Who Benefits from State Corporate Tax Cuts? A Local Labor Markets Approach with Heterogeneous Firms

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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

We 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

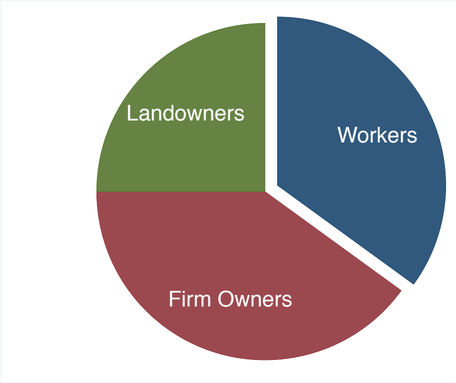
Allow for monopolistically competitive & heterogeneously productive firms

This Paper

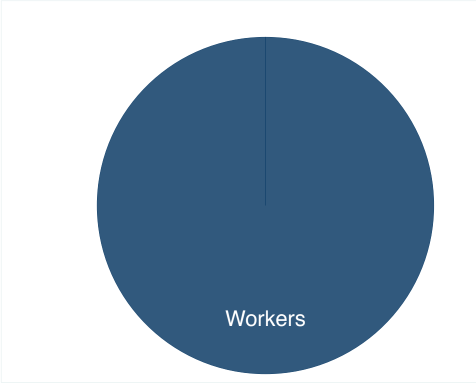
- **Question:** What are the welfare effects of cutting **corporate taxes** in an open economy on **workers**, **firm owners**, and **landowners**?
- **Contributions**
  1. New **evidence** on business location
  2. New **framework** for evaluating welfare effects
  3. New **assessment** of corporate taxation in an open economy

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)

Outline: 3 Steps

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**
   - 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**
   - 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

Broader Contribution: Local Labor Markets with Firms

- Last few years - important **link between workers and location**
  - Kline 2010, Moretti 2011, Busso et al 2013, Diamond 2013, Notowidigdo 2013, Suárez Serrato and Wingender 2012
- This literature and benchmark models have representative/identical, perfectly competitive firms & **no link between firms and location**
  - Incidence: Kotlikoff & Summers 1987, Gordon & Hines 2002
  - Locational: Rosen 1979, Roback 1982
- Monopolistically competitive and heterogeneously productive firms

Roadmap

1. **Model**
2. **Incidence Expressions, Identification**
3. **Data and Reduced-Form Analysis of Business Location**
4. **Incidence and Parameter Estimates**
5. **Policy Implications**

Model

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.

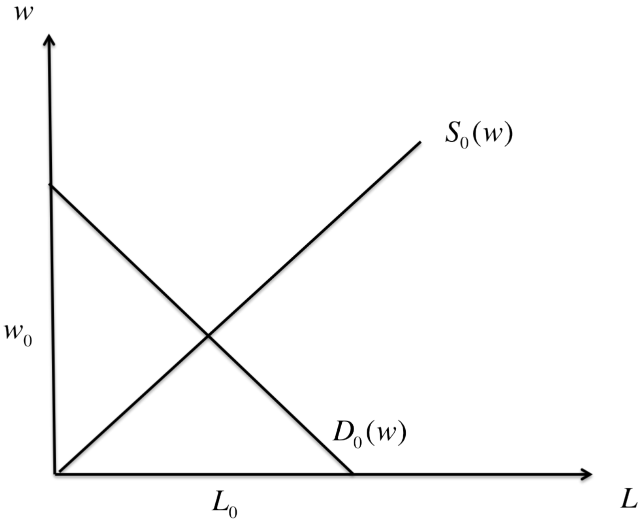
—Delaware Governor Jack Markell (11/3/2013) [1]

[1] "Low wages 'aren't what it's about anymore': Delaware's governor on bringing jobs home," *The Washington Post* 11/3/2013.

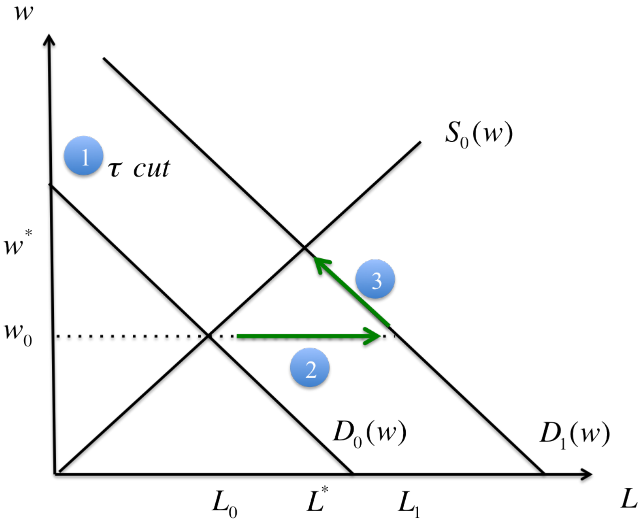
A Spatial Equilibrium Model with Firms: Outline

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 $\mathbf{b}(\theta)$

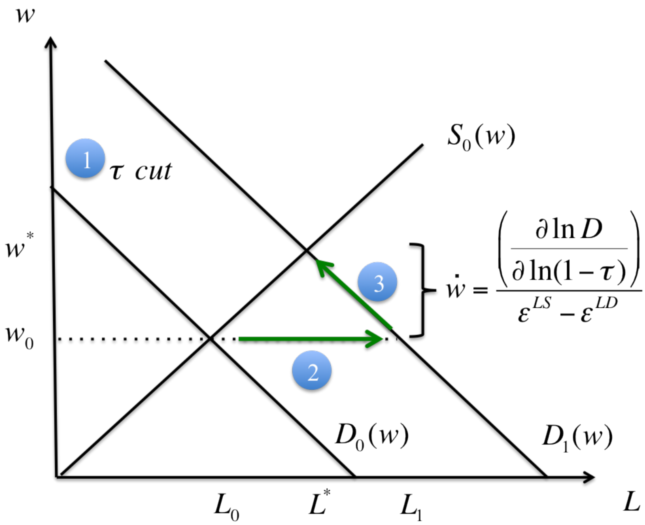
Equilibrium in the Local Labor Market



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

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

- 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

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:

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

Local Population:

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

(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:

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

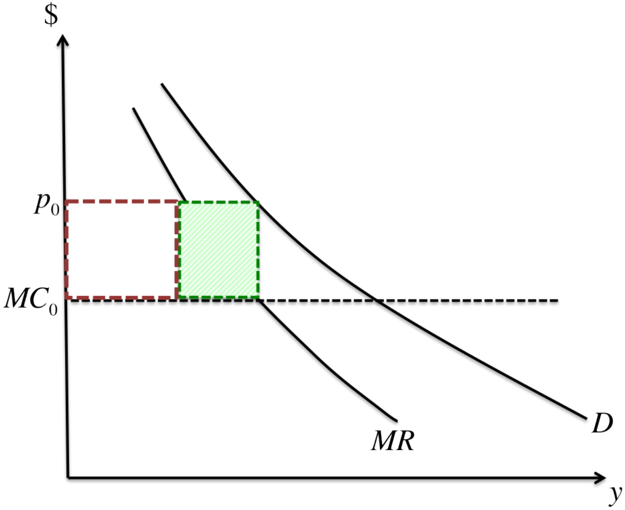
Key Parameter: η_c elasticity of housing supply

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

Establishment Production



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

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

- Firm Value Function

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

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

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:

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

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:

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

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	$1 - \delta(\varepsilon^{PD} + 1) + \gamma(\varepsilon^{PD} + 1)\dot{w}_c$ $= 1 + \underbrace{\gamma(\varepsilon^{PD} + 1)}_{-\frac{\text{Labor cost factor}}{\text{Net Markup}}} \times \left(\dot{w}_c - \frac{\delta}{\gamma}\right)$

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

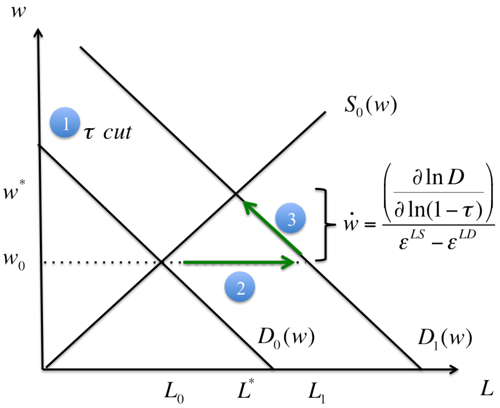
$$\Delta \ln w_{c,t} = \underbrace{\left(\dot{w}(\theta)\right)}_{\beta^W} \Delta \ln(1-\tau^b_{c,t}) + \phi^1_t + u^1_{c,t}$$

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

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

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

Identification of Local Incidence on Welfare



$$\dot{w} = \frac{\left(\frac{\partial \ln D}{\partial \ln(1-\tau)}\right)}{\varepsilon^{LS} - \varepsilon^{LD}}$$

- Reduced forms:
  $\dot{w} = \beta^W$, $\dot{N} = \beta^N$
  $\implies \varepsilon^{LS} = \frac{\beta^N}{\beta^W}$
- Labor Demand
  $\varepsilon^{LD} = \gamma(\varepsilon^{PD} + 1) - \frac{\gamma}{\sigma^F} - 1$
- Establishment Location
  $\frac{\partial \ln D}{\partial \ln(1-t)} = \beta^E + \frac{\gamma}{\sigma^F}\beta^W$

$$\beta^W = \frac{\beta^E + \frac{\gamma}{\sigma^F}\beta^W}{\frac{\beta^N}{\beta^W} - \gamma(\epsilon^{PD} + 1) + \frac{\gamma}{\sigma^F} + 1} \implies \boxed{\gamma(\varepsilon^{PD} + 1) = \left(\frac{\beta^N - \beta^E}{\beta^W} + 1\right)}$$

Identification of Local Incidence on Welfare

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

Data

Non-Tax Data

1. **Annual Data**
   - Number of establishments from County Business Patterns
   - Population from BEA
2. **Decadal Data**
   - Wage and rental cost indexes from 1980-2000 Censuses and 2009 ACS
   - Adjust for changes in composition of observable characteristics
3. **Geographical Level**
   - Focus on county groups called consistent PUMAs [490 localities]
4. **Bartik**: Construct Bartik shock to predict labor demand:

$$Bartik_{c,t} = \sum_{Ind} \text{EmpShare}_{Ind,t-1,c} \times \Delta \text{Emp}_{Ind,t,\text{National}}$$

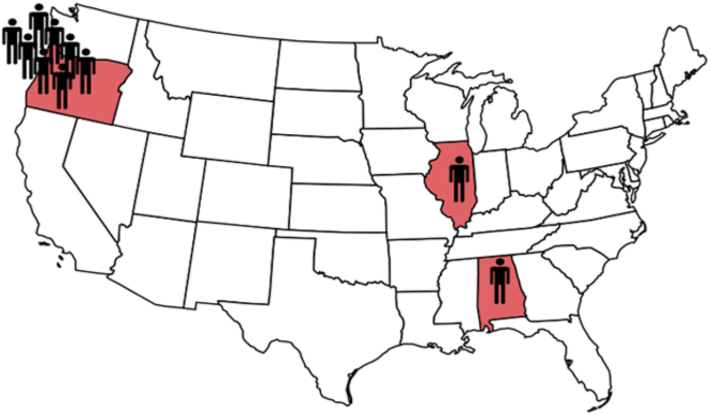
Three Types of Firm Taxes

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

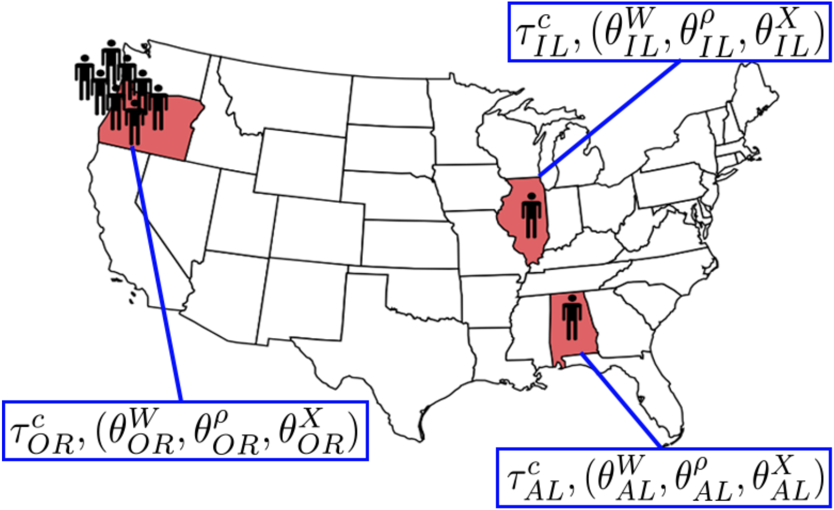
$$\tau_i^A = \sum_s \tau_s^c \omega_{is}$$

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

Nike Apportionment Example



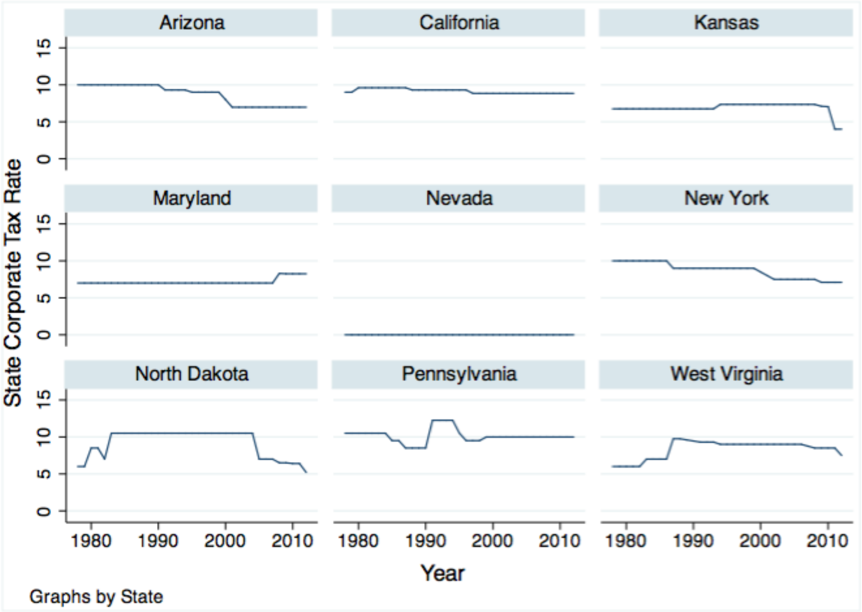
Nike Apportionment Example



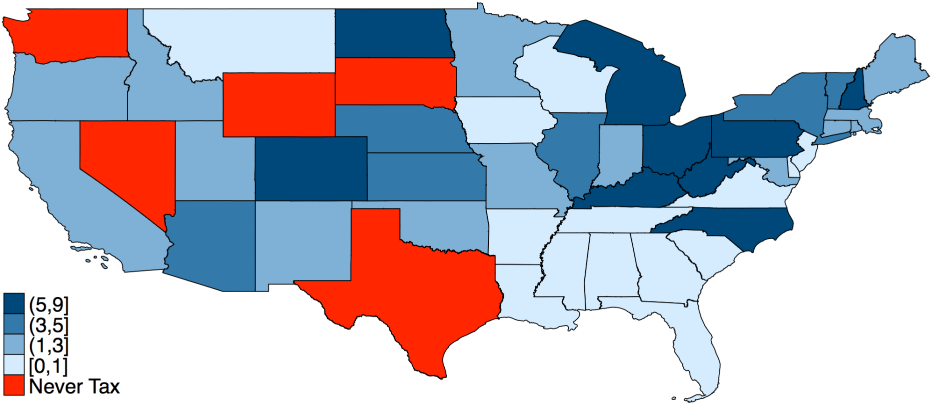
Nike Apportionment Example (2/2)

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

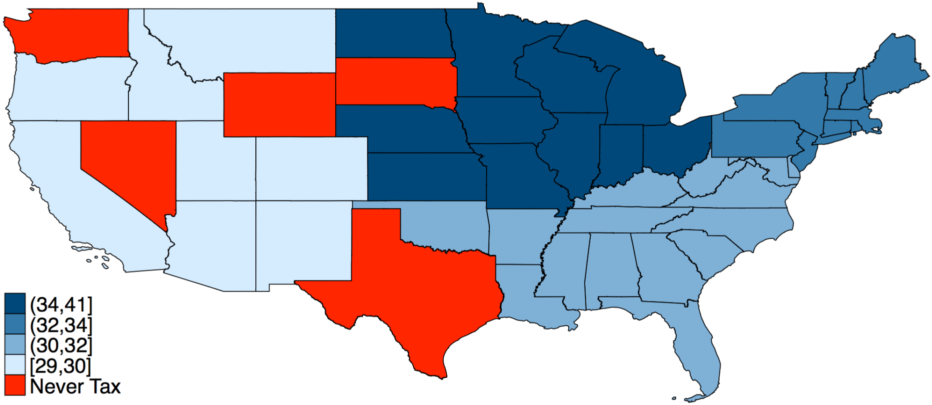
State	I. Using Payroll	II. Using Sales
	Apportioned Profit ($M)	
OR	(80% of 6) = 4.8	2
IL	(10% of 6) = .6	2
AL	(10% of 6) = .6	2
	Corporate Tax Liability ($M)	
OR with $\tau^c_{OR} = 50\%$	2.4	1
IL with $\tau^c_{IL} = 10\%$	.06	0.2
AL with $\tau^c_{AL} = 0\%$	0	0
Total Tax Liability ($M)	3	1.2


Arizona
California
Kansas
Maryland
Nevada
New York
North Dakota
Pennsylvania
West Virginia
State Corporate Tax Rate
0
5
10
15
1980
1990
2000
2010
Year
Graphs by State

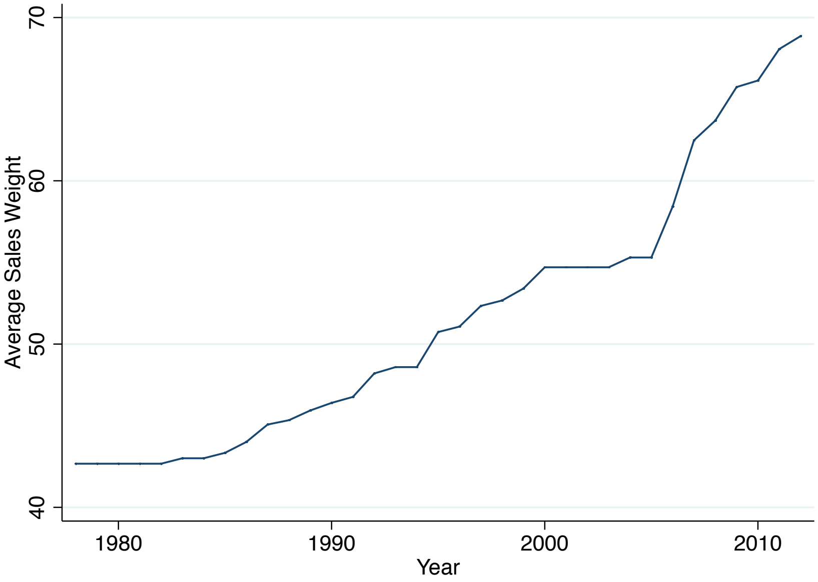
Number of Corporate Tax Rate Changes by State: '77-'12



Number of Corporate Tax Rate Changes by Region: '77-'12



Gradual Shift Towards Sales Apportionment



Using Variation from Apportionment

Goolsbee and Maydew (Journal of Public Economics, 2000)

- Use variation in payroll burden $\tau_s^c \theta_s^w$
- Find that reducing payroll weight from 33% to 25% increases manufacturing employment by 1%

This paper

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

- where $\omega_{is} = \underbrace{\left(\theta_s^w \frac{W_{is}}{W}\right)}_{payroll} + \underbrace{\left(\theta_s^\rho \frac{R_{is}}{R}\right)}_{property} + \underbrace{\left(\theta_s^x \frac{X_{is}}{X}\right)}_{sales}$
- Use RefUSA data to construct ω_{is} for each firm i
- Take average of all local establishments to obtain $\bar{\tau}^A$

Average Business Tax Rate

- Use data on shares of establishments to calculate the average business tax in a conpsuma:

$$\Delta \ln(1-\tau^b)_{c,t} \equiv \underbrace{f^{SC}_{c,t} \Delta \ln(1-\tau^c)_{c,t} + f^{MC}_{c,t} \Delta \ln(1-\bar{\tau}^A)_{c,t}}_{\text{Corporate}} + \underbrace{f^{P}_{c,t} \Delta \ln(1-\tau^{INC})_{c,t}}_{\text{Personal}}$$

- Calculate shares $f^{SC}_{c,t}, f^{MC}_{c,t}, f^{P}_{c,t}$ using County Business Patterns and RefUSA data

Reduced-form Effects on Business Location (and Local Economic Activity)

Business Taxes & Establishment Growth

Specification

$$\ln E_{c,t} - \ln E_{c,t-10} = \beta[\ln(1-\tau^{b}_{c,t}) - \ln(1-\tau^{b}_{c,t-10})] + \mathbf{D}'_{s,t}\mathbf{\Psi}_{s,t} + u_{c,t}$$

- LHS: Establishment Growth
- RHS: Growth in net-of-business tax rate
- $\mathbf{D}_{s,t}$ is a vector of year dummies and state dummies for industrial Midwest in the 1980s

Validity of Business Tax Variation

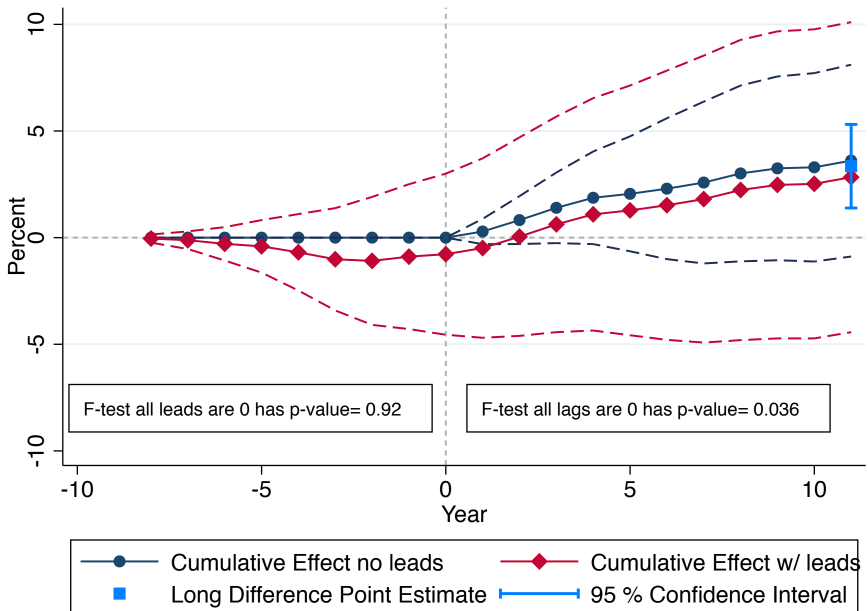
- Potential for bias due to:
  - Concomitant changes in corporate tax base, esp. tax credits
  - Concomitant changes in spending
  - Concurrent changes in productivity
  - Prior economic conditions

Business Taxes & Establishment Growth

Establishment Growth	(1)	(2)	(3)	(4)	(5)	(6)
Δ ln Net-of-Business-Tax Rate	4.07**	4.14**	4.06**	3.35**	3.91**	3.24**
	(1.82)	(1.80)	(1.83)	(1.43)	(1.78)	(1.41)
Δ State ITC		-0.46				-0.17
		(0.32)				(0.30)
Δ ln Gov. Expend./Capita			-0.01			-0.01
			(0.01)			(0.01)
Bartik				0.59***		0.57***
				(0.19)		(0.18)
Change in Other States' Taxes					-4.66***	-4.18***
					(1.60)	(1.43)
Fixed Effects	Year	Year	Year	Year	Year	Year
Observations	1,470	1,470	1,470	1,470	1,470	1,470
R-squared	0.472	0.475	0.472	0.491	0.481	0.500

Tax changes & growth are over 10 years. *** p<0.01, ** p<0.05, * p<0.1
Robust standard errors clustered by state in parentheses

Cumulative Effects of Business Tax Cuts on Est. Growth



Additional Validity Tests of Business Location Estimate

- Synthetic controls for states that change taxes
- Specifications over shorter durations that flexibly control for measures of prior economic conditions
- No detectable responsiveness of other state tax rates

Bottom Line: The approx. 3.5% effect on establishment growth over ten years is robust and economically sensible

Business Taxes & Local Economic Activity

B: Other Outcomes	Population Growth		Wage Growth		Rental Cost Growth	
	(1)	(2)	(1)	(2)	(1)	(2)
Δ ln Net-of-Business-Tax Rate	4.28**	3.74**	1.45	0.78	1.17	0.32
	(1.65)	(1.48)	(0.94)	(0.82)	(1.44)	(1.37)
Bartik		0.44**		0.56***		0.70**
		(0.19)		(0.08)		(0.27)
Observations	1,470	1,470	1,470	1,470	1,470	1,470
R-squared	0.085	0.113	0.402	0.490	0.139	0.189

Tax changes & growth are over 10 years. *** $p<0.01$, ** $p<0.05$, * $p<0.1$
Robust standard errors clustered by state in parentheses

Empirical Implementation

4 Reduced-Form Equations of the Model

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

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

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

$$\Delta \ln w_{c,t} = \underbrace{(\dot{w}(\theta))}_{\beta^W} \Delta \ln(1-\tau^b_{c,t}) + \phi^3_t + u^3_{c,t}$$

$$\Delta \ln r_{c,t} = \underbrace{\left(\frac{1+\varepsilon^{LS}}{1+\eta_c}\dot{w}(\theta) \right)}_{\beta^R} \Delta \ln(1-\tau^b_{c,t}) + \phi^4_t + u^4_{c,t}$$

Identification of Local Incidence on Welfare

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

- Housing expenditure share $\alpha = .3$ from Consumer Expenditure Survey
- Output Elasticity of Capital $\delta = .9\gamma$ from BEA

Economic Incidence Estimates Using RF Effects

A. Incidence

	(1)	(2)	(3)	(4)	(5)	(6)
Landowners	1.17	1.17	1.17	0.32	1.86	0.62
	(1.43)	(1.43)	(1.43)	(1.36)	(1.56)	(0.60)
Workers	1.1*	0.69	1.1*	0.68	0.98	0.58*
	(0.59)	(0.44)	(0.59)	(0.52)	(0.84)	(0.33)
Firmowners	1.63*	1.63*	2.08**	0.81	1.54*	0.9***
	(0.90)	(0.90)	(0.95)	(1.4)	(0.92)	(0.34)
Specification						
Net-of-Business Tax	Y	Y	Y	Y	Y	N
Net-of-Corporate Tax	N	N	N	N	N	Y
Housing share α	0.3	0.65	0.3	0.3	0.3	0.3
Output elasticity ratio δ/γ	0.9	0.9	0.5	0.9	0.9	0.9
Bartik	N	N	N	Y	Y	N
Net-of-Personal Tax	N	N	N	N	Y	N

Economic Incidence Estimates Using RF Effects (cont.)

B. Share of Incidence

	(1)	(2)	(3)	(4)	(5)	(6)
Landowners	0.30	0.34	0.27	0.18	0.42**	0.29*
	(0.19)	(0.24)	(0.2)	(0.48)	(0.17)	(0.16)
Workers	0.28***	0.20	0.25***	0.37	0.22*	0.28***
	(0.09)	(0.16)	(0.07)	(0.43)	(0.12)	(0.08)
Firmowners	0.42***	0.47***	0.48***	0.45***	0.35***	0.43***
	(0.12)	(0.10)	(0.17)	(0.13)	(0.09)	(0.10)
Conventional View Test						
χ^2 of $(S^W = 1, S^F = 0)$	132.67	108.14	48.8	6.96	76.27	195.92
P-value	0.00	0.00	0.00	0.01	0.00	0.00
Specification						
Net-of-Business Tax	Y	Y	Y	Y	Y	N
Net-of-Corporate Tax	N	N	N	N	N	Y
Housing share α	0.3	0.65	0.3	0.3	0.3	0.3
Output elasticity ratio δ/γ	0.9	0.9	0.5	0.9	0.9	0.9
Bartik	N	N	N	Y	Y	N
Net-of-Personal Tax	N	N	N	N	Y	N

Robustness: Economic Incidence Estimates

Panel (a) Incidence

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Workers $\dot{w} - \alpha \dot{r}$	1.15*	1.1*	1.54**	1.34*	1.36*	1.1*	1.39***	1.39***	.68
	(.59)	(.61)	(.64)	(.72)	(.71)	(.59)	(.52)	(.52)	(.52)
Landowners $\dot{r}$	.93	1.07	1.17	1.63	1.72	1.17	1.79	1.79	.32
	(1.52)	(1.48)	(1.61)	(1.54)	(1.56)	(1.43)	(1.22)	(1.22)	(1.36)
Firmowners $\dot{\pi}$	1.6*	1.56*	2.05**	1.69*	2.03**	1.63*	1.98**	1.98**	.81
	(.89)	(.91)	(.9)	(.99)	(1.02)	(.9)	(.88)	(.88)	(1.4)
Specifications									
Political Controls	Y	N	N	N	N	N	N	N	N
Sales Tax Rate	N	Y	N	N	N	N	N	N	N
Δ Sales Tax Rate	N	N	Y	N	N	N	N	N	N
Income Tax Rate	N	N	N	Y	N	N	N	N	N
Δ Income Tax Rate	N	N	N	N	Y	N	N	N	N
Δ Gov. Expend/capita	N	N	N	N	N	Y	N	Y	N
Corporate Tax Rev. to GDP	N	N	N	N	N	N	Y	Y	N
Bartik	N	N	N	N	N	N	N	N	Y
Gross Receipt Tax Control	N	N	N	N	N	N	N	N	N

Robustness: Economic Incidence Estimates (cont.)

Panel (b) Shares of Incidence

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Worker Share	.31**	.29***	.32**	.29***	.27**	.28***	.27***	.27***	.37
	(.13)	(.11)	(.14)	(.1)	(.11)	(.09)	(.07)	(.07)	(.43)
Landowner Share	.25	.29	.25	.35**	.34**	.3	.35***	.35***	.18
	(.26)	(.21)	(.23)	(.14)	(.17)	(.19)	(.13)	(.13)	(.48)
Firmowner Share	.44***	.42***	.43***	.36***	.4***	.42***	.38***	.38***	.45***
	(.14)	(.13)	(.12)	(.09)	(.1)	(.12)	(.09)	(.09)	(.13)
Conven.View Test									
	145.34	130.84	73.08	85.61	94.50	130.47	116.5	115.71	6.96
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.010
Specifications									
Political Controls	Y	N	N	N	N	N	N	N	N
Sales Tax Rate	N	Y	N	N	N	N	N	N	N
Δ Sales Tax Rate	N	N	Y	N	N	N	N	N	N
Income Tax Rate	N	N	N	Y	N	N	N	N	N
Δ Income Tax Rate	N	N	N	N	Y	N	N	N	N
Δ Gov. Expend/capita	N	N	N	N	N	Y	N	Y	N
Corporate Tax Rev. to GDP	N	N	N	N	N	N	Y	Y	N
Bartik	N	N	N	N	N	N	N	N	Y
Gross Receipt Tax Control	N	N	N	N	N	N	N	N	N

Structural Estimation

- **4 Parameters of interest**
- **4 Simultaneous equations with the following outcomes:**
  1. Establishment Growth
  2. Population Growth
  3. Wage Growth
  4. Rental Cost Growth
- RF effects of **Taxes** on **4 Outcomes** to estimate σ^F, σ^W, η
- Enhance precision with supplement labor demand (Bartik) Shocks
  1. RF effects of **Both Shocks** on **4 Outcomes** $\Rightarrow \sigma^F$, σ^W, η
  2. RF effects of **Both Shocks** on **4 Outcomes** $\Rightarrow \sigma^F$, σ^W, η, ε^{PD}

Parameters θ

1. **Estimated Parameters**
   1. Productivity Dispersion σ^F
   2. Preference Dispersion σ^W
   3. Housing Supply Elasticity η
   4. Product Demand Elasticity ε^{PD}

2. **Calibrated Parameters**
   - Housing expenditure share $\alpha = .3$ from Consumer Expenditure Survey
   - Output Elasticity of Labor $\gamma \in [.1, .3]$ from IRS, BEA
   - Output Elasticity of Capital $\delta = .9\gamma$ from BEA residual of L, M

4 Reduced-Form Equations of the Model

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

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

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

$$\Delta \ln w_{c,t} = \underbrace{(\dot{w}(\theta))}_{\beta^W} \Delta \ln(1-\tau^b_{c,t}) + \phi^3_t + u^3_{c,t}$$

$$\Delta \ln r_{c,t} = \underbrace{\left(\frac{1+\varepsilon^{LS}}{1+\eta_c}\dot{w}(\theta) \right)}_{\beta^R} \Delta \ln(1-\tau^b_{c,t}) + \phi^4_t + u^4_{c,t}$$

Estimating Structural Parameters

1. **Reduced Form:** Estimate reduced form $\hat{\mathbf{b}}$ and covariance $\hat{\mathbf{V}}$
2. **Recover Structural Parameters via Classical Minimum Distance:**

$$\hat{\theta} = \arg\min_{\theta \in \Theta} \; [\hat{\mathbf{b}} - \mathbf{m}(\theta)]' \hat{\mathbf{V}}^{-1} [\hat{\mathbf{b}} - \mathbf{m}(\theta)]$$

Results:

Panel (a) Business Tax Shock				
	Population	Wage	Rent	Establishments
Empirical Moments				
Business Tax	4.275***	1.451	1.172	4.074**
	(1.642)	(0.938)	(1.428)	(1.815)
Predicted Moments ($\gamma = .15, \varepsilon^{PD} = -2.5$)				
Business Tax	3.514	0.839	0.591	4.542

Over-id Test	
χ^2-Stat	2.453
χ^2-P-Value	0.117

Test: $\beta^E = \beta^N - (\gamma(\varepsilon^{PD} + 1) - 1)\beta^W$	
T-stat	-1.566
P-value	0.117

Enhancing precision with supplemental LD shocks

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

$$\Delta \ln E_{c,t} = b_1 \Delta \ln(1-\tau^b_{c,t}) + b_5 Bartik_{c,t} + \tilde{\phi}^1_t + \tilde{u}^1_{c,t}$$
$$\Delta \ln N_{c,t} = b_2 \Delta \ln(1-\tau^b_{c,t}) + b_6 Bartik_{c,t} + \tilde{\phi}^2_t + \tilde{u}^2_{c,t}$$
$$\Delta \ln w_{c,t} = b_3 \Delta \ln(1-\tau^b_{c,t}) + b_7 Bartik_{c,t} + \tilde{\phi}^3_t + \tilde{u}^3_{c,t}$$
$$\Delta \ln r_{c,t} = b_4 \Delta \ln(1-\tau^b_{c,t}) + b_8 Bartik_{c,t} + \tilde{\phi}^4_t + \tilde{u}^4_{c,t}$$

8 Moments from Tax and Bartik Shocks

Panel (b) All Shocks

	Population	Wage	Rent	Establishments
Empirical Moments				
Business Tax	1.516	1.534	1.857	1.749
	(1.915)	(1.117)	(1.562)	(1.540)
Bartik	0.446**	0.554***	0.697***	0.600***
	(0.183)	(0.079)	(0.257)	(0.189)
Personal Tax	1.731	-0.588	-1.192	1.247
	(1.247)	(0.728)	(1.173)	(1.420)
B. Predicted Moments ($\gamma = .15, \varepsilon^{PD} = -2.5$)				
Business Tax	0.736	0.944	1.111	1.893
Bartik	0.424	0.571	0.730	0.479
Personal Tax	1.052	-0.596	-1.559	0.322
Over-id Test			Test: $\beta^E = \beta^N - (\gamma(\varepsilon^{PD} + 1) - 1)\beta^W$	
χ^2-Stat	4.665		T-stat	-1.217
χ^2-P-Value	0.458		P-value	0.224

Structural Elasticities Using Estimated Parameters

	A. All Shocks						
Calibrated Parameters	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Output Elasticity γ	0.150	0.150	0.150	0.200	0.250	0.150	0.250
Housing Share α	0.300	0.500	0.650	0.300	0.300	0.300	0.500
Elasticity of Product Demand ε^{PD}	-2.500	-2.500	-2.500	-2.500	-2.500	-4.000	-4.000
Estimated Parameters							
Idiosyncratic Location	0.277**	0.271**	0.233**	0.321*	0.304	0.149	0.136
Prod. Disp. σ^F	(0.138)	(0.120)	(0.092)	(0.186)	(0.186)	(0.096)	(0.093)
Idiosyncratic Location	0.829***	0.686***	0.621***	0.845***	0.843***	0.839***	0.649**
Pref. Disp. σ^W	(0.282)	(0.260)	(0.230)	(0.294)	(0.295)	(0.294)	(0.253)
Elasticity of Housing	0.513	2.185	1.157	1.600	0.707	1.995	2.812
Supply η	(1.417)	(6.206)	(2.661)	(5.065)	(2.301)	(7.320)	(13.688
Overid Test (p-value)	0.458	0.390	0.393	0.385	0.444	0.390	0.507

Structural Elasticities Using Estimated Parameters (cont.)

	B. Business Tax Shock				C. All Shocks, Estimated ε^{PD}		
Calibrated Parameters	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Output Elasticity γ	0.150	0.150	0.250	0.150	0.150	0.150	0.250
Housing Share α	0.300	0.650	0.300	0.300	0.300	0.650	0.300
Elasticity of Product Demand ε^{PD}	-2.500	-2.500	-2.500	-4.000		Estimated Below	
Estimated Parameters							
Idiosyncratic Location Prod. Disp. σ^F	0.119*	0.117*	0.106	0.048	0.109	0.105	0.138
	(0.065)	(0.064)	(0.075)	(0.039)	(0.392)	(0.194)	(0.411)
Idiosyncratic Location Pref. Disp. σ^W	0.188	0.128	0.171	0.170	0.892***	0.571**	0.753***
	(0.184)	(0.147)	(0.176)	(0.175)	(0.337)	(0.234)	(0.245)
Elasticity of Housing Supply η	6.367	5.724	7.328	6.424	1.925	1.783	3.056
	(15.899)	(13.090)	(20.574)	(16.136)	(8.085)	(6.503)	(25.617)
Elasticity of Product Demand ε^{PD}					-4.704	-4.439	-4.986
					(11.945)	(6.471)	(12.190)
Overid Test (p-value)	0.117	0.117	0.098	0.088	0.251	0.334	0.290

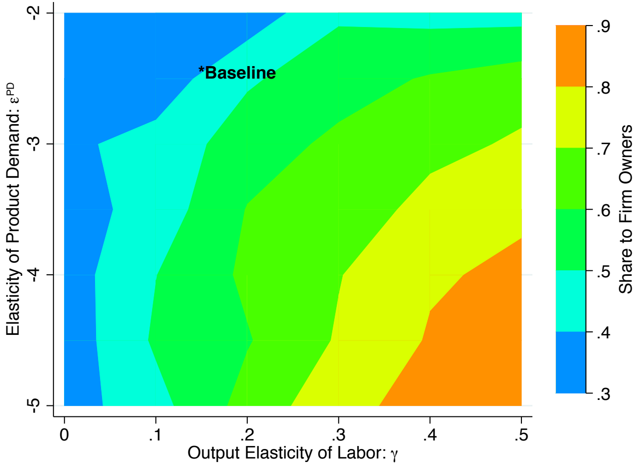
Economic Incidence Using Estimated Parameters

	A. Incidence				
	(1)	(2)	(3)	(4)	(5)
		All Shocks		Business	All Shocks
Calibrated Parameters				Tax	Est. ε^{PD}
Output Elasticity γ	0.150	0.150	0.150	0.150	0.150
Housing Share α	0.300	0.650	0.300	0.300	0.300
Elasticity of Product	-2.500	-2.500	-4.000	-2.500	-4.704
Demand ε^{PD}					(11.945)
Estimated Incidence					
Wages $\dot{w}$	0.944**	1.088**	0.655*	0.839	0.646
	(0.408)	(0.457)	(0.348)	(0.847)	(1.028)
Landowners $\dot{r}$	1.111	0.886	0.428	0.591	0.420
	(1.119)	(1.052)	(1.079)	(1.373)	(1.517)
Workers $\dot{w} - \alpha\dot{r}$	0.611**	0.512	0.527*	0.662	0.520
	(0.293)	(0.355)	(0.269)	(0.517)	(0.703)
Firm Owners $\dot{\pi}$	0.990***	0.958***	1.110***	1.014***	1.141
	(0.092)	(0.103)	(0.157)	(0.191)	(1.012)
Elasticity of Labor	0.780**	0.757	0.958	4.188	0.902
Supply ε^{LS}	(0.386)	(0.729)	(0.588)	(4.795)	(0.645)
Elasticity of Labor	-1.766***	-1.867***	-2.457***	-2.485***	-2.933
Demand ε^{LD}	(0.269)	(0.252)	(0.646)	(0.692)	(6.731)

Economic Incidence Using Estimated Parameters (cont.)

	B. Shares of Incidence				
	(1)	(2)	(3)	(4)	(5)
		All Shocks		Business	All Shocks
Calibrated Parameters				Tax	Estimated ε^{PD}
Output Elasticity γ	0.150	0.150	0.150	0.150	0.150
Housing Share α	0.300	0.650	0.300	0.300	0.300
Elasticity of Product Demand ε^{PD}	-2.500	-2.500	-4.000	-2.500	-4.704 (11.945)
Estimated Incidence					
Landowners $\dot{r}$	0.410 (0.263)	0.376 (0.339)	0.207 (0.434)	0.261 (0.430)	0.202 (0.621)
Workers $\dot{w} - \alpha\dot{r}$	0.225* (0.134)	0.217 (0.197)	0.255 (0.185)	0.292** (0.142)	0.250 (0.290)
Firm Owners $\dot{\pi}$	0.365** (0.168)	0.407** (0.164)	0.537* (0.297)	0.447 (0.392)	0.548 (0.734)
Test of Standard View (p-value)	0.000	0.000	0.000	0.000	0.026

Firm Owner's Share of Incidence for Calibrated Values of γ and ε^{PD}



Two Additional Considerations

1. **Regional Heterogeneity**
   - We document average effects, but regions can vary (e.g., housing market elasticities η_c) $\Rightarrow$ equity and efficiency impacts vary
   - Everything is bigger in Texas, including the efficiency costs of business location incentives
2. **Accounting for (small) Government Spending Changes**
   - Quantify 3 scenarios: cutting services, infrastructure, both
   - Expenditure shares on services exceed those on infrastructure, so worker amenities hit more
   - Shared impact even for infrastructure only case (lower productivity $\Rightarrow$ lower wages)
   - This reinforces conclusion that firm owners enjoy substantial portion of benefit

Behavioral Responses and Efficiency

Q: If businesses aren't that responsive, then why do we observe low state corporate taxes?

- **Fiscal externalities, not mobility** may explain why states have low rates
- **Amenable feature of state corporate tax system**

Revenue-Maximizing Corporate Tax Rate

1. If states wanted to maximize corporate tax revenues, the maximal tax rate would be:

$$\tau_c^* = \frac{1}{\dot{\bar{\pi}}_c + \dot{E}_c}$$

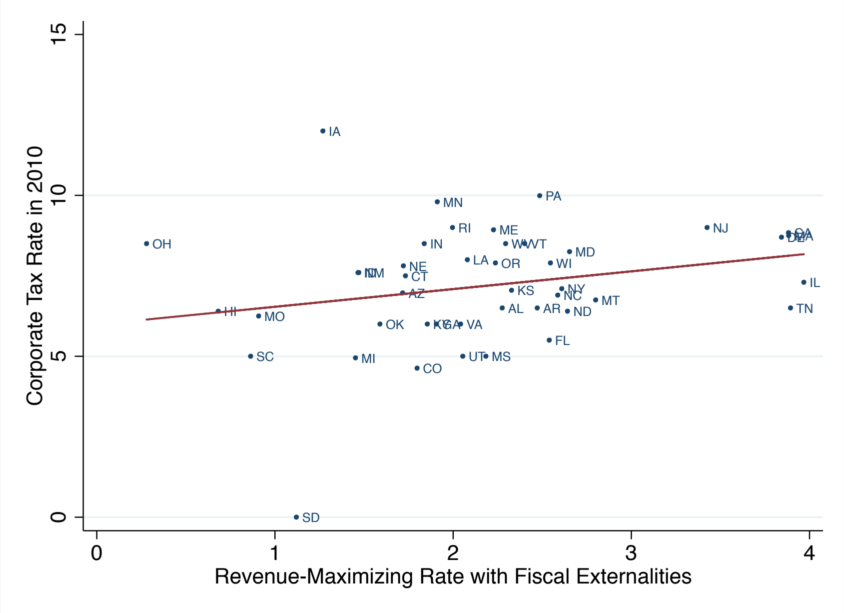
2. However, this rate doesn't account for fiscal externalities from other taxes (or from other spending)

$$\tau_c^{**} = \frac{1}{\dot{\bar{\pi}}_c + \dot{E}_c + (\mathrm{revshare}_c^{\mathrm{pers}}/\mathrm{revshare}_c^{C})(\dot{w}_c + \dot{N}_c)},$$

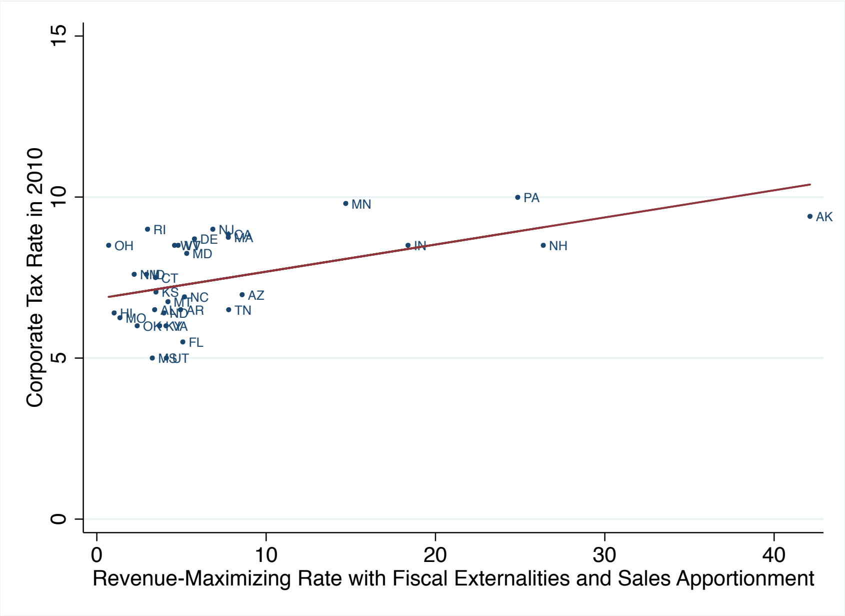
3. Depends on size of location (e.g. states versus cities). It is likely that more local $\Rightarrow$ smaller σ^F $\Rightarrow$ smaller t^*

4. Depends on policy design: source based versus destination based

Corporate Rates vs Revmax Rate w/ Fiscal Externalities



Rates, Fiscal Externalities, and Apportionment



Revenue-Maximizing Corporate Tax Rates

State	Sales Apport. Weight θ_s^x	Corporate Tax Rate τ_s	Revenue Max. Corp. Rate τ_s^*	τ_s^{**}	$\tau_s^{**}/(1-\theta_s^x)$
Kansas	33	7.1	30.6	2.2	3.4
Indiana	90	8.5	32.9	1.8	17.7
U.S. Avg	66.1	6.7	31.9	2.8	7.1
U.S. Med	50.0	7.1	31.5	2.1	4.4
U.S. Min	33.3	0.0	28.6	0.3	0.7
U.S. Max	100.0	12.0	36.8	24.1	36.1

Conclusion

Conventional view: corporate taxation in an open economy hurts workers since "shareholders can take their companies and run"

1. New Measure of Local Business Taxes
2. New Reduced Form-Effects
3. New Tractable Spatial Equilibrium Framework with Firms

New Assessment: in terms of equity and efficiency, corporate taxation in an open economy may not be as bad as we thought

APPENDIX

Incidence Estimates Accounting for Government Spending

	(1)	(2)	(3)	(4)
Assumptions for Analysis				
Value of Government Services	N	Y	N	Y
Value for Infrastructure	N	N	Y	Y
Change in Funds	None	Services	Infrastructure	Proportional
Incidence				
Landowners	0.32	0.32	0.32	0.32
Firm Owners	0.81	0.81	0.71	0.8
Workers	0.68	0.25	0.68	0.29
Share of Incidence				
Landowners	18%	23%	19%	23%
Firm Owners	45%	59%	41%	57%
Workers	38%	18%	40%	21%