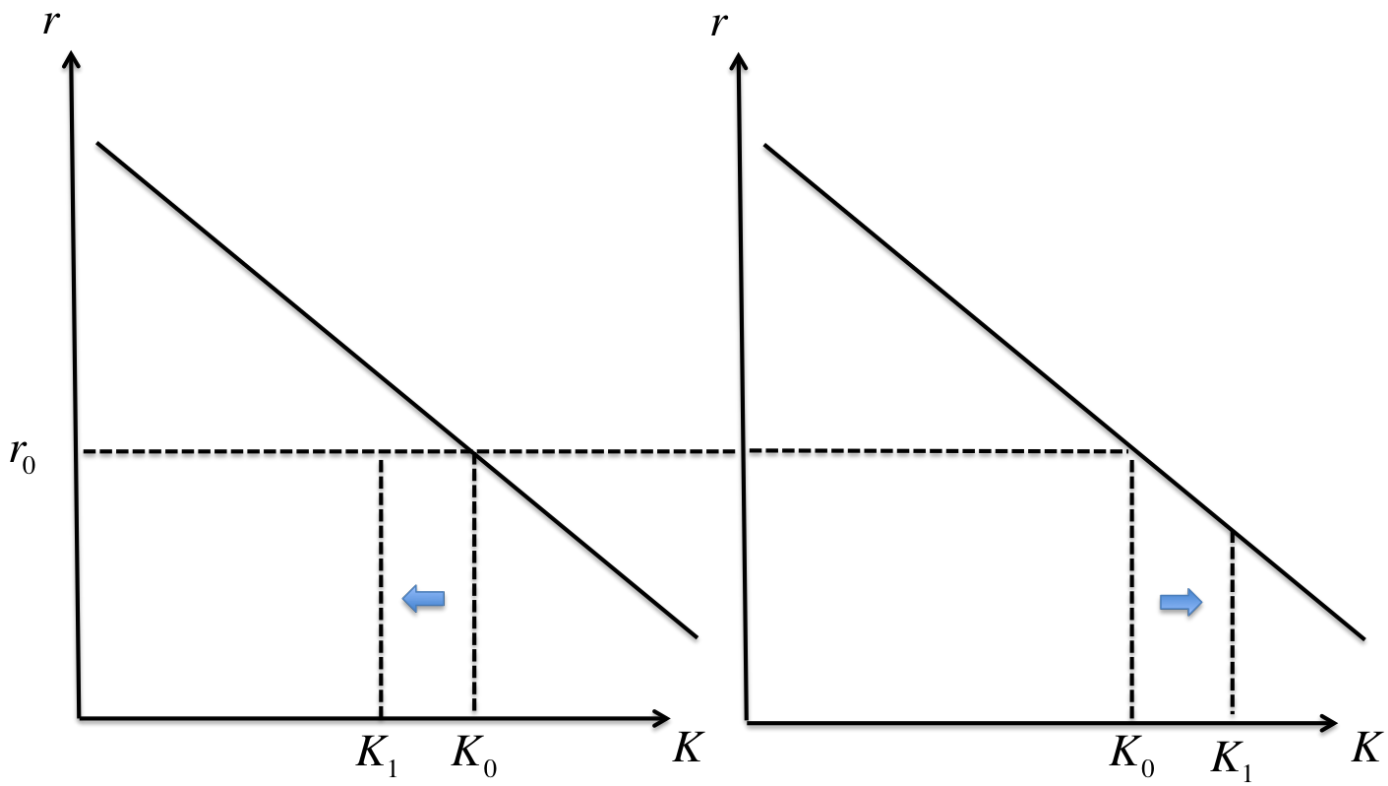
1. One factor (capital)
2. Two locations: east and west
3. Capital market in each location
4. Total K fixed in economy overall

Initial equilibrium



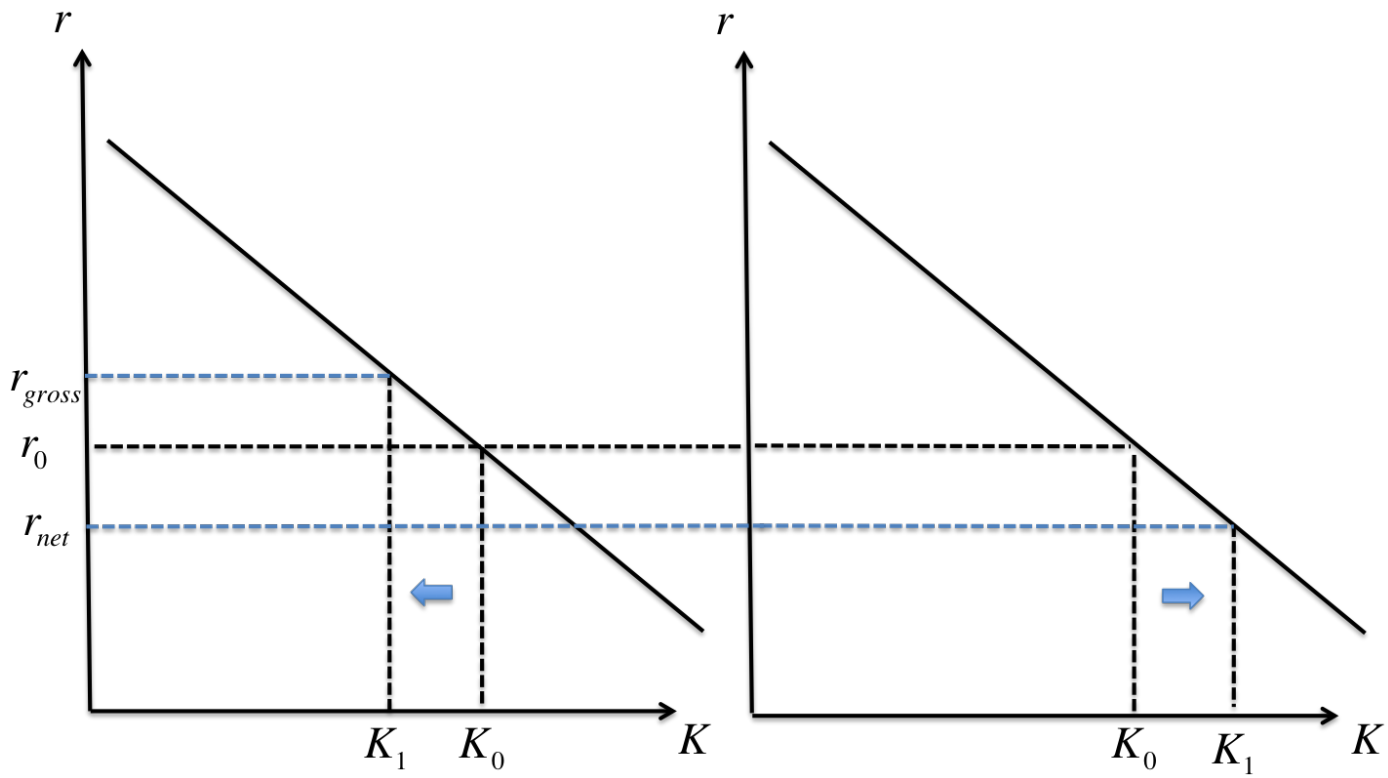
Tax in west

Causes capital to flee to east



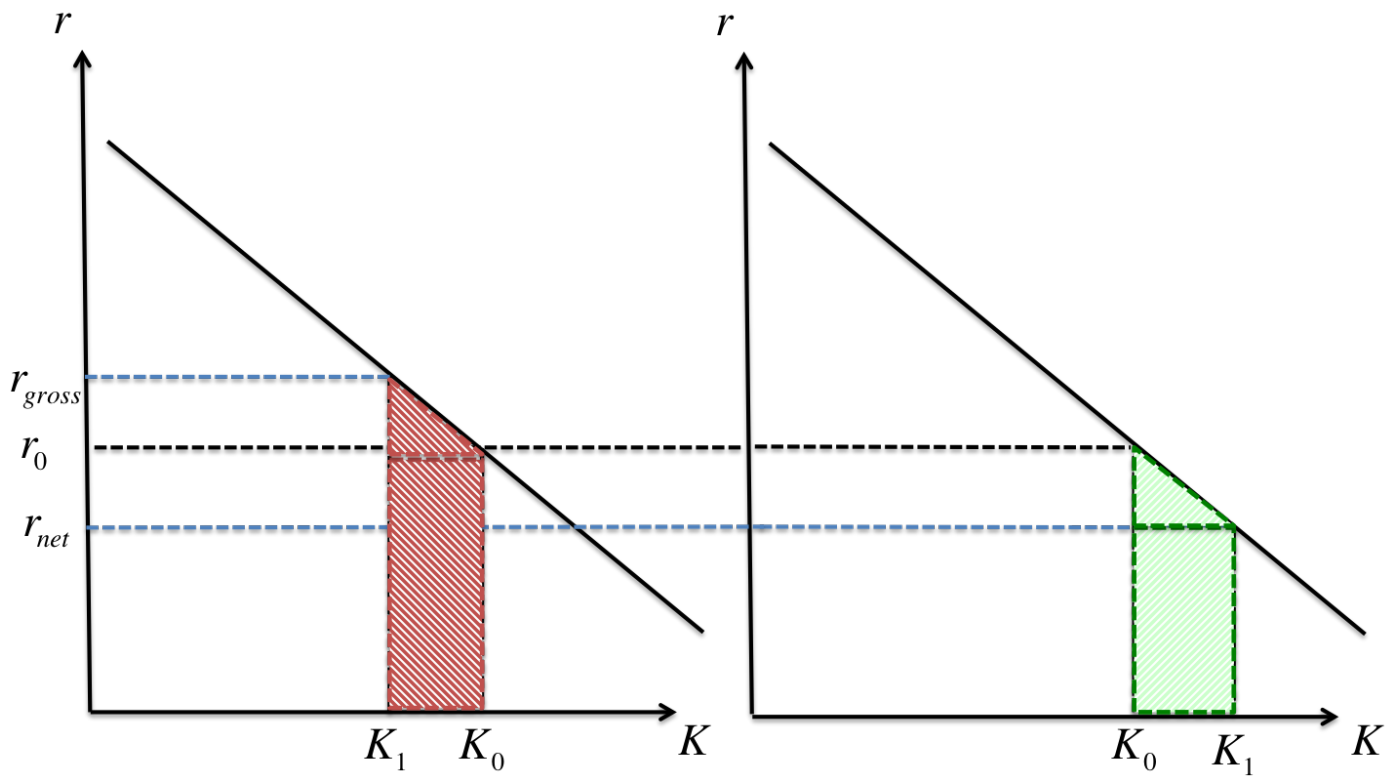
New allocation of capital

- K flows to east, lowering net returns in both
- Flows continue until after tax return is equalized across markets



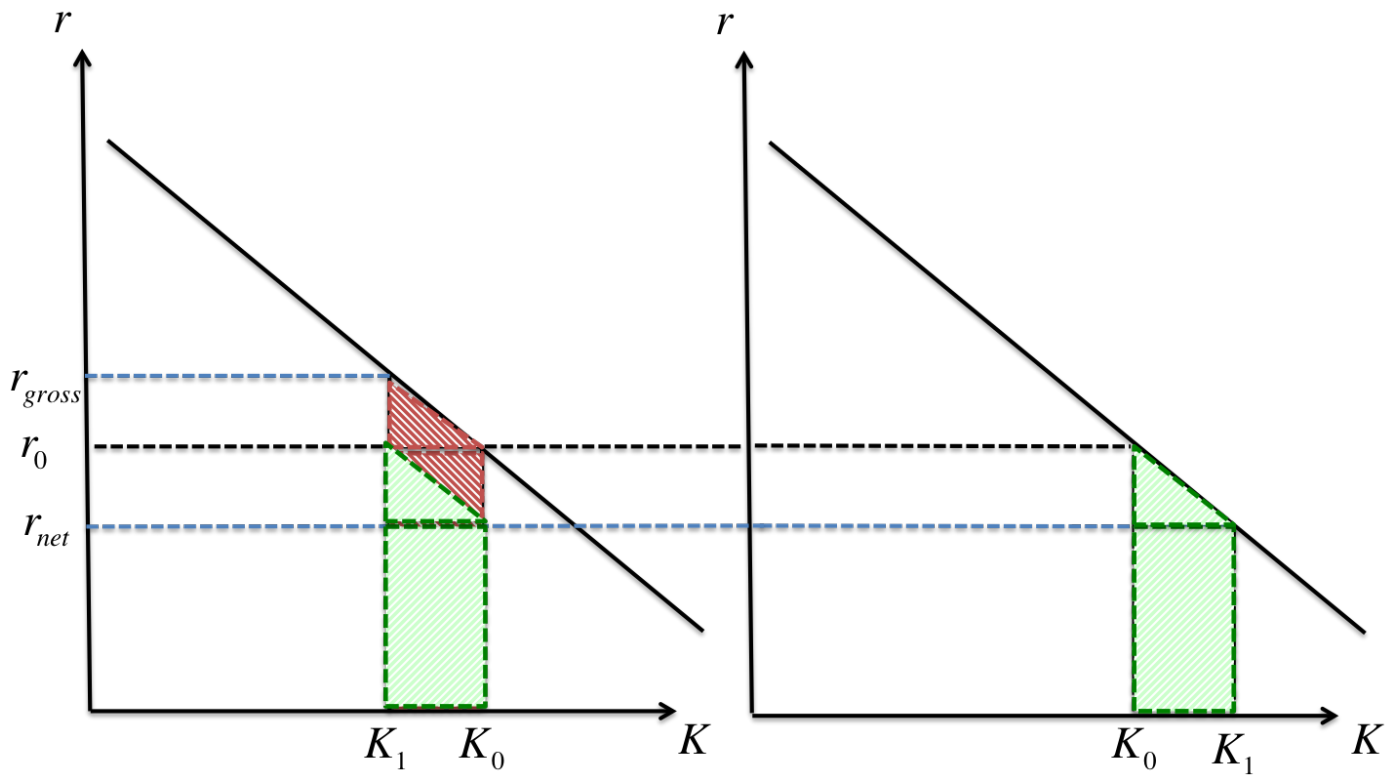
Welfare changes in each location

- Welfare in west falls by red amount
- Welfare in east increases



Net welfare changes in aggregate

- Net welfare loss in red



What determines size of welfare loss in this toy example?

1. Size of tax change
2. Size of market being taxed (depends on fundamentals)
3. Elasticity of demand in both regions (quantity response more generally, which depends on S and D elasticities)
4. Strength of complementarities across markets (e.g., labor market)
5. Assumptions about effects/value of government spending (assumed to be zero here)
6. Presence of existing distortions

Could formalize these ideas more, but this example provides intuition for some key forces in the Harberger model

Brief overview of (Harberger, JPE 1962)

(Harberger, JPE 1962) brief overview of setup

1. Goals
   - Characterize effects of corporate tax change in a GE model
   - Who bears the burden of corporate taxes? (also capital, output taxes)
2. Two sectors (or locations)
   - Corporate sector produces output X
   - Non-corporate sector produces output Y
3. Markets
   - Capital: prices r_i, quantities K_i where $i \in \{X, Y\}$
   - Labor: prices w_i, quantities L_i
   - Goods: prices p_i, quantities X, Y
4. Agents
   - Workers (representative, perfectly mobile, supply 1 unit of labor)
   - Firm (representative, perfectly competitive, CRS)
5. Equilibrium Conditions
   - Good and factor markets clear, factor price equalization
   - Consumers max utility, firms earn zero profits

Two Main Effects of Taxing K_x

1. **Substitution effects:** capital bears incidence
2. **Output effects:** capital may not bear all incidence

Substitution effects

- Tax on K_x shifts production in X away from K so aggregate demand for K goes down
- Because total K is fixed, r falls $\rightarrow$ K bears some of the burden

Another intuition for this is that capital is misallocated across sectors, which lowers r and rK

Output effects

- Tax on K_x makes X more expensive
- Demand shifts to Y
- *Case 1:* $K_x/L_x > K_y/L_y$ (X: cars, Y: bikes)
  - X more capital intensive $\rightarrow$ lower aggregate demand for K
  - Output + subst. effect: K bears the burden of the tax
- *Case 2:* $K_x/L_x < K_y/L_y$ (X: bikes, Y: cars)
  - X less capital intensive $\rightarrow$ higher aggregate demand for K
  - Subst. and output effects have opposite signs $\rightarrow$ labor may bear some the tax

Takeaways

Harberger showed that under a variety of reasonable assumptions, capital bears exactly 100 percent of the tax. Note that this is the burden on all capital – as capital flees the corporate sector, it depresses returns in the noncorporate sector as well. Both the realism of the model and the characterization of the corporate income tax as an extra tax on capital in the corporate sector are subject to question, as discussed in considerable detail by the subsequent literature on the effects of the corporate tax. – Alan Auerbach

See Auerbach TPE paper on who bears the corporate tax for more details on what's missing (e.g., dynamics, investor taxation, corporate financial policy, assumption that corporate and non-corporate sectors represent different industries, etc)

Other Comments

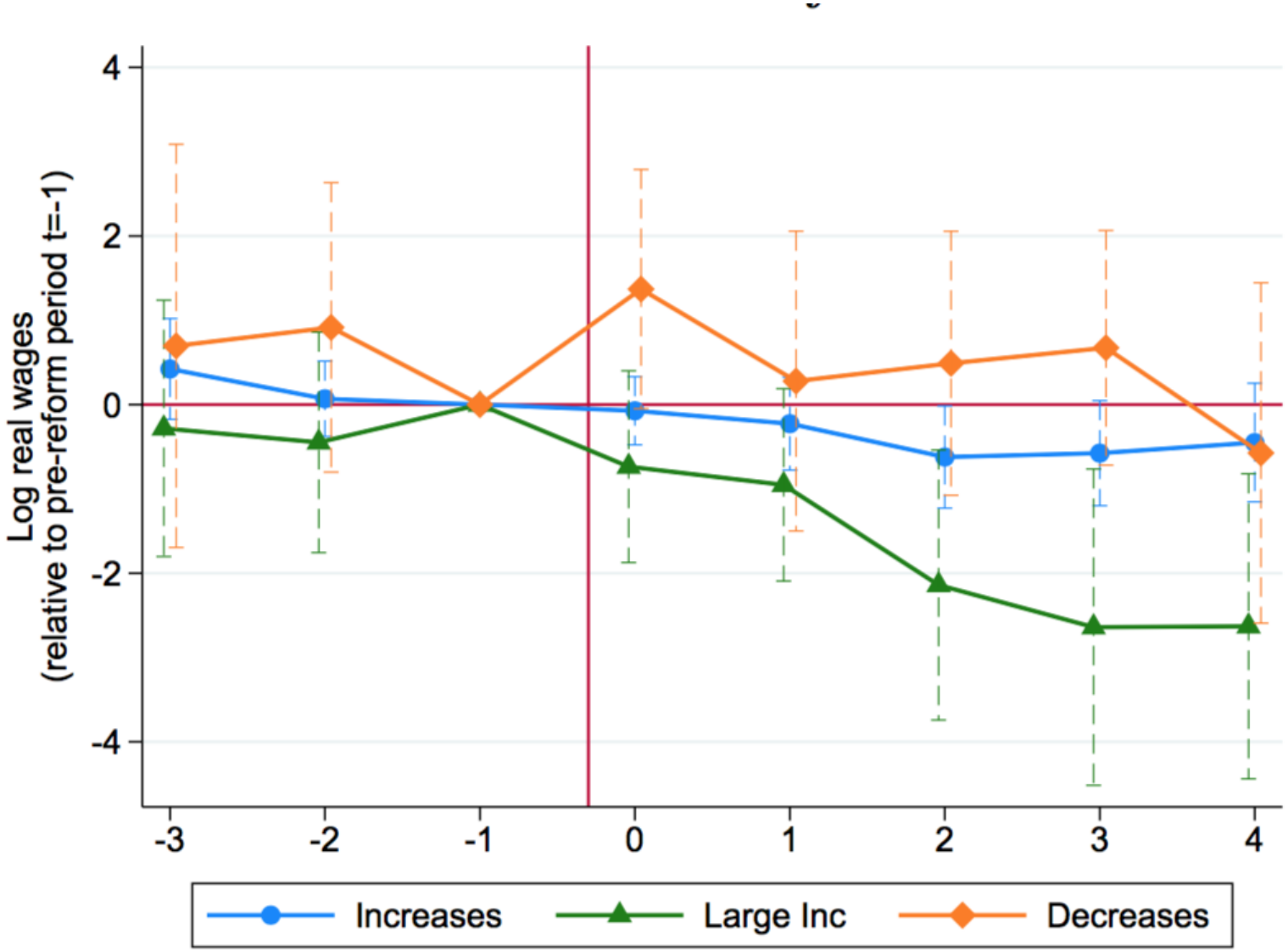
1. Harberger is workhorse analytical model: 2 sector and 2 factors
2. Fixed supply of capital and labor (short run, closed economy)
3. Key intuition is misallocation (magnitude depends on factor intensity, demand elasticities, etc)
4. Fullerton and Ta (2017) simplifies Harberger analysis (Cobb Douglas)
5. Similar to Hecksher-Ohlin model
6. When interpreting as locations not sectors, then implicitly assume no trade costs. Similarly, implicitly assumes no adjustment costs for capital and labor (so long run in that sense)
7. Abstracts from amenity or productivity effects of government spending (lump sum rebates or purchases in same share as consumers)
8. Don't have time to fully cover it (but see appendix slides)

Empirical Estimates of Corporate Tax Incidence on Wages

Overview of Fuest, Peichl, Siegloch (AER, 2018)

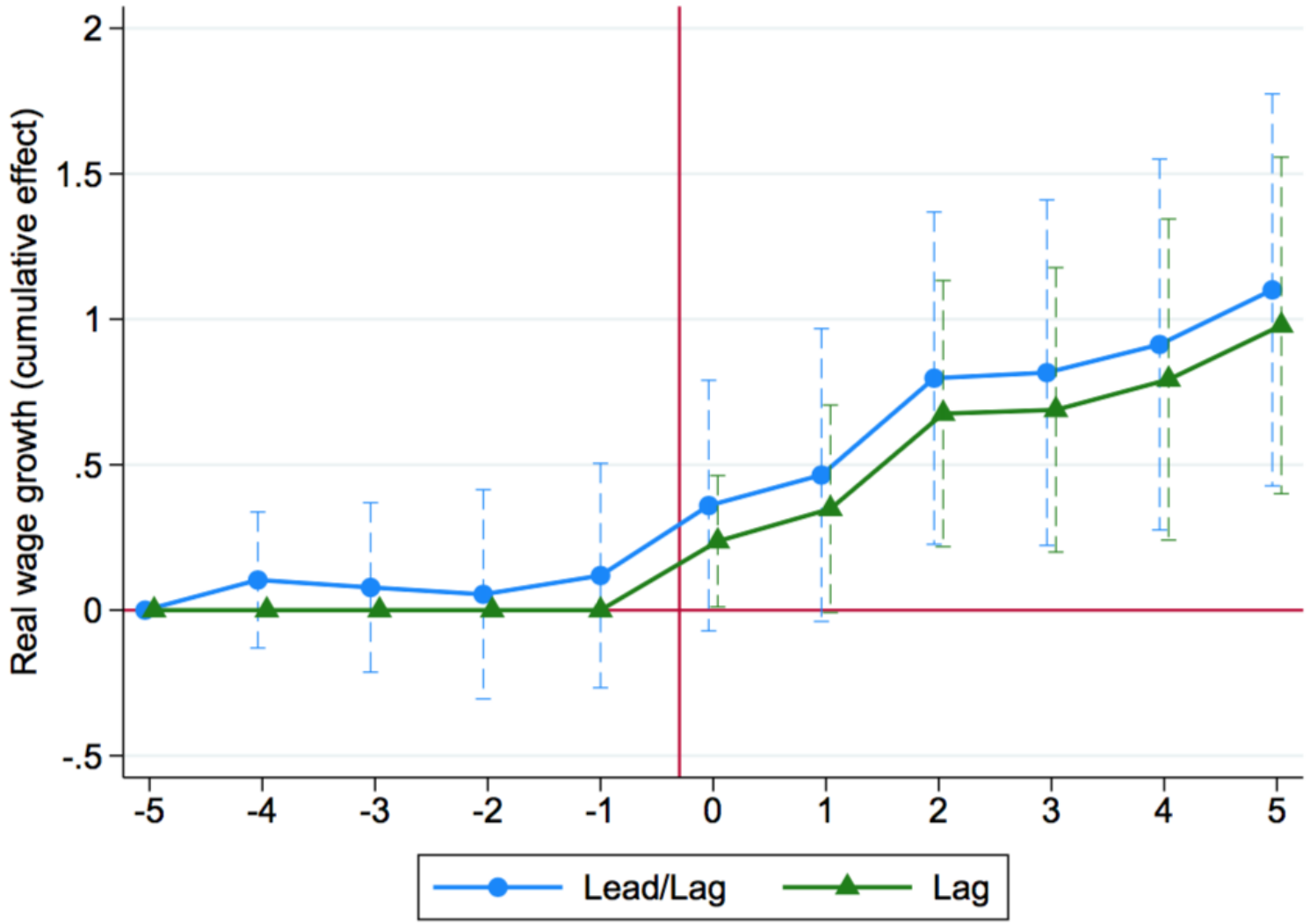
- Paper: C. Fuest, A. Peichl, S. Siegloch . "Do Higher Corporate Taxes Reduce Wages? Micro Evidence from Germany?"
- Question: What is the effect of corporate taxes on wages?
- Data: 20-year panel of German municipalities. Administrative linked employer-employee data
- Findings:
  - Workers bear roughly half the burden of corporate taxes
  - Low-skilled, young and female employees bear a larger share of the tax burden

Event Study: Effects of corp tax change on log real wages



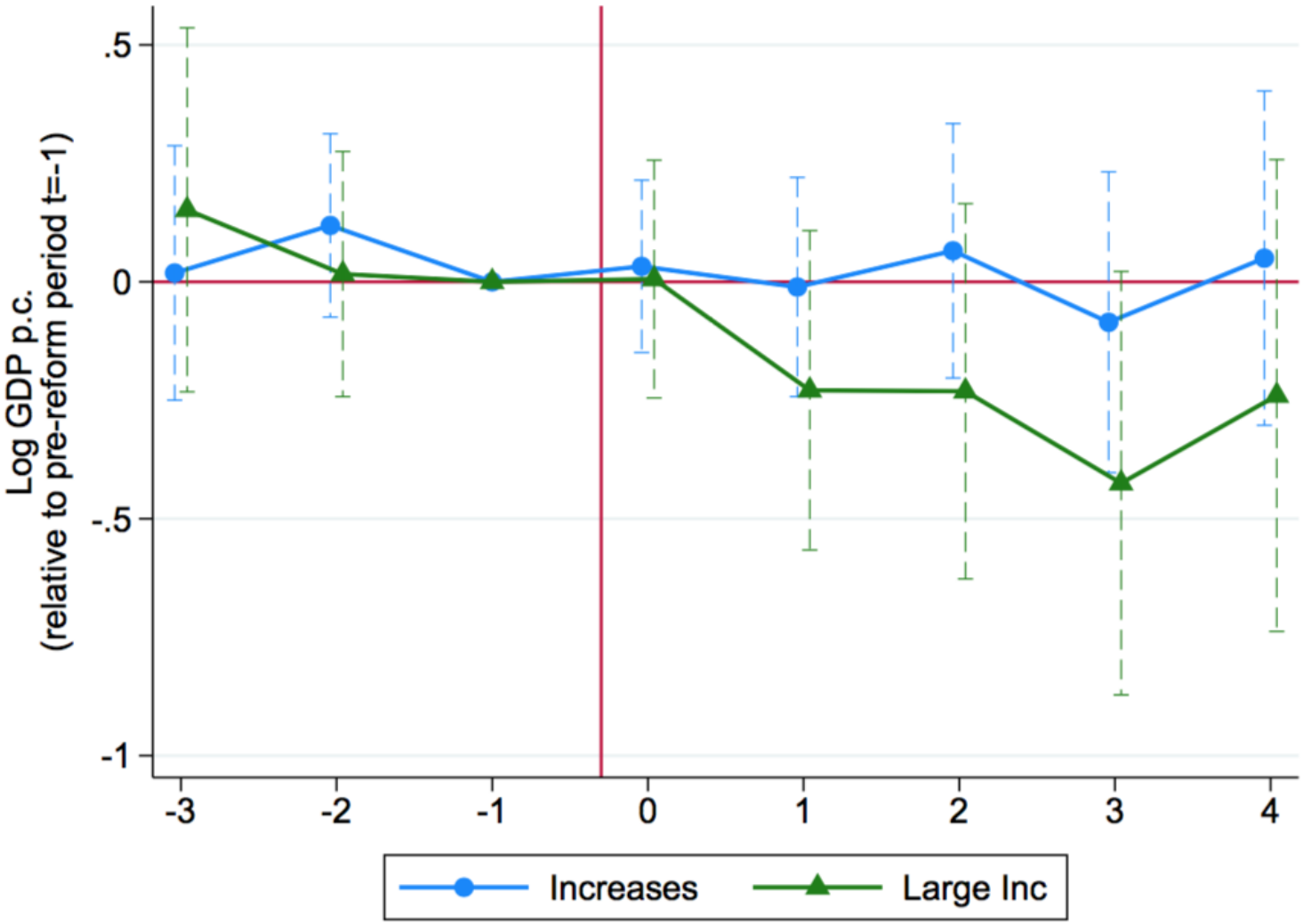
Source: Fuest, Peichl, Siegloch.

Distributed lag: Effects of corp tax change on log real wages



Source: Fuest, Peichl, Siegloch.

Event Study: Effects of corp tax change on log GDP



Source: Fuest, Peichl, Siegloch.

Estimating equation:

$$\ln w_{f,t}^{p50} = \delta \ln(1 - \tau_{m,t}) + \mu_f + \mu_m + \psi_{s,t} + \varepsilon_{f,t},$$

Effects of corp tax change on median wages

Table 1: Differences-in-differences estimates: baseline wage effects

	(1)	(2)	(3)	(4)	(5)	(6)
Log net-of-LBT rate	0.388	0.229	0.386	0.396	0.343	0.399
	(0.127)	(0.110)	(0.127)	(0.128)	(0.164)	(0.118)
Incidence (I^w)	0.505	0.288	0.502	0.516	0.442	0.520
	(0.170)	(0.140)	(0.170)	(0.172)	(0.217)	(0.159)
State × year FE	✓			✓	✓	✓
Year FE		✓				
CZ × year FE			✓			
Municipal controls $t-2$				✓		
Firm controls $t-2$					✓	
Worker shares						✓
Observations	44,654	44,654	44,654	44,654	25,241	44,654

Source: LIAB and Statistical Offices of the Laender. *Notes:* This table presents the DiD estimates, $\hat{\delta}$, of regression model (3) at the firm level. Coefficients measure the wage elasticity with respect to the net-of-local-business-tax rate. The incidence effect I^w is measured according to formula (4) as the share of the total tax burden borne by workers. All regression models include municipal and firm fixed effects. Additional control variables and fixed effects (year, "state × year" or "commuting zone (CZ) × year") vary depending on the specification (as indicated at the bottom of the table). The estimation sample is restricted to all establishments liable to the LBT in non-merged municipalities. Standard errors are clustered at the municipal level. Corresponding standard errors for the incidence measure are obtained using the Delta method. Our preferred (baseline) specification is shown in column (1).

Source: Fuest, Peichl, Siegloch.

Heterogeneous effects on median wages

Table 4: Differences-in-differences estimates: wage effects by worker type

Stratified by ...	Effect of log net-of-LBT rate by worker type			N
Skill	High	Medium	Low	9,295,488
	0.013	0.357	0.377	
	(0.120)	(0.115)	(0.168)	
Gender	Female	Male		9,295,488
	0.530	0.325		
	(0.129)	(0.119)		
Occupation	Blue-collar	White-collar		9,295,442
	0.363	0.250		
	(0.132)	(0.104)		
Age	Young	Medium	Old	9,295,488
	0.507	0.317	0.329	
	(0.127)	(0.111)	(0.106)	

Source: LIAB and Statistical Offices of the Laender. *Notes:* This table presents the DiD estimates $\hat{\delta}$ of regression model (3) with the log individual wage as dependent variables for different worker types as indicated in the table. The heterogeneous effects are estimated by interacting the LBT rate with dummy variables for different firms types. Coefficients measure the wage elasticity with respect to the net-of-local-business-tax rate. All specifications include worker, firm and municipal fixed effects, as well as "state × year" and "worker type × year" fixed effects. The estimation sample comprises all establishments liable to the LBT in non-merged municipalities. Standard errors are clustered at the municipal level.

Source: Fuest, Peichl, Siegloch.

III. User Cost, Impact of TCJA, Open Questions

User Cost, Impact of TCJA, Open Research Questions

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   - User Cost expression with taxes
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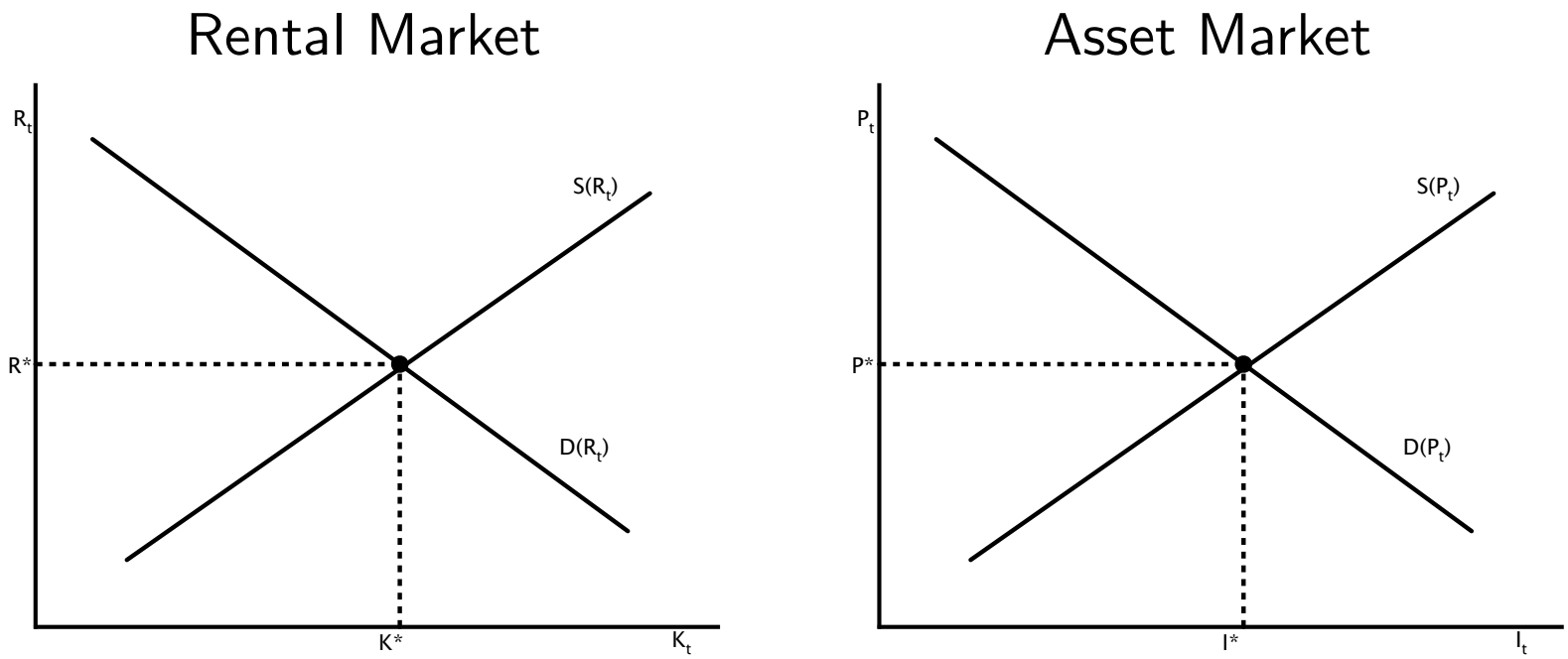
3. Additional Research Questions

Rental and asset markets are linked

Use the link between rental and asset markets to analyze capital markets



where R_t is the **rental price** of using capital services K_t and P_t is the **purchase price**, which depends on the level of investment I_t.

4 key equations

1. **Stock Adjustment:** $K_t = (1 - \delta)K_{t-1} + I_t$
2. **Asset pricing equilibrium** The rental cost of using an asset is simply the cost of buying the good and re-selling it after one period
3. **Rental market equilibrium:** $K = D(R)$
4. **Investment market equilibrium:** $I = S(P)$

2. Asset pricing equilibrium (without taxes)

What is the relationship between rental and capital prices?

The rental cost of using an asset is simply the cost of buying the good and re-selling it after one period

$$R_t = P_t - \frac{(1-\delta)P_{t+1}}{1+r}$$

- r is the nominal rate of interest
- P_{t+1} is next year's price for the good

2. Analyzing Rental Price

We can rearrange the expression to show rental prices depend on three things:

$$R_t = \frac{rP_t + \delta P_{t+1} + P_t - P_{t+1}}{1 + r}$$

1. Interest cost[2]: rP_t
2. Depreciation: δP_{t+1}
3. Market re-evaluation: $P_t - P_{t+1}$

Rental prices are higher, the higher is r, the greater is the physical rate of depreciation, and the faster the price of the asset is declining

2. Analyzing Rental Price: Car example

$$R_t = \frac{rP_t + \delta P_{t+1} + P_t - P_{t+1}}{1 + r}$$

- If cars lose their value quickly (i.e., $P_t >> P_{t+1}$), then rental prices will be pretty high

2. Analyzing Capital Prices

We can also use the rental price expression to calculate the implied capital price

$$P_t = R_t + \frac{R_{t+1}(1-\delta)}{(1+r)} + \frac{R_{t+2}(1-\delta)^2}{(1+r)^2} + ...$$

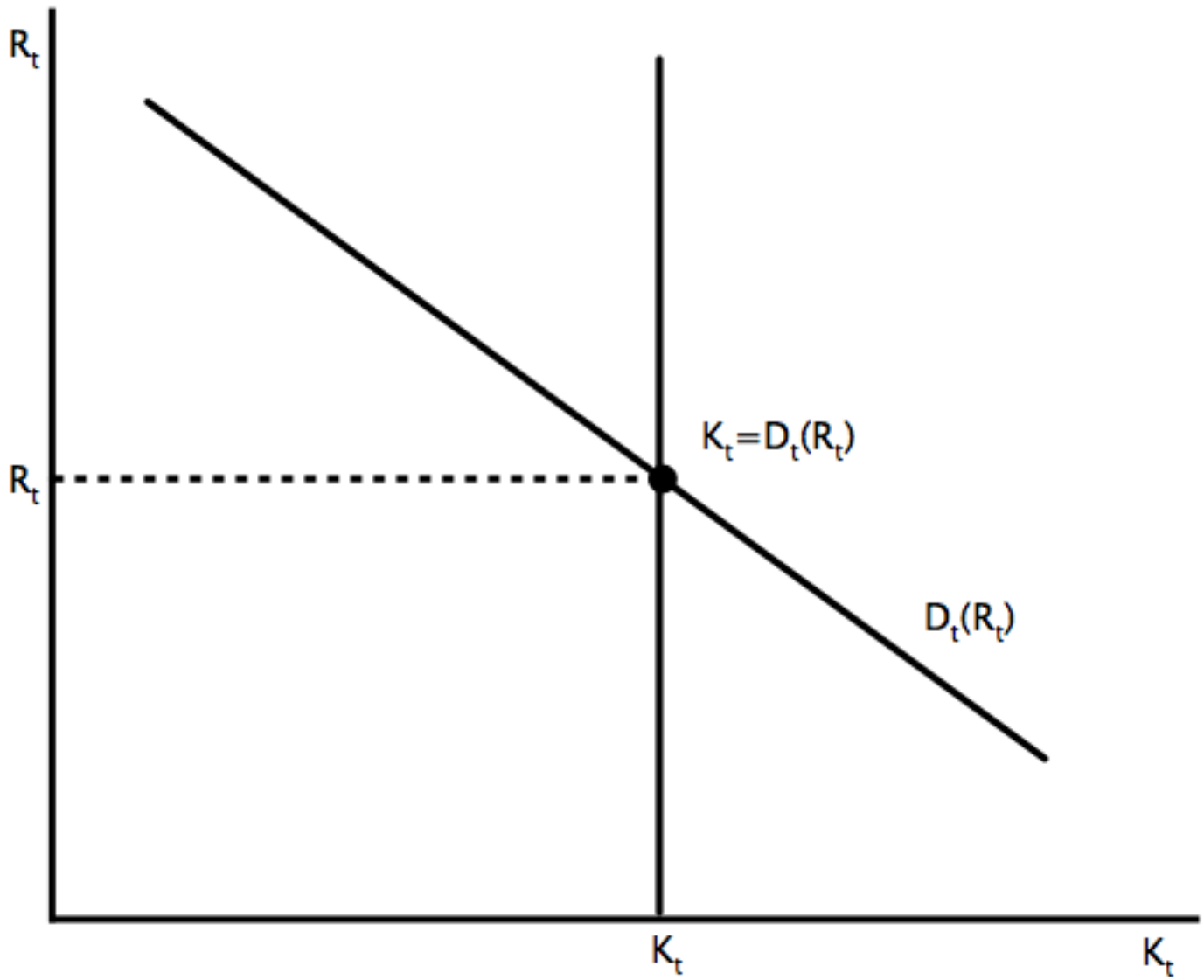
- This equation can be obtained by recursively substituting for future prices in the rental price equation
- This equation should look familiar to you (prices are PV of cash flow stream)
- Capital prices are higher when rental payments to the owner are large and soon

3. Rental Market Equilibrium for Housing Services

$$K_t = D(R_t)$$

- The demand for housing services depends on the flow cost of housing services (i.e., the rental rate R_t). R_t is what I pay to use the asset
- Housing services are provided by the stock of housing K_t
- The demand side of the market links the current rental price and the current stock

3. Rental Market Equilibrium

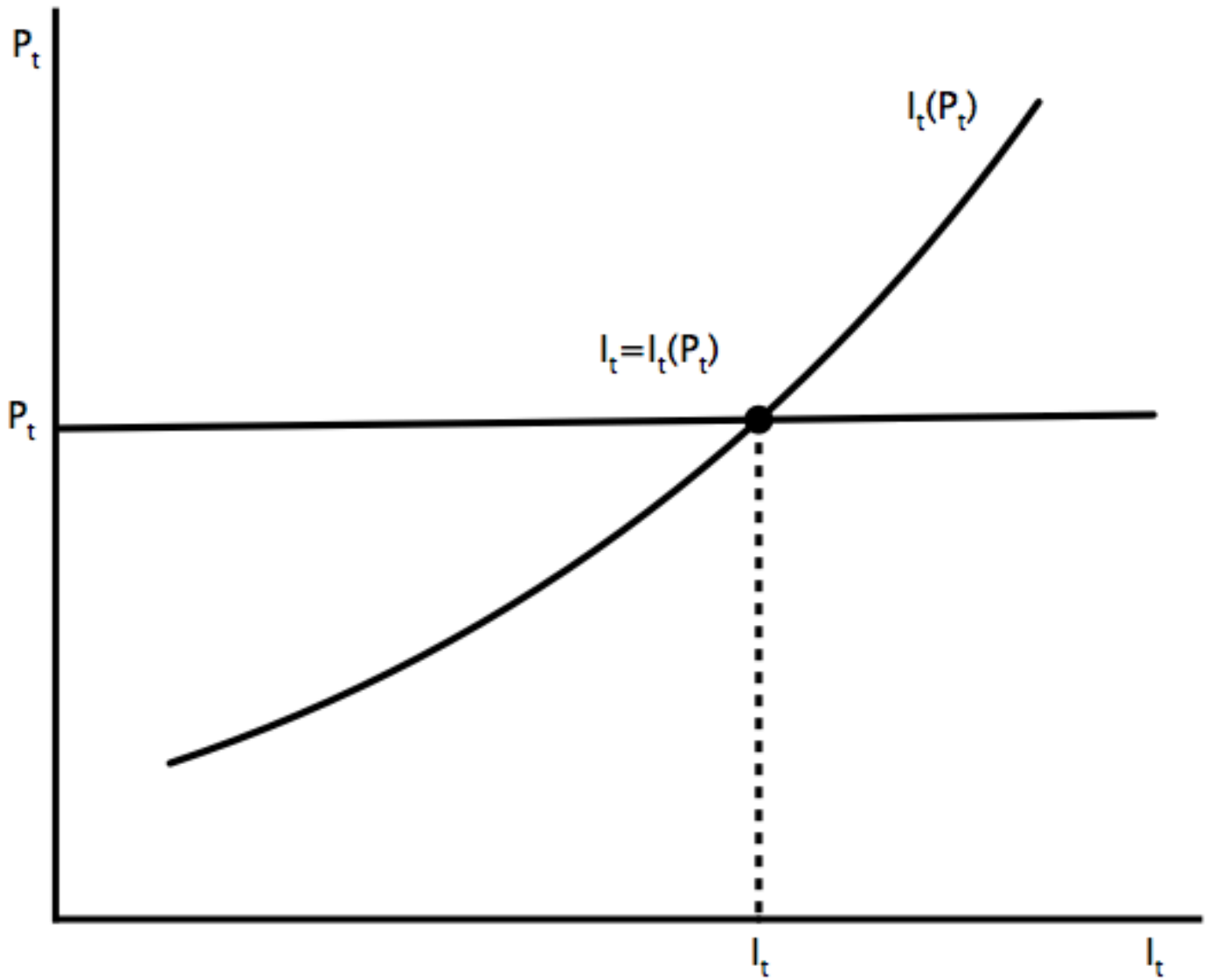


4. Investment Market Equilibrium

$$I_t = S(P_t)$$

- The supply of new construction, investment depends on its current price
- Think of this as a new car producer who decides how much to supply based on the current price
- Alternatively, housing construction firms see high house prices and build. They build more when prices are high.

4. Investment Market Equilibrium



4 key equations

$$K_t = (1-\delta)K_{t-1} + I_t \tag{1}$$

$$R_t = P_t - \frac{(1-\delta)P_{t+1}}{1+r} \tag{2}$$

$$K_t = D(R_t) \tag{3}$$

$$I_t = I(P_t) \tag{4}$$

4 equations and 4 unknowns, but depends on past and the future. Where do past and future come in?

Market Equilibrium: Past and Future in Housing

- When we look at a market equilibrium for the housing market at any one point in time, we must realize that today's market is influenced by both the past and future
- The effect of the past comes through the effect of past production decisions on the stock of housing
- The effect of the future comes from the effect of future expected rental rates on the current price

What does the system look like in steady state?

$$\bar{K} = (1-\delta)\bar{K} + \bar{I}$$

$$\bar{R} = \bar{P} - \frac{(1-\delta)\bar{P}}{1+r}$$

$$\bar{K} = D(\bar{R})$$

$$\bar{I} = S(\bar{P})$$

What does the system look like in steady state?

$$\bar{I} = \delta \bar{K}$$

$$\bar{R} = \bar{P}\left(1 - \frac{(1-\delta)}{1+r}\right)$$

$$\bar{K} = D(\bar{R})$$

$$\bar{I} = S(\bar{P})$$

What does the system look like in steady state?

We can use the first two equations to plug into the second two equations and obtain the supply and demand in the use market.

$$\bar{I} = \delta \bar{K}$$

$$\frac{\bar{R}}{\left(1 - \frac{(1-\delta)}{1+r}\right)} = \bar{P}$$

$$\bar{K} = D(\bar{R})$$

$$\underbrace{\bar{I}}_{\delta \bar{K}} = S\Big(\underbrace{\bar{P}}_{\frac{\bar{R}}{\left(1-\frac{(1-\delta)}{1+r}\right)}} \Big)$$

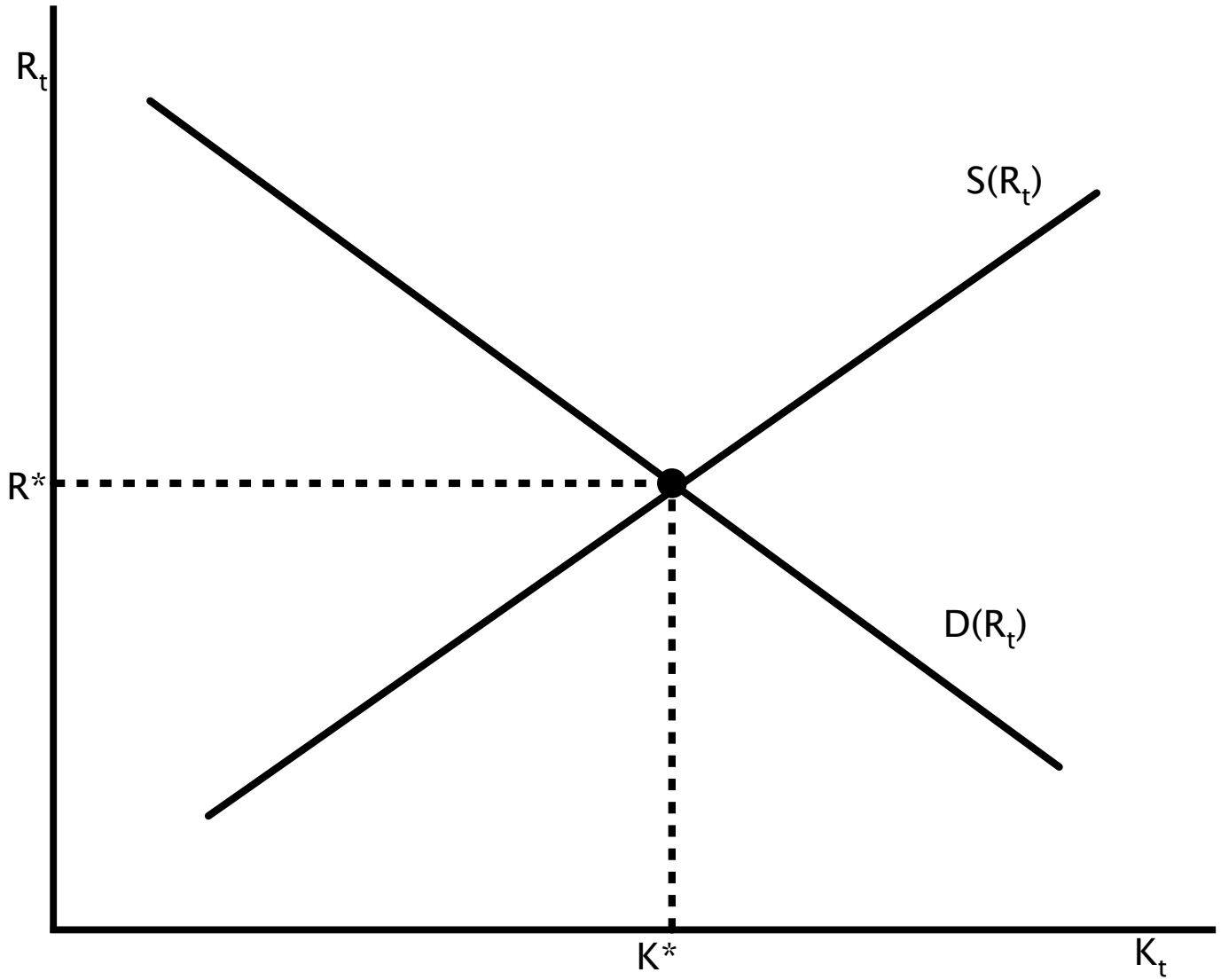
What does the system look like in steady state?

$$\bar{K} = D(\bar{R})$$

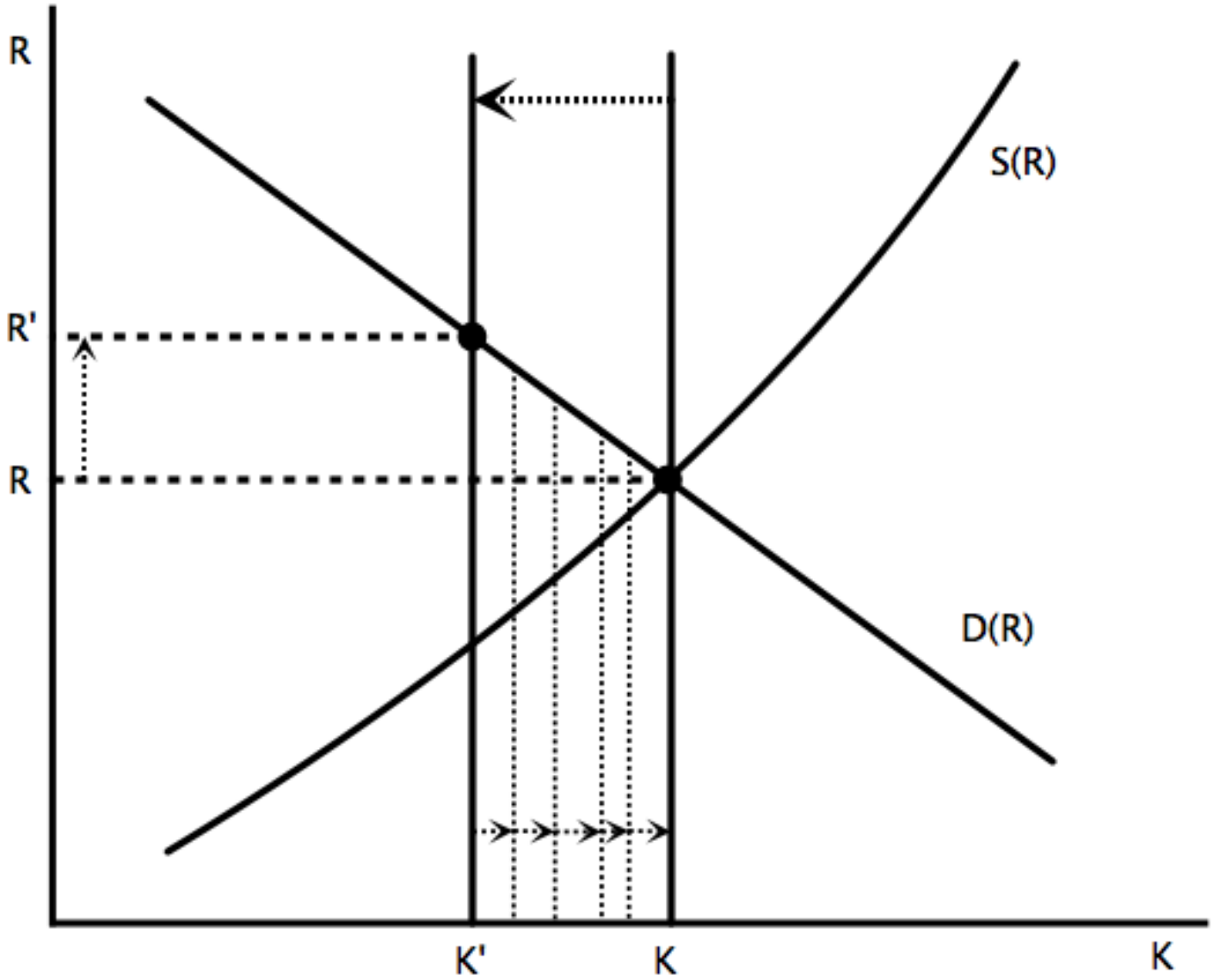
$$\bar{K} = \frac{1}{\delta} S \left(\frac{\bar{R}}{\left(1 - \frac{(1-\delta)}{1+r}\right)} \right)$$

This shows that we have a familiar supply and demand diagram where the quantity is K and the price is R

Capital Market Equilibrium



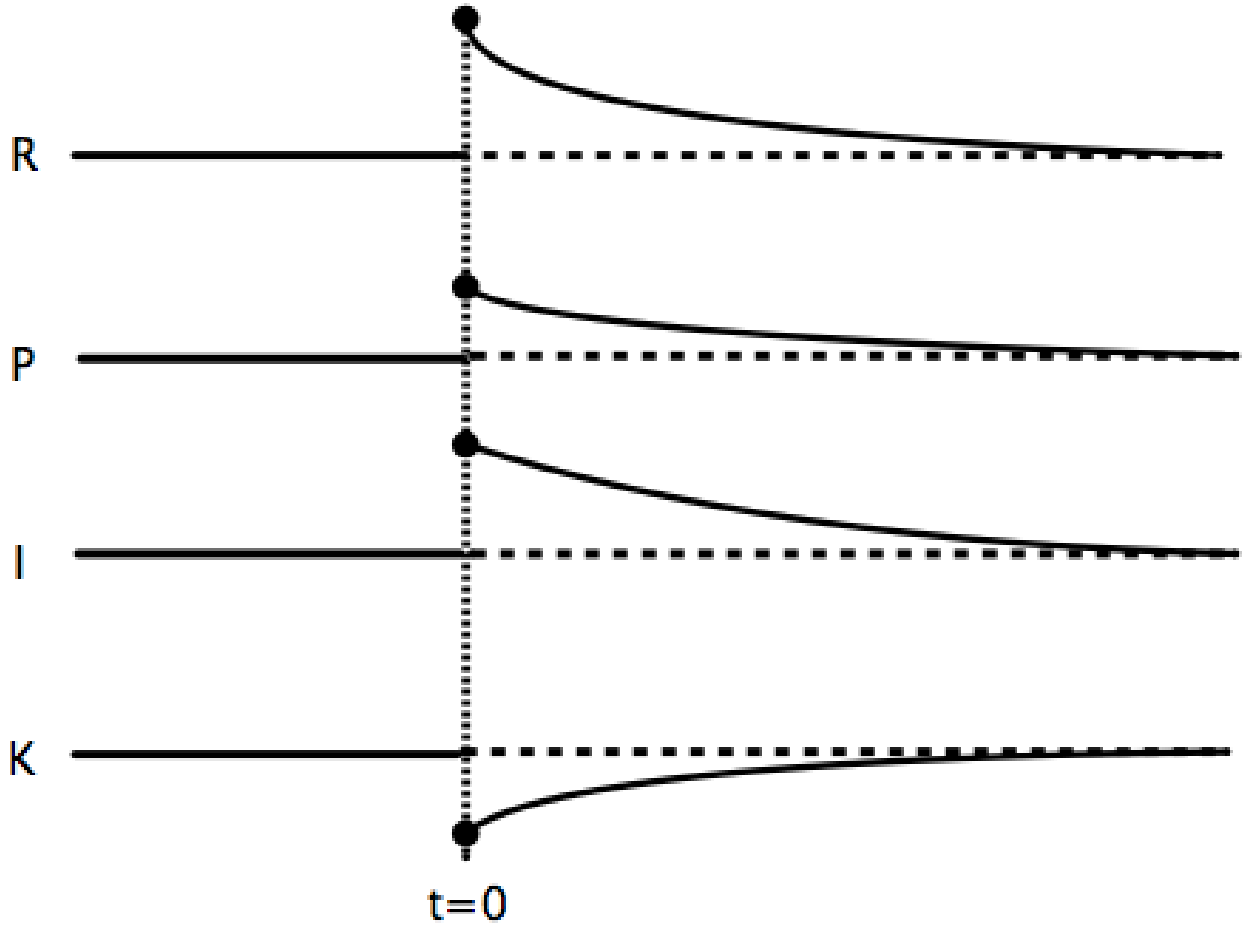
Earthquake Destroys part of capital stock



Earthquake Destroys part of capital stock

- The main impact is on the use market. Lower K increases R.
- Higher rental prices cause the asset price P to increase.
- However, since rental rates we decline as we rebuild capital stock, the increase in P is smaller than increase in R
- Investment follows P, so it will jump and slowly decline as we rebuild the stock

Earthquake Destroys part of capital stock



Speed of Adjustment

What determines the speed of convergence to the steady state?

1. **Elasticity of demand** in the rental market ε^D. For example, the more the rental price goes up following a destruction of the capital stock, the faster we will converge to steady state (since it will make the capital price go up more, and thereby also investments). With a higher elasticity (in absolute value), the rental price will go up more.
2. **Elasticity of supply** in the investment market ε^S. This will make investment go up more when the capital price goes up.
3. The **depreciation rate** δ. This may be the most important aspect, since it puts a lower bound on the speed of convergence. The slowest rate at which the economy ever can return to the steady state is δ.

User Cost expression with taxes

User Cost expression with taxes

Jorgenson's (1963) user cost of capital R_t is the classic way to analyze the effect of taxation on investment

$$R = \frac{q(1 - \tau z)(r + \delta - \pi)}{1 - \tau}$$

- q is the price of capital goods and π is the corresponding inflation rate
- τ is the corporate tax rate
- z is the present value of depreciation deductions per dollar of new capital
- Can also include an investment tax credit term (which would enter, e.g., $z = ITC/\tau$)
- r is the firm's nominal cost of funds (presumably a weighted avg of debat and equity costs)
- δ is the rate at which capital depreciates

Comments on User Cost expression with taxes

With immediate expensing, $z = 1$ so the tax terms cancel, yielding:

$$R = q(r + \delta - \pi)$$

- This expression is the continuous time version of what we had before without taxes
- Dynamics/expectations re path of q, τ, z, ITC change the expression
- See Hall and Jorgenson (AER,1967) for derivations or more recent notes by Poterba (MIT open course web 14.471 Fall 2012) or Auerbach (2005) paper "Taxation and Capital Spending"
- See Yagan (AER, 2015) appendix D for empirical implementation

User Cost, Impact of TCJA, Open Research Questions

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Measuring User Cost (Barro Furman, BPEA 2018)

Start by ignoring debt financing and assume τ and z are constant:

$$R = \frac{(1 - \tau z)(r + \delta)}{1 - \tau}$$

- τ and z summarize the tax system (note $\lambda \equiv z$ in BF)
- r is set to 8.2 (see paper for discussion); implicitly assumes horizontal supply of capital
- δ is the rate at which capital depreciates
  - Equipment $\delta = 8.8\%$
  - Structures $\delta = 2.0\%$
  - Rental residential property $\delta = 2.7\%$
  - R&D intellectual property $\delta = 12.3\%$
  - Other intellectual property $\delta = 19.5\%$

BF then add debt financing tradeoff between tax advantage and cost of higher default probability

Measuring User Cost (Barro Furman, BPEA 2018)

Adding this extra term for debt financing gives:

$$R = \frac{(1-\tau z)(r+\delta)}{1-\tau} - \frac{1}{2}\left(\frac{\tau}{1-\tau}\right) \textit{debtshare} \times i$$

- $\frac{1}{2}$ is from calibrated marginal cost of debt financing (see eq 5; fn 14)
- *debtshare* is the share of financing from debt, which they set to 1/3
- i is the nominal interest rate on corporate bonds

TCJA effect on C-corp tax rates

Barro and Furman (BPEA, 2018)

BF consider three scenarios:

1. **Baseline in 2017:** $\tau = 38\%$
   - Federal $(\frac{2}{3})35\% + (\frac{1}{3})31.85\%$ (from DPAD) $= 34\%$
   - Add 4% for state corporate tax
2. **Law as written (applicable as of 2027):** $\tau = 27\%$
   - Federal $= 21\%$
   - Adjust to reflect NOL limitations and smaller offsets (1.5pp)
   - Add 4% for state corporate tax
3. **Provisions permanent (applicable as of 2019):** $\tau = 26\%$
   - Federal $= 21\%$
   - Adjust to reflect NOL limitations and smaller offsets (0.25pp)
   - Add 4% for state corporate tax

TCJA effect on C-corp user costs

Barro and Furman (BPEA, 2018)

Table 5
Estimated Effects on C Corporations from 2017 Tax Law

	Baseline	Scenario I Law as written	Scenario II Provisions permanent
Corporate-profits tax rate, τ	38%	27%	26%
Effective expensing rate, λ			
Equipment	0.812	0.812	1.000
Structures	0.338	0.338	0.338
Rental residential property	0.336	0.336	0.336
R&D intellectual property	1.132	1.011	1.192
Other intellectual property	0.842	0.842	0.842
User cost of capital, Ω (% change from baseline)			
Equipment	0.186	0.180 (-3%)	0.168 (-10%)
Structures	0.139	0.125 (-10%)	0.124 (-11%)
Rental residential property	0.149	0.134 (-10%)	0.132 (-11%)
R&D intellectual property	0.185	0.202 (+10%)	0.189 (+2%)
Other intellectual property	0.300	0.291 (-3%)	0.290 (-3%)
Average		*(-4%)*	*(-8%)*

TCJA effect on pass-through tax rates

Barro and Furman (BPEA, 2018)

BF consider three scenarios:

1. **Baseline in 2017:** $\tau = 35.2\%$
   - Assumed value for average marginal tax rate for owners of non-C-corporate businesses
2. **Law as written (applicable as of 2027):** $\tau = 35.5\%$
   - Reflects elimination of DPAD and some bracket creep due to shifting to chained CPI
3. **Provisions permanent (applicable as of 2019):** $\tau = 31.1\%$
   - Reflects reduction in individual tax rates and allowable part of the 20 percent pass-through deduction
   - Partially offset with higher marginal rates from capping SALT

TCJA effect on pass-through user costs

Barro and Furman (BPEA, 2018)

Table 9

Estimated Effects on Pass-through Businesses from 2017 Tax Law

	Baseline	Law as written	Provisions permanent
Pass-through tax rate, τ	35.2%	35.5%	31.1%
Effective expensing rate, λ			
Equipment	0.812	0.812	1.000
Structures	0.338	0.338	0.338
Rental residential property	0.336	0.336	0.336
R&D intellectual property	1.000	0.785	1.000
Other intellectual property	0.842	0.842	0.842
User cost of capital, Ω (% change from baseline)			
Equipment	0.184	0.185 (0)	0.167 (-9%)
Structures	0.135	0.136 (+1%)	0.130 (-4%)
Rental residential property	0.145	0.146 (+1%)	0.139 (-4%)
R&D intellectual property	0.202	0.226 (+12%)	0.202 (0)
Other intellectual property	0.297	0.298 (0)	0.294 (-1%)
Average		*(+1%)*	*(-5%)*

From user cost changes to impacts on economic activity

Barro and Furman (BPEA, 2018)

1. **Production Function**
   - $Y = AK^{\alpha}L^{1-\alpha}$ where $\alpha = .38$
   - $K^{\alpha} = K_1^{\alpha_1} K_2^{\alpha_2} K_3^{\alpha_3} K_4^{\alpha_4} K_5^{\alpha_5}$ for each type of capital
2. **Elasticity of capital labor ratio (K/L) w.r.t user cost**
   - $MPK = \alpha A \left(\frac{K}{L}\right)^{-(1-\alpha)}$
   - Implies that the elasticity of (K/L) to user cost is $-1/(1-\alpha) \approx 1.6$
3. **Output per worker**
   - Elasticity of (Y/L) to user cost is $-\alpha/(1-\alpha) \approx .6$
   - With 5 types of capital, numerator is α_k-weighted average of user cost change
   - Also note that wages are proportional to Y/L from labor FOC

TCJA effect on C-corp economic activity

Barro and Furman (BPEA, 2018)

User cost of capital, Ω (% change from baseline)			
Equipment	0.186	0.180 (-3%)	0.168 (-10%)
Structures	0.139	0.125 (-10%)	0.124 (-11%)
Rental residential property	0.149	0.134 (-10%)	0.132 (-11%)
R&D intellectual property	0.185	0.202 (+10%)	0.189 (+2%)
Other intellectual property	0.300	0.291 (-3%)	0.290 (-3%)
Average		*(-4%)*	*(-8%)*
Percent change in capital-labor ratio, K/L			
Equipment		5.6%	14.3%
Structures		12.9%	16.1%
Rental residential property		13.0%	16.2%
R&D intellectual property		-7.1%	2.3%
Other intellectual property		5.4%	8.0%
Average		*6.6%*	*12.5%*
Percent change in output per worker, Y/L		2.5%	4.7%

Notes: The effective expensing rate, λ, is calculated as a present value, including tax credits. The economic and tax law parameters were listed in Tables 3 and 4 and are described in the text where appropriate. Averages reflect the average percent changes for each type of capital, weighted by the capital income shares.

TCJA effect on pass-through economic activity

Barro and Furman (BPEA, 2018)

User cost of capital, Ω (% change from baseline)			
Equipment	0.184	0.185 (0)	0.167 (-9%)
Structures	0.135	0.136 (+1%)	0.130 (-4%)
Rental residential property	0.145	0.146 (+1%)	0.139 (-4%)
R&D intellectual property	0.202	0.226 (+12%)	0.202 (0)
Other intellectual property	0.297	0.298 (0)	0.294 (-1%)
Average		*(+1%)*	*(-5%)*
Percent change in capital-labor ratio, K/L			
Equipment		-1.2%	12.2%
Structures		-1.5%	7.2%
Rental residential property		-1.5%	7.2%
R&D intellectual property		-13.1%	2.8%
Other intellectual property		-1.0%	4.2%
Average		*-2.1%*	*8.3%*
Percent change in output per worker, Y/L		-0.8%	3.1%

Note: Uses pass-through tax rates as shown. R&E credit assumed to be zero in all cases. See Tables 3, 4 and 5 on other aspects.

TCJA effect on overall economic activity, switching

Barro and Furman (BPEA, 2018)

Table 10
Estimated Effects on Economy-wide Output per Worker

	Initial share	Percent change in output per worker, Y/L: Law as written	Percent change in output per worker, Y/L: Provisions permanent
C corporations	39%	2.5%	4.7%
Pass-throughs	36%	-0.8%	3.1%
Government, Households, and Institutions	25%	0.0%	0.0%
Percent change in overall output per worker		**0.9%**	**3.1%**
Sensitivity analysis when productivity rises by 10% for switchers			
Percent change in overall output per worker		*1.6%*	*3.5%*

Notes: The initial shares in value added are in Table 3. Values of change in output per worker for law-as-written and provisions-permanent scenarios are from Table 5 for C corporations and Table 9 for pass-through businesses. These values reflect changing capital-labor ratios within sectors. The change in output per worker is assumed to be zero for government, households, and institutions. The percent change in overall output per worker is the sum of the changes by sector weighted by the final shares, which are assumed because of shifting across

Open Questions from Barro Furman

1. **Tax rate vs base**
   - Effects of expensing vs interest deductibility
   - How to model NOLs, etc, and their impacts on user cost and growth
2. **Actual Investment responses**
   - Do estimates line up with predictions? Heterogeneity by type of capital
   - Where does investment come from? Extensive, intensive, FDI?
   - More broadly, what are the effects on the international provisions?
   - Crowd-out from deficits? How do responses change w/ higher r?
3. **Output per worker and wages**
   - How do these changes impact Y/L and wages? what are the distributional impacts?
4. **Others**
   - How much corporate form switching was there? Are there productivity gains from switching? Tax revenue impacts?
   - What do firms do with the windfalls to old capital?
   - How much reallocation of capital and labor is there?

User Cost, Impact of TCJA, Open Research Questions

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A few more open research questions

1. **Business Income, Taxation, and Inequality**
   - Who owns C-corporations? Important for top wealth & inequality
   - How much of business wealth is self-made versus inherited? How does this respond to taxation?
2. **Business Property Taxes**
   - Effect of prop taxes (expected prop tax/fiscal health) on firm location
3. **Reform**
   - How much would dollar depreciate if the DBCFT reform were enacted? Effects on wealth?
   - International Reforms related to tax evasion and avoidance
4. **Other topics**
   - Rents vs normal returns to capital
   - Size, causes, and consequences of business location subsidies
   - How do federal changes affect state revenues and economic activity (e.g,. bonus)?
   - Repatriation: decision to send money back in 2003 holiday
   - Corporate financial policy

IV. Taxes, Financial Policy, and Investment (Poterba)

V. International Taxation (Hines)