The Regional Specialization Trade-off

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  1. How does regional specialization affect growth?
  2. What is the optimal regional specialization?

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- Financial frictions account for 56% of adverse specialization effect on growth
- Efficient regional specialization in 1950 raises welfare by 1.2-2.2 percent

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1. **Regional growth:**

   [Solow (1956), Baumol (1986), Barro and Sala-i-Martin (1991), Autor & Dorn (2013), Giannone (2022), Eckert & Peters (2023), Comin et al (2021), Gaubert et al (2020), Caselli et al (2016)]

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3. **Long-run implications of financial frictions:**

   [Kiyotaki & Moore (1997), Bernanke, Gertler & Gilchrist (1999), Mendoza (2010), Gertler & Karadi (2012), Bianchi (2011), Bianchi & Mendoza (2019), Bonciani et al (2023)]

   Contribution: Derive financial friction in multi-industry setting + long-run effects

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5. Conclusion

Empirical results

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  - Robustness: other measures (HHI, max share), other variables (employment, value added)

▸ Topcoding ▸ Further Details

Fact 1: The specialization trade-off

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- Define
  - r for commuting zone $r = \{1, ..., 722\}$
  - Y_r as dependent variable
  - $Gini_{r,1950}$ as 1950 Gini on income p.c. by 3-digit industry

$$Y_r = \alpha + \beta \cdot Gini_{r,1950} \qquad\qquad + \epsilon_r$$

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$$Y_r = \alpha + \beta \cdot Gini_{r,1950} + \gamma' \cdot Z_r \qquad + \epsilon_r$$

  - Z_r including a set of control variables:
    - 1950 log income p.c. [Barro & Sala-i-Martin (1992)]
    - 1950 population [Eckert, Ganapati & Walsh (2024)]
    - 1950 share of high-skilled workers [Autor & Dorn (2013)]
    - 1950 old-age dependency ratio [Autor, Dorn & Hanson (2019)]
    - 1950 share of female workers [Fosso, Bergholt, Furlanetto (2025)]

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$$Y_r = \alpha + \beta \cdot Gini_{r,1950} + \gamma' \cdot Z_r + \delta \cdot \hat{g}_r + \epsilon_r$$

  - Z_r including a set of control variables
  - $\hat{g}_r$ as shift-share predicted growth from structural change [Borusyak et al (2025)]

$$\hat{g}_r = \sum_{i=1}^{I} s_{i,r,1950} \cdot g_i^{US}$$

  with
    - $s_{i,r,1950}$ as 1950 income share in industry i
    - g_i^{US} as 1950-2020 US growth in industry i

Fact 1: The specialization trade-off after controls

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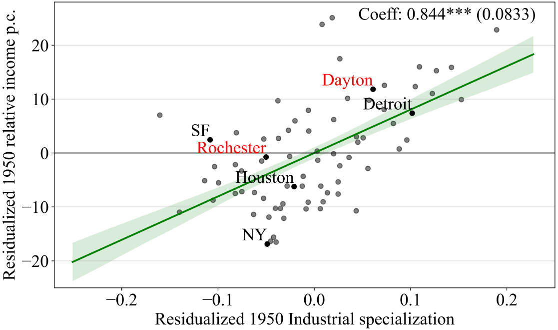

Figure 1: 1950 Income level

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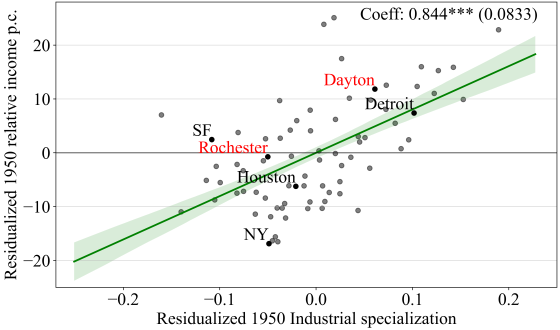

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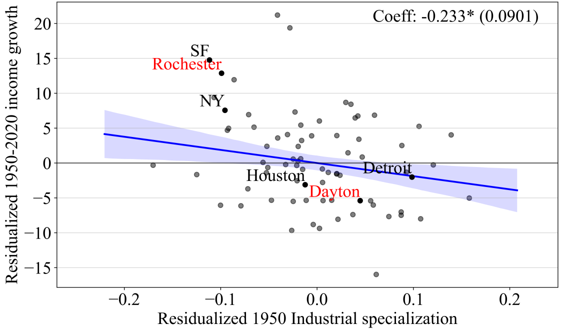

Figure 2: 1950-2020 Growth

Regression table

Fact 2: As regions grow, they become more specialized

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  1. Characterize relationship between specialization and income
  2. Observe how regions move in distribution

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- Key point: dynamics can be highly non-linear [Imbs & Wacziarg (2003)]
- Define non-parametric locally weighted regression:
  - i as single observation: Commuting Zone $\times$ Year
  - y_i as Gini on income p.c. by 3-digit industry
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with

- $(\hat{\alpha}(x_i), \hat{\beta}(x_i)) = \arg\min_{\alpha,\beta} \sum_j w_j(x_i)(y_i - (\alpha + \beta x_j))^2$
- weights $w_j(x_i)$ choice of kernel (tricube, rectangular, Gaussian)

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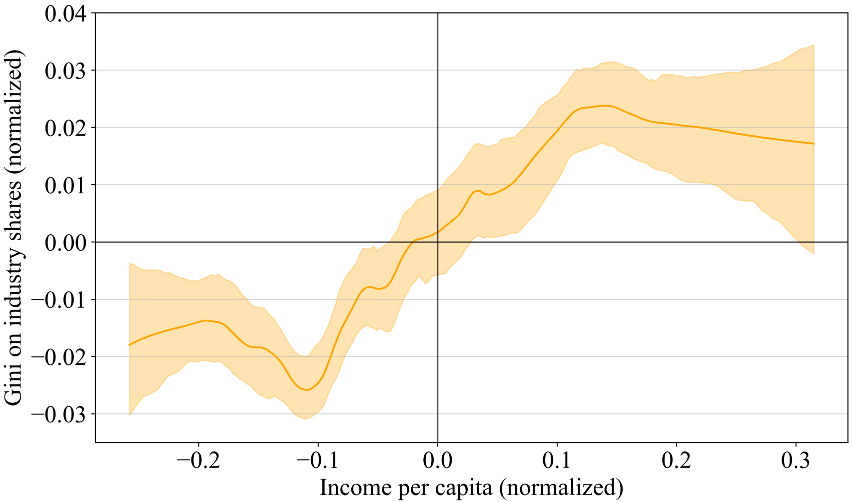

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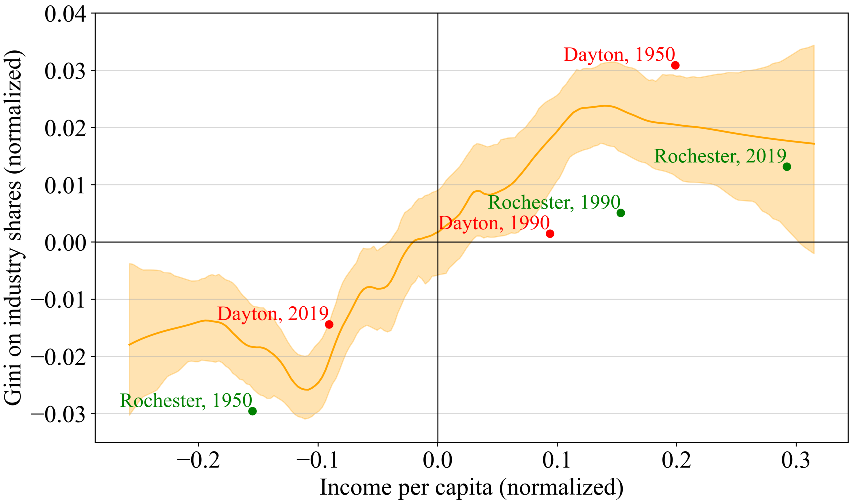

▸ Further details

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- Define
  - Revealed Comparative Advantage (RCA): $RCA_{irt} = \frac{Y_{irt}}{Y_{rt}} / \frac{Y_{it}^{US}}{Y_{t}^{US}}$ [Morris-Levenson & Prato (2021)]
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  - RankRCA_{irt}: Rank region-industries by RCA
  - $\delta_{r,t}$ as region-year FE
  - $\gamma_{i,t}$ as industry-year FE
  - h as horizon

$$\text{logRankRCA}_{i,r,t} = \alpha + \beta_h \cdot \text{logRankRCA}_{i,r,t-h} + \delta_{r,t} + \gamma_{i,t} + \epsilon_{i,r,t}$$

- Coefficent β_h: Rank-rank elasticity of RCA (persistence measure)

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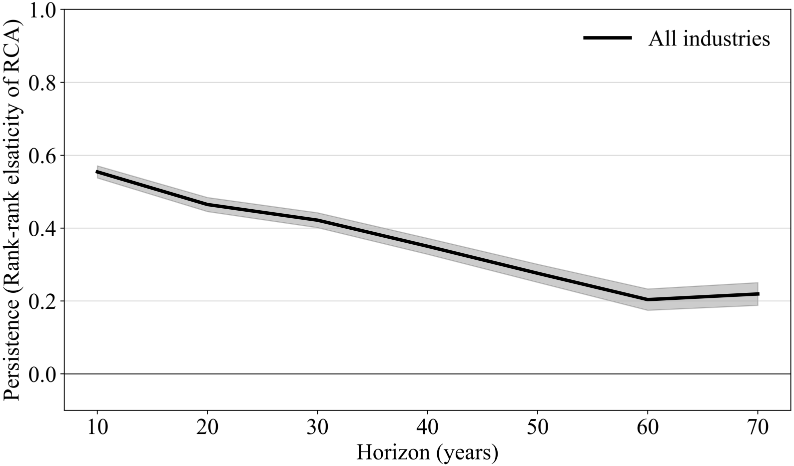

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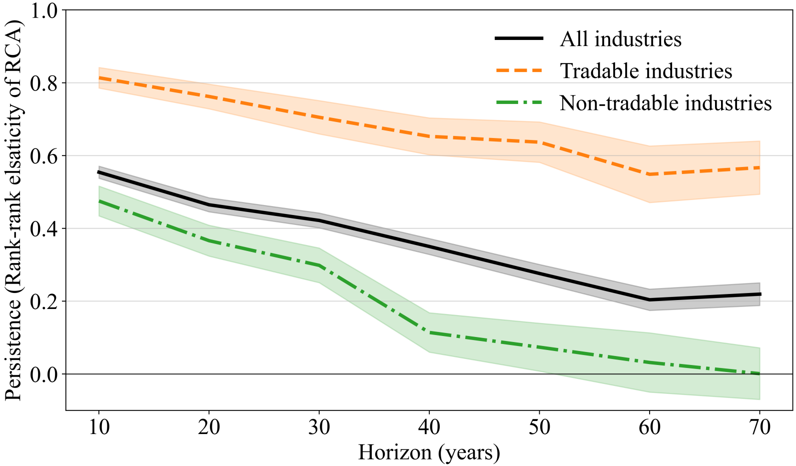

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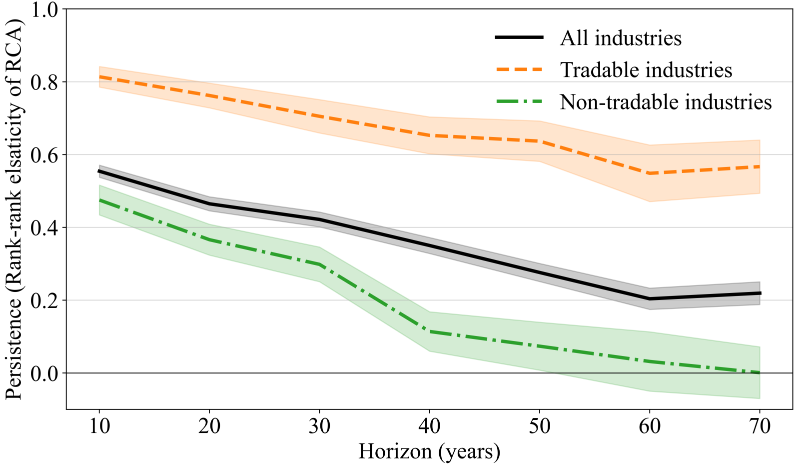

- **Effect size:** 1%↑ 1950 tradable ranking = 0.57%↑ 2020 tradable ranking

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- Next: Formalize specialization trade-off theoretically

  1. Quantify role of specialization for long-run growth
  2. Assess welfare under optimal specialization

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    - Borrowing against collateral: ($\theta \times$ market value of productive capital stock)

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subject to

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Consumption-savings: $u'(c_t) = \beta R_t \, \mathbb{E}_t \big[u'(c_{t+1}) \big] + \eta_t$

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3. **Consistency:**
   - Law of motion of aggregate bond holdings: $B' = \Gamma(B, \mathcal{K}, \mathcal{Z})$
   - Capital pricing function: $q(B, \mathcal{K}, \mathcal{Z}) = \hat{q}(B, \mathcal{K}, \mathcal{Z})$

Specialization and financial frictions: Intuition

- The role of specialization:
  - Benefits: Productivity & income $\uparrow$ *(agglomeration)*
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Shock to industry i → Decline in value of capital → Collateral constraint tightens → Investment declines

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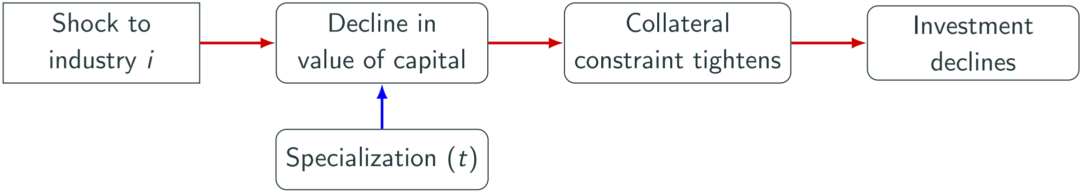

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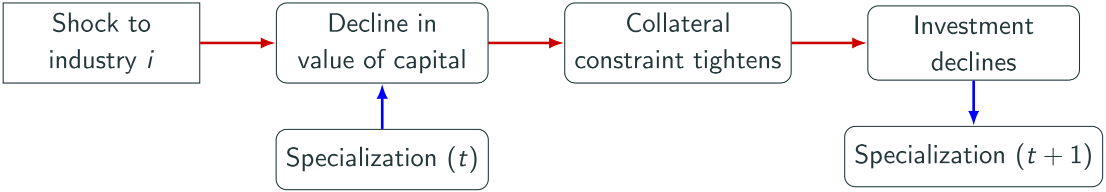

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  3. $[I > 1 \text{ and } \Phi > 0]$: $Cov(q, z_i) = F(\sum_i w_i)$ → **Specialization matters for exposure**

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- Collateral constraint **determines ability to invest**:

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Quantitative Analysis

Calibration

- Functional forms:
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  2. Discount factor: Matching U.S. NFA position

Calibration

Parameter	Value	Source/ Target
Parameters set independently		
Risk Aversion	$\gamma = 5$	Average value in literature
Capital Share	$\alpha = 0.3$	Avg. US capital income share
Adjustment Costs	$\Phi_i \in [0, 3.26]$	Hall (2004); Groth & Khan (2010)
Agglomeration	$\xi_i \in [0.1, 0.29]$	Bartelme et al. (2024)
Collateral regime	$\theta = 0.35$	Historical LTV ratio (Graham et al, 2015)
Interest Rate	$\bar{R} = 1.3\%, \rho_R = 0.01$	U.S. 90-day T-Bills
	$\sigma_R = 0.0186$	
TFP Process	$\rho_i \in [0.71, 0.9]$	Std. and autoc. of U.S. industry TFP
	$\sigma_i \in [0.013, 0.027]$	
Parameters set internally		
1950 capital stock	$k_{i,1950} \in [0.1, 0.29]$	Matching income shares
Discount Factor	$\beta = 0.95$	Avg. NFA position = -20% of GDP

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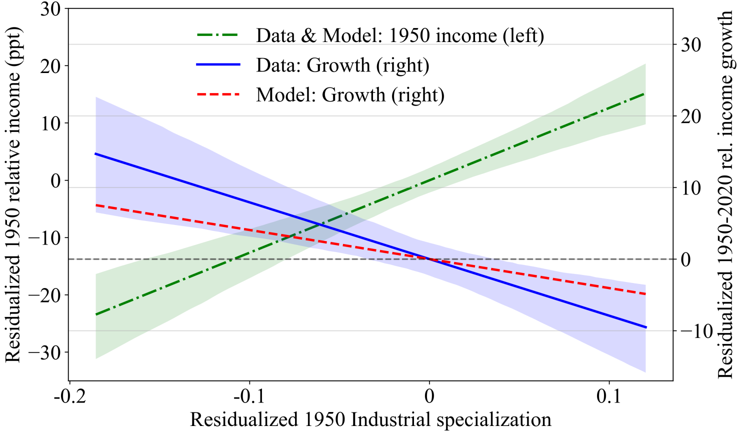

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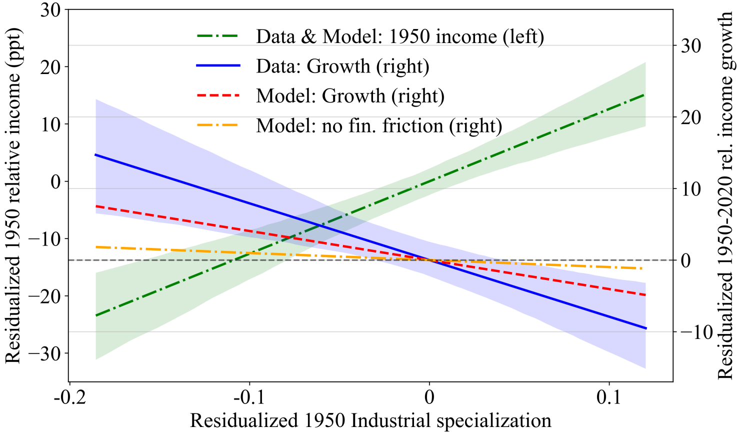

⇒ Financial friction captures 56% of adverse specialization effect on growth!

IRF to a 2SD adverse productivity shock to one industry

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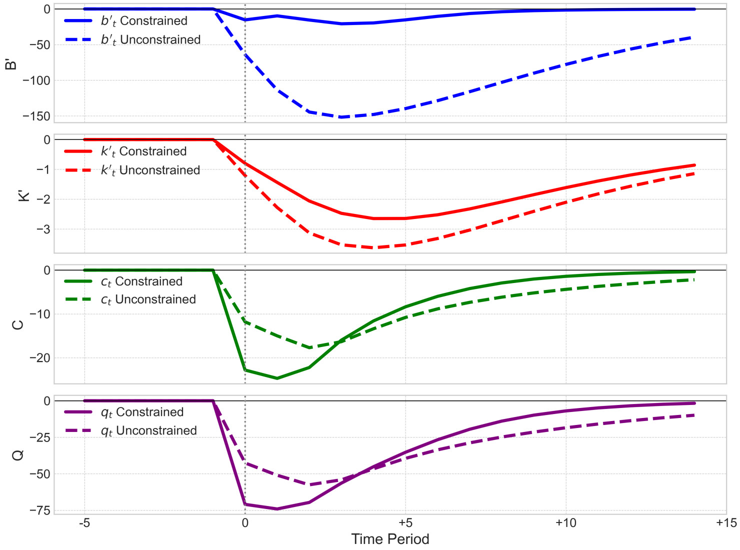

Efficiency & Welfare

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     $\Rightarrow$ Increase specialization
  2. Pecuniary externality: Price of capital = function of capital portfolio + bond position

     $\Rightarrow$ Increase diversification

Constrained-efficient Planner

- Planner maximizes

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subject to

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    - $\lambda_t = u'(c_t) - \frac{u''(c_t)}{u'(c_t)}\theta\eta_t q_t - u''(c_t)\sum_i^I \delta_{i,t}\phi_{i,t}$ as shadow value of wealth

Portfolio all.: $\underbrace{\lambda_t\phi_{i,t}}_{\text{MC}} = \beta\mathbb{E}_t\Big[\underbrace{\lambda_{t+1}\big(\bar{z}_{i,t+1}(\xi_i+\alpha)k_{i,t+1}^{\xi_i+\alpha-1} - \phi_{i,t+1}\big)}_{\text{Social net MPK}} + \underbrace{\sum\nolimits_i^I \delta_{i.t}\Omega_{i,t+1}^K}_{\text{GE effect on price}}\Big] + \underbrace{\Xi}_{\substack{\text{Market}\\\text{Clearing}}}$

Key optimality conditions (Planner Equilibrium)

- Define:
  - $\eta_t^* \geq 0$ as Lagrange multiplier on the collateral constraint
  - δ_i as Lagrange multiplier on implementability constraint
  - $\lambda_t = u'(c_t) - \frac{u''(c_t)}{u'(c_t)}\theta\eta_t q_t - u''(c_t)\sum_i^I \delta_{i,t}\phi_{i,t}$ as shadow value of wealth

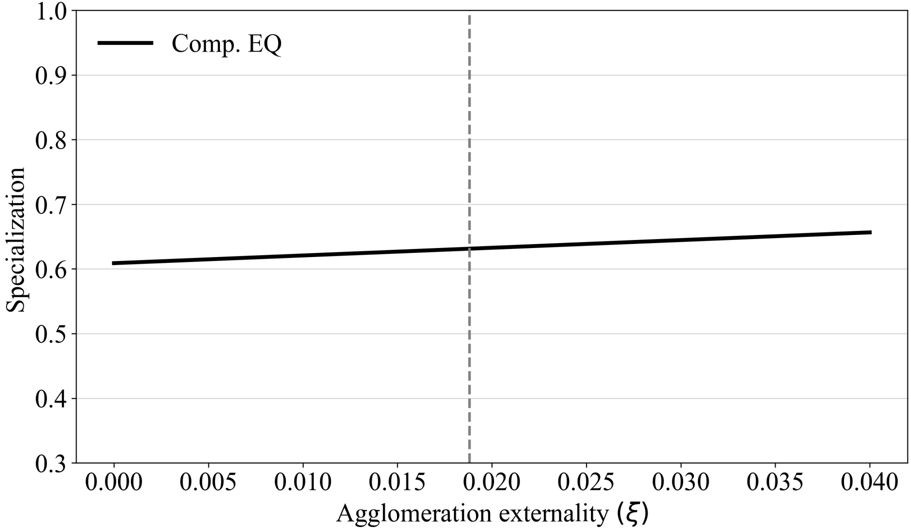
Portfolio all.: $\underbrace{\lambda_t \phi_{i,t}}_{\text{MC}} = \beta \mathbb{E}_t \left[\underbrace{\lambda_{t+1}\left(\bar{z}_{i,t+1}(\xi_i + \alpha) k_{i,t+1}^{\xi_i+\alpha-1} - \phi_{i,t+1}\right)}_{\text{Social net MPK}} + \underbrace{\sum_i^I \delta_{i.t}\Omega_{i,t+1}^K}_{\text{GE effect on price}} \right] + \underbrace{\Xi}_{\text{Market Clearing}}$

Cons.-savings: $\lambda_t = \beta R\, \mathbb{E}_t \Big[\lambda_{t+1} + \underbrace{\sum_i^I \delta_i \Omega_{i,t+1}^B}_{\text{GE effect on price}} \Big] + \eta_t^*$

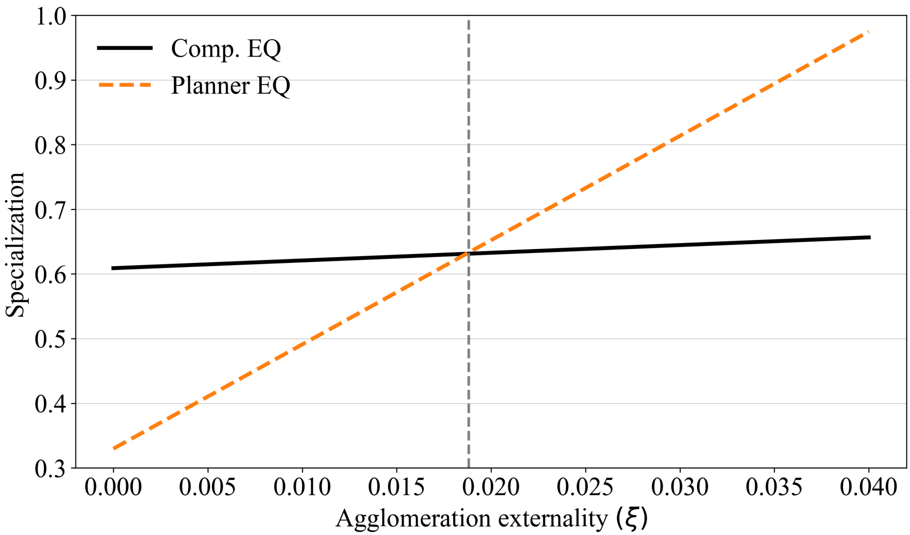
‣ Equilibrium definition ‣ Planner implementation

The planner's specialization trade-off

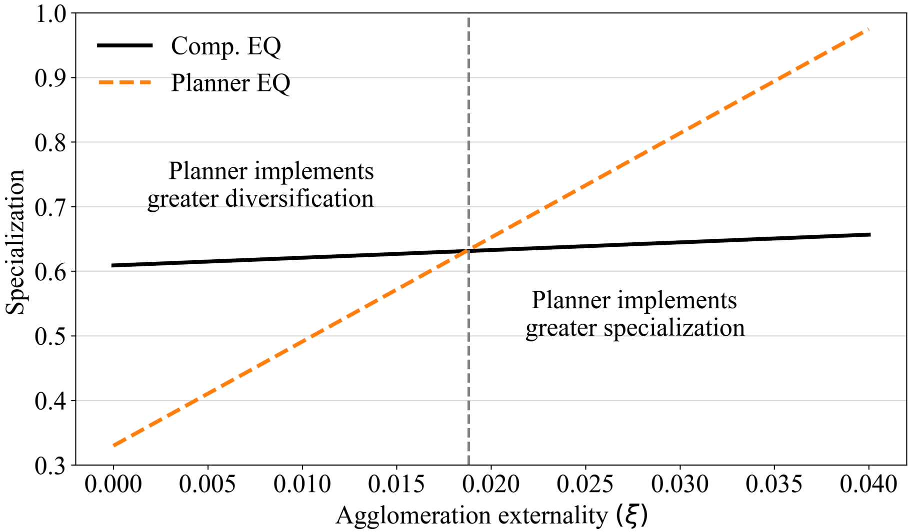
The planner's specialization trade-off



The planner's specialization trade-off



The planner's specialization trade-off



Constrained-efficient regional specialization in 1950

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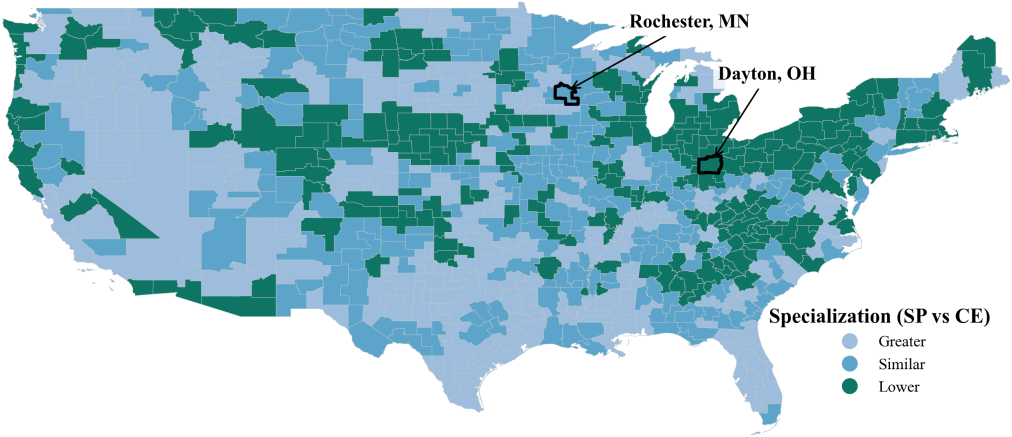

Constrained-efficient welfare gains in 1950

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- Define welfare: $\Lambda = \left(\frac{V_{SP}}{V_{CE}}\right)^{\frac{1}{1-\gamma}} - 1$

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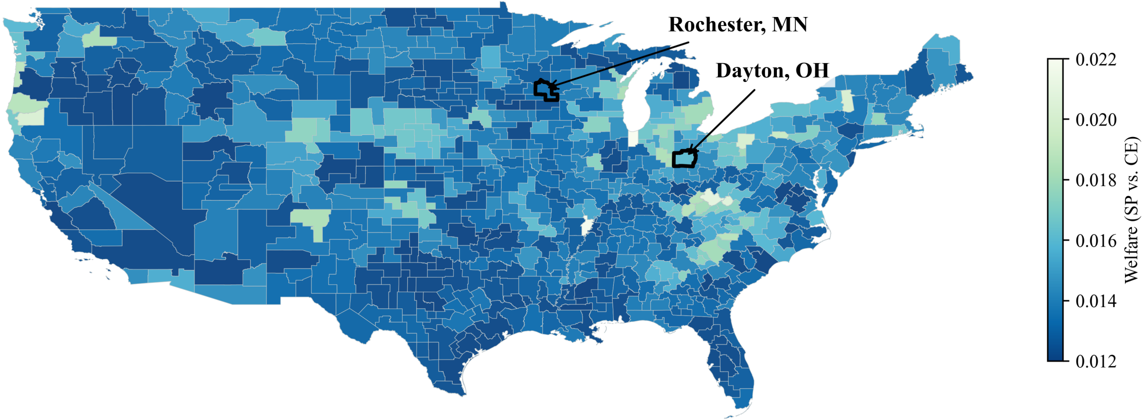

Conclusion

Conclusion

- **Empirical take-away**: The Regional Specialization Trade-off

  $\Rightarrow$ Highly specialized regions are richer initially and have lower long-run growth

- **Theoretical take-away**:

  $\Rightarrow$ Specialization: productivity $\uparrow$ + exposure to sectoral shock $\uparrow$

  $\Rightarrow$ Frictions make reallocation costly & long-lasting

- **Quantitative take-away**:

  $\Rightarrow$ Financial frictions play key role in generating adverse specialization effect on growth

  $\Rightarrow$ Efficient degree of specialization implies sizable welfare gains

Thank you very much!

Appendix

Topcoding income

- Topcoding: Recode/ cut income above certain theshold
  - In individual-level income survey
  - Prevent identification of individuals in sample

- Problem: manipulates income distribution for high earners

- Regression approach (following Heathcote et al, 2023):
  - Assume underlying distribution of income is Pareto
  - Forecast the mean top-coded income by extrapolating Pareto density fitted to upper end of non-top-coded income
  - Following algorithm by David Domeij

▸ Return

Industry details

Industry details

	Industry	1950	1990	2020	Tradable
1	Agriculture	20.71	3.61	3.46	Yes
2	Business Services	2.96	4.43	7.61	Yes
3	Communication	0.61	1.52	1.36	No
4	Construction	8.75	9.98	11.91	No
5	Durable	13.53	15.88	10.77	Yes
6	Entertainment	0.66	1.06	1.28	No
7	Finance	2.20	4.47	4.79	No
8	Mining	3.99	1.90	1.82	Yes
9	Nondurable	9.48	8.64	5.77	Yes
10	Personal Services	2.37	1.39	1.60	No
11	Routine Prof. Serv.	4.39	11.26	13.19	No
12	Non-routine Prof. Serv.	0.37	2.02	3.33	Yes
13	Public	4.67	7.96	6.98	No
14	Retail	11.84	11.15	13.26	No
15	Transportation	8.09	6.61	6.91	Yes
16	Utilities	1.80	2.53	2.34	No
17	Wholesale	3.59	5.60	3.63	Yes

Return

Fact 1: Controls

Fact 1: Controls

	1950-2020 Growth		1950 Income p.c.	
	(1)	(2)	(3)	(4)
Specialization	-0.233*		0.844***	
	(0.0901)		(0.084)	
Tradable		-0.151***		0.110**
		(0.0388)		(0.0423)
Non-tradable		0.632		-0.43
		(0.294)		(0.456)
1950 measures:				
$\hat{g}$	-0.180***	-0.133*	-0.187**	-0.319***
	(0.0471)	(0.0521)	(0.058)	(0.0631)
log income p.c.	-0.868***	-0.885***		
	(0.0339)	(0.0323)		
High-skill labor share	1.435***	1.618***	6.042***	5.692***
	(0.41)	(0.418)	(0.402)	(0.431)
Old-age dependency ratio	0.0145**	0.0120*	-0.0187***	-0.0230***
	(0.00532)	(0.00553)	(0.00484)	(0.00526)
Female labor share	0.984***	0.965***	0.0754	0.283
	(0.167)	(0.184)	(0.164)	(0.187)
Population	170.6***	163.0***	136.8***	152.0***
	(35.55)	(33.46)	(25.75)	(31.66)
N	722	722	722	722
adj. R-sq	0.538	0.544	0.41	0.344

▸ Return

Regional specialization in the U.S.

Regional specialization in the U.S.

The US **labor markets become more specialized** over time.

Year	Gini on income shares			Gini on employment shares		
	Mean	CV	p90/p10	Mean	CV	p90/p10
1950	0.46	0.162	1.55	0.45	0.152	1.50
1970	0.48	0.123	1.35	0.47	0.116	1.35
1990	0.47	0.089	1.23	0.46	0.082	1.26
2010	0.53	0.089	1.29	0.50	0.073	1.20
2020	0.53	0.089	1.24	0.51	0.068	1.20

Table 1: U.S. Regional specialization over time

▸ Return

Production and agglomeration

Production and agglomeration

- Multiple industries $i \in \{i, \dots, I\}$ produce single tradable good c

- Productivity processes (AR1):

$$\bar{z}_{i,t} = \tilde{z}_i + g_{i,t} t + \rho u_{i,t-1} + \epsilon_{i,t} \quad \text{with } \epsilon_{i,t} \sim \mathcal{N}(0, \sigma_i^2)$$

- Agglomeration:

$$z_{i,t} = \bar{z}_{i,t} \cdot k_{i,t}^{\xi_i}$$

with intra-industry agglomeration $\xi_i \geq 0$ [Bartelme et al (2024)]