MIT Graduate Public Economics II (14.472)

Firm taxation in Spatial Public Finance

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Lecture 3

Outline

1. Overview and Conceptual Framework
2. Firm Location Decisions
   - Model of firm location
   - Empirical implementation: taxes and firm location
3. Spatial Model with Heterogeneous Firms
   - Model overview
     - Worker Location, Housing, and Local Labor Supply
     - Firm Location and Local Labor Demand
   - Incidence
   - Connecting the theory to the data
     - Structural and Reduced-Form of the Model
4. Fundamental Reforms and National Welfare Effects
   - Fundamental reform and apportionment
5. Classic questions in local public finance and fiscal federalism

Outline

Most pbp spending in US is on local business incentives

State and Local economic development spending

Table 3 Resources Devoted to State and Local Economic Development in the United States

CURRENT PROGRAMS		
Policy/program	Annual dollars (in billions)	
State and local business tax incentives and other cash incentives	46.3	
Customized training programs	0.6	
Other state economic development programs	2.8	
Subtotal, state/local programs		49.7
Manufacturing extension (federal/state/fees)	0.4	
Economic Development Administration (EDA)	0.3	
Economic development portion of HUD's Community Development Block Grants	1.1	
Small Business Administration	0.8	
Other economic development programs in USDA, HUD, Commerce	2.0	
Subtotal, mostly federal spending		4.6
Opportunity Zones tax credits	1.5	
New markets tax credit	1.4	
Other tax expenditures that might promote local economic development	2.3	
Subtotal, federal tax expenditures		5.3
Total of federal programs and tax expenditures		9.9
Total of all levels of government		59.6
PAST PROGRAMS		
Empowerment zones/enterprise communities (peak annual activity in early 2000s)	1.5	
Appalachian Regional Commission (peak annual spending 1966–1975)	1.6	
Tennessee Valley Authority (peak annual spending 1950–1955)	1.5	

Source: Tim Barik (2019). See (Slattery and Zidar, 2019) for more discussion.

State and local business tax incentives policies

- Incentive policies are highly controversial
  - Attracting firms is key for local economic growth and prosperity
  - Others question incentive spending effectiveness and mounting costs
- Places have different policy instruments
  - Firm-specific subsidies
  - State corporate tax rates and base rules
  - Infrastructure and local government service provision
- Evaluating these policies requires overcoming three challenges
  1. Data limitations: difficult to measure prevalence, size, and composition of incentives
  2. Lack of transparency: hard to determine selection process
  3. Do not observe how economic activity would have evolved in the absence of deals

Conceptual Framework (Slattery and Zidar, 2019)

1. Objective of state and local government is to maximize local welfare

$$V = \sum_{i \in workers} \psi_i^W V_i^W + \sum_{i \in owners} \psi_i^O V_i^O + \sum_{i \in politicians} \psi_i^P V_i^P \quad (1)$$

   - Workers: $V_i^W = w - p - t + g$ is real wages less taxes plus gov amenities
     - Higher wages, higher local prices, higher taxes, less g. Big wage gain if unemployed.
     - ψ_i is individual i's social welfare weight
   - Owners $V_i^O = (1 - t_{corp} + incentive_i)profits_i$
     - Higher factor costs, higher product demand, higher taxes, less g.
     - Effects on suppliers and other firms
   - Politicians: Re-election odds, campaign contributions, pork, etc
2. Policy Instruments
   - Firm-specific tax incentive
   - Lower state corporate tax rate
   - Narrow state corporate tax base (e.g., provide a state investment tax credit)
   - Many others

Welfare Considerations

$\frac{dV}{dPolicy}$

- Effects on different groups
- Effects on factor prices (boost for labor and land), output prices (negative congestion effects)
- Increase in net tax burden on local residents and/or lower government services
- Deadweight loss from higher local tax burden

Also important effects on these groups of agents in other locations

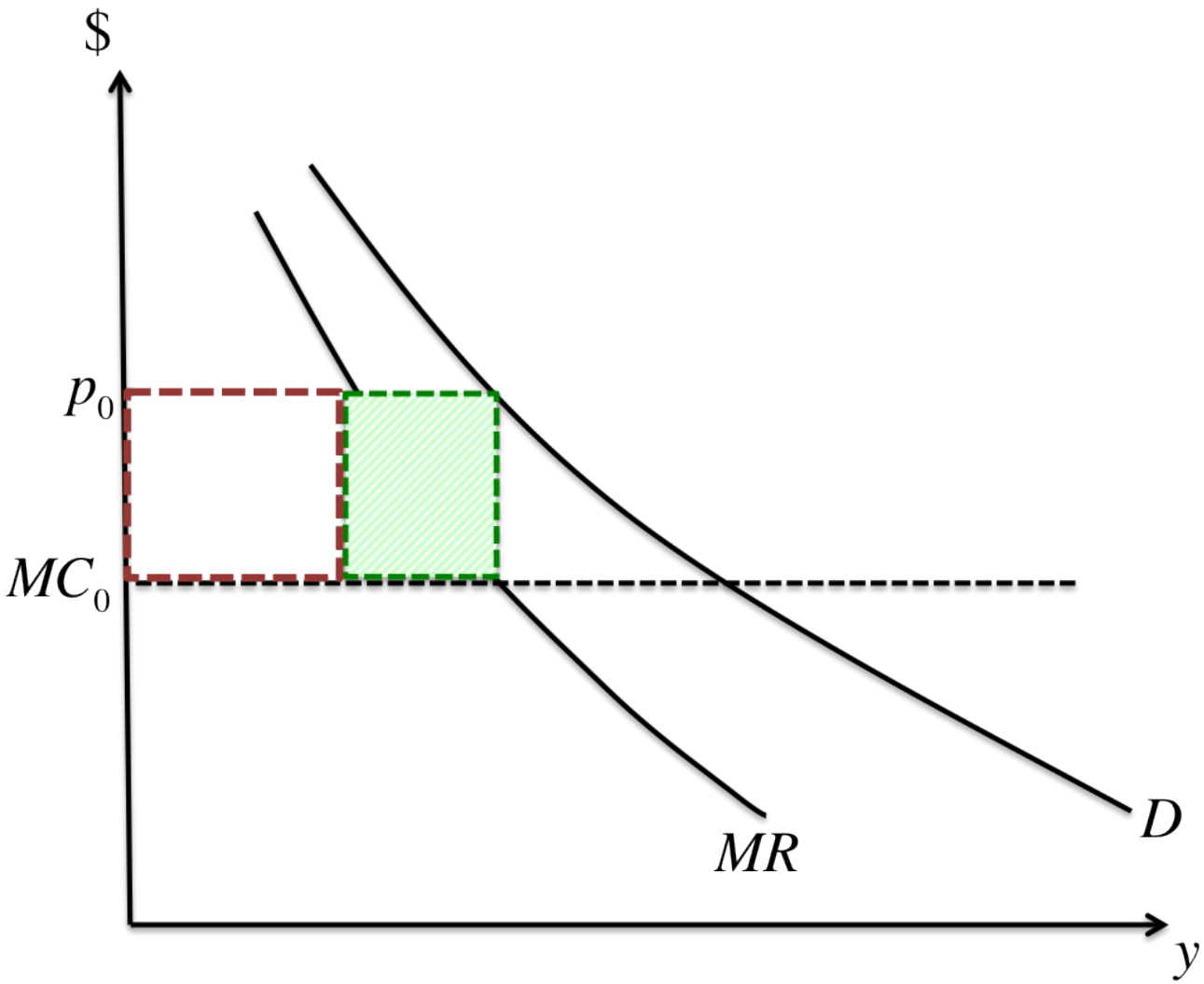
Local Benefits and Costs of Different Instruments

1. Firm-specific subsidies
   - Some places might get more location-specific value
   - Can better target mobile firms (or not extract rents from new firms) or firms with more spillovers
   - Political economy benefits: more certainty, pork, salience
2. But
   - Hard to know which firms are inframarginal (the "but for" debate)
   - Hard to "pick winners", allocation of spending may be more about politics than economics
   - Lower tax revenue and lower public goods
   - Congestion, higher factor prices, etc

Outline

How do taxes affect firm location?

Firm owners want to maximize after-tax profits



Source: Suárez Serrato and Zidar (AER, 2016)

Local Labor Demand: Establishment Production

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

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- Establishment j produces its variety with the following technology

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

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

- Firm Value Function

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

Source: Suárez Serrato and Zidar (AER, 2016)

Location Choice & Local Establishment Shares

Fraction of Establishments:

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

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Establishment Growth:

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

Key Parameter:

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

Source: Suárez Serrato and Zidar (AER, 2016)

Empirical Implementation

Estimating Equation:

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

Regression

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

Source: Suárez Serrato and Zidar (AER, 2016)

Empirical Implementation

Reduced Form:

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

Regression

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

Source: Suárez Serrato and Zidar (AER, 2016)

Empirical Implementation

Alternative Estimating Equation (from FMSZ, 2018):

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

where

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

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

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

Source: Fajgelbaum, Morales, Suárez Serrato, and Zidar (Restud, 2019)

How do business tax cuts affect firm location?

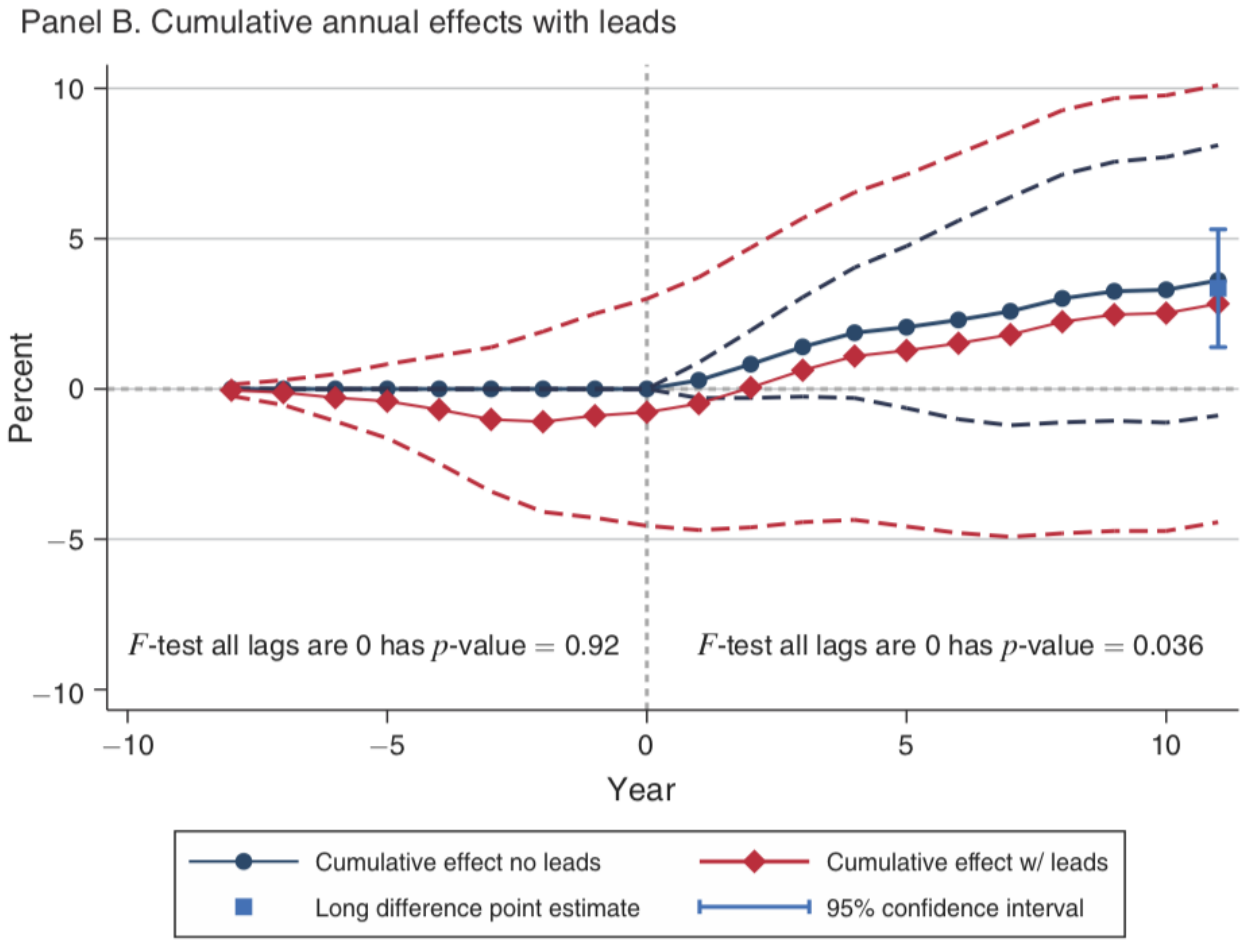


FIGURE 4. CUMULATIVE EFFECTS OF BUSINESS TAX CUTS ON ESTABLISHMENT GROWTH

Source: Suárez Serrato Zidar (AER, 2016). See Giroud Rauh (JPE, 2019), Hines (AER, 1996).

Outline

A Spatial Equilibrium Model with Firms

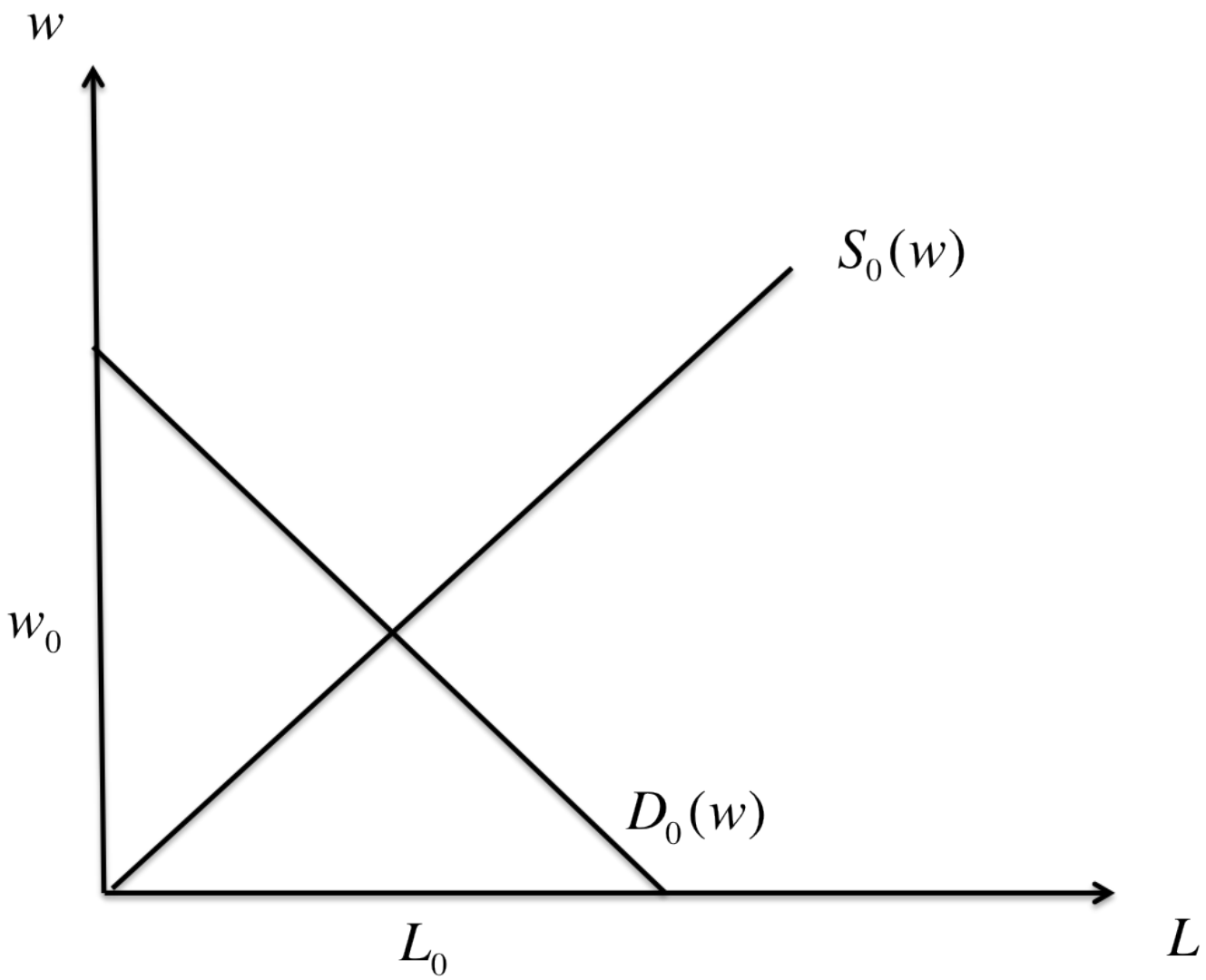
You have to start this conversation with the philosophy that businesses have more choices than they ever have before. And if you don't believe that, you say taxes don't matter. But if you do believe that, which I do, it's one of those things, along with quality of life, quality of education, quality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

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

A Spatial Equilibrium Model with Firms: Outline

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

Equilibrium in the Local Labor Market



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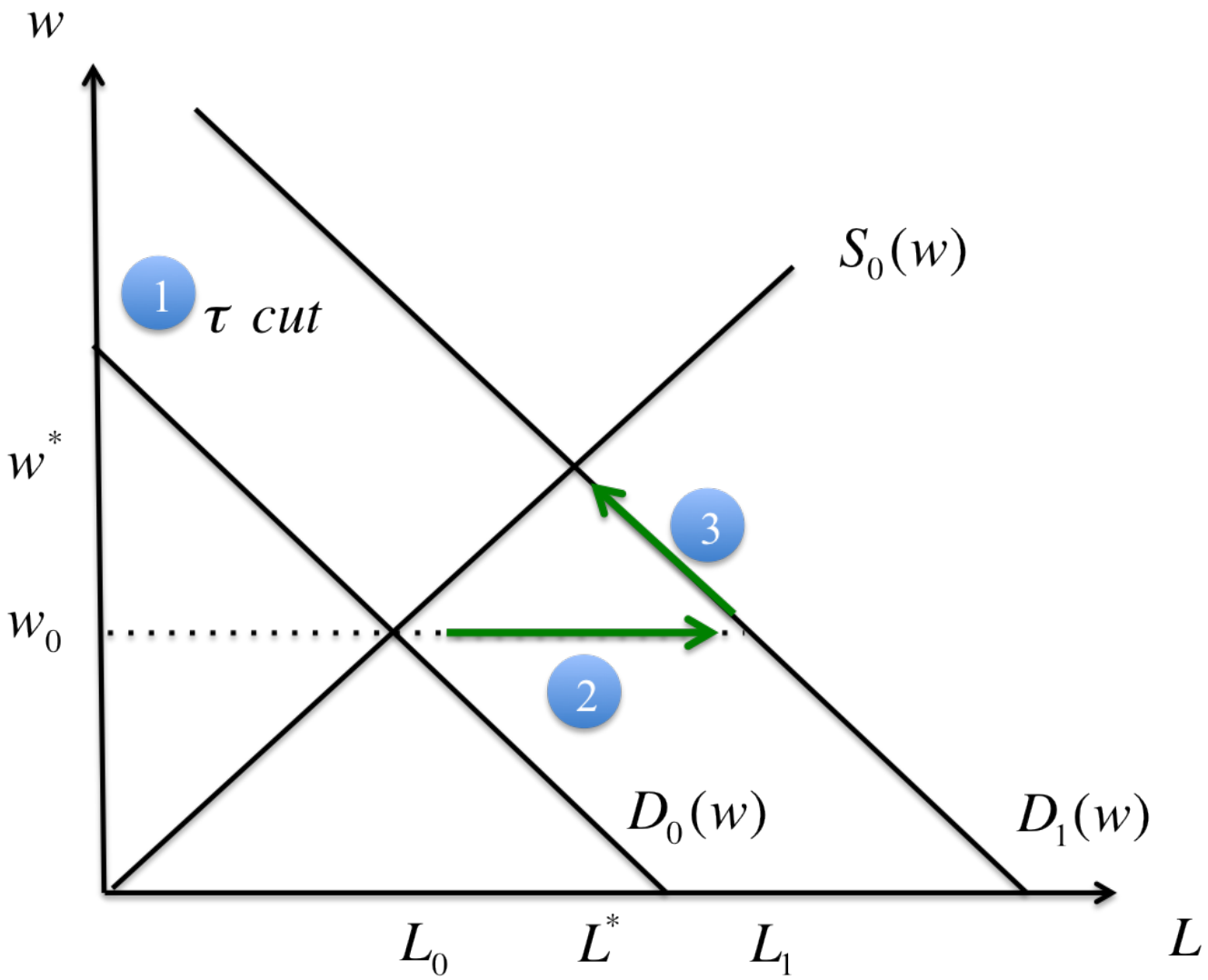

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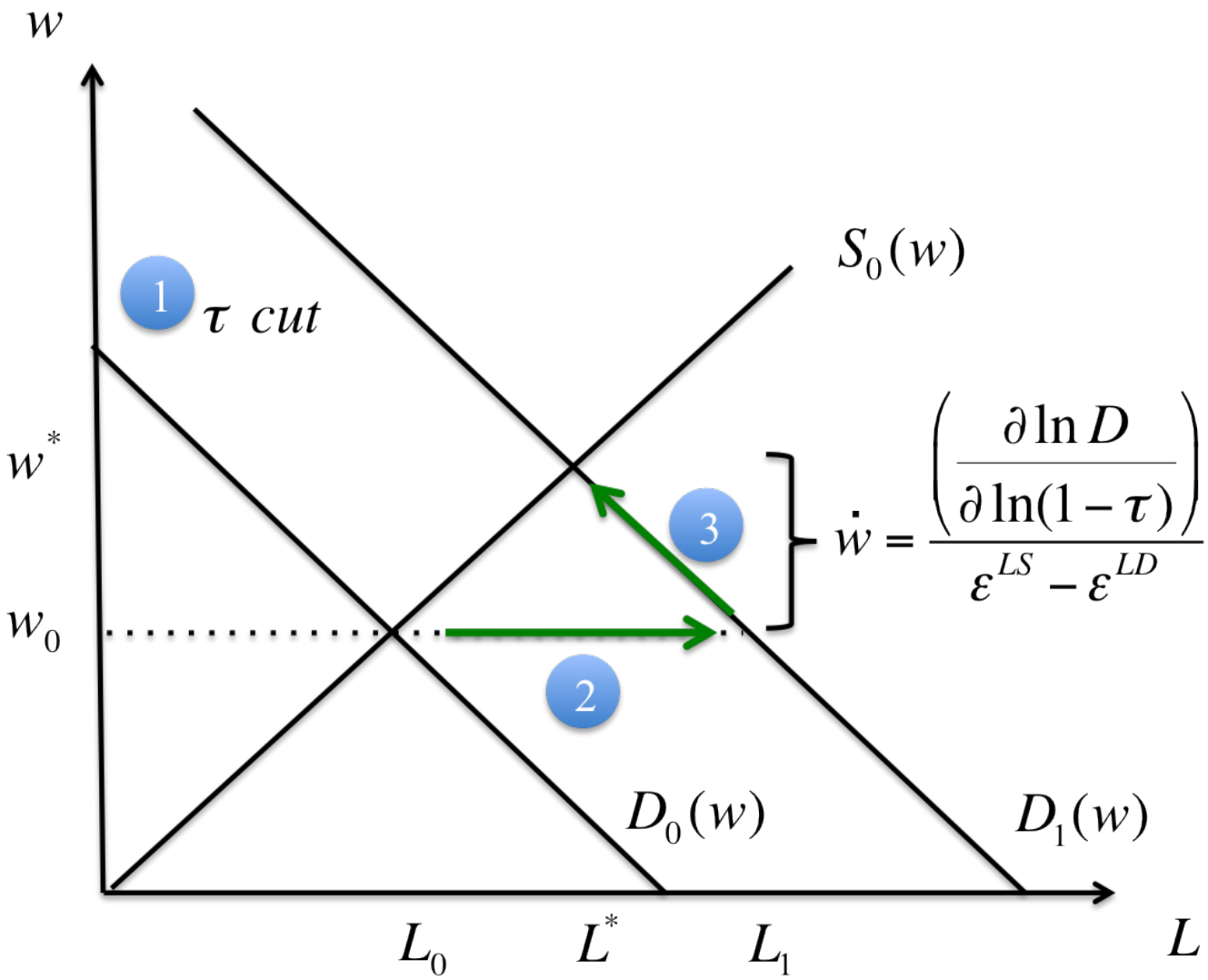

Model Setup

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

Household Problem

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

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

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Indirect Utility of a Worker:

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

Local Labor Supply

Location choice: Workers choose location with max utility:

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

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Local Population:

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

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(Log) Local Labor Supply:

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

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

Housing Market

Housing Market: Upward-sloping supply of housing:

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

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

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

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

Key Parameter: η_c elasticity of housing supply

Local Labor Supply: Key points

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

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

Local Labor Demand

Aggregate labor demand for firms in location c:

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

Elasticity of labor demand:

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

More elastic ε^{LD} when:

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

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

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

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

Smaller wage increase if:

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

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

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

- Smaller rent increases if housing supply is very elastic

Firm Profits:

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

- Mechanical effects vs. higher production costs

Welfare Effects of Corporate Tax Cut

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

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

Empirical Implementation

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

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

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

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

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

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

Outline

Fundamental reform and apportionment

Reforming how we tax corporate income

Corporate tax base

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

State business taxes: three types of firm taxes

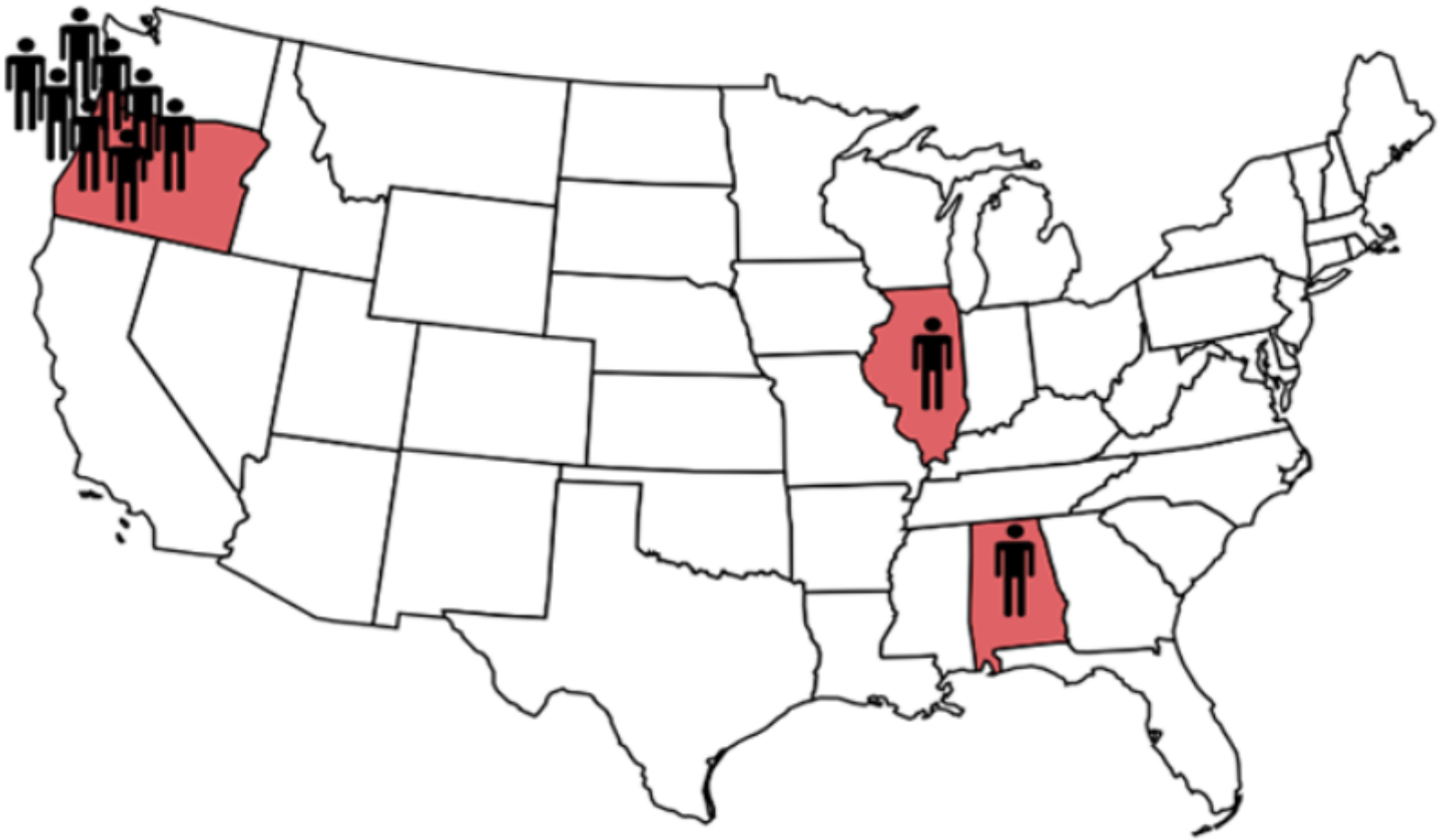
1. Partnership and S-corps: τ^{INC} personal income tax rate
   - Synthetic changes as in Zidar (2013) using NBER's TAXSIM
2. Single-state C-corps: τ^{c} corporate income tax rate
   - Digitized corporate tax rates from "Book of the States"
3. Multi-state C-corps: τ^{A} apportioned corporate income tax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

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

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

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

Nike apportionment example



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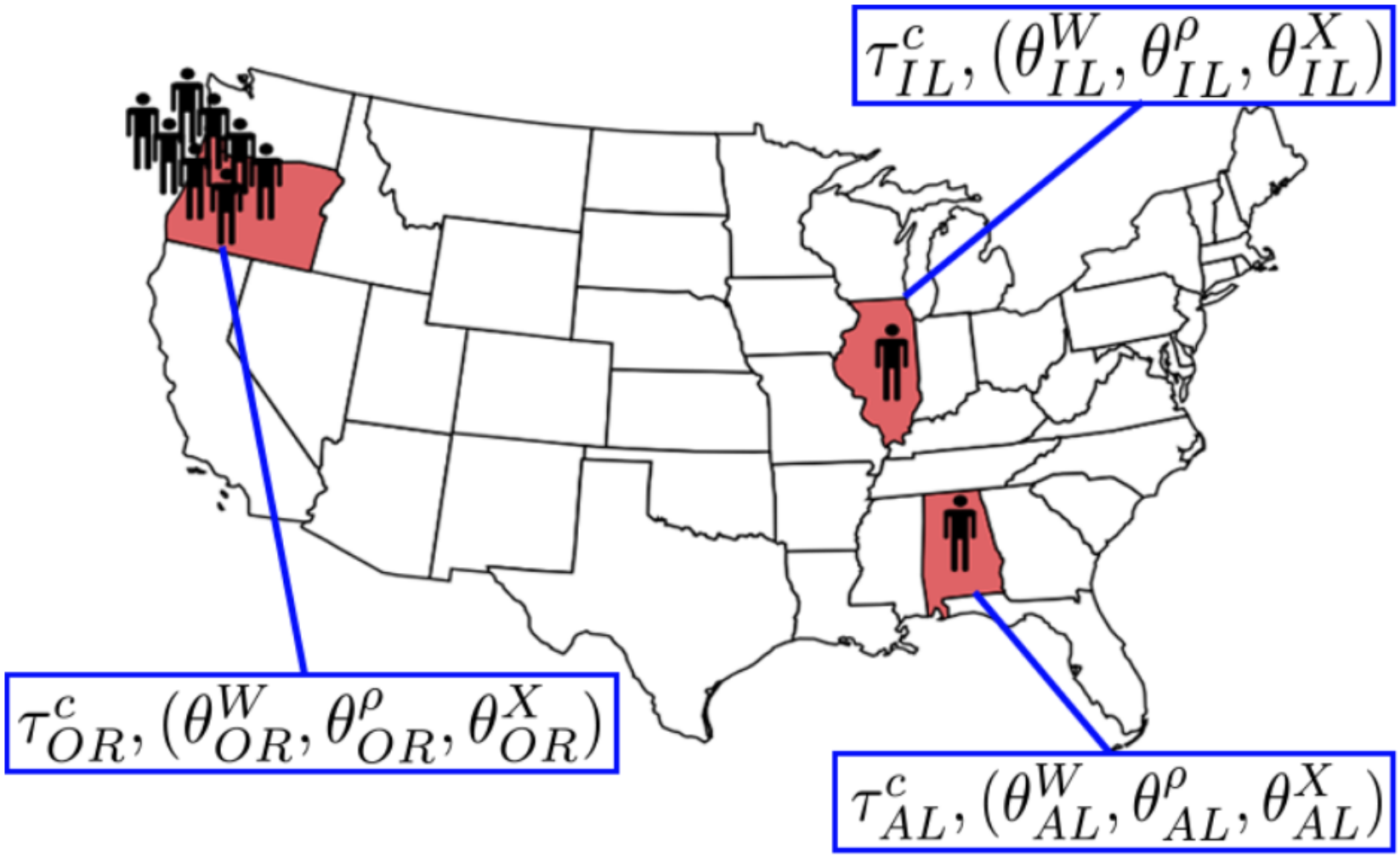


Source: Suárez Serrato and Zidar (AER, 2016).

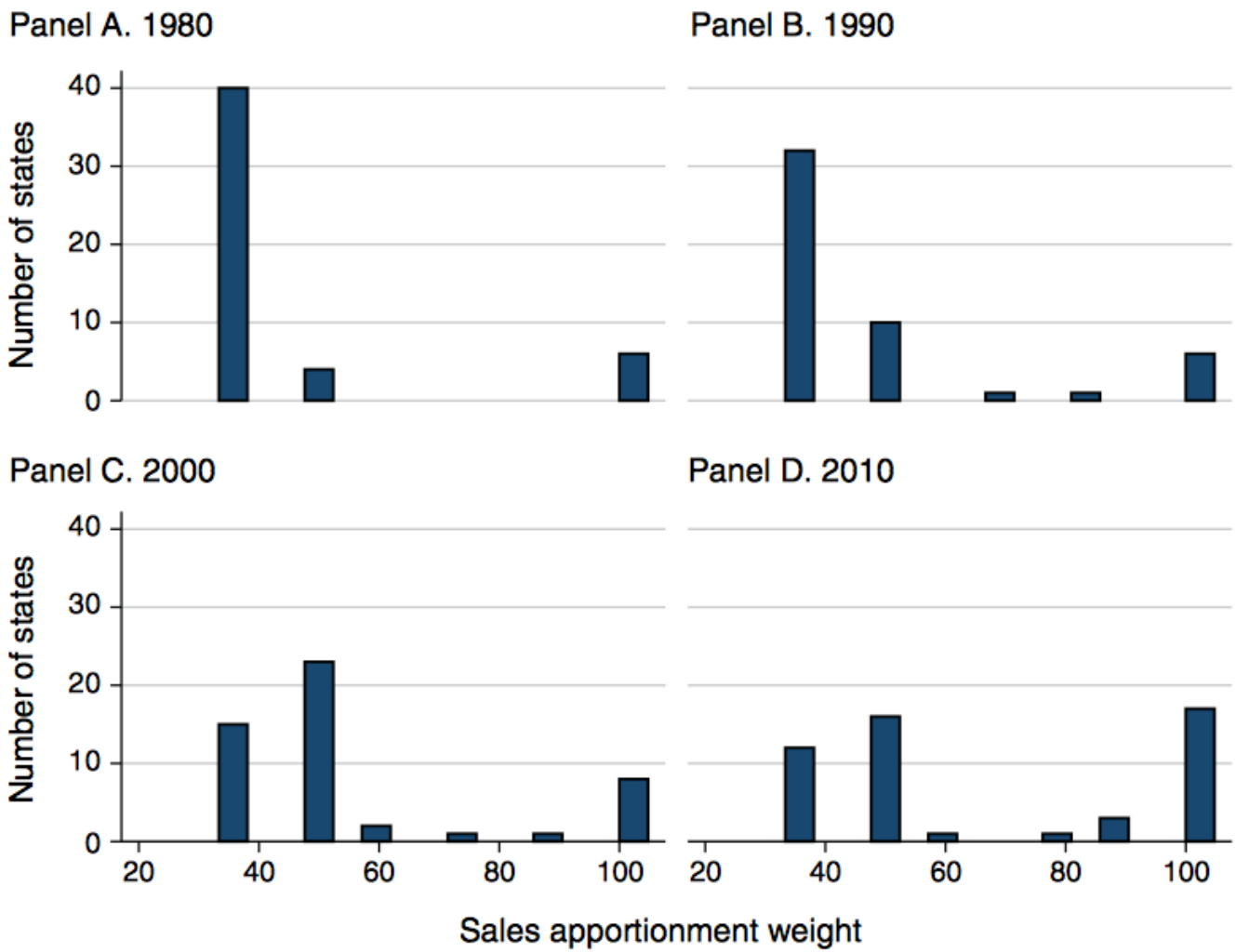
Nike apportionment example

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

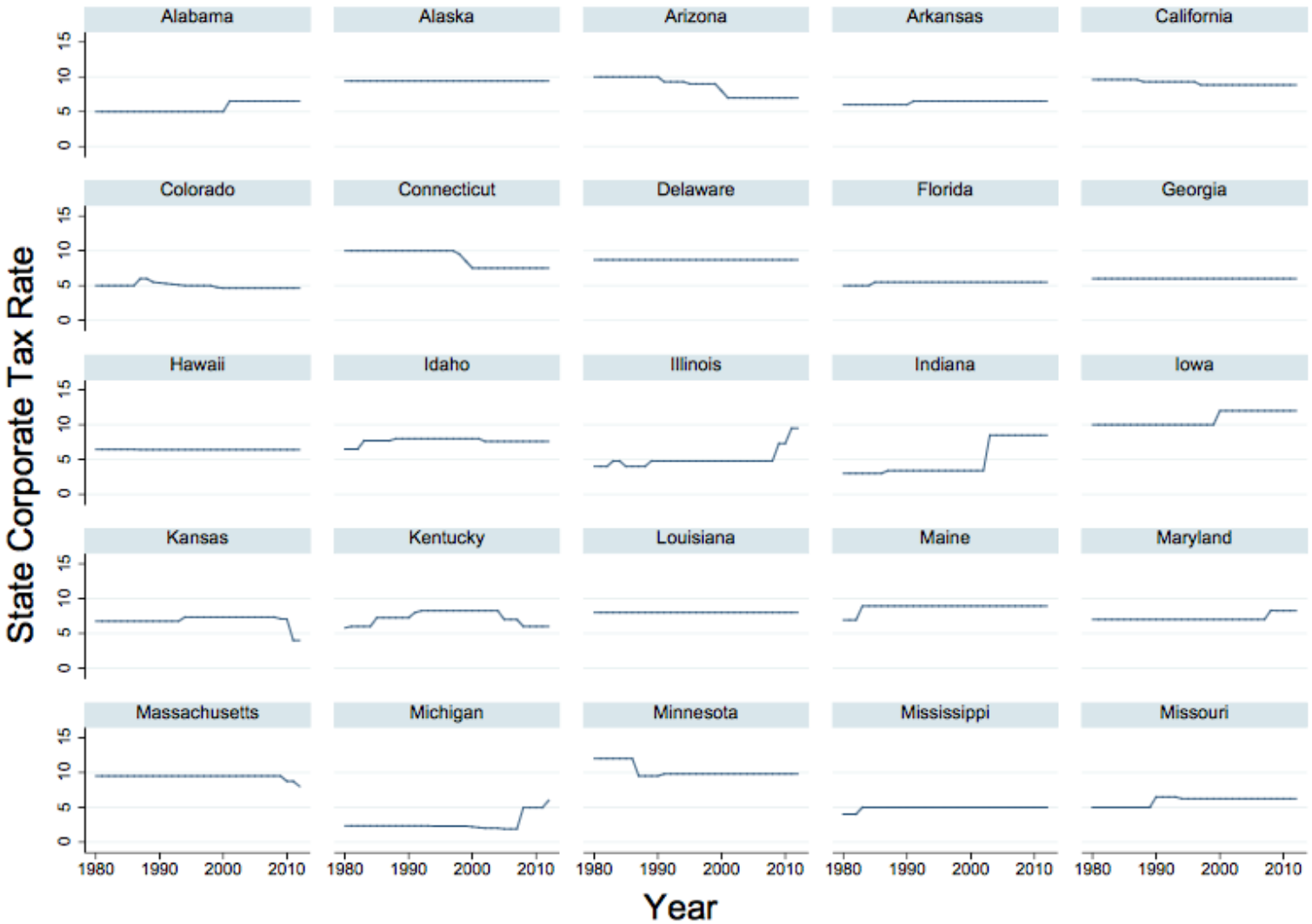
State	I. Using Payroll	II. Using Sales
	Apportioned Profit (\$M)	
OR	(80% of 6) = 4.8	2
IL	(10% of 6) = .6	2
AL	(10% of 6) = .6	2
	Corporate Tax Liability (\$M)	
OR with $\tau^c_{OR} = 50\%$	2.4	1
IL with $\tau^c_{IL} = 10\%$	.06	0.2
AL with $\tau^c_{AL} = 0\%$	0	0
Total Tax Liability (\$M)	3	1.2

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

Evolution of apportionment weights

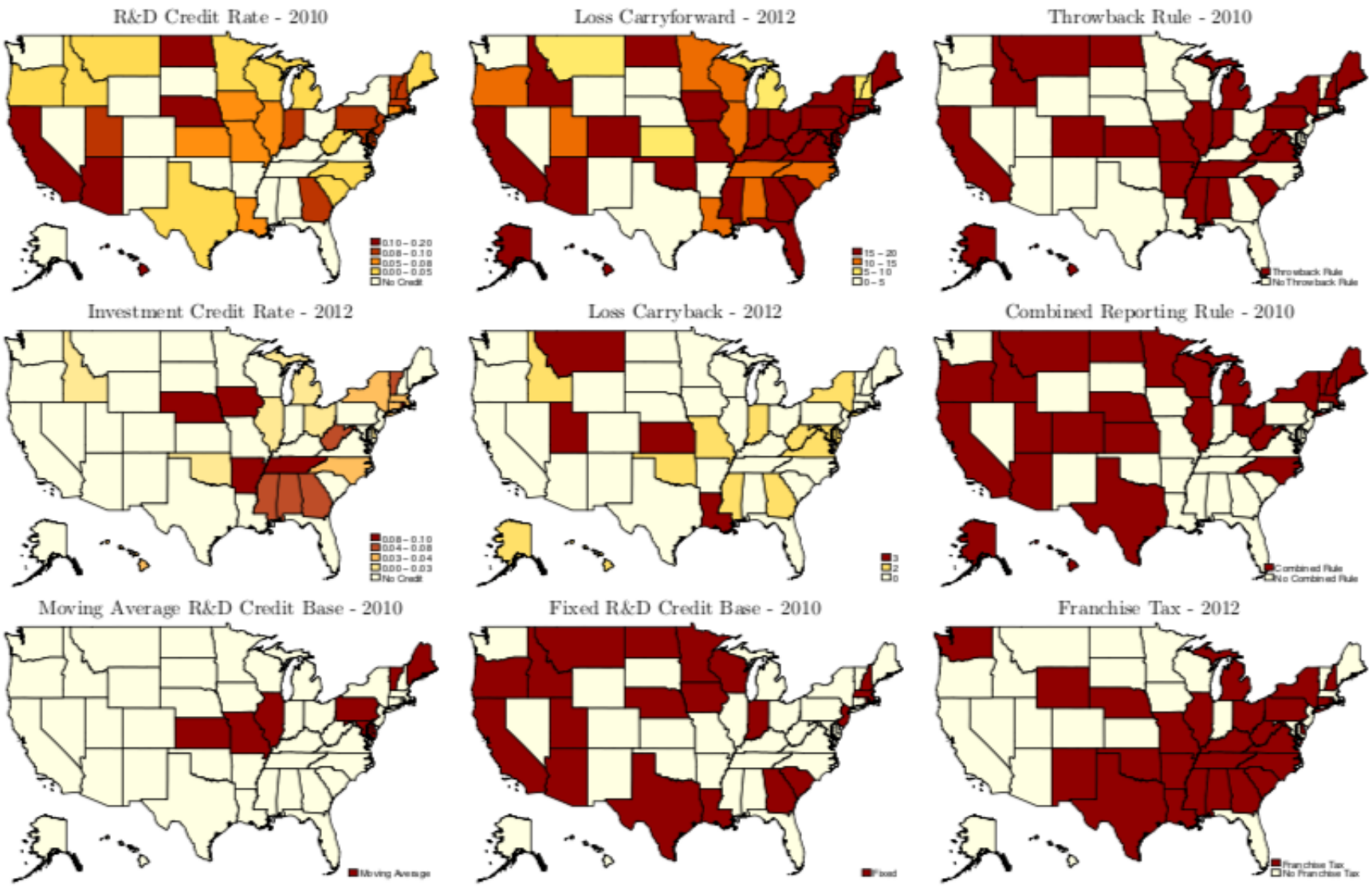


State corporate tax rates



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

State corporate tax base



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

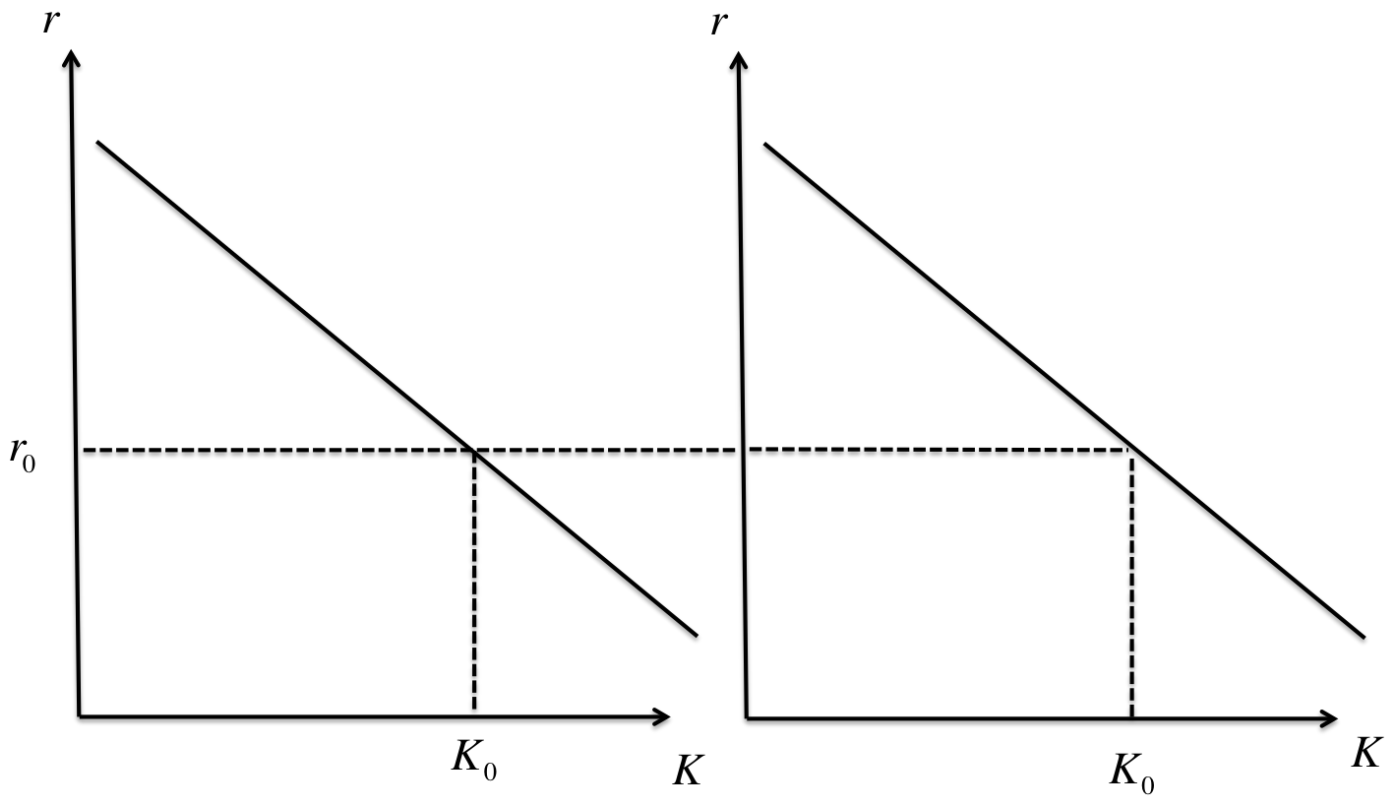
Simple spatial model: One factor, two locations

Impact of Capital Tax: One factor, two locations

Setup

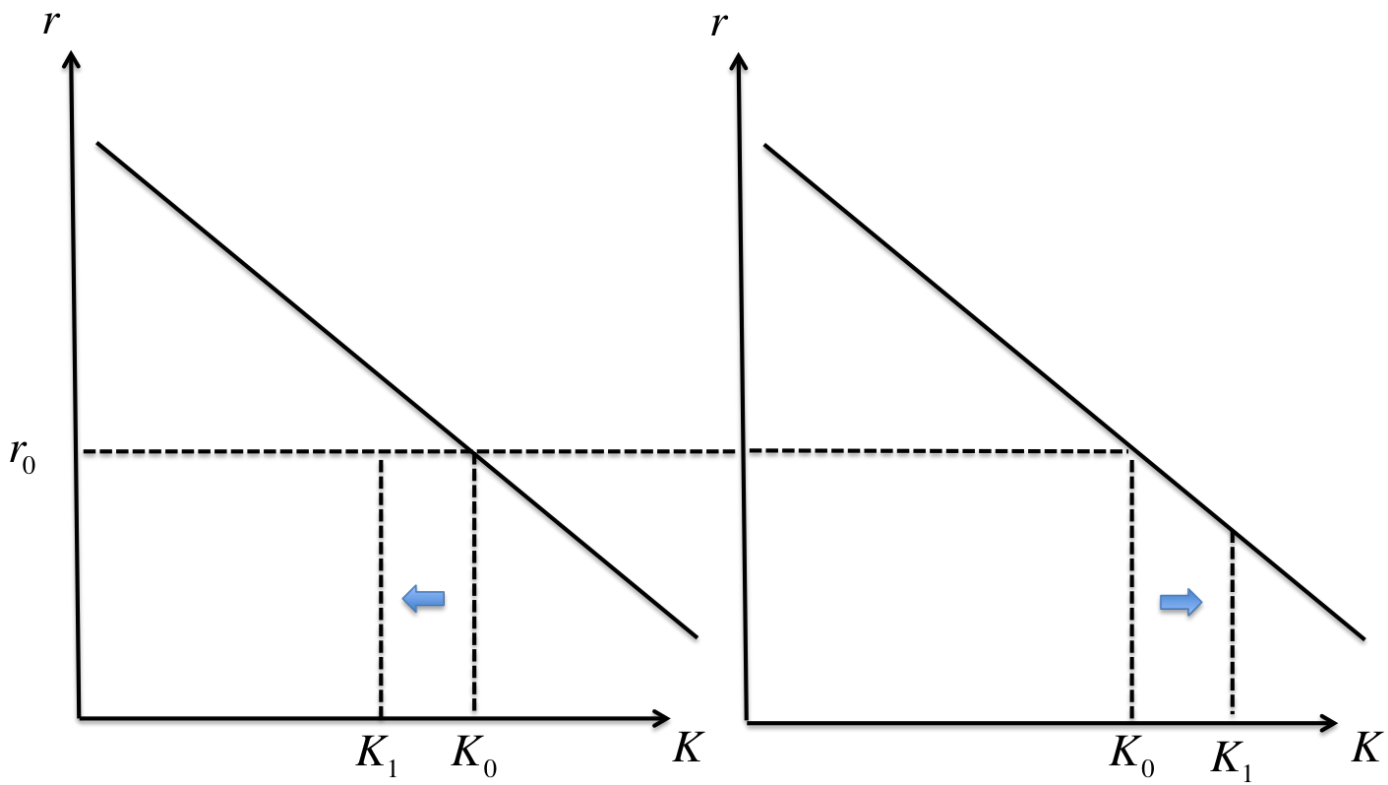
1. One factor (capital)
2. Two locations: east and west
3. Capital market in each location
4. Total K fixed in economy overall

Initial equilibrium



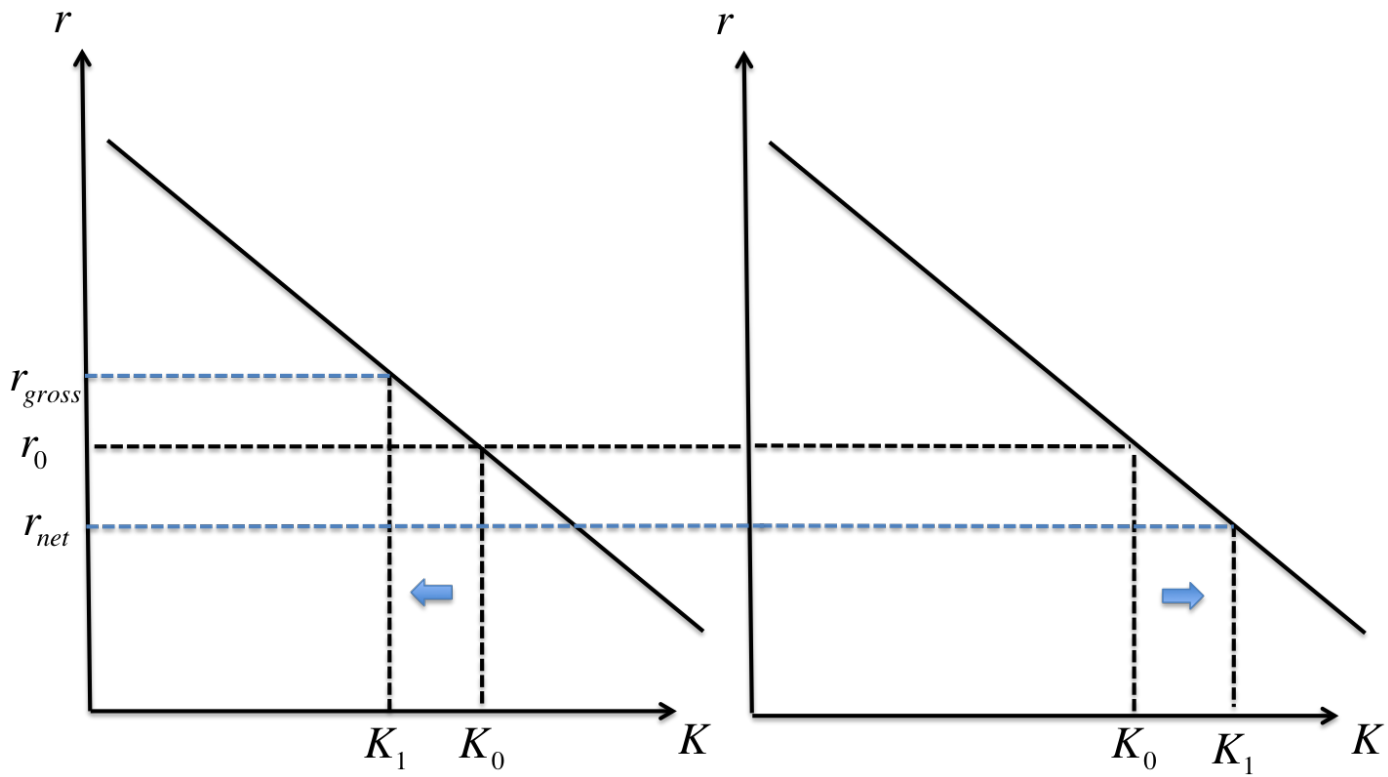
Tax in west

Causes capital to flee to east



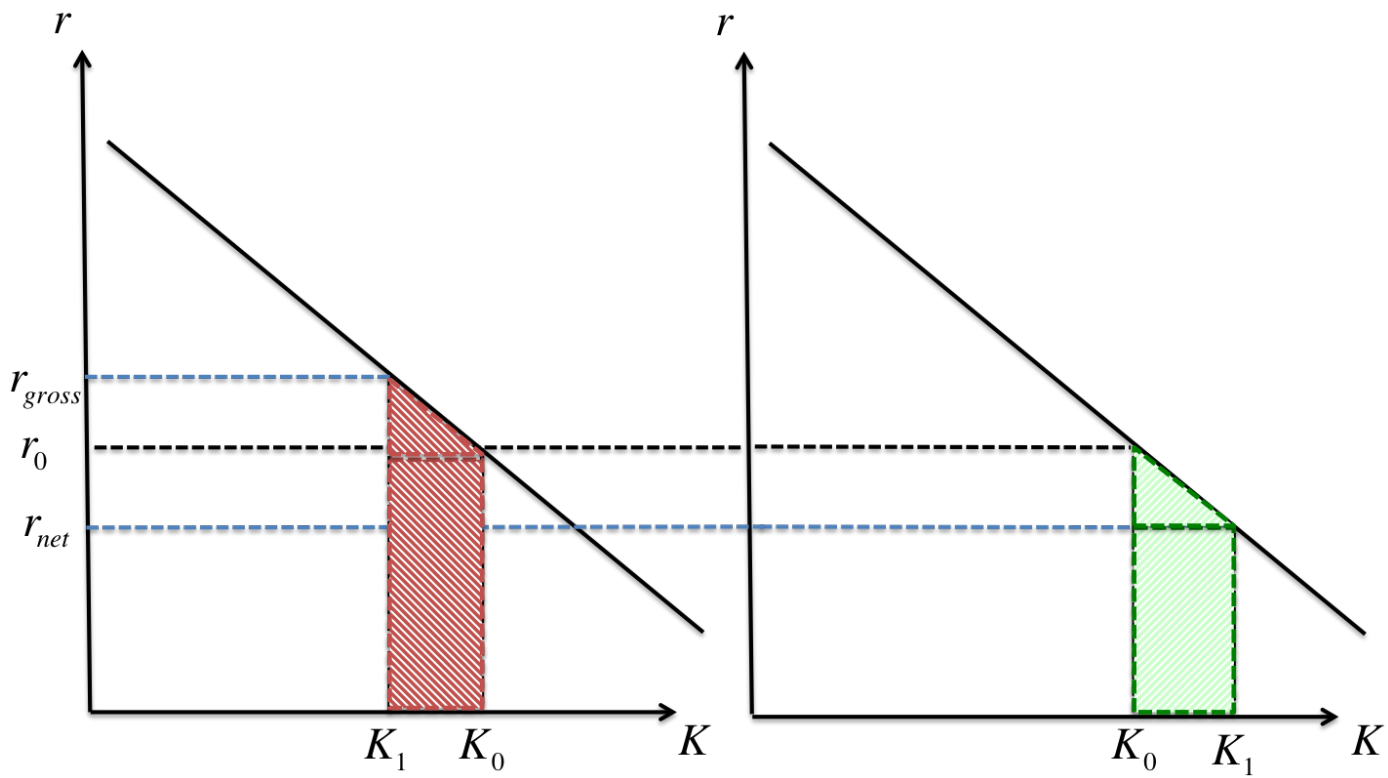
New allocation of capital

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



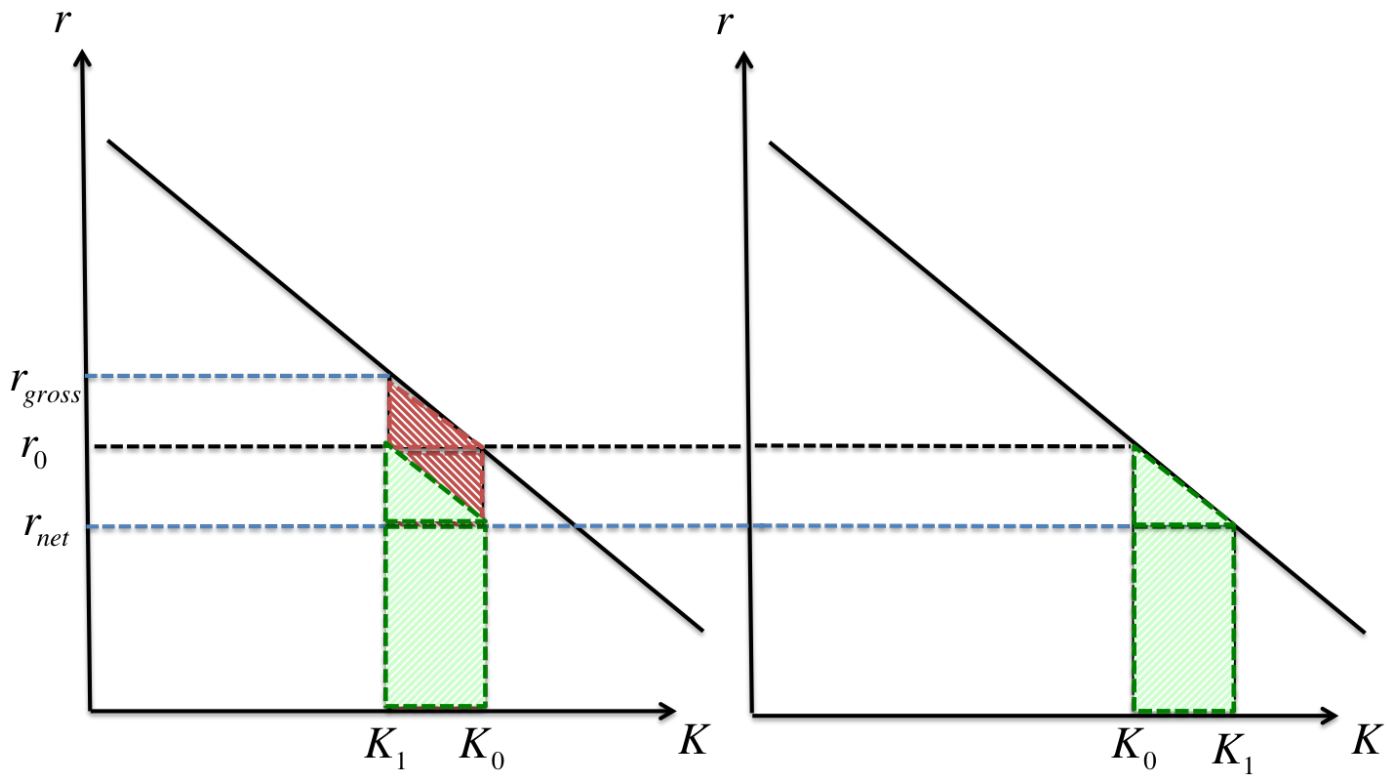
Welfare changes in each location

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



Net welfare changes in aggregate

- Net welfare loss in red



What determines size of welfare loss in this toy example?

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

This example provides intuition for key forces in the Harberger model

Quantifying GE Effects of Tax Reforms

FMSZ (Restud, 2018):Tax Harmonization

Question: what are aggregate effects of dispersion in tax rates across U.S. states?

1. Quantitative Geography Model with U.S. State Tax System
   - States with heterogeneous fundamentals (productivity, amenities, trade costs, factor shares, fixed factors, ownership rates)
   - Workers and firms sort across states according to idiosyncratic draws
   - Firms are monopolistically competitive
   - 3 major state taxes and federal transfers, which finance state spending which may be valued by workers and firms
2. Estimation
   - Elasticities of worker and firm location with respect to taxes
   - Fundamentals match distribution of employment, wages, and trade
3. Counterfactuals
   - Vary or eliminate tax dispersion keeping government spending constant
   - Also analyze GE impact of the North Carolina income tax cuts, rolling back tax system to 1980, and eliminating state and local tax deduction
4. Results: heterogeneity in state tax rates leads to aggregate losses
   - Harmonizing state taxes increases worker welfare by 0.6% with fixed G, 1.2% if government spending responds endogenously
   - Harmonization within Census regions achieves most of these gains

Outline

Classic questions in local public finance and fiscal federalism

Classic Qs in local public finance and fiscal federalism

We should also know over which matters several local tribunals are to have jurisdiction, and in which authority should be centralized —Aristotle, Politics 4.15

The federal system was created with the intention of combining the different advantages which result from the magnitude and the littleness of nations —Alexis de Tocqueville (1835)

Local public finance and fiscal federalism

- Fiscal federalism deals with role of different levels of government in providing goods and services
  - In the US: $\approx 1/3$ of public spending provided by state and local govs
  - Local fiscal autonomy varies considerably across countries & overtime
- Sub-federal public good provision can better satisfy geographically heterogeneous preferences
- But decentralized provision
  - Misses economies of scale
  - May not fully internalize externalities of local spending

$\Rightarrow$ **What is the optimal allocation of responsibilities across levels of government?**

Some key questions in local public finance

1. How large should local governments be? (theory of clubs)
2. Will equilibrium exist and is it efficient (Tiebout model and its issues)
3. What is the demand for local public goods (hedonics, sorting)?
4. Which public services can best be provided and financed at federal, state, or local level (fiscal federalism/IO of public sector)?
   - How much fiscal autonomy of local governments?
   - Effects of local versus national control?
   - Can/should state and local governments redistribute?
   - Can/should state and local governments play a role in stabilizing economies?
   - Effects of transfers from higher levels of government?
   - Effects of competition across governments?
   - Effects of (educ) financing approaches on spending and outcomes?

Oates (1972)

Question: what form of government is best for resolving allocation, distribution, and stabilization problems?

- Musgrave (1959): Three roles of government
  - Ensure an efficient use of resources
  - Establish an equitable distribution of income
  - Maintain stable employment and prices
- Case for centralized government
  - A central agency should manage monetary policy, so **stabilization** at local levels depends on fiscal policy which may have spillovers, have small effects, and encourage debt financing and affect financial flows. Also shocks are likely correlated across locations.
  - Local **redistribution** would create strong incentives for wealthy to flee and for the poor to migrate into the community (e.g., Stigler (1957), Epple and Romer (1991), Feldstein and Wrobel (1998))
  - Central gov must provide certain "national" public goods (like national defense) that provide services to the entire population of the country.
  - Risk and income can be more easily spread and distributed
  - Central governments consolidate bargaining power against external agents

Oates (1972): case for a decentralized government

Question: what form of government is best for resolving allocation, distribution, and stabilization problems?

- There a local public goods whose consumption is limited to their own jurisdictions
- Uniform levels of consumption may not be efficient if **preferences and local technologies are heterogeneous**. Tiebout sorting can restore efficiency with local provision.
- Local governments do not do any redistribution: individuals receive in local public goods exactly what they are paying in taxes (= benefit principle of taxation)
- Decentralization may result in greater experimentation and innovation due to **competitive pressures** across governments
- Local gov't may provide a **better institutional setting** that promotes better decision making by compelling more explicit recognition of the costs of public programs and having better information about local performance and preferences (see, e.g., Besley and Coate (2003))

See Oates (JEL, 1999) for more details. Also Gordon (QJE, 1983)

Appendix: Local capital markets

Capital markets: 4 key equations

We will use 4 equations to analyze capital markets

1. **Stock Adjustment:** the amount of capital today depends on how much there was yesterday, depreciation, and new investment

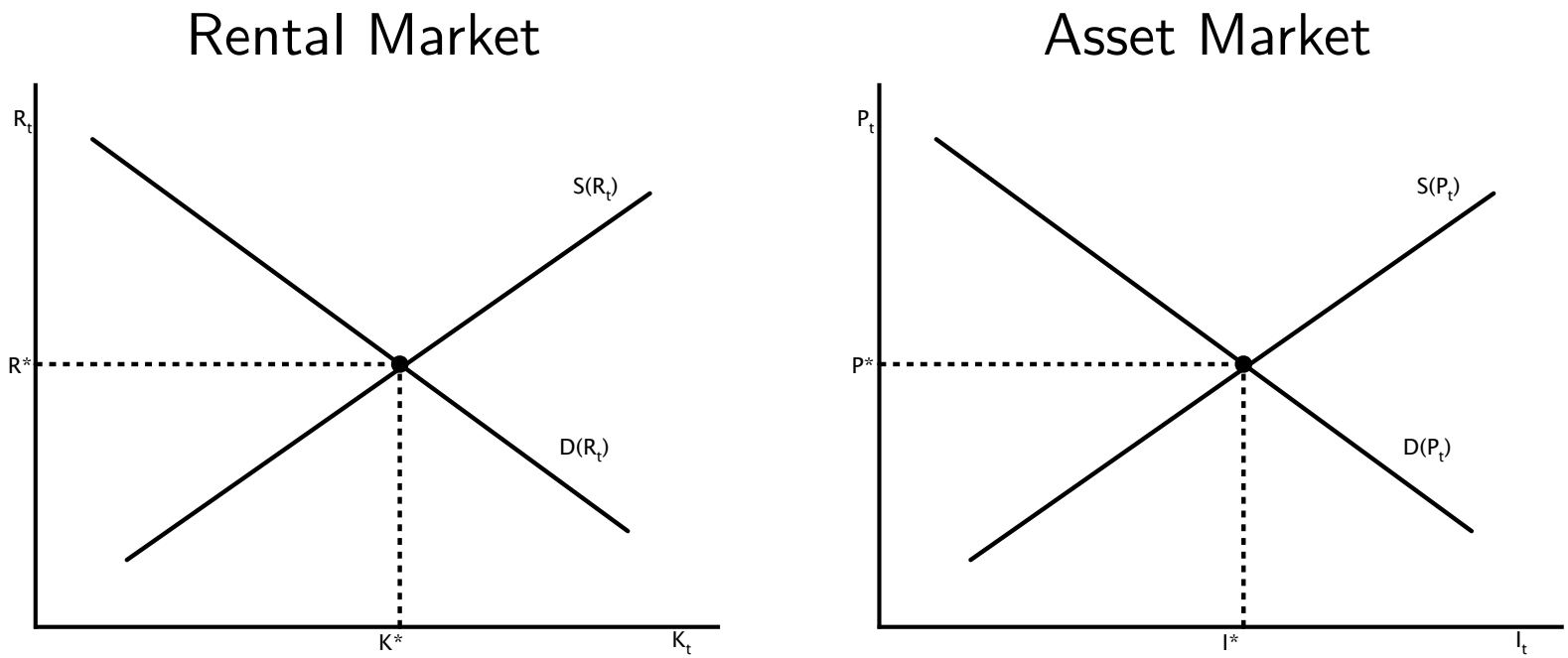
2. **Asset pricing equilibrium**:[2] the rental price of using an asset is simply the cost of buying the good and re-selling it after one period

3. **Rental market equilibrium:** the demand for using capital services is downward sloping

4. **Investment market equilibrium:** the supply of capital assets is upward sloping

Rental and asset markets are linked

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



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

4 key equations

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

2. Asset pricing equilibrium (without taxes)

What is the relationship between rental and capital prices?

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

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

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

2. Asset pricing equilibrium: Housing example

Suppose

- Suppose $r = .10$ and $\delta = 0$
- P_{t+1}=\$ 110 K
- P_t=\$ 100 K
- What is R_t?

2. Asset pricing equilibrium: Housing example

Suppose

- Suppose $r = .10$ and $\delta = 0$
- P_{t+1}=\$ 110 K
- P_t=\$ 100 K
- What is R_t?

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

$$R_t = 100 - \frac{110}{1+.1}$$

$$R_t = 0$$

2. Analyzing Rental Price

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

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

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

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

2. Analyzing Rental Price: Car example

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

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

2. Analyzing Capital Prices

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

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

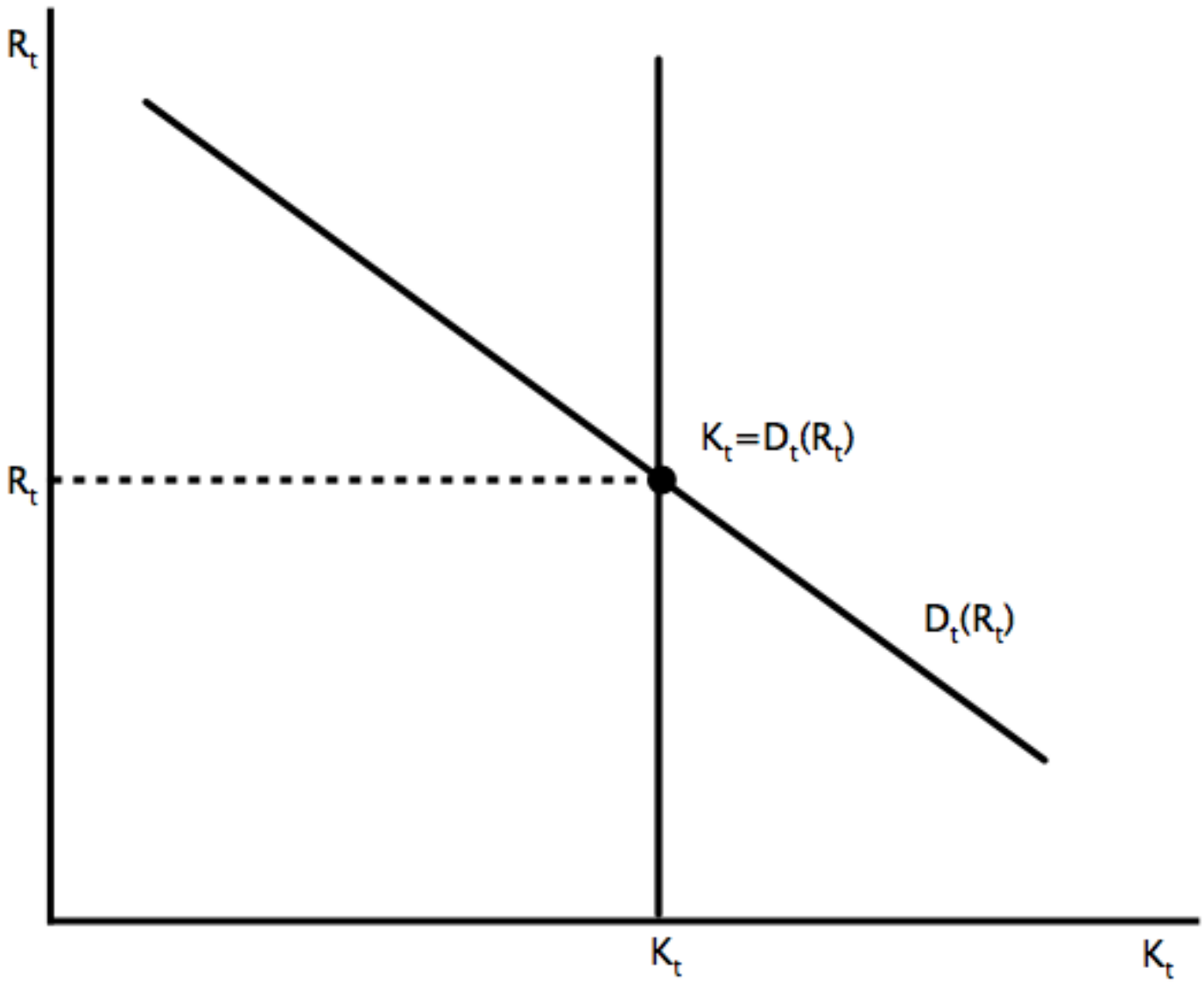
- This equation can be obtained by recursively substituting for future prices in the rental price equation
- This equation should look familiar to you (prices are PV of cash flow stream)
- Capital prices are higher when rental payments to the owner are large and soon

3. Rental Market Equilibrium for Housing Services

$$K_t = D(R_t)$$

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

3. Rental Market Equilibrium

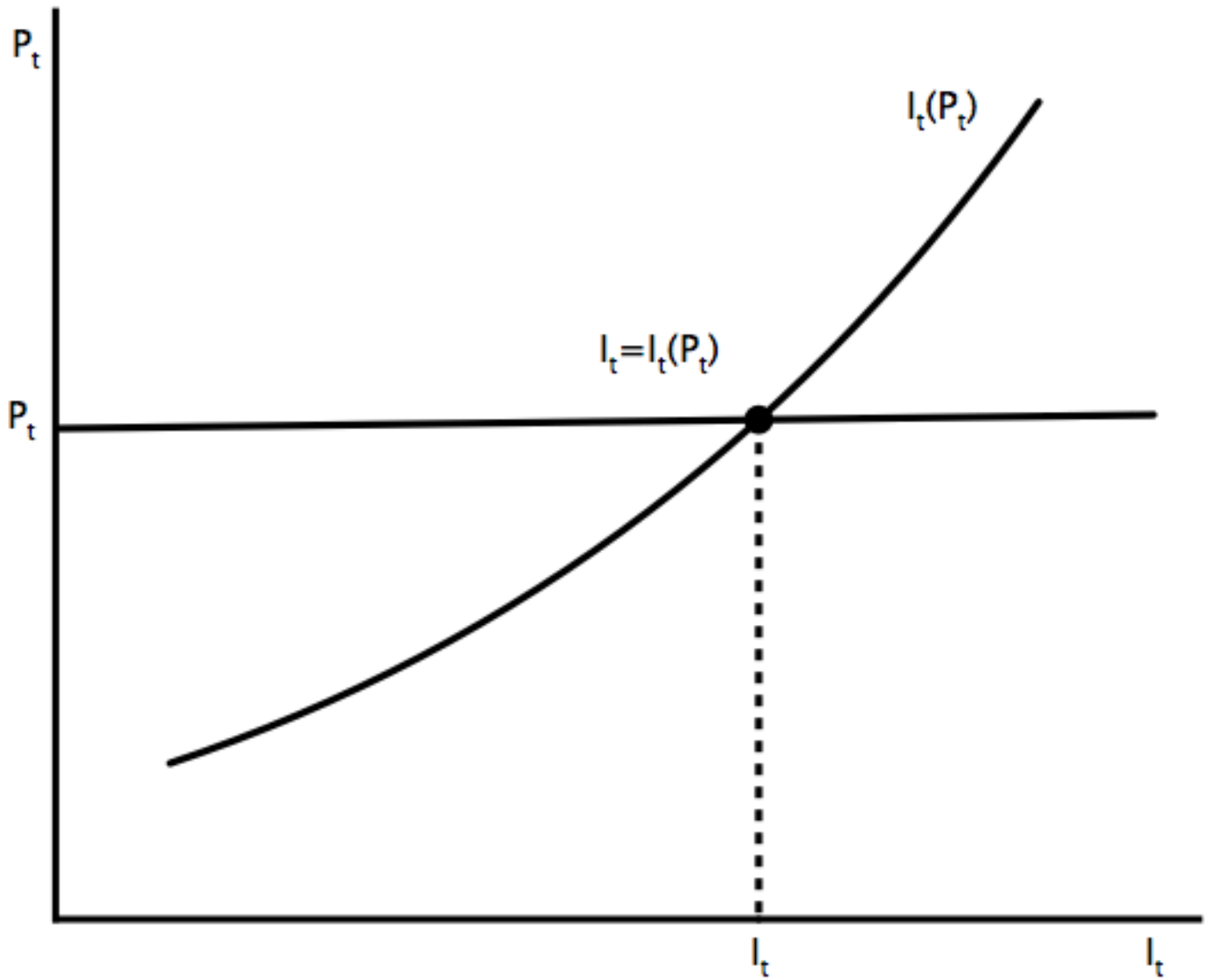


4. Investment Market Equilibrium

$$I_t = S(P_t)$$

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

4. Investment Market Equilibrium



4 key equations

$$K_t = (1-\delta)K_{t-1} + I_t \tag{2}$$

$$R_t = P_t - \frac{(1-\delta)P_{t+1}}{1+r} \tag{3}$$

$$K_t = D(R_t) \tag{4}$$

$$I_t = I(P_t) \tag{5}$$

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

Market Equilibrium: Past and Future in Housing

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

What does the system look like in steady state?

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

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

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

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

What does the system look like in steady state?

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

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

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

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

What does the system look like in steady state?

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

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

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

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

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

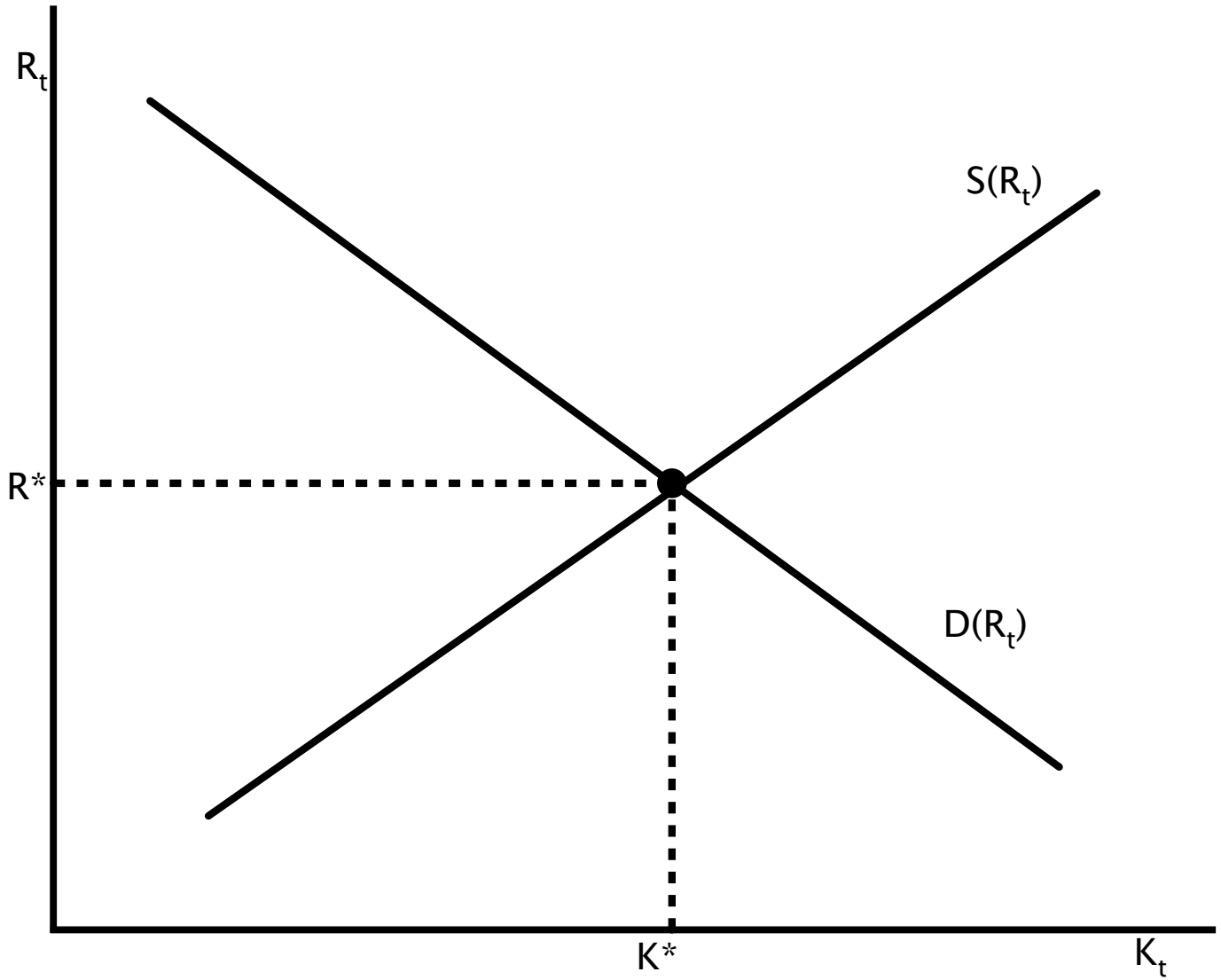
What does the system look like in steady state?

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

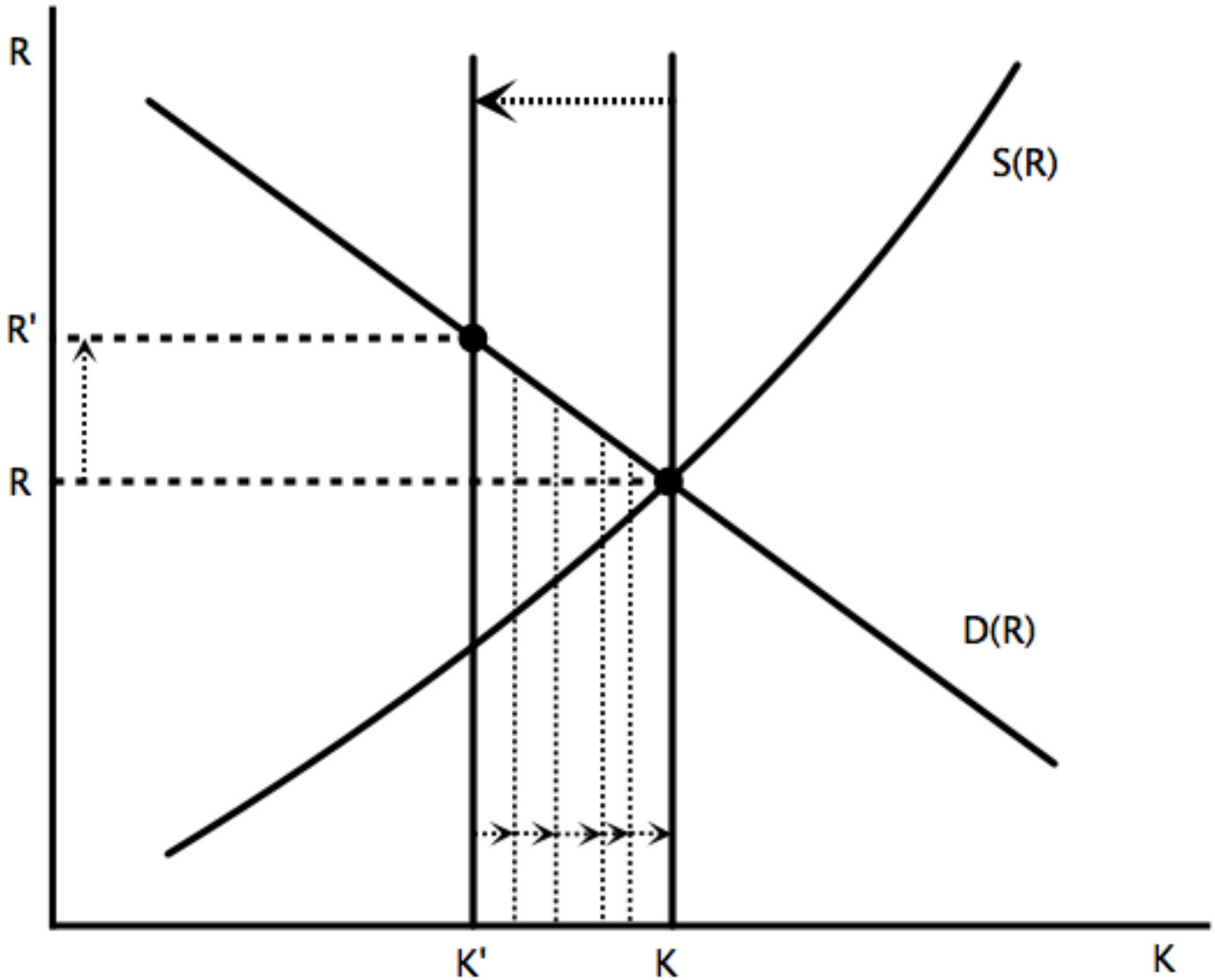
$$\bar{K} = \frac{1}{\delta} S\left(\frac{\bar{R}}{\left(1 - \frac{(1-\delta)}{1+r}\right)}\right)$$

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

Capital Market Equilibrium



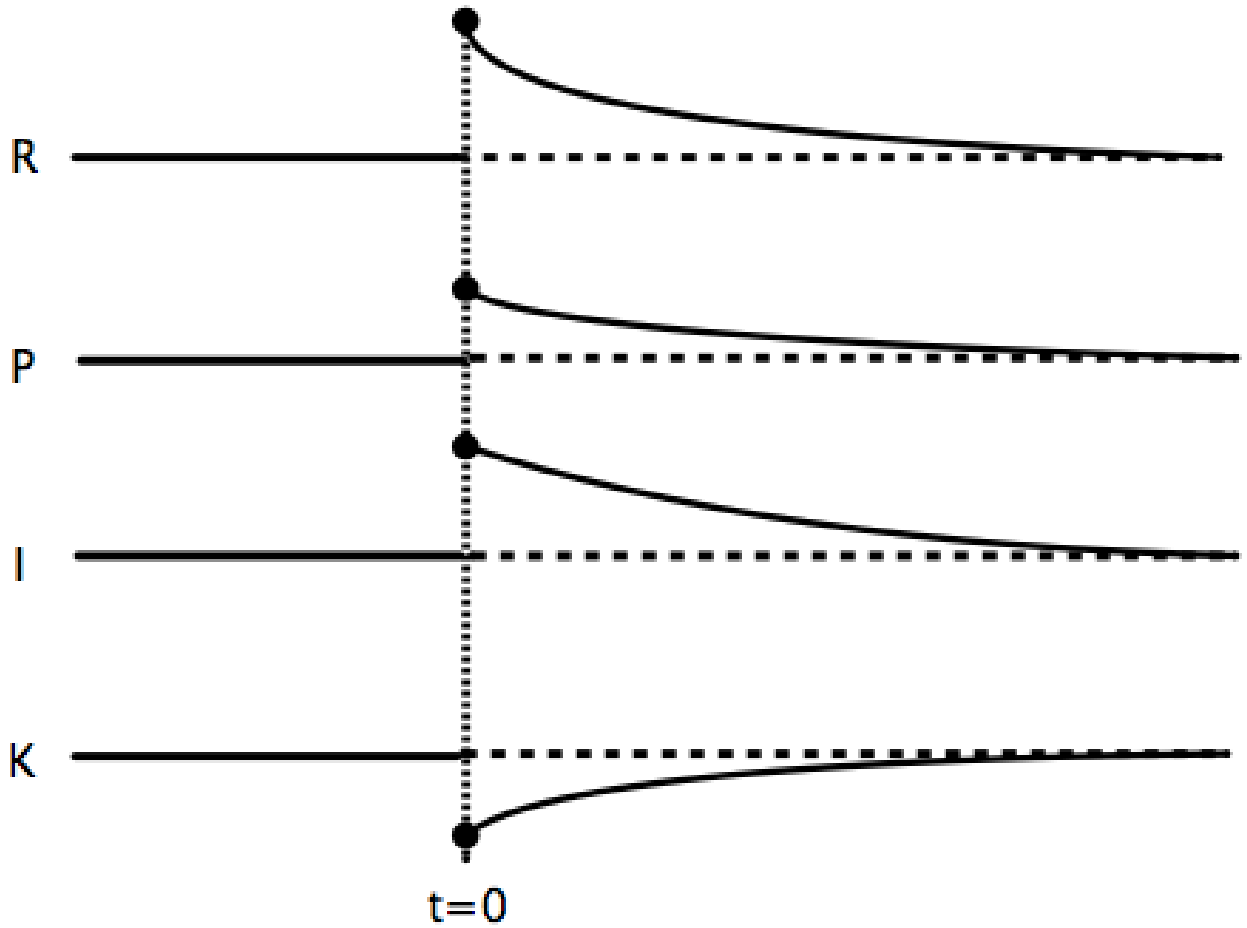
Earthquake Destroys part of capital stock



Earthquake Destroys part of capital stock

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

Earthquake Destroys part of capital stock



Speed of Adjustment

What determines the speed of convergence to the steady state?

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