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

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Oxford University Centre for Business Taxation, Academic symposium

June 24, 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 excess profits, they cannot bear incidence

2. Firms are **perfectly mobile**
   - Every firm is marginal in their location decisions
We relax two crucial assumptions

1. Firms are **perfectly competitive**
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2. Firms are **perfectly mobile**
   - Every firm is marginal in their location decisions

Allow for **monopolistically competitive & heterogeneously productive firms**
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

- Workers
- Firm Owners
- Landowners
Who Benefits from State Corporate Tax Cuts?

Our Estimate
- Workers
- Firm Owners
- Landowners

Standard Model
- Workers
1. Reduced-form effects of corporate tax cuts
   - Implement state apportionment system using establishment data
   - Establishment growth increases by roughly 3.5% following a 1% corporate tax cut

2. Develop spatial equilibrium model with firms
   - Allow workers, firm owners, landowners to bear incidence
   - Map reduced-form effects to parameters governing welfare

3. Structural estimates and incidence
   - Minimize distance between reduced-form expressions and estimates
   - Evaluate consequences for equity & efficiency of corporate tax policy
Business Taxes & Establishment Growth

Specification

\[ \ln E_{c,t} - \ln E_{c,t-10} = \beta \left[ \ln(1 - \tau_{c,t}^b) - \ln(1 - \tau_{c,t-10}^b) \right] + D_{s,t}' \Psi_{s,t} + u_{c,t} \]

- LHS: Establishment Growth
- RHS: Growth in net-of-business tax rate
- \( D_{s,t} \) 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

<table>
<thead>
<tr>
<th>Establishment Growth</th>
<th>(1)</th>
<th>(2)</th>
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<th>(4)</th>
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<tbody>
<tr>
<td>Δ ln Net-of-Business-Tax Rate</td>
<td>4.07**</td>
<td>4.14**</td>
<td>4.06**</td>
<td>3.35**</td>
<td>3.91**</td>
<td>3.24**</td>
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<td></td>
<td>(1.82)</td>
<td>(1.80)</td>
<td>(1.83)</td>
<td>(1.43)</td>
<td>(1.78)</td>
<td>(1.41)</td>
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<td>Δ State ITC</td>
<td>-0.46</td>
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<td>(0.32)</td>
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<td>Δ ln Gov. Expend./Capita</td>
<td>-0.01</td>
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<tr>
<td>Bartik</td>
<td></td>
<td>0.59***</td>
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<td>0.57***</td>
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<td>Change in Other States' Taxes</td>
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<td>-4.66***</td>
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<td>(1.60)</td>
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<td>(1.43)</td>
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<tr>
<td>Fixed Effects</td>
<td>Year</td>
<td>Year</td>
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<td>Observations</td>
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<td>R-squared</td>
<td>0.472</td>
<td>0.475</td>
<td>0.472</td>
<td>0.491</td>
<td>0.481</td>
<td>0.500</td>
</tr>
</tbody>
</table>

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

- F-test all leads are 0 has p-value = 0.92
- F-test all lags are 0 has p-value = 0.036

Cumulative Effect no leads
Cumulative Effect w/ leads
Long Difference Point Estimate
95% Confidence Interval

F-test all leads are 0 has p-value = 0.92
F-test all lags are 0 has p-value = 0.036

Year
Percent

Cumulative Effect no leads
Cumulative Effect w/ leads
Long Difference Point Estimate
95% Confidence Interval
Model
A Spatial Equilibrium Model with Firms: Overview

1. **Worker Location, Labor Supply**

2. **Housing Market**
   Kline (2010), Notowidigdo (2012)

3. **Firm Location and Labor Demand**

4. **Results**: Incidence \( \dot{w}(\theta), \dot{\pi}(\theta), \dot{r}(\theta) \)
   - \( \varepsilon^{LS}(\theta) \) and \( \varepsilon^{LD}(\theta) \), and \( b(\theta) \)
Equilibrium in the Local Labor Market
Equilibrium in the Local Labor Market

\[ \dot{w} = \frac{\partial \ln D}{\partial \ln (1 - \tau)} \left( \frac{\partial \ln D}{\partial \ln (1 - \tau)} \right) \]

\[ \tau \text{ cut} \]

\[ w^* \]

\[ w_0 \]
Model Setup

1. **Geography:** Small open economy $c$

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
Local Labor Supply

**Location choice:** Workers choose location with max utility:

\[
\max_c a_0 + \ln w_c - \alpha \ln r_c + \bar{A}_c + \xi_{nc}. \\
\equiv u_c
\]
Local Labor Supply

**Location choice:** Workers choose location with max utility:

$$\max_c \left[ a_0 + \ln w_c - \alpha \ln r_c + \bar{A}_c + \xi_{nc} \right] \equiv u_c$$

**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:

$$\max_c (a_0 + \ln w_c - \alpha \ln r_c + \bar{A}_c + \xi_{nc}) \equiv u_c$$

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: $\sigma_W$, dispersion of idiosyncratic preferences $\xi_{nc}$
Establishment Production

The diagram illustrates the relationship between price ($\, P_0$) and quantity (\, $y$) with marginal cost ($\, MC_0$) and marginal revenue ($\, MR$) curves. The shaded area represents the profit maximization point where $P_0$ intersects $MC_0$. The demand curve ($\, D$) is also depicted.
Demand for variety $j$ is $y_{jc} = l \left( \frac{p_{jc}}{\bar{P}} \right)^{\epsilon^{PD}}$.
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:

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

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

Firm Value Function

$$V_{jc}^F = \frac{\ln(1 - \tau_s^b)}{-(\varepsilon_{PD} + 1)} - \gamma \ln w_c - \delta \ln \rho + \bar{B}_c + \zeta_{jc}$$

$$\equiv v_c$$
Fraction of Establishments:

\[ E_c = P \left( V_{jc}^F = \max_{c'} \{ V_{jc'}^F \} \right) = \frac{\exp \frac{v_c}{\sigma^F}}{\sum_{c'} \exp \frac{v_{c'}}{\sigma^F}} \]
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 \( \sigma^F \)
- Larger \( \sigma^F \) 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:

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

More elastic $\varepsilon^{LD}$ when:

- Higher output elasticity of labor $\gamma$
- Higher product demand elasticity $\epsilon^{PD}$
- Lower productivity dispersion $\sigma^F$ (i.e. firms more mobile)
Let $\dot{w}_c(\theta) \equiv \frac{\partial \ln w_c}{\partial \ln (1-\tau^b)}$. Incidence on wages is:

$$
\dot{w}_c(\theta) = \left( \frac{1 + \eta_c - \alpha}{\sigma^W (1 + \eta_c) + \alpha} \right) - \sigma^F \left( \mu - 1 \right) \gamma \left( \epsilon^{PD} + 1 - \frac{1}{\sigma^F} \right) + 1
$$

Smaller wage increase if:

1. Productivity Dispersion $\sigma^F$ is large (i.e. immobile firms)

2. Preferences Dispersion $\sigma^W$ is small (i.e. mobile people)

3. Any other reason why $\epsilon^{LS}$ and $|\epsilon^{LD}|$ are large
Result: Local Incidence of State Corporate Taxes

Rental Costs: \[ \dot{r}_c(\theta) = \left( \frac{1 + \epsilon^{LS}}{1 + \eta_c} \right) \hat{w}_c \]

- Smaller rent increases if housing supply is very elastic

Firm Profits:

\[ \dot{\pi}_c(\theta) = 1 - \delta(\epsilon^{PD} + 1) + \gamma(\epsilon^{PD} + 1)\hat{w}_c \]

- Reducing Capital Wedge
- Higher Labor Costs

- Mechanical effects vs. higher production costs
Local Incidence of Corporate Tax Cut

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Benefit</th>
<th>Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workers</td>
<td>Disposable Income</td>
<td>$\dot{w}_c - \alpha \dot{r}_c$</td>
</tr>
<tr>
<td>Landowners</td>
<td>Housing Costs</td>
<td>$\dot{r}_c$</td>
</tr>
<tr>
<td>Firm Owners</td>
<td>After-tax Profit</td>
<td>$1 - \delta (\varepsilon^{PD} + 1) + \gamma (\varepsilon^{PD} + 1) \dot{w}_c$</td>
</tr>
</tbody>
</table>
Empirical Implementation of Model
4 Reduced-Form Equations of the Model

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

\[
\Delta \ln E_{c,t} = \left( \frac{1}{-\sigma^F(\epsilon^{PD} + 1)} - \frac{\gamma}{\sigma^F} \dot{w}(\theta) \right) \Delta \ln(1 - \tau_{c,t}^b) + \phi^1_t + u^1_{c,t}
\]

\[
\beta^E
\]

\[
\Delta \ln N_{c,t} = \left( \epsilon^{LS} \dot{w}(\theta) \right) \Delta \ln(1 - \tau_{c,t}^b) + \phi^2_t + u^2_{c,t}
\]

\[
\beta^N
\]

\[
\Delta \ln w_{c,t} = \left( \dot{w}(\theta) \right) \Delta \ln(1 - \tau_{c,t}^b) + \phi^3_t + u^3_{c,t}
\]

\[
\beta^W
\]

\[
\Delta \ln r_{c,t} = \left( \frac{1 + \epsilon^{LS}}{1 + \eta_c} \dot{w}(\theta) \right) \Delta \ln(1 - \tau_{c,t}^b) + \phi^4_t + u^4_{c,t}
\]

\[
\beta^R
\]
<table>
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<tr>
<th>Calibrated Parameters</th>
<th>Incidence</th>
<th>Shares of Incidence</th>
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<tr>
<td></td>
<td>(1) Tax Only</td>
<td>(2) Tax &amp; Bartik</td>
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<tr>
<td>Output Elasticity $\gamma$</td>
<td>0.15</td>
<td>0.15</td>
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<tr>
<td>Elasticity of Product Demand $\varepsilon^{PD}$</td>
<td>-2.500</td>
<td>-2.500</td>
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**Estimates**

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<tbody>
<tr>
<td>Wages $\dot{w}$</td>
<td>1.438*</td>
<td>1.211**</td>
<td>1.004</td>
<td>0.371</td>
<td>0.273</td>
<td>0.230</td>
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<tr>
<td></td>
<td>(0.798)</td>
<td>(0.592)</td>
<td>(0.708)</td>
<td>(0.251)</td>
<td>(0.338)</td>
<td>(0.463)</td>
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<tr>
<td>Landowners $\dot{r}$</td>
<td>1.159</td>
<td>0.724</td>
<td>0.523</td>
<td>0.371</td>
<td>0.273</td>
<td>0.230</td>
</tr>
<tr>
<td></td>
<td>(1.329)</td>
<td>(1.241)</td>
<td>(1.298)</td>
<td>(0.251)</td>
<td>(0.338)</td>
<td>(0.463)</td>
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<tr>
<td>Workers $\dot{w} - \alpha \dot{r}$</td>
<td>1.090**</td>
<td>0.994***</td>
<td>0.847**</td>
<td>0.348***</td>
<td>0.375***</td>
<td>0.372**</td>
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<tr>
<td></td>
<td>(0.476)</td>
<td>(0.316)</td>
<td>(0.419)</td>
<td>(0.105)</td>
<td>(0.145)</td>
<td>(0.152)</td>
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<tr>
<td>Firm Owners $\dot{\pi}$</td>
<td>0.879***</td>
<td>0.930***</td>
<td>0.908*</td>
<td>0.281</td>
<td>0.351</td>
<td>0.399</td>
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<td></td>
<td>(0.180)</td>
<td>(0.133)</td>
<td>(0.512)</td>
<td>(0.191)</td>
<td>(0.220)</td>
<td>(0.405)</td>
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</tbody>
</table>
**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
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**New Assessment:** in terms of equity and efficiency, corporate taxation in an open economy may not be as bad as we thought
### Identification of Local Incidence on Welfare

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<td>Housing Costs</td>
<td>$\hat{\beta}^R$</td>
</tr>
<tr>
<td>Firm Owners</td>
<td>After-tax Profit</td>
<td>$1 + \left(\frac{\hat{\beta}^N - \hat{\beta}^E}{\hat{\beta}^W} + 1\right) (\hat{\beta}^W - \frac{\delta}{\gamma})$</td>
</tr>
</tbody>
</table>

Note that $\left(\frac{\beta^N - \beta^E}{\beta^W} + 1\right) = \gamma (\varepsilon^{PD} + 1)$
Q: If businesses aren’t that responsive, then why do we observe low state corporate taxes?
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
If states wanted to maximize corporate tax revenues, the maximal tax rate would be:

\[ \tau^*_c = \frac{1}{\dot{\pi}_c + \dot{E}_c} \]
Revenue-Maximizing Corporate Tax Rate

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

\[ \tau_c^* = \frac{1}{\dot{\pi}_c + \dot{E}_c} \]

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

\[ \tau_{c}^{**} = \frac{1}{\dot{\pi}_c + \dot{E}_c + (\text{revshare}_{c}^{\text{pers}}/\text{revshare}_{c}^{C})(\dot{w}_c + \dot{N}_c)}, \]

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

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

\[
Bartik_{c,t} = \sum_{Ind} \text{EmpShare}_{Ind,t-1,c} \times \Delta \text{Emp}_{Ind,t,National}
\]
Three Types of Firm Taxes

1. Partnership and S-corps: $\tau^{INC}$ personal income tax rate
   - Synthetic changes as in Zidar (2013) using NBER’s TAXSIM

2. Single-state C-corps: $\tau^C$ corporate income tax rate
   - Digitized corporate tax rates from “Book of the States”

3. Multi-state C-corps: $\tau^A$ apportioned corporate income tax rate
   - Depends on corporate rate, apportionment, and activity weights

\[
\tau^A_i = \sum_s \tau^C_s \omega_{is}
\]

where \( \omega_{is} = \left( \theta^w_s \frac{W_{is}}{W} \right) + \left( \theta^p_s \frac{R_{is}}{R} \right) + \left( \theta^x_s \frac{X_{is}}{X} \right) \)

- payroll
- property
- sales
Nike Apportionment Example
Nike Apportionment Example

\[ \tau^c_{IL}, (\theta^W_{IL}, \theta^\rho_{IL}, \theta^X_{IL}) \]

\[ \tau^c_{OR}, (\theta^W_{OR}, \theta^\rho_{OR}, \theta^X_{OR}) \]

\[ \tau^c_{AL}, (\theta^W_{AL}, \theta^\rho_{AL}, \theta^X_{AL}) \]
Suppose Nike earns $2 M of profit in every state
Their tax liability differs based on how profits are apportioned
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

<table>
<thead>
<tr>
<th>State</th>
<th>I. Using Payroll</th>
<th>II. Using Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>OR</td>
<td>80</td>
<td>2</td>
</tr>
<tr>
<td>IL</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>AL</td>
<td>10</td>
<td>2</td>
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Suppose Nike earns $2 M of profit in every state. Their tax liability differs based on how profits are apportioned.

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<tr>
<td></td>
<td>Apportioned Profit ($M)</td>
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</tr>
<tr>
<td>OR</td>
<td>80</td>
<td>2</td>
</tr>
<tr>
<td>IL</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>AL</td>
<td>10</td>
<td>2</td>
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<tr>
<th></th>
<th>Corporate Tax Liability ($M)</th>
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<tbody>
<tr>
<td>OR with $\tau_{OR} = 50%$</td>
<td>40</td>
<td>1</td>
</tr>
<tr>
<td>IL with $\tau_{IL} = 10%$</td>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td>AL with $\tau_{AL} = 0%$</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Total Tax Liability ($M) 41 3
Graphs by State
Number of Corporate Tax Rate Changes by Region: ’77–’12
Gradual Shift Towards Sales Apportionment

The graph illustrates a gradual increase in average sales weight over the years from 1980 to 2010.
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 $\omega_{is} = \left( \theta_s^w \frac{W_{is}}{W} \right) + \left( \theta_s^\rho \frac{R_{is}}{R} \right) + \left( \theta_s^x \frac{X_{is}}{X} \right)$

- Use RefUSA data to construct $\omega_{is}$ for each firm $i$
- Take average of all local establishments to obtain $\bar{\tau}^A$
Use data on shares of establishments to calculate the average business tax in a conpsuma:

\[
\Delta \ln(1 - \tau^b)_{c,t} \equiv f_{c,t}^{SC} \Delta \ln(1 - \tau^c)_{c,t} + f_{c,t}^{MC} \Delta \ln(1 - \bar{\tau}^A)_{c,t} + f_{c,t}^{P} \Delta \ln(1 - \tau^{INC})_{c,t}
\]

Corporate

Personal

Calculate shares \( f_{c,t}^{SC} \), \( f_{c,t}^{MC} \), \( f_{c,t}^{P} \) using County Business Patterns and RefUSA data.
Household Problem

\[
\max_{h, X} \begin{cases} 
\ln A & \text{amenities} \\
\alpha \ln h & \text{housing} \\
(1 - \alpha) \ln X & \text{composite good}
\end{cases} 
+ \alpha \ln h + (1 - \alpha) \ln X 
\quad \text{s.t.} \quad rh + \int_{j \in J} p_j x_j dj = w
\]

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

\[
\begin{align*}
\max_{h,X} & \quad \ln A_{\text{amenities}} + \alpha \ln h + (1 - \alpha) \ln X \\
& \quad \text{s.t. } rh + \int_{j \in J} p_j x_j \, dj = w
\end{align*}
\]

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

Indirect Utility of a Worker:

\[
V_{nc}^W = a_0 + \ln w_c - \alpha \ln r_c + \ln A_{nc}
\]

\[
\text{Disposable income } A_{\text{amenities}} \equiv \bar{A}_c + \xi_{nc}
\]
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:

\[
\ln r_c = \frac{1}{1 + \eta_c} \left( \ln N_c + \ln w_c \right) + C_1
\]

Key Parameter: \( \eta_c \) elasticity of housing supply
Establishment Equation:

\[
\Delta \ln E_{c,t} = \left( \frac{1}{-\sigma^F (\varepsilon^{PD} + 1)} - \frac{\gamma}{\sigma^F} \dot{w}(\theta) \right) \Delta \ln(1 - \tau_{c,t}^b) + \phi^1_t + u^1_{c,t}
\]
Establishment Equation:

\[
\Delta \ln E_{c,t} = \left( \frac{1}{-\sigma^F(\epsilon^{PD} + 1)} - \frac{\gamma}{\sigma^F} \dot{w}(\theta) \right) \Delta \ln(1 - \tau_{c,t}^b) + \phi_t^1 + u_{c,t}^1
\]

Business tax changes have two effects on establishment location decisions:

1. Lower taxes attract establishments \( \frac{1}{-\sigma^F(\epsilon^{PD} + 1)} > 0 \)
2. More establishments bid up wages \( \frac{\gamma}{\sigma^F} \dot{w}(\theta) > 0 \)

Implication:

- Bivariate OLS estimate on taxes \( \beta^E \neq \frac{1}{-\sigma^F(\epsilon^{PD} + 1)} \).
Given parameters \((\sigma^W, \eta, \gamma, \varepsilon^{PD})\) and \(\hat{\beta}^E\), estimate \(\sigma^F\)

\[
\sigma_{CMD}^F = 0.1^{**} (0.06)
\]

\[
\sigma_{OLS}^F = 0.331^{***} (0.17)
\]
1. **Reduced Form**: Estimate reduced form $\hat{b}$ and covariance $\hat{V}$
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2. **Recover Structural Parameters via Classical Minimum Distance:**

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

**Results:**

<table>
<thead>
<tr>
<th>Establishments Population Wage Rent Business Tax</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predicted Moments</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>4.084</td>
</tr>
<tr>
<td>2.323</td>
</tr>
<tr>
<td>1.438</td>
</tr>
<tr>
<td>1.159</td>
</tr>
</tbody>
</table>

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<tr>
<th>Empirical Moments</th>
<th>4.074**</th>
<th>2.331</th>
<th>1.451</th>
<th>1.172</th>
</tr>
</thead>
</table>

(1.80) (1.46) (0.94) (1.42)

$\chi^2$ (1) Stat 0.001

$\chi^2$ P-Value 0.979
1. **Reduced Form:** Estimate reduced form \( \hat{b} \) and covariance \( \hat{V} \)

2. **Recover Structural Parameters via Classical Minimum Distance:**

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

**Results:**

<table>
<thead>
<tr>
<th>Business</th>
<th>Establishments</th>
<th>Population</th>
<th>Wage</th>
<th>Rent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tax</td>
<td>4.084</td>
<td>2.323</td>
<td>1.438</td>
<td>1.159</td>
</tr>
<tr>
<td>Predicted Moments</td>
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\[ \chi^2(1) \text{ Stat} \quad 0.001 \quad \chi^2 \text{ P-Value} \quad 0.979 \]
Enhancing precision with supplemental LD shocks

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

\[ \Delta \ln E_{c,t} = b_1 \Delta \ln (1 - \tau_{c,t}^b) + b_5 \text{Bartik}_{c,t} + \phi_1 + \tilde{u}_1^{c,t} \]
\[ \Delta \ln N_{c,t} = b_2 \Delta \ln (1 - \tau_{c,t}^b) + b_6 \text{Bartik}_{c,t} + \phi_2 + \tilde{u}_2^{c,t} \]
\[ \Delta \ln w_{c,t} = b_3 \Delta \ln (1 - \tau_{c,t}^b) + b_7 \text{Bartik}_{c,t} + \phi_3 + \tilde{u}_3^{c,t} \]
\[ \Delta \ln r_{c,t} = b_4 \Delta \ln (1 - \tau_{c,t}^b) + b_8 \text{Bartik}_{c,t} + \phi_4 + \tilde{u}_4^{c,t} \]
### 8 Moments from Tax and Bartik Shocks

<table>
<thead>
<tr>
<th></th>
<th>Establishments</th>
<th>Population</th>
<th>Wage</th>
<th>Rent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Business Tax</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Predicted Moments</td>
<td>2.783</td>
<td>1.300</td>
<td>1.211</td>
<td>0.724</td>
</tr>
<tr>
<td>Empirical Moments</td>
<td><strong>3.354</strong>**</td>
<td>1.743</td>
<td>0.777</td>
<td>0.323</td>
</tr>
<tr>
<td></td>
<td>(1.41)</td>
<td>(1.27)</td>
<td>(0.83)</td>
<td>(1.35)</td>
</tr>
<tr>
<td><strong>Bartik</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Predicted Moments</td>
<td>0.542</td>
<td>0.453</td>
<td>0.568</td>
<td>0.740</td>
</tr>
<tr>
<td>Empirical Moments</td>
<td><strong>0.595</strong>***</td>
<td><strong>0.445</strong>**</td>
<td><strong>0.557</strong>***</td>
<td><strong>0.702</strong>***</td>
</tr>
<tr>
<td></td>
<td>(0.19)</td>
<td>(0.18)</td>
<td>(0.08)</td>
<td>(0.27)</td>
</tr>
<tr>
<td>$\chi^2(2)$ Stat</td>
<td>0.569</td>
<td>$\chi^2$ P-Value</td>
<td>0.752</td>
<td></td>
</tr>
</tbody>
</table>

Note: $\hat{\sigma}^F = 0.17^{*}(0.10)$, $\hat{\sigma}^W = 0.77^{**}(0.31)$, $\hat{\eta} = 2.47(5.10)$
## Estimates of Economic Incidence

<table>
<thead>
<tr>
<th>Calibrated Parameters</th>
<th>Incidence (1) Tax Only</th>
<th>Incidence (2) Tax &amp; Bartik</th>
<th>Incidence (3)</th>
<th>Shares of Incidence (4) Tax Only</th>
<th>Shares of Incidence (5) Tax &amp; Bartik</th>
<th>Shares of Incidence (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Elasticity $\gamma$</td>
<td>0.15</td>
<td>0.15</td>
<td>0.15</td>
<td>0.15</td>
<td>0.15</td>
<td>0.15</td>
</tr>
<tr>
<td>Elasticity of Product Demand $\varepsilon^{PD}$</td>
<td>-2.500</td>
<td>-2.500</td>
<td>-6.852</td>
<td>-2.500</td>
<td>-2.500</td>
<td>-6.852</td>
</tr>
</tbody>
</table>

### Estimates

<table>
<thead>
<tr>
<th>Category</th>
<th>Estimate (1)</th>
<th>Estimate (2)</th>
<th>Estimate (3)</th>
<th>Estimate (4)</th>
<th>Estimate (5)</th>
<th>Estimate (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wages $\dot{w}$</td>
<td>1.438* (0.798)</td>
<td>1.211** (0.592)</td>
<td>1.004 (0.708)</td>
<td>0.371 (0.251)</td>
<td>0.273 (0.338)</td>
<td>0.230 (0.463)</td>
</tr>
<tr>
<td>Landowners $\dot{r}$</td>
<td>1.159 (1.329)</td>
<td>0.724 (1.241)</td>
<td>0.523 (1.298)</td>
<td>0.371 (0.251)</td>
<td>0.273 (0.338)</td>
<td>0.230 (0.463)</td>
</tr>
<tr>
<td>Workers $\dot{w} - \alpha \dot{r}$</td>
<td>1.090** (0.476)</td>
<td>0.994*** (0.316)</td>
<td>0.847** (0.419)</td>
<td>0.348*** (0.105)</td>
<td>0.375*** (0.145)</td>
<td>0.372** (0.152)</td>
</tr>
<tr>
<td>Firm Owners $\dot{\pi}$</td>
<td>0.879*** (0.180)</td>
<td>0.930*** (0.133)</td>
<td>0.908* (0.512)</td>
<td>0.281 (0.191)</td>
<td>0.351 (0.220)</td>
<td>0.399 (0.405)</td>
</tr>
</tbody>
</table>
Firm Owner’s Share of Incidence for Calibrated Values of $\gamma$ and $\varepsilon^{PD}$

Output Elasticity of Labor: $\gamma$

Elasticity of Product Demand: $\varepsilon^{PD}$

* Baseline

Share to Firm Owners
Shares of Incidence for Calibrated Values of $\gamma$ and Estimated $\varepsilon^{PD}$
Corporate Rates vs Revmax Rate w/ Fiscal Externalities

Corporate Tax Rate in 2010 vs Revenue-Maximizing Rate with Fiscal Externalities
Rates, Fiscal Externalities, and Apportionment

Corporate Tax Rate in 2010 vs. Revenue-Maximizing Rate with Fiscal Externalities and Sales Apportionment

- States represented on the graph include: AL, AK, AZ, AR, CA, CT, DE, FL, HI, ID, IN, KS, KY, MD, MA, MN, MS, MO, MT, NH, NJ, NM, NC, ND, OH, OK, PA, RI, TN, UT, VT, VA, WV.
### Revenue-Maximizing Corporate Tax Rates

<table>
<thead>
<tr>
<th>State</th>
<th>Sales Apport. Weight $\theta_s^x$</th>
<th>Corporate Tax Rate $\tau_s$</th>
<th>Revenue Max. Corp. Rate $\tau_s^*$</th>
<th>$\tau_s^{**}$</th>
<th>$\tau_s^{**}/(1 - \theta_s^x)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kansas</td>
<td>33</td>
<td>7.1</td>
<td>36.9</td>
<td>2.3</td>
<td>3.5</td>
</tr>
<tr>
<td>Indiana</td>
<td>90</td>
<td>8.5</td>
<td>40.3</td>
<td>1.8</td>
<td>18.4</td>
</tr>
<tr>
<td>U.S. Avg</td>
<td>66.1</td>
<td>6.7</td>
<td>38.8</td>
<td>3.0</td>
<td>7.5</td>
</tr>
<tr>
<td>U.S. Med</td>
<td>50.0</td>
<td>7.1</td>
<td>38.3</td>
<td>2.2</td>
<td>4.6</td>
</tr>
<tr>
<td>U.S. Min</td>
<td>33.3</td>
<td>0.0</td>
<td>33.8</td>
<td>0.3</td>
<td>0.7</td>
</tr>
<tr>
<td>U.S. Max</td>
<td>100.0</td>
<td>12.0</td>
<td>46.6</td>
<td>28.1</td>
<td>42.1</td>
</tr>
</tbody>
</table>