Large Firms, Monopsony, and Concentration in the Labor Market

741 Macroeconomics
Topic 7

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2024 Fall

Motivation

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  … but no firm is really “large” in Hopenhayn-Rogerson – each firm is measure zero

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  - The wage HHI of a local labor market is 0.11-0.35 on average.
    - "Effective" number of firms: 3-9
  - Local labor market: 3-digit NAICS $\times$ commuting zone

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- Today: a model of oligopsony in the labor market

General Equilibrium Oligopsony Model

– Based on Berger-Mongey-Herkenhoff (2022)

Environment

- Static model
- Representative family
  - Continuum of labor markets $j \in [0,1]$
  - Labor market j has a fixed number of firms $i \in \{1, 2, \ldots, M_j\}$
  - Continuum of workers within a family, choosing where to work (i, j)
- Firms
  - Each firm produces final goods using $y_{ij} = z_{ij}^{1-\alpha} n_{ij}^{\alpha}$
- Markets
  - Local labor market: Cournot competition for labor

Representative Family

- A mass L of workers within a family
- Each worker $l \in [0,L]$ has efficiency unit of labor $\epsilon_{ij}(l)$ when working at (i,j)
- The family solves

$$\max_{C,\{\mathbb{1}_{ij}(l)\}} \; C$$

$$\text{s.t.} \quad C = \int_0^1 \sum_{i=1}^{M_j} \int_0^L w_{ij}\epsilon_{ij}(l)\mathbb{1}_{ij}(l)djdl + \Pi$$

- Assume the distribution of $\epsilon_{ij}(l)$ follow nested Fréchet (GEV)

$$\Pr\left(\{\epsilon_{ij}(l) \le a_{ij}\}_{ij}\right) = \exp\left[-G\left(\{a_{ij}\}_{ij}\right)\right], \quad G(\{a_{ij}\}) = \int_0^1 \left(\sum_{i=1}^{M_j} a_{ij}^{-(\eta+1)}\right)^{\frac{\eta+1}{\theta+1}} dj$$

with $\eta > \theta$

Representation Result

- The family's problem can be equivalently represented as

$$\max_{C,\{\ell_{ij}\}:\sum_{ij}\ell_{ij}=1} \quad C$$

$$\text{s.t.} \quad C = \int_0^1 \sum_{i=1}^{M_j} w_{ij}\ell_{ij}S_{ij}(\{\ell_{ij}\})dj \times L + \Pi$$

where

$$S_{ij}(\{\ell_{ij}\}) = \left(\frac{\ell_{ij}}{\sum_i \ell_{ij}}\right)^{-1/(\eta+1)} \left(\sum_i \ell_{ij}\right)^{-1/(\theta+1)}$$

- ℓ_{ij}: share of workers working for firm i in market j
- S_{ij}: average efficiency of workers in (i,j), and it captures selection:

  more workers work in $(i,j) \Rightarrow$ average efficiency of workers worsens

- See Donald-Fukui-Miyauchi (2024) Appendix D for a proof

Nested CES Labor Supply System

Solutions: Given a vector of wages, $\{w_{ij}\}_{ij}$,

- The share of workers who choose to work in (i, j) is

$$\ell_{ij}(\{w_{ij}\}_{ij}) = \left(\frac{w_{ij}}{\mathbf{w}_j}\right)^{\eta+1} \left(\frac{\mathbf{w}_j}{\mathbf{W}}\right)^{\theta+1}$$

where $\quad \mathbf{w}_j \equiv \left[\sum_i w_{ij}^{\eta+1}\right]^{1/(\eta+1)}, \quad \mathbf{W} \equiv \left[\int_0^1 \mathbf{w}_j^{\theta+1} dj\right]^{1/(\theta+1)}$

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- The efficiency units of labor supply for (i, j) is

$$n_{ij}(\{w_{ij}\}_{ij}) \equiv \ell_{ij} S_{ij}(\{\ell_{ij}\}) L = \left(\frac{w_{ij}}{\mathbf{w}_j}\right)^{\eta} \left(\frac{\mathbf{w}_j}{\mathbf{W}}\right)^{\theta} L$$

Oligopsonistic Labor Market

- The inverse labor supply function is

$$w_{ij}(\{n_{ij}\}) = \left(\frac{n_{ij}}{\mathbf{n}_j}\right)^{\frac{1}{\eta}} \left(\frac{\mathbf{n}_j}{\mathbf{N}}\right)^{\frac{1}{\theta}}$$

$$\mathbf{n}_j \equiv \left[\sum_i n_{ij}^{\frac{\eta+1}{\eta}}\right]^{\frac{\eta}{\eta+1}}, \quad \mathbf{N} \equiv \left[\int_0^1 \mathbf{n}_j^{\frac{\theta+1}{\theta}} dj\right]^{\frac{\theta}{\theta+1}}$$

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- Firms engage in Cournot competition, taking competitor's hiring as given, $n_{-ij} = n^*_{-ij}$

$$\max_{n_{ij}} z_{ij}^{1-\alpha} n_{ij}^{\alpha} - w_{ij}(n_{ij}, n^*_{-ij}) n_{ij}$$

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  - General solution:

$$w_{ij} = \mu_{ij} \times \alpha z_{ij}^{1-\alpha} n_{ij}^{\alpha-1}, \quad \mu_{ij} \equiv \frac{\varepsilon_{ij}}{\varepsilon_{ij}+1}, \quad \varepsilon_{ij} \equiv \frac{d \ln n_{ij}}{d \ln w_{ij}}$$

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wage markdown MPL

Wage Markdown

- With our functional form assumption, the labor supply elasticity takes the form of

$$\varepsilon_{ij}(s_{ij}) = \left[\frac{1}{\eta}(1 - s_{ij}) + \frac{1}{\theta}s_{ij}\right]^{-1}, \quad \mu_{ij}(s_{ij}) = \frac{\varepsilon_{ij}(s_{ij})}{\varepsilon_{ij}(s_{ij}) + 1}$$

  where

$$s_{ij} = \frac{w_{ij}n_{ij}}{\sum_k w_{kj}n_{kj}} \tag{1}$$

  is the labor market share of firm i in market j

  1. Competitive labor market: $\theta, \eta \to \infty$ so that $\varepsilon_{ij} \to \infty$
  2. Monopsonistic competition within a market j: $s_{ij} \to 0$ so that $\varepsilon_{ij} \to \eta$
  3. Monopsony within a market j: $s_{ij} \to 1$ so that $\varepsilon_{ij} \to \theta$

- See also Atkeson-Burstein (2008)

Equilibrium System

- Relative employment between i and k:

$$\frac{n_{ij}}{n_{kj}} = \left(\frac{w_{ij}}{w_{kj}}\right)^{\eta} = \left(\frac{\mu_{ij}(s_{ij}) z_{ij}^{1-\alpha} n_{ij}^{\alpha-1}}{\mu_{kj}(s_{ij}) z_{kj}^{1-\alpha} n_{kj}^{\alpha-1}}\right)^{\eta}$$

- Solving for n_{ij}/n_{kj} gives

$$\frac{n_{ij}}{n_{kj}} = \left(\frac{\mu_{ij}(s_{ij}) z_{ij}^{1-\alpha}}{\mu_{kj}(s_{kj}) z_{ij}^{1-\alpha}}\right)^{\frac{\eta}{1+\eta(1-\alpha)}}$$

- Substituting into (1) gives the system of equations in terms of $\{s_{ij}\}$

$$s_{ij} = \frac{\left(\mu_{ij}(s_{ij}) z_{ij}^{1-\alpha}\right)^{\frac{1+\eta}{1+\eta(1-\alpha)}}}{\sum_k \left(\mu_{kj}(s_{kj}) z_{kj}^{1-\alpha}\right)^{\frac{1+\eta}{1+\eta(1-\alpha)}}}$$

- Given $\{s_{ij}\}$, one can immediately obtain $\{w_{ij}, n_{ij}, \ell_{ij}\}$

Equilibrium System

The equilibrium $\{s_{ij}\}$ solve

$$s_{ij} = \frac{\left(\mu_{ij}(s_{ij})z_{ij}^{1-\alpha}\right)^{\frac{1+\eta}{1+\eta(1-\alpha)}}}{\sum_k \left(\mu_{kj}(s_{kj})z_{kj}^{1-\alpha}\right)^{\frac{1+\eta}{1+\eta(1-\alpha)}}}$$

- Proof: Relative employment between i and k:

$$\frac{n_{ij}}{n_{kj}} = \left(\frac{w_{ij}}{w_{kj}}\right)^{\eta} = \left(\frac{\mu_{ij}(s_{ij})z_{ij}^{1-\alpha}n_{ij}^{\alpha-1}}{\mu_{kj}(s_{ij})z_{kj}^{1-\alpha}n_{kj}^{\alpha-1}}\right)^{\eta} \quad \Leftrightarrow \quad \frac{n_{ij}}{n_{kj}} = \left(\frac{\mu_{ij}(s_{ij})z_{ij}^{1-\alpha}}{\mu_{kj}(s_{kj})z_{ij}^{1-\alpha}}\right)^{\frac{\eta}{1+\eta(1-\alpha)}}$$

- Substituting into (1) gives the expression
- Given $\{s_{ij}\}$, we can immediately compute $\{\mu_{ij}, n_{ij}, w_{ij}\}$

Implications for Labor Share

- Define the aggregate labor share as

$$LS = \frac{\int_0^1 \sum_{i \in j} w_{ij} n_{ij} dj}{\int_0^1 \sum_{i \in j} y_{ij} dj}$$

- Define the payroll weighted HHI as

$$\text{HHI} = \int_0^1 s_j \text{HHI}_j dj, \quad s_j = \frac{\sum_{i \in j} w_{ij} n_{ij}}{\int_0^1 \sum_{i \in j} w_{ij} n_{ij} dj}, \quad \text{HHI}_j = \sum_{i \in j} s_{ij}^2$$

- Result:

$$LS = \alpha \left[(1 - \text{HHI}) \left(\frac{\eta}{\eta + 1} \right)^{-1} + \text{HHI} \left(\frac{\theta}{\theta + 1} \right)^{-1} \right]^{-1}$$

Bringing the Model to the Data

Identification

- Key parameters: (θ, η)
- Labor supply equation with potential labor supply shifter ξ_{ij}

$$n_{ij}(\{w_{ij}\}_{ij}) = \xi_{ij} \left(\frac{w_{ij}}{\mathbf{w}_j} \right)^{\eta} \left(\frac{\mathbf{w}_j}{\mathbf{W}} \right)^{\theta} L$$

- Taking log,

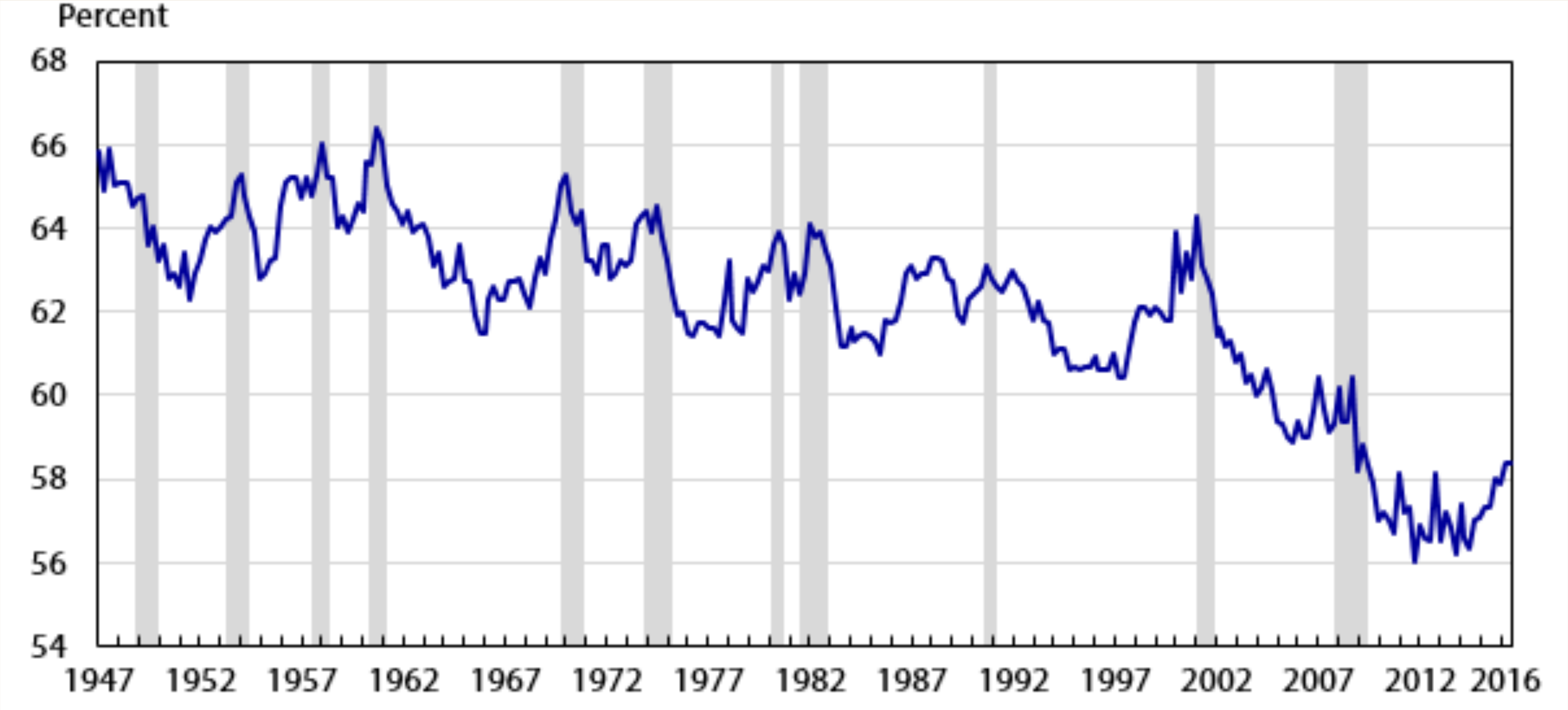
$$\log n_{ij} = \eta \log(w_{ij}) + (\theta - \eta) \log \mathbf{w}_j - \theta \log \mathbf{W} + \log L + \log \xi_{ij}$$

  - With suitable instruments (labor demand shifter), one can identify (θ, η)
    1. Berger-Mongey-Herkenhoff (2021): changes in state corporate taxes
    2. Felix (2023): changes in tariffs

Estimation Results

- BHM's implementation: US Census LBD data
- Market: 3-digit NAICS $\times$ commuting zone
- Estimates: $\eta = 10.85, \theta = 0.42$
- With $HHI = 0.11$ in 2014, the model implies **30%** aggregate wage markdown

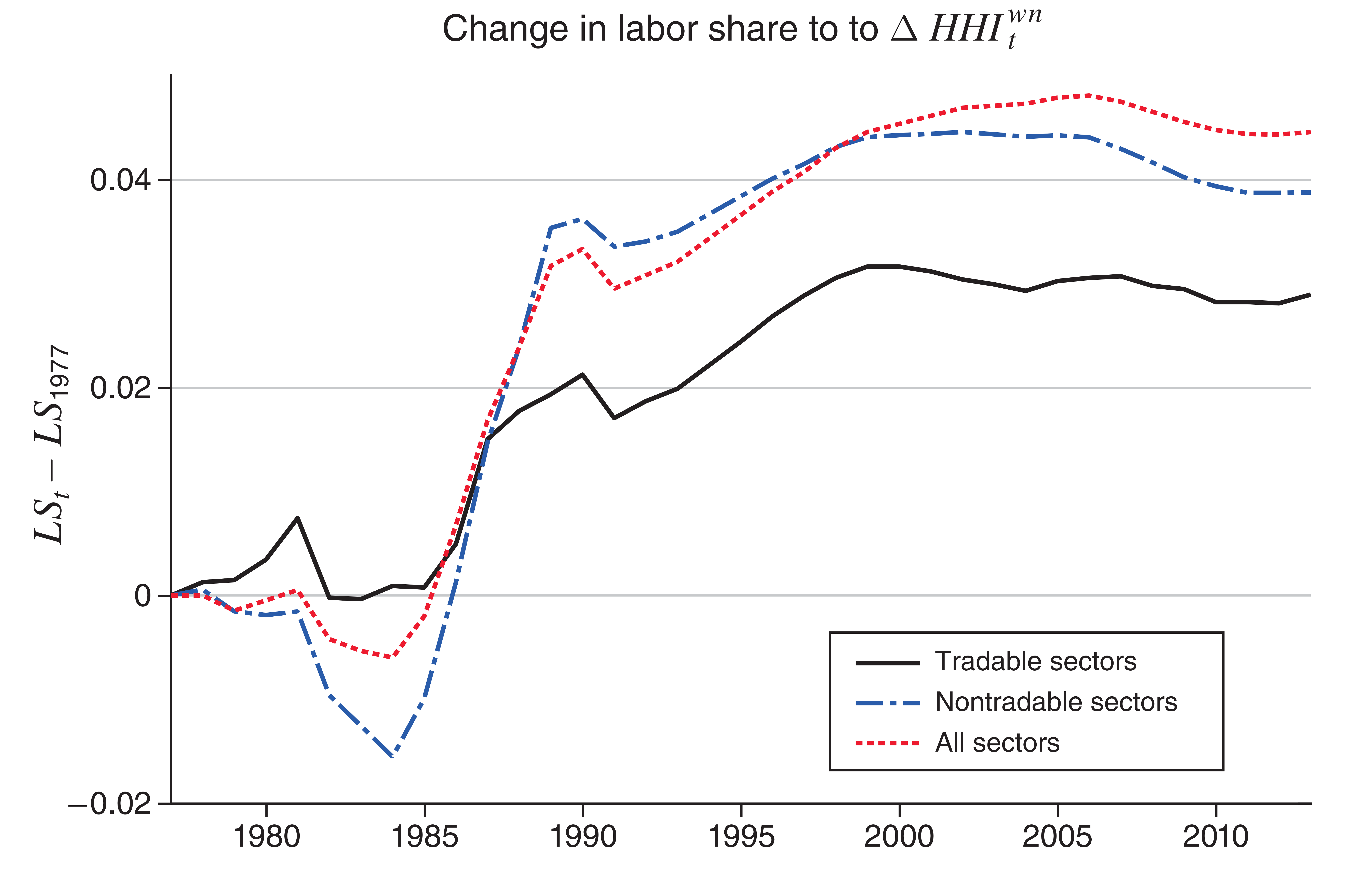
Labor Share



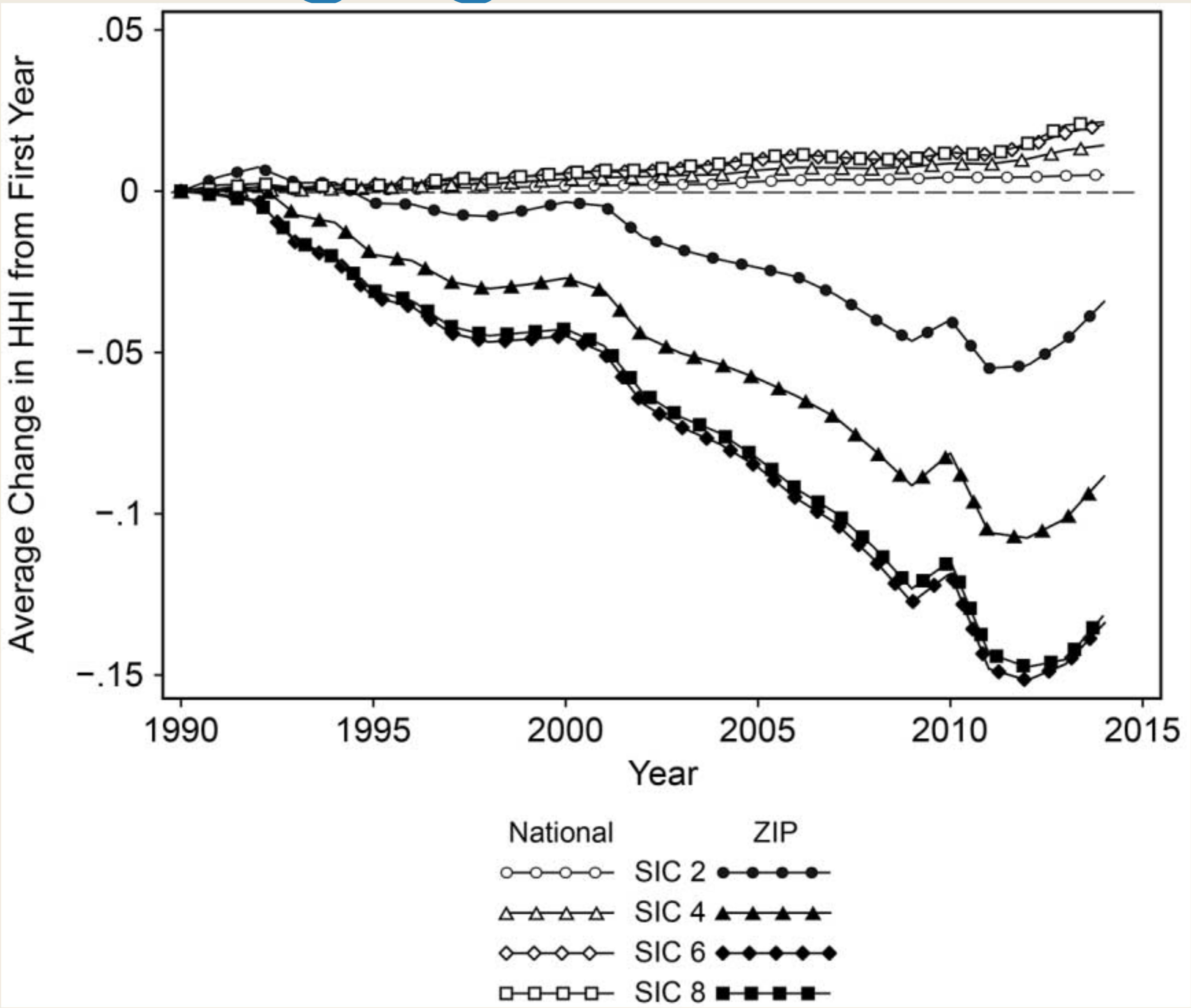
- Can the changes in concentration explain the changes in labor share?

Labor Share Increases due to ΔHHI

- Fix (η, θ, α) and feed the changes in HHI over time



Diverging Trends in HHI



Source: Rossi-Hansberg, Sarte, & Trachter (2021)

Direct Test of the Mechanism

1. Do exogenous changes in concentration move wages in the local labor market?
    - Yes! (Arnold, 2021)
    - M&As at the national level $\Rightarrow$ quasi-exogenous changes in local concentration
    - Wages & employment decline in markets with increased labor market concentration

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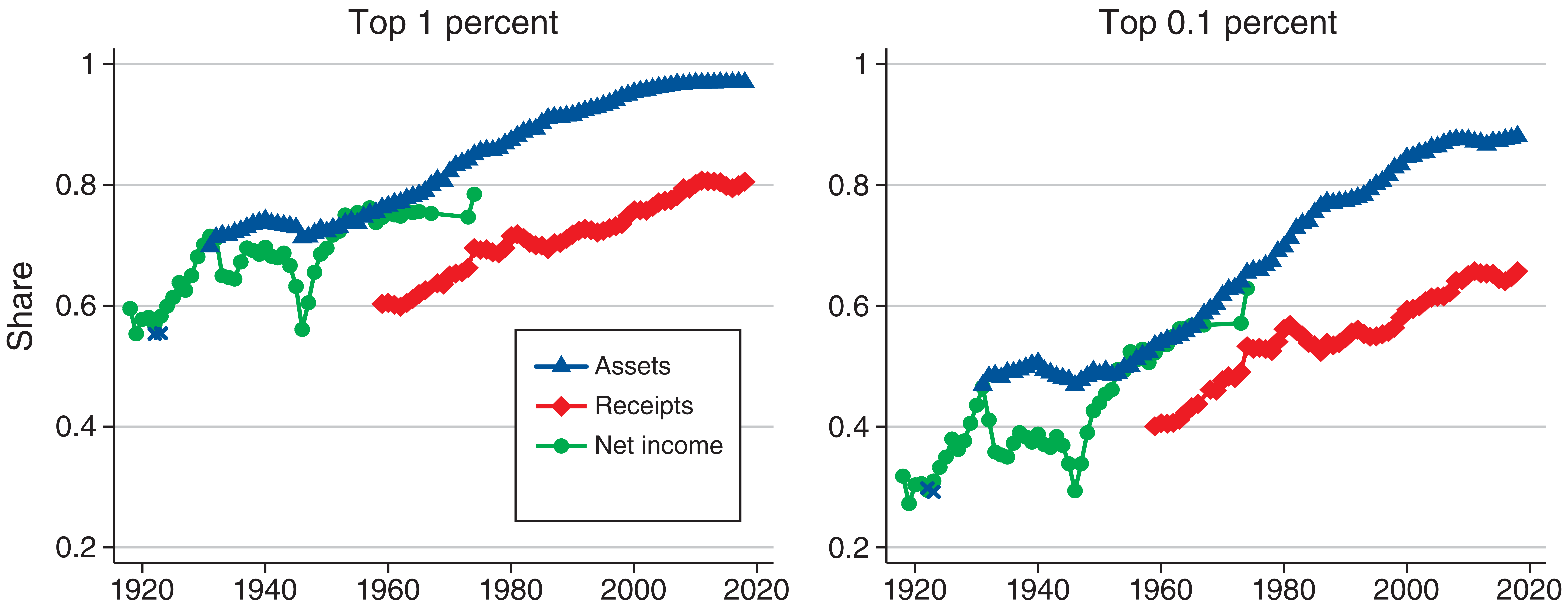
2. Do exogenous changes in your competitor's wages move your wage?
   - No! (Derenoncourt & Weil, 2024)
   - Company-wide voluntary minimum wage increases
     (a) raise wages and retention of the company that implemented it…
     (b) …but have no effect on wages and hiring of the competitors

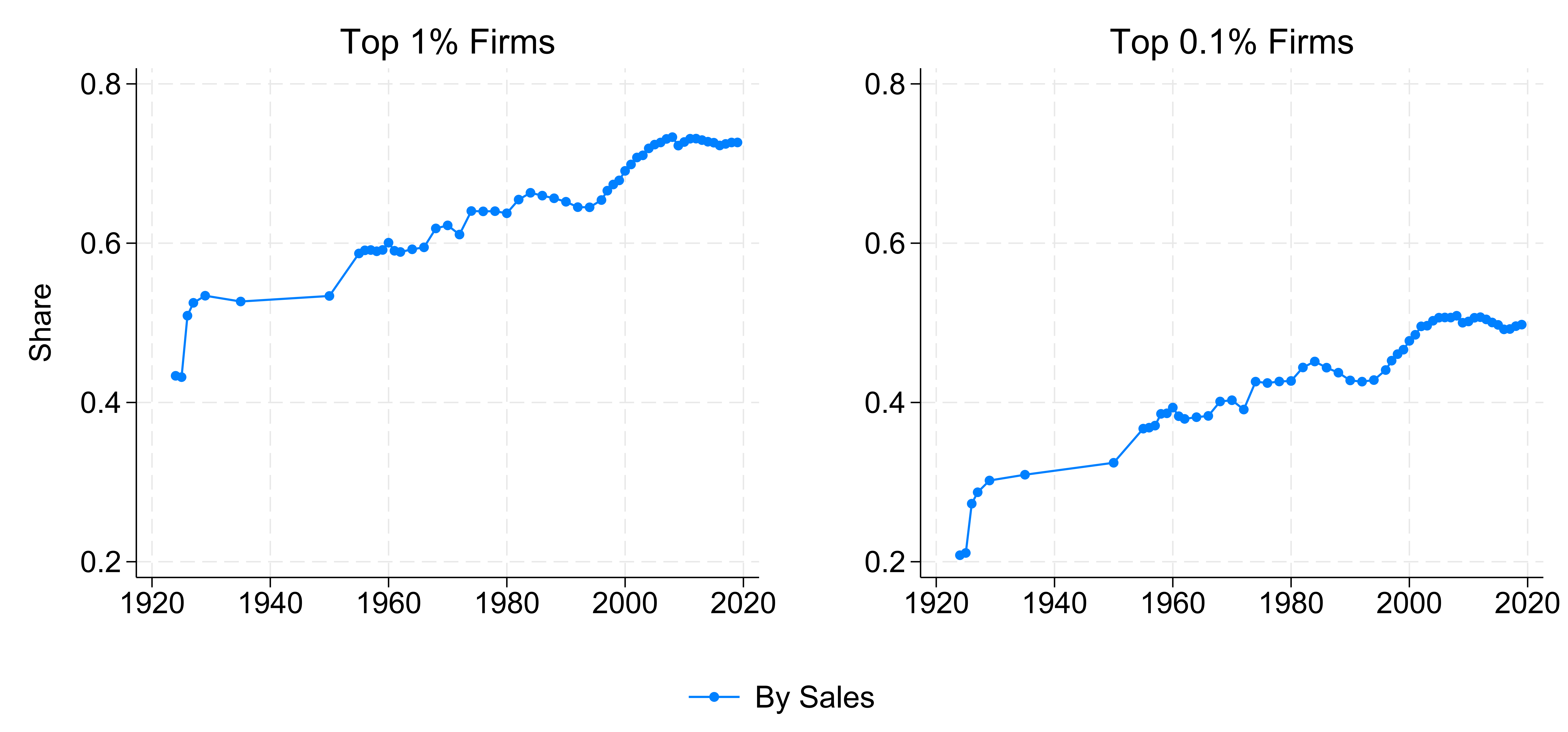
The Rise of Large Firms

100 Years of Rising Concentration in the US



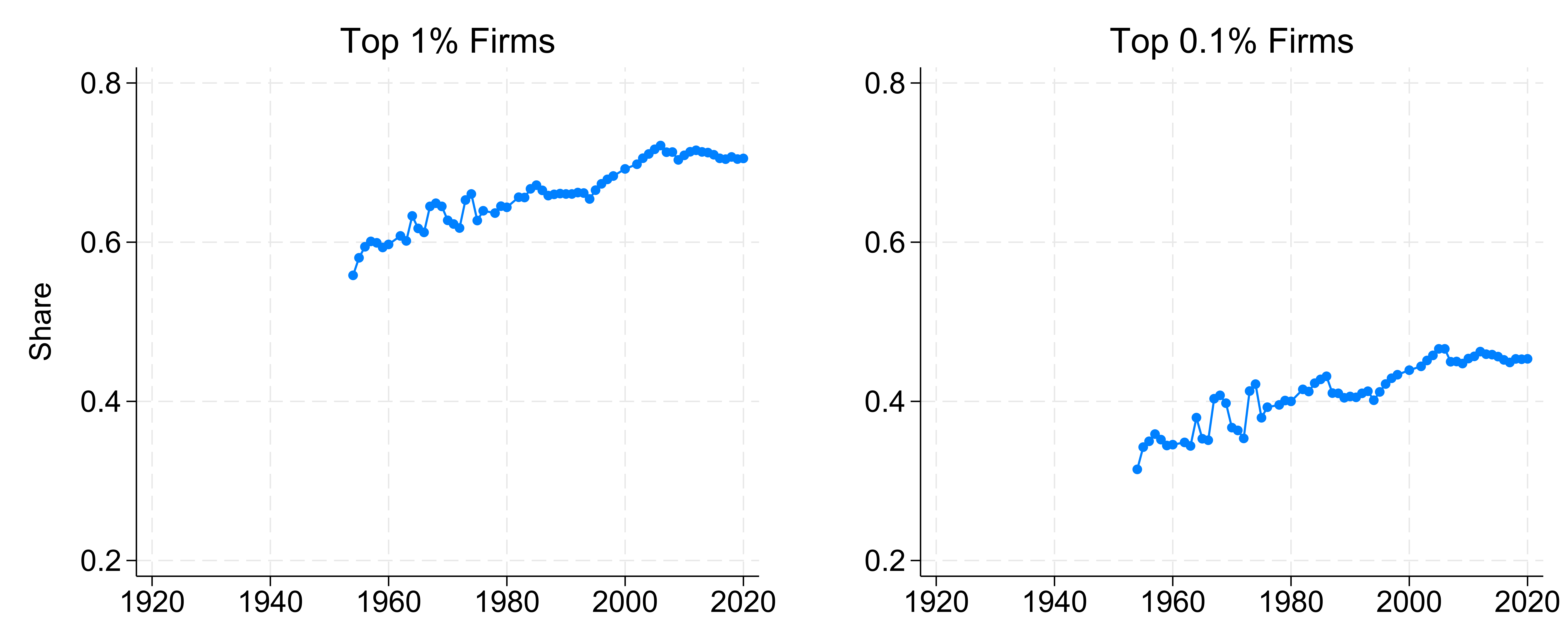
Source: Kwon, Ma, & Zimmermann (2024)

Germany



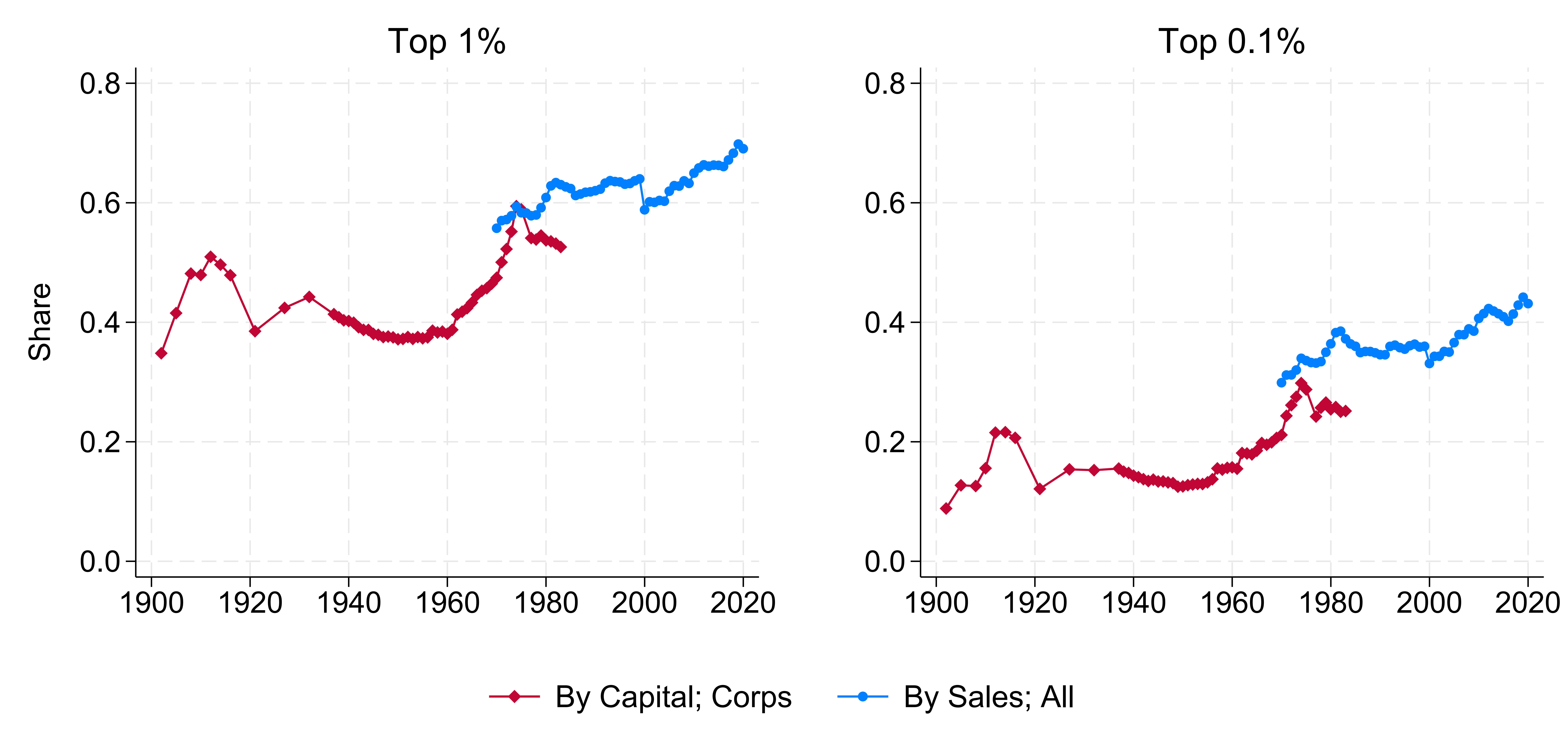
Source: Ma, Zhang, Zimmermann (2024)

Austria



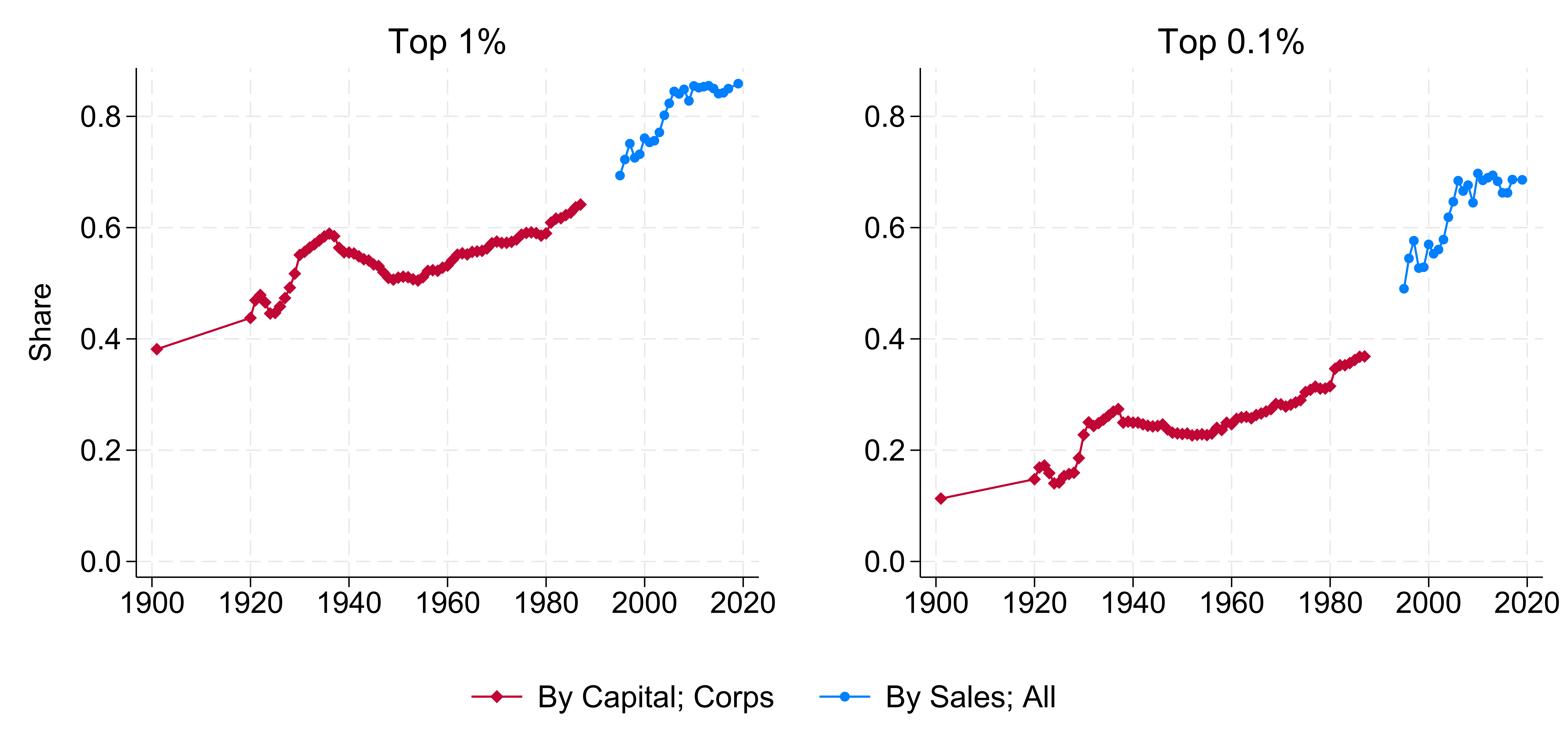
Source: Ma, Zhang, Zimmermann (2024)

Denmark



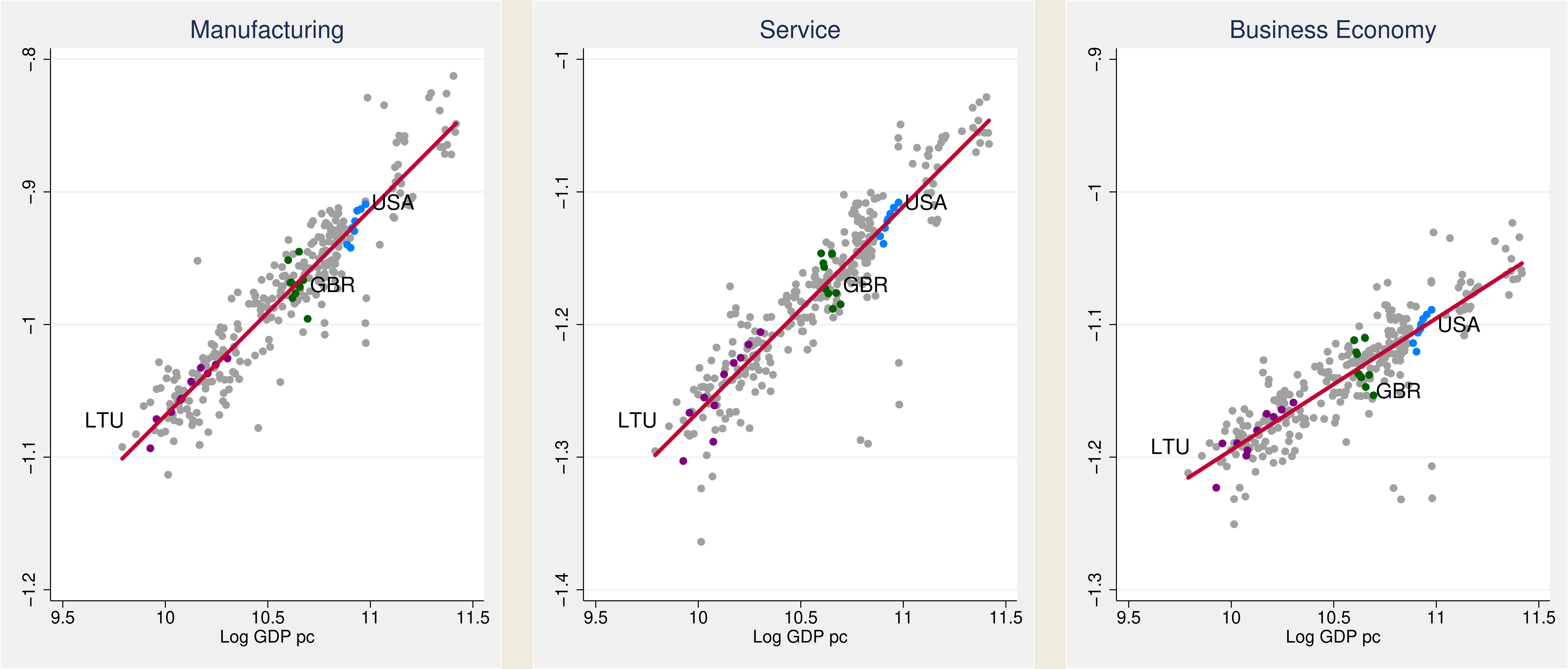
Source: Ma, Zhang, Zimmermann (2024)

Switzerland



Source: Ma, Zhang, Zimmermann (2024)

Power Law and Economic Development

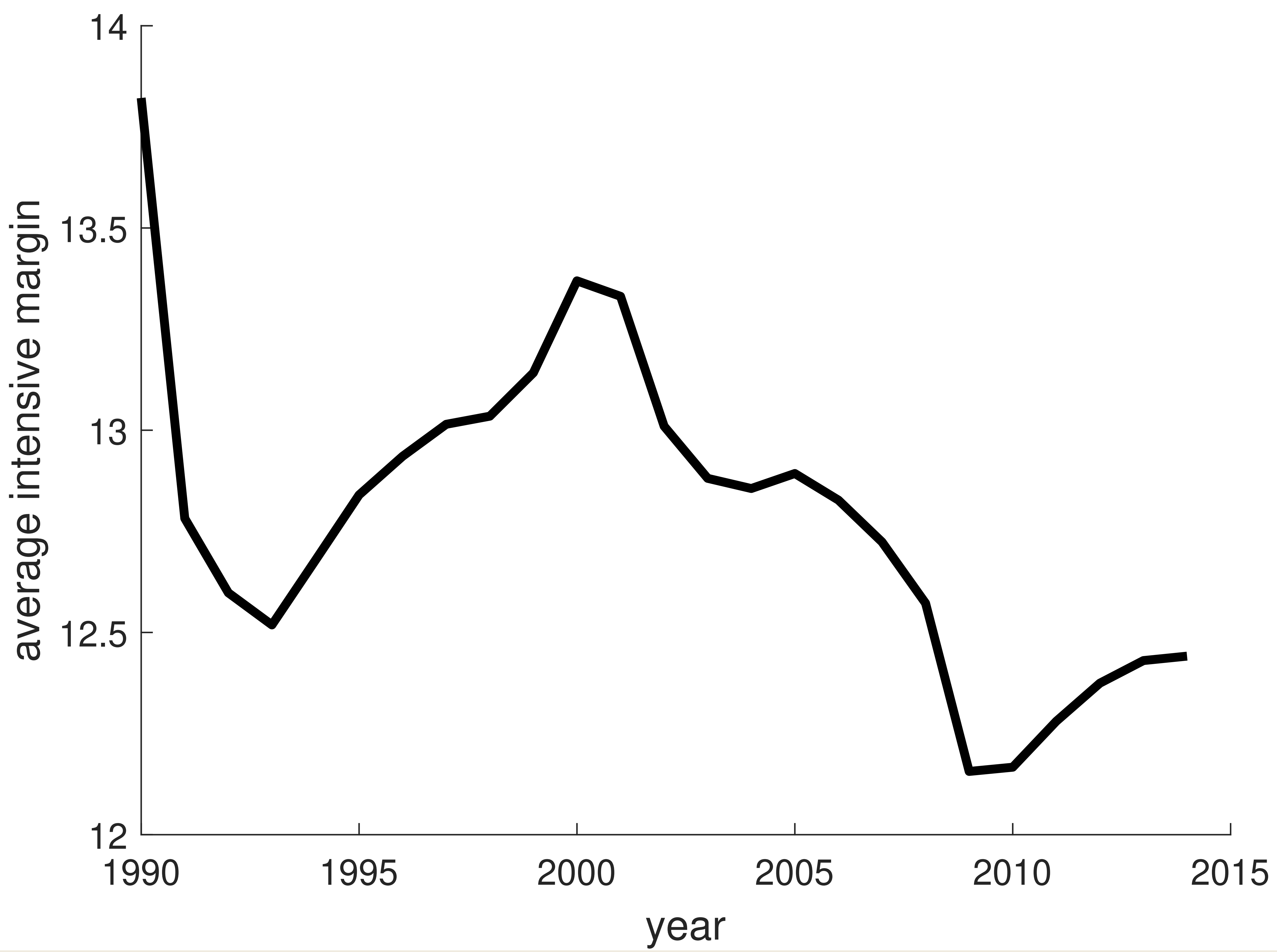


(a) Manufacturing (b) Service (c) Business Economy

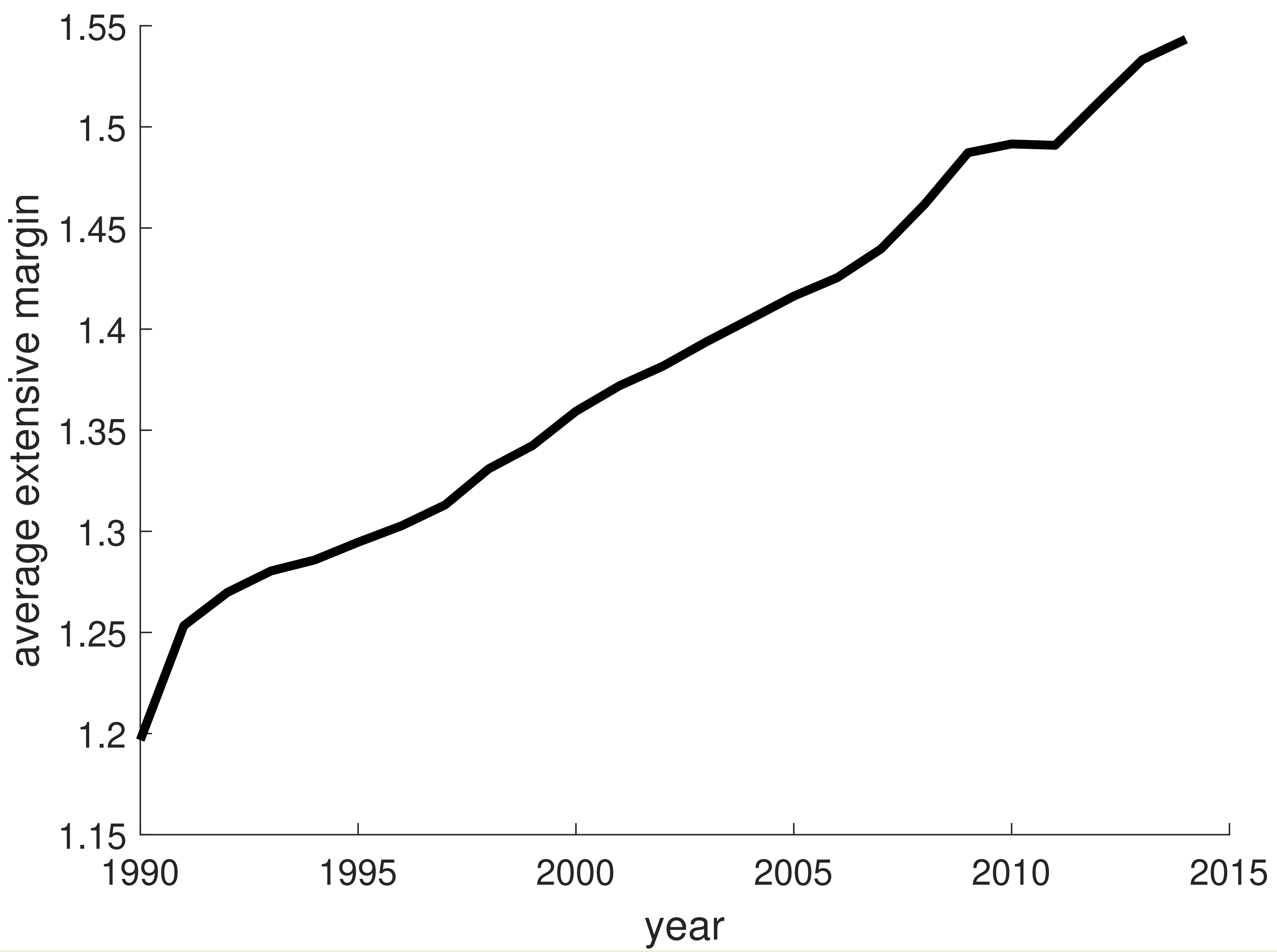
Source: Chen (2023)

Firm Growth Through Establishments

Average size of establishment



Number of establishments



Source: Cao, Hayyatt, Mukoyama, Sager (2022)

Wrapping Up

1. Please fill out the teaching evaluation

2. The final project is due Jan 20th
   - Option 1:
     one of the things we discussed in the class
   - Option 2:
     replicate one of lecture notes 4-6 and extend in a direction that you think is interesting
   - Option 3:
     research proposal