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

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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 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**
   - 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**
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

- Landowners
- Firm Owners
- Workers

Standard Model

Workers
Context and Challenges

- **Empirical:** 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. 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
Broader Contribution: Local Labor Markets with Firms

- Last few years - important **link between workers and location**

- 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. Data and Reduced-Form Analysis of Business Location
2. Model
3. Model-based Parameter Estimates
4. Welfare Consequences & Policy Implications
5. Conclusion
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: $\tau^{INC}$ 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

\[ \tau_{IL}^c, (\theta_{IL}^W, \theta_{IL}^\rho, \theta_{IL}^X) \]

\[ \tau_{OR}^c, (\theta_{OR}^W, \theta_{OR}^\rho, \theta_{OR}^X) \]

\[ \tau_{AL}^c, (\theta_{AL}^W, \theta_{AL}^\rho, \theta_{AL}^X) \]
Suppose Nike earns $2 M of profit in every state
Their tax liability differs based on how profits are apportioned
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>
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</tbody>
</table>

Corporate Tax Liability ($M) = 41
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>
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<tbody>
<tr>
<td></td>
<td>Apportioned Profit ($M)</td>
<td></td>
</tr>
<tr>
<td>OR</td>
<td>80</td>
<td>2</td>
</tr>
<tr>
<td>IL</td>
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<td>AL</td>
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</table>

<table>
<thead>
<tr>
<th>Corporate Tax Liability ($M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OR with $\tau_{OR}^c = 50%$</td>
</tr>
<tr>
<td>IL with $\tau_{IL}^c = 10%$</td>
</tr>
<tr>
<td>AL with $\tau_{AL}^c = 0%$</td>
</tr>
</tbody>
</table>

**Total Tax Liability ($M)**

|             | 41 | 3 |
Gradual Shift Towards Sales Apportionment

Average Sales Weight

Year

1980 1990 2000 2010
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 $\omega_{is} = \left( \theta_s^w \frac{W_{is}}{W} \right) + \left( \theta_s^\rho \frac{R_{is}}{R} \right) + \left( \theta_s^x \frac{X_{is}}{X} \right)$

- Use RefUSA data to construct $\omega_{is}$ for each firm $i$
- Take average of all local establishments to obtain $\bar{\tau}^A$
Average Business Tax Rate

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

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

- Corporate

- Personal

- Calculate shares \( f_{c,t}^{SC}, f_{c,t}^{MC}, f_{c,t}^{P} \) using County Business Patterns and RefUSA data
Reduced-form Effects on Business Location
Business Taxes & Establishment Growth

Specification

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

- **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>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<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>
</tr>
<tr>
<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>
</tr>
<tr>
<td>Δ State ITC</td>
<td>-0.46</td>
<td>-0.17</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.32)</td>
<td>(0.30)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Δ ln Gov. Expend./Capita</td>
<td>-0.01</td>
<td></td>
<td>-0.01</td>
<td></td>
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<td></td>
<td>(0.01)</td>
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<td>(0.01)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Bartik</td>
<td></td>
<td></td>
<td></td>
<td>0.59***</td>
<td>0.57***</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.19)</td>
<td>(0.18)</td>
<td></td>
</tr>
<tr>
<td>Change in Other States’ Taxes</td>
<td>-4.66***</td>
<td>-4.18***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.60)</td>
<td>(1.43)</td>
<td></td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Fixed Effects</th>
<th>Year</th>
<th>Year</th>
<th>Year</th>
<th>Year</th>
<th>Year</th>
<th>Year</th>
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<tbody>
<tr>
<td>Observations</td>
<td>1,470</td>
<td>1,470</td>
<td>1,470</td>
<td>1,470</td>
<td>1,470</td>
<td>1,470</td>
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<tr>
<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
Annual Establishment Growth and Business Taxes

**Specification**

\[
\ln E_{c,t} - \ln E_{c,t-1} = \sum_{h=h}^{\bar{h}} \beta_h [\ln(1 - \tau_{c,t-h}^b) - \ln(1 - \tau_{c,t-1-h}^b)] + D'_{s,t} \Psi_{s,t} + e_{c,t}
\]

**Cumulative Effects**

<table>
<thead>
<tr>
<th>Year</th>
<th>Net-of-Tax Change</th>
<th>Cumulative Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>0.01</td>
<td>( \beta_0 )</td>
</tr>
<tr>
<td>2001</td>
<td>0</td>
<td>( \beta_0 + \beta_1 )</td>
</tr>
<tr>
<td>2002</td>
<td>0</td>
<td>( \beta_0 + \beta_1 + \beta_2 )</td>
</tr>
<tr>
<td>2003</td>
<td>0</td>
<td>( \beta_0 + \beta_1 + \beta_2 + \beta_3 )</td>
</tr>
</tbody>
</table>
## Cumulative Effects of Business Tax Cuts on Est. Growth

### Different (Lead,Lag) Combinations

<table>
<thead>
<tr>
<th>Establishment Growth</th>
<th>(0,5)</th>
<th>(2,5)</th>
<th>(5,5)</th>
<th>(0,10)</th>
<th>(2,10)</th>
<th>(5,10)</th>
<th>(10,10)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cumulative Effect over 5 Years</strong></td>
<td>1.51**</td>
<td>1.80*</td>
<td>1.59</td>
<td>1.77*</td>
<td>2.38</td>
<td>2.39</td>
<td>2.34</td>
</tr>
<tr>
<td></td>
<td>(0.75)</td>
<td>(1.02)</td>
<td>(1.14)</td>
<td>(1.03)</td>
<td>(1.58)</td>
<td>(1.72)</td>
<td>(2.10)</td>
</tr>
<tr>
<td><strong>Cumulative Effect over 10 Years</strong></td>
<td></td>
<td></td>
<td></td>
<td>2.79*</td>
<td>3.49</td>
<td>3.49</td>
<td>3.70</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(1.51)</td>
<td>(2.27)</td>
<td>(2.36)</td>
<td>(2.81)</td>
</tr>
<tr>
<td><strong>P-value of All Lags=0:</strong></td>
<td>0.003</td>
<td>0.012</td>
<td>0.051</td>
<td>0.000</td>
<td>0.002</td>
<td>0.037</td>
<td>0.036</td>
</tr>
<tr>
<td><strong>P-value of All Leads=0:</strong></td>
<td>0.74</td>
<td>0.40</td>
<td>0.66</td>
<td>0.46</td>
<td>0.92</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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
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)

A Spatial Equilibrium Model with Firms: Outline

1. Setup

2. Worker Location, Labor Supply

3. Housing Market
   Kline (2010), Notowidigdo (2012)

4. Firm Location and Labor Demand

5. 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

The diagram illustrates the equilibrium in the local labor market with the following components:

- The vertical axis represents the wage level ($w$).
- The horizontal axis represents the quantity of labor ($L$).
- The supply curve is labeled $S_0(w)$.
- The demand curve is labeled $D_0(w)$.
- The equilibrium wage is denoted as $w_0$.
- The equilibrium quantity of labor is denoted as $L_0$. 

The diagram shows the intersection of the supply and demand curves at the equilibrium point $(w_0, L_0)$, indicating the market-clearing wage and quantity of labor.
Equilibrium in the Local Labor Market
Equilibrium in the Local Labor Market

\[ \dot{w} = \frac{\frac{\partial \ln D}{\partial \ln (1-\tau)}}{\varepsilon^{LS} - \varepsilon^{LD}} \]

- \( S_0(w) \)
- \( D_0(w) \)
- \( D_1(w) \)
- \( w_0 \)
- \( w^* \)
- \( L_0 \)
- \( L^* \)
- \( L_1 \)
- \( \tau \) cut
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:**
   - Monopolististically 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
\[
\max_{h,X} \left\{ \ln A + \alpha \ln h + (1 - \alpha) \ln X \right\} \quad \text{amenities} \quad \text{housing} \quad \text{composite good}
\]
\[
s.t. \quad rh + \int_{j \in J} p_j x_j dj = w
\]

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

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

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

Indirect Utility of a Worker:

\[
V_{nc}^W = a_0 + \ln w_c - \alpha \ln r_c + \ln A_{nc} \equiv \bar{A}_c + \xi_{nc}
\]

Disposable income

Amenities
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 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:

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

Key Parameter: \( \sigma^W \), dispersion of idiosyncratic preferences \( \xi_{nc} \).
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:**

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

(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 \(\xi_{nc}\)
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:

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

Key Parameter: \( \eta_c \) 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** $\sigma^W$
     Higher $\sigma^W$ means smaller inflows of people following wage increases
  2. **Housing Supply Elasticity** $\eta_c$
     Lower $\eta_c$ means rents get bid up more when people move in

Higher $\sigma^W$ and lower $\eta_c$ make $\varepsilon^{LS}$ smaller, so LS is more vertical
Objectives of the demand side of the model are:

1. **Allow for economic profits**
   Driven by monopolistically competitive, heterogeneously productive firms

2. **Allow for firm mobility to compete away profits**
   Mobility driven by heterogeneous idiosyncratic location-specific productivities

3. **Capture realism of state corporate system (in paper)**
   Apportionment formulas affect marginal factor costs and labor demand
Demand for variety $j$ is $y_{jc} = I \left( \frac{p_{jc}}{P} \right)^{\varepsilon^{PD}}$
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

$$y_{jc} = B_{jc} I_{jc}^{\gamma} k_{jc}^\delta M_{jc}^{1-\gamma-\delta}$$

$$\equiv \bar{B}_c + \zeta_{jc}$$
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

\[
y_{jc} = B_{jc} I_{jc}^{\gamma} k_{jc}^{\delta} M_{jc}^{1-\gamma-\delta} \equiv B_c + \zeta_{jc}
\]

Firm Value Function

\[
V_{jc}^F = \frac{\ln(1 - \tau_s^b)}{-(\varepsilon_{PD} + 1)} - \gamma \ln w_c - \delta \ln \rho + B_c + \zeta_{jc}.
\]

\( \equiv v_c \)
Fraction of Establishments:

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

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

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 $c$:

$$L^D_c = E_c \times \mathbb{E}_{\zeta} [l^*(\zeta_{jc})|c]$$

Elasticity of labor demand:

$$\frac{\partial \ln L^D_c}{\partial \ln w_c} = \gamma \left( \epsilon^{PD} + 1 - \frac{1}{\sigma^F} \right) - 1 \equiv \varepsilon^{LD}$$

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:

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

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

- Smaller rent increases if housing supply is very elastic

Firm Profits:

\[
\pi_c(\theta) = 1 - \delta(\varepsilon^{PD} + 1) + \gamma(\varepsilon^{PD} + 1) \dot{w}_c
\]

- Reducing Capital Wedge
- Higher Labor Costs

- Mechanical effects vs. higher production costs
### Sufficient Statistics for Incidence of Corporate Tax Cut

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<thead>
<tr>
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<td>Housing Costs</td>
<td>$\hat{r}_c$</td>
</tr>
<tr>
<td>Firm Owners</td>
<td>After-tax Profit</td>
<td>$1 - \delta (\epsilon^{PD} + 1) + \gamma (\epsilon^{PD} + 1) \hat{w}_c$</td>
</tr>
</tbody>
</table>
Empirical Implementation of Model: Overview

- 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 $\sigma^F, \sigma^W, \eta$

- Enhance precision with supplement labor demand (Bartik) Shocks
  1. RF effects of Both Shocks on 4 Outcomes $\Rightarrow \sigma^F, \sigma^W, \eta$
  2. RF effects of Both Shocks on 4 Outcomes $\Rightarrow \sigma^F, \sigma^W, \eta, \epsilon^{PD}$
1. **Estimated Parameters**
   1. Productivity Dispersion $\sigma^F$
   2. Preference Dispersion $\sigma^W$
   3. Housing Supply Elasticity $\eta$
   4. Product Demand Elasticity $\varepsilon^{PD}$

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

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

\[
\Delta \ln N_{c,t} = \left( \varepsilon^{LS} \hat{w}(\theta) \right) \Delta \ln (1 - \tau^{b}_{c,t}) + \phi^2_t + u^2_{c,t} \\
\beta^N
\]

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

\[
\Delta \ln r_{c,t} = \left( \frac{1 + \varepsilon^{LS}}{1 + \eta_c} \hat{w}(\theta) \right) \Delta \ln (1 - \tau^{b}_{c,t}) + \phi^4_t + u^4_{c,t} \\
\beta^R
\]
Establishment Equation:

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

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

Business tax changes have two effects on establishment location decisions:

1. Lower taxes attract establishments 
   \[ \frac{1}{-\sigma^F (\varepsilon^{PD} + 1)} > 0 \]

2. More establishments bid up wages 
   \[ \frac{\gamma}{\sigma^F} \dot{w}(\theta) > 0 \]

Implication:

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

\[
\begin{align*}
\sigma_{CMD}^F &= 0.1^{**} (0.06) \\
\sigma_{OLS}^F &= 0.331^{***} (0.17)
\end{align*}
\]
4 Reduced-Form Equations of the Model

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

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

\[ \Delta \ln N_{c,t} = \left( \varepsilon^{LS} \dot{w}(\theta) \right) \Delta \ln (1 - \tau_{c,t}^b) + \phi_t^2 + u_{c,t}^2 \]

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

\[ \Delta \ln r_{c,t} = \left( \frac{1 + \varepsilon^{LS}}{1 + \eta_c} \dot{w}(\theta) \right) \Delta \ln (1 - \tau_{c,t}^b) + \phi_t^4 + u_{c,t}^4 \]
1. Reduced Form: Estimate reduced form $\hat{b}$ and covariance $\hat{V}$
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>Establishments Population Wage Rent Business Tax</th>
<th>Predicted Moments</th>
<th>Empirical Moments</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.084</td>
<td>4.074**</td>
<td></td>
</tr>
<tr>
<td>2.323</td>
<td>2.331</td>
<td></td>
</tr>
<tr>
<td>1.438</td>
<td>1.451</td>
<td></td>
</tr>
<tr>
<td>1.159</td>
<td>1.172</td>
<td></td>
</tr>
</tbody>
</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 Tax</th>
<th>Establishments</th>
<th>Population</th>
<th>Wage</th>
<th>Rent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predicted Moments</td>
<td>4.084</td>
<td>2.323</td>
<td>1.438</td>
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<td>Empirical Moments</td>
<td><strong>4.074</strong></td>
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</tr>
</tbody>
</table>

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

$\chi^2(1)$ Stat 0.001 $\chi^2$ P-Value 0.979
Enhancing precision with supplemental LD shocks

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

\[ \Delta \ln E_{c,t} = b_1 \Delta \ln (1 - \tau_{c,t}^b) + b_5 \text{Bartik}_{c,t} + \tilde{\phi}_1^1 + \tilde{u}_1^1 \]
\[ \Delta \ln N_{c,t} = b_2 \Delta \ln (1 - \tau_{c,t}^b) + b_6 \text{Bartik}_{c,t} + \tilde{\phi}_2^2 + \tilde{u}_2^2 \]
\[ \Delta \ln w_{c,t} = b_3 \Delta \ln (1 - \tau_{c,t}^b) + b_7 \text{Bartik}_{c,t} + \tilde{\phi}_3^3 + \tilde{u}_3^3 \]
\[ \Delta \ln r_{c,t} = b_4 \Delta \ln (1 - \tau_{c,t}^b) + b_8 \text{Bartik}_{c,t} + \tilde{\phi}_4^4 + \tilde{u}_4^4 \]
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>Bartik and Tax Shock ((\gamma = .15, \varepsilon^{PD} = -2.5))</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>3.354**</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>0.595***</td>
<td>0.445**</td>
<td>0.557***</td>
<td>0.702***</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</th>
<th>Shares of Incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td></td>
<td>Tax Only</td>
<td>Tax &amp; Bartik</td>
</tr>
<tr>
<td>Output Elasticity $\gamma$</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>
</tr>
<tr>
<td></td>
<td></td>
<td>(10.337)</td>
</tr>
</tbody>
</table>

### Estimated Parameters

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<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>
</tr>
<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>
</tr>
<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>
</tr>
<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>
</tr>
<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>
</tr>
<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>
</tr>
<tr>
<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>
</tr>
</tbody>
</table>
Firm Owner’s Share of Incidence for Calibrated Values of $\gamma$ and $\varepsilon^{PD}$
Shares of Incidence for Calibrated Values of $\gamma$ and Estimated $\varepsilon^{PD}$

![Graph showing shares of incidence for different output elasticities of labor. The graph includes lines representing the share of incidence for firms, workers, and land, with the x-axis representing output elasticity of labor ($\gamma$) and the y-axis representing share of incidence. The lines are labeled as follows: blue for firms, red dashed for workers, and green dashed for land.](image-url)
Sufficient Statistics for Incidence of Corporate Tax Cut

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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>$1 + \left( \frac{\hat{\beta}^N - \hat{\beta}^E}{\hat{\beta}^W} + 1 \right) \left( \hat{\beta}^W - \frac{\delta}{\gamma} \right)$</td>
</tr>
</tbody>
</table>

Note that \( \left( \frac{\beta^N - \beta^E}{\beta^W} + 1 \right) = \gamma (\epsilon^{PD} + 1) \)
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:

\[ \tau^*_c = \frac{1}{\dot{\bar{\pi}}_c + \dot{E}_c} \]
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)

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

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
## 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 $\frac{\tau_{s}^{*}}{\tau_{s}^{**}}$</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>
</tr>
<tr>
<td>Indiana</td>
<td>90</td>
<td>8.5</td>
<td>40.3</td>
<td>1.8</td>
</tr>
<tr>
<td>U.S. Avg</td>
<td>66.1</td>
<td>6.7</td>
<td>38.8</td>
<td>3.0</td>
</tr>
<tr>
<td>U.S. Med</td>
<td>50.0</td>
<td>7.1</td>
<td>38.3</td>
<td>2.2</td>
</tr>
<tr>
<td>U.S. Min</td>
<td>33.3</td>
<td>0.0</td>
<td>33.8</td>
<td>0.3</td>
</tr>
<tr>
<td>U.S. Max</td>
<td>100.0</td>
<td>12.0</td>
<td>46.6</td>
<td>28.1</td>
</tr>
</tbody>
</table>

Note: The table shows the revenue-maximizing corporate tax rates for different states and the U.S. averages. The calculations include the sales apportionment weight $\theta_{s}^{x}$ and the corporate tax rate $\tau_{s}$, along with derived rates $\tau_{s}^{*}$ and $\tau_{s}^{**}$.
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
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