Escaping the Losses from Trade: The Impact of Heterogeneity on Skill Acquisition

Preliminary

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Motivation

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  - Potential losses from greater import competition
- Several margins of adjustment to overcome initial losses
  - Regional migration Caliendo, Dvorkin & Parro (2017), Dix-Carneiro & Kovak (2018),...
  - Switching industries and/or occupations Dix-Carneiro (2014), Traiberman (2017),...

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  - Estimate import penetration effects on college enrollment
- Dynamic trade **model** with heterogeneous households
  - SOE model with HO-type comparative advantage
  - Aiyagari-OLG model with costly education choice

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$\rightarrow$ Quantify the effects of trade on skill acquisition and welfare

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- **Evidence:**
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  - Skill acquisition responds to trade openness
    - ★ But it takes time: wealth inequality matters
  - Endogenous skill acquisition and wealth distribution are key

Literature Review

- Trade and human capital
  - Findlay & Kierzkowski (1983), Falvey et al. (2010), Harris & Robertson (2013), Blanchard & Willmann (2016), Danziger (2017)
  - Atkin (2016), Greenland & Lopestri (2016), Blanchard & Olney (2018)
- Trade and inequality
  - Helpman et al. (2010, 2017), Antràs et al. (2017)
  - Burstein et al. (2013), Burstein et al. (2016), Burstein & Vogel (2017)
- Trade shocks and labor market adjustments
  - Autor, Dorn & Hanson (2013), Pierce & Schott (2016), Artuç Chaudhuri & McLaren (2010), Caliendo, Dvorkin & Parro (2018),...
- Labor market conditions and skill acquisition
  - Charles, Hurst & Notowidigdo (2016)
- Trade and heterogeneous-agents macro models
  - Lyon & Waugh (2017, 2018)

Outline

1. Evidence
2. Model
3. Dynamic effects of trade openness
4. Policies

Evidence

Meauring trade shocks – ADH (2013)

- Import penetration in region (market) i in period t

$$\Delta IPW_{it} = \sum_j \frac{L_{ijt}}{L_{it}} \frac{\Delta M_{jt}}{L_{jt}}$$

j: industry, M_{jt}: Chinese imports, L_{ijt}: workers in sector j,

$$L_{it} = \sum_j L_{ijt}, \text{ and } L_{jt} = \sum_i L_{ijt}$$

- Instrument by imports to other high-income countries from China ▸ More
  - Regions: 722 commuting zones.
  - Periods: 1990-2000, 2000-2007.

Estimating the effect of trade shocks

- Effect of *import competition* on variable y_{it} (β)

$$\Delta y_{it} = \gamma_t + \beta \Delta IPW_{it} + \delta X_{it} + e_{it}$$

  - y_{it}: labor market outcomes (employment, labor income) and educational attainment
  - X_{it}: labor force characteristics + regional dummies

\+ *labor market effects across different education groups*

- Data from Census and *American Community Survey* (IPUMS)
- Import penetration data from ADH (2013), ΔIPW_{it}:
  - *Median*: \$1,140 in 1990-2000 and \$2,600 in 2000-2007
  - *IQR*: \$600 in 1990-2000 and \$1,500 in 2000-2007

Effect on labor market opportunities

Employment decreases more for less educated workers

Δy_{it}: change in fraction of pop employed by education, ages 30-55

	All	High School	Some Coll	2-y program	Bachelor
Employment	-0.42^{***}	-0.48^{***}	-0.29^{***}	-0.34^{***}	-0.09
	(0.13)	(0.17)	(0.09)	(0.09)	(0.1)

Notes: *"Some Coll" are all individuals with some college, "2-y program" are those who graduated from a 2 year program, and "Bachelor" are those with a bachelor degree or more;* *** *significant at 1%,* ** *at 5%,* * *at 10%*

- A \$1,000 increase in imports
  - Decreases employment by 42 bps
  - More detrimental for workers with less education
  - No effect for workers with bachelor degree or more

Effect on labor market opportunities

Income also decreases more for less educated workers

Δy_{it}: log change in labor income by education, ages 30-55

	All	High School	Some Coll	2-y program	Bachelor
All sectors	-0.63^{***}	-1.16^{***}	-0.55^{***}	-0.91^{**}	-0.27
	(0.20)	(0.34)	(0.21)	(0.42)	(0.24)

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- A \$1,000 increase in imports
  - Decreases labor income by 0.63%
  - Larger decline for less educated workers
  - No effect for workers with bachelor degree or more

▸ Sectors

Effect on education

Dealing with migration

Issue:

- Individuals age 18-25 migrate often and in response to trade shock
  (change in composition of control and treatment groups)

  → 48% (50%) of freshmen in colleges $>$ 100 mi away from perm home in 1990 (2015)
  → A \$1,000 increase in imports decreases pop 18-25 by 1.54%

- ACS does not include households leaving for college (unlike CPS)

  → Hard to link college students with region where come from

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A possible solution:

- ACS reports last year region
- Restrict to ages 18-25 in college with *at most* one year finished
- Link to region last year

$\Longrightarrow$ Testing for enrollment, not completion, and cannot see household's income

Effect on education

Education increases in responses to a trade shock

y_{it}: change college enrollment ages 18-25

	1990-2007	1990-2000	2000-2007
Enrollment	0.24^{**}	-0.02	0.16^{*}
	(0.08)	(0.09)	(0.1)
Enrollment$_{t+1}$	-	0.47^{**}	-
		(0.022)	

Notes: *; *** significant at 1%, ** at 5%, * at 10%*

- A $1,000 increase in imports
  - + Increases college enrollment by 24 bps
  - + Most effect comes from period 2000-20007
    - Total change during 2000-2007 $\approx$ 330bps
  - + Similar results for HG completion in Greenland & Lopresti (2016)
  - + Significantly strong delayed effect on enrollment of 47 bps

Model

International trade model with heterogeneous households

- Small open economy trading goods and financial assets

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- Firms: **services** and **manufacturing** sectors
  - Intermediate goods $\rightarrow$ *Tradable* (differentiated across countries)
    - Inputs: college workers, non-college workers and capital
  - Final goods $\rightarrow$ *Non-tradable*
    - Inputs: domestic and imported intermediate goods

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  - + Final goods $\rightarrow$ *Non-tradable*
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- **Households**: continuum & finitely-lived
  - Education: one-time investment in college at age $j = 1$ (terms of services)
  - Work J_R periods *subject to* idiosyncratic labor risk
  - Fin wealth formed by *two assets*, inherited by newborn at J_R (bequest)
    - domestically produced capital
    - internationally traded one-period riskless bonds

Firms – sector $i \in \{m, s\}$

- Final non-tradable goods technologies

$$Q_i = \left[\omega_i^{\frac{1}{\eta_i}} D_i^{\frac{\eta_i - 1}{\eta_i}} + (1 - \omega_i)^{\frac{1}{\eta_i}} \left(D_i^* \right)^{\frac{\eta_i - 1}{\eta_i}} \right]^{\frac{\eta_i}{\eta_i - 1}}$$

  + D_i: domestic intermediate and D_i^*: imported intermediate
  + Profit maximization: $\max_{D_i, D_i^*} \{ q_i Q_i - p_i D_i - p_i^* \tau_i D_i^* \}$
  + τ_i iceberg cost $\rightarrow$ control *trade openness*

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- Intermediate tradable goods technologies: $Y_i = K_i^{\alpha} L_i^{1-\alpha}$ where

$$L_i = \left(\gamma_i L_{ic}^{\frac{\sigma - 1}{\sigma}} + (1 - \gamma_i) L_{in}^{\frac{\sigma - 1}{\sigma}} \right)^{\frac{\sigma}{\sigma - 1}}$$

  - *Key assumption*: $\gamma_s > \gamma_m$ and $\sigma > 1$

    $\rightarrow$ services is more intensive in *skilled* labor (Cravino and Sotelo (2018))

Households

Households

- Value of college ($e = e^c$) age $j = 1$, capital k, bonds s, and productivity x:

$$V_1(k, s, x, u, e^c) = \max_{c_s, c_m, x_s, x_m, k', s'} \left\{ U(c) + \beta \mathbb{E}\left[V_2(k', s', x', e^c) | x \right] \right\}$$

$$q_s(c_s + x_s) + q_m(c_m + x_m) + s' + q_s \kappa u \leq w_n x \frac{\bar{h}}{2} + r q_x k + (1 + r^*) s,$$

$$k' = x + (1 - \delta) k, \quad q_x k' + s' \geq \underline{a}_{1,c}, \quad c = \mathcal{C}(c_s, c_m), \quad x = \mathcal{X}(x_s, x_m)$$

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- Value of non-college ($e = e^n$), or college ($e = e^c$) and $j \geq 2$

$$V_j(k, s, x, e) = \max_{c_s, c_m, b', s'} \left\{ U(c) + \beta \mathbb{E}\left[V_{j+1}(k', s', x', e) | x \right] \right\}$$

$$q_s(c_s + x_s) + q_m(c_m + x_m) + s' \leq w_e x \bar{h} + r q_x k + (1 + r^*)s,$$

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- Terminal condition $V^e_{J_R+1}(k, s, x) = \mathbb{E}_{u,x}\left[\max\left\{ V^c_1(k, s, x, u), V^n_1(k, s, x) \right\} \right]$

Effect of Trade Openness

Calibration

→ **Particular case:**

- $\mathcal{X}(x_s, x_m) = x_m$ and *financial autarky* $(s = 0)$

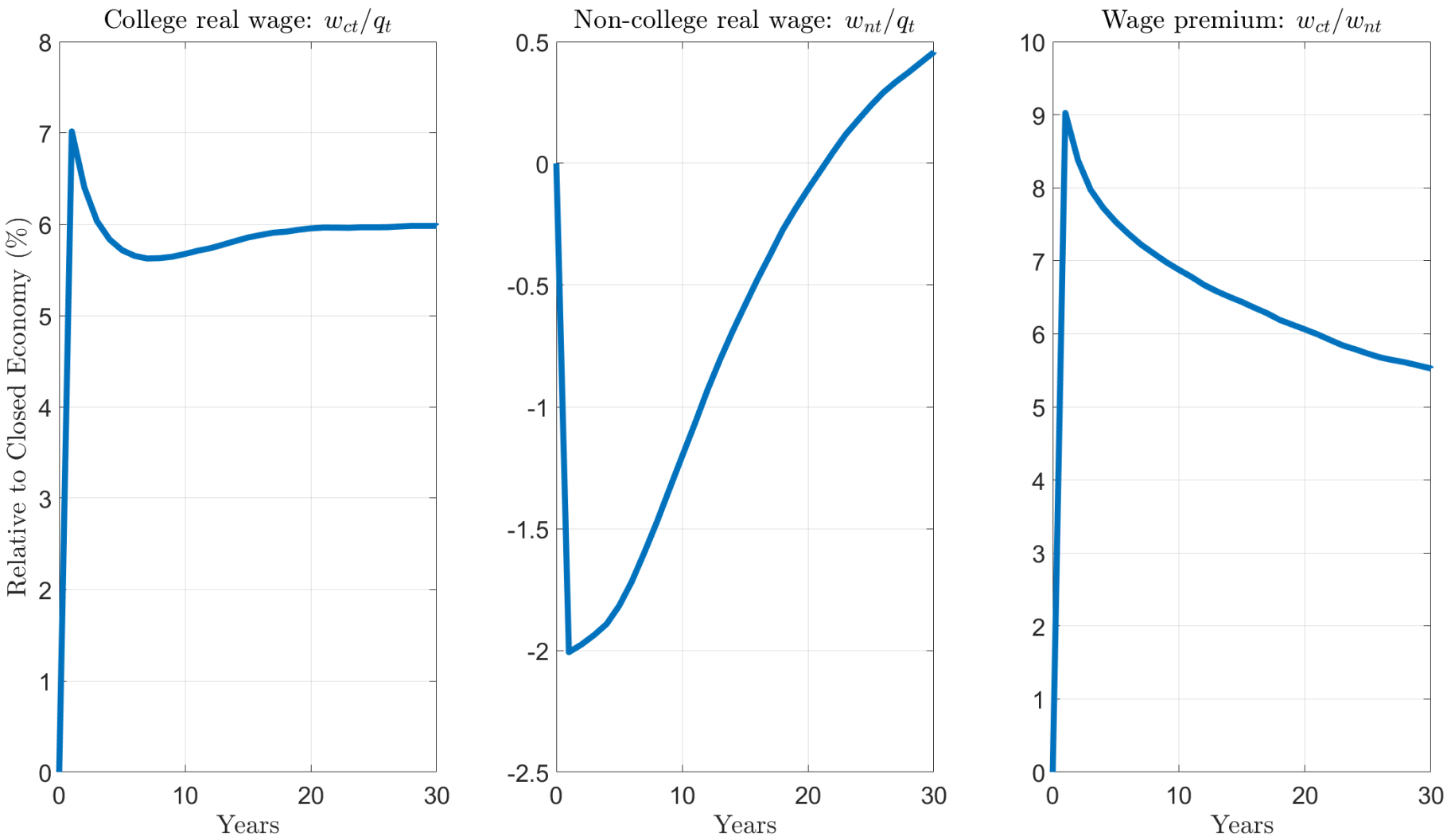
  - Education cost κ to match $\approx 30\%$ college graduates
  - Borrowing limit
    - Student loans: $\underline{a}_{c,j} < 0$ ages $j = 1, \ldots, 5$
      $\rightarrow \underline{a}_{c,j} \approx 75\%$ of cost of education
    - No borrowing $\underline{a}_{e,j} = 0$ otherwise
  - College labor weight: $\gamma_s = 1 - \gamma_m = 0.7$ ▸ more
  - Exogenous demand for exports $B_i^*(p_i) = \bar{B}_i^* p_i^{1-\eta_i^*}$

Effects of Trade Shocks

Exercise:

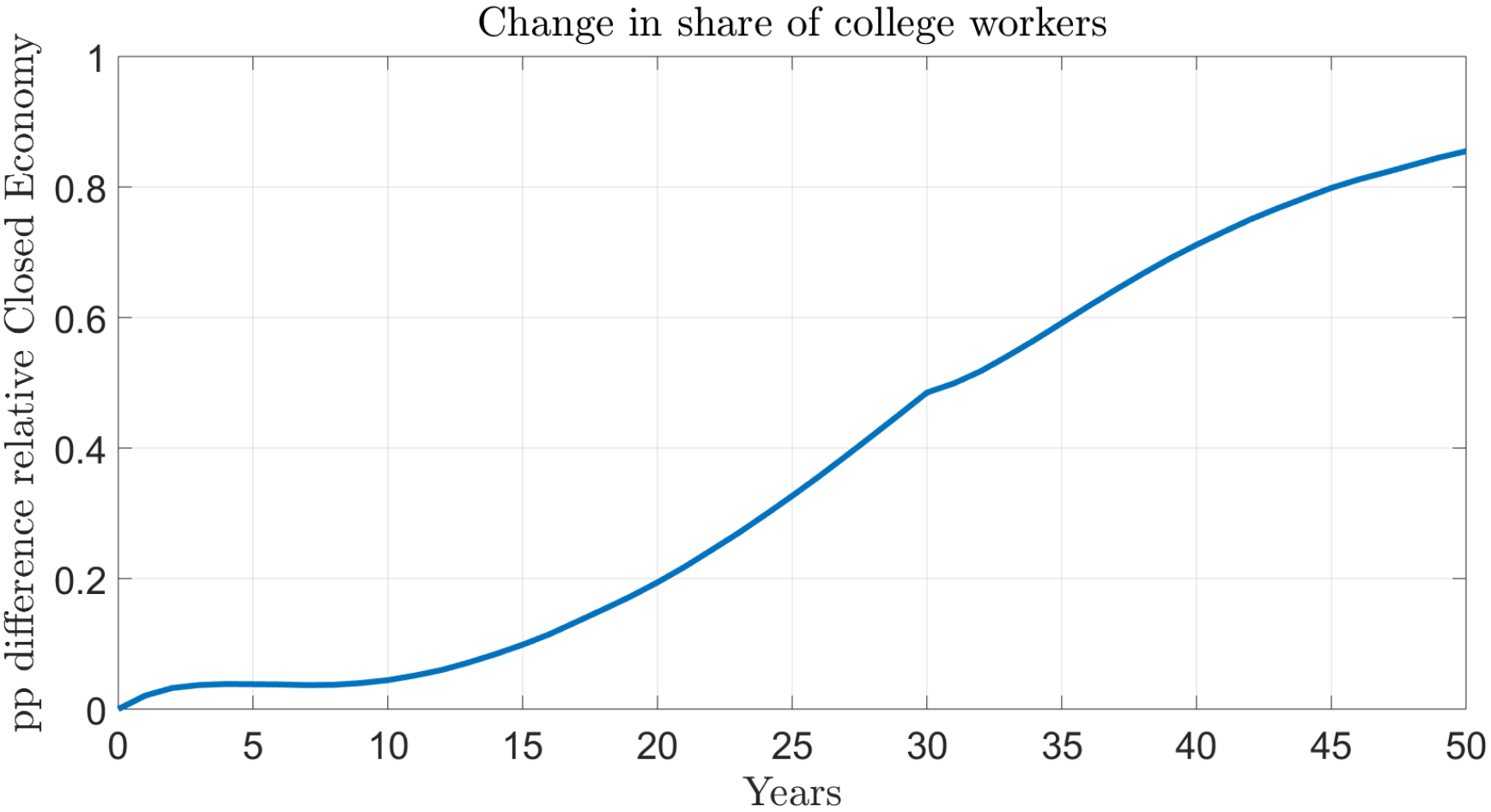
- At $t = 0$ the economy is at a steady state with high τ_m
- At $t = 1$, τ_m unexpectedly decreases
  - A sudden and permanent shock
  - Manufacturing home-bias declines from 95% to 80%

Increase in inequality and "overshooting"

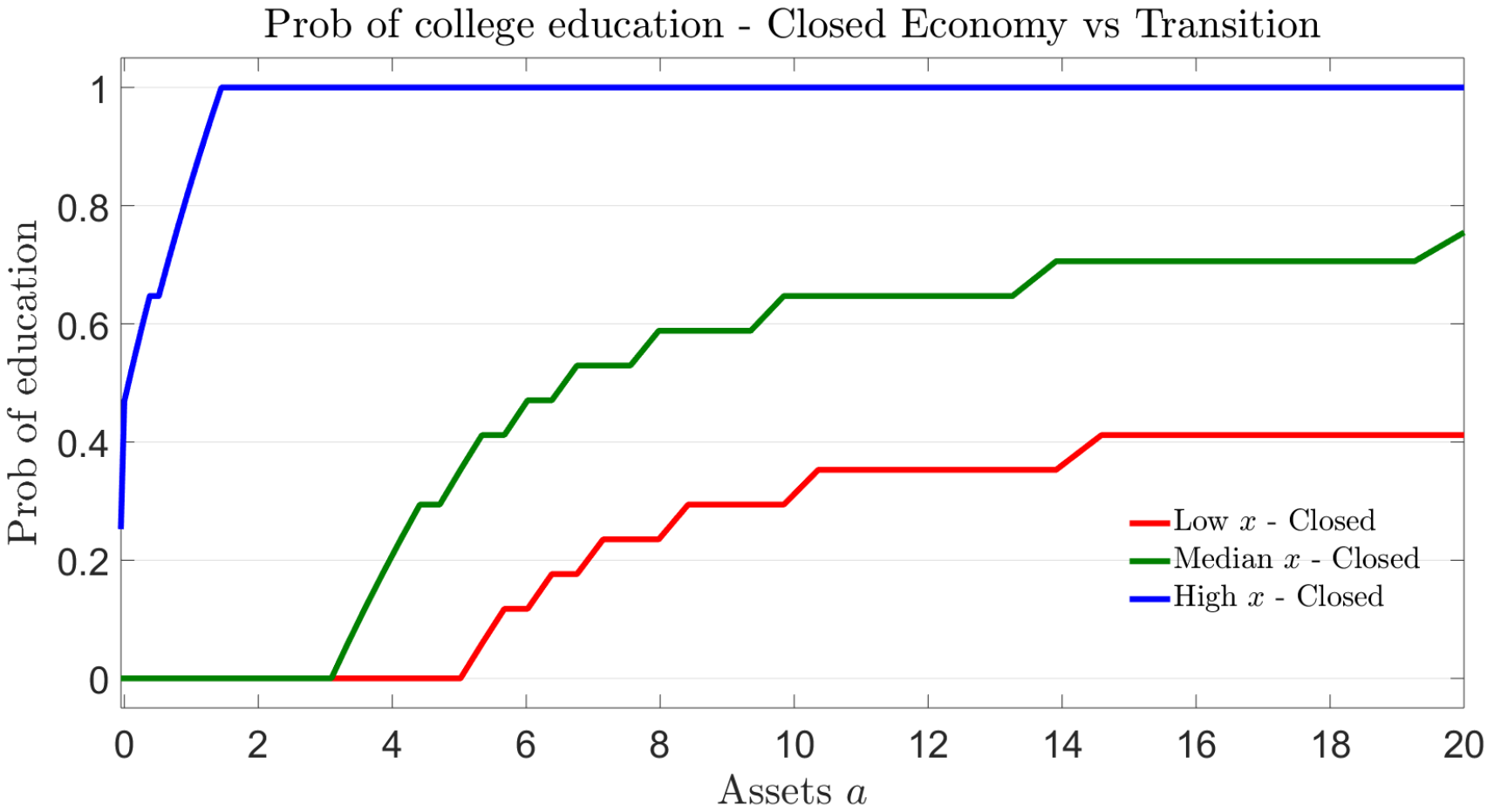


q_t is the price of the consumption bundle $\mathcal{C}(c_s, c_m)$ ▸ r

College enrollment increases . . . but slowly



Who gets more educated? The productive and wealthy



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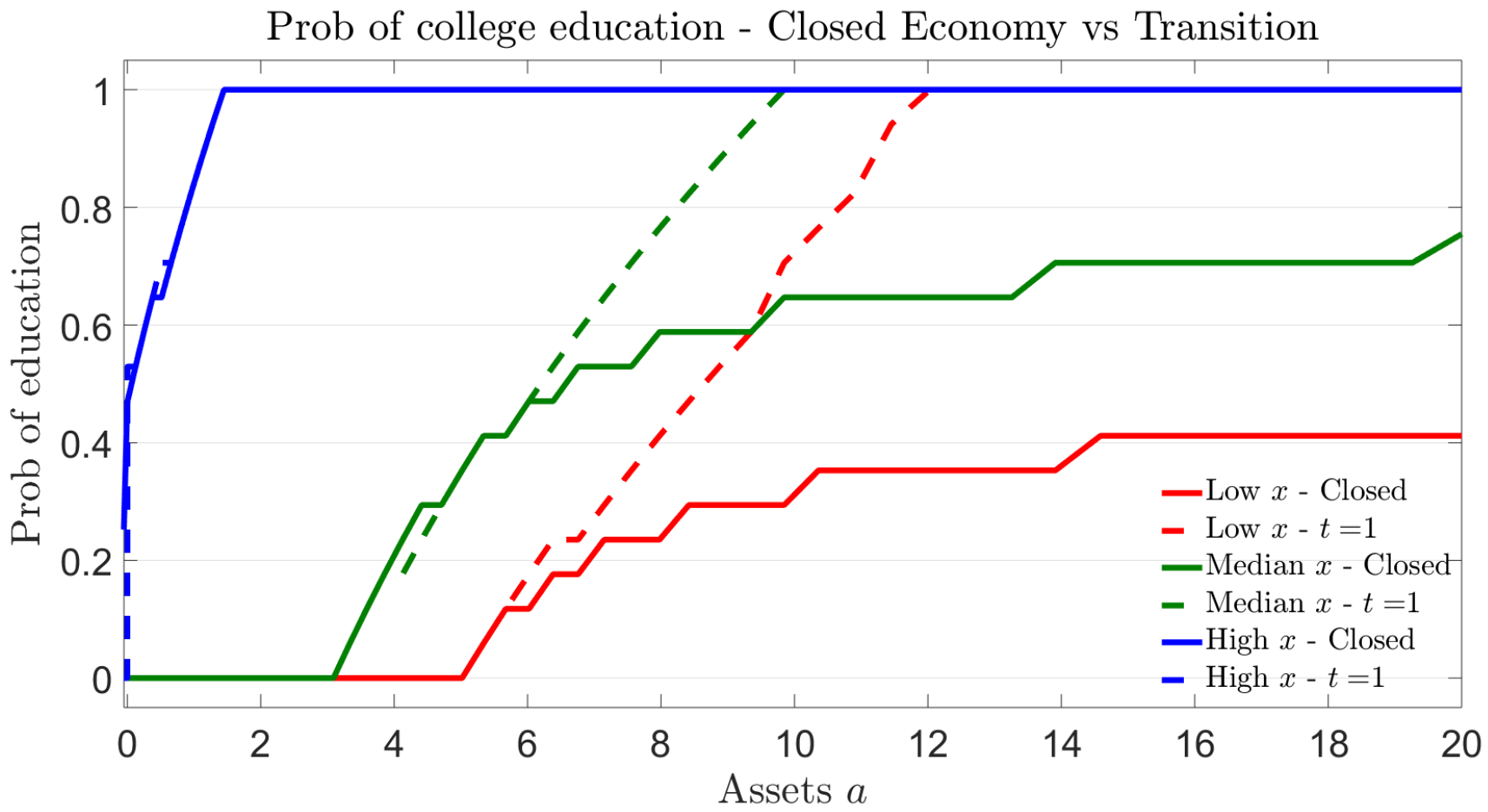

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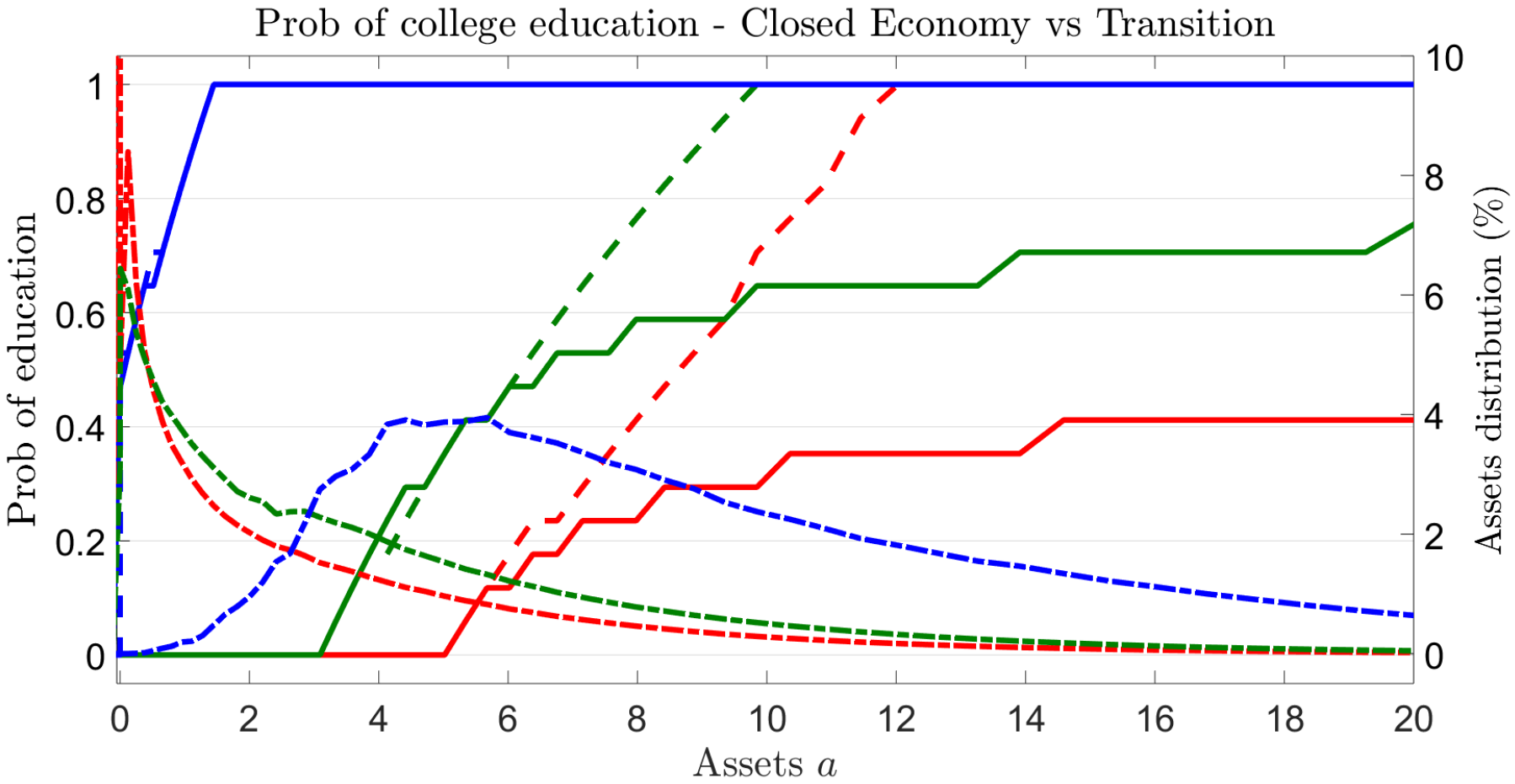


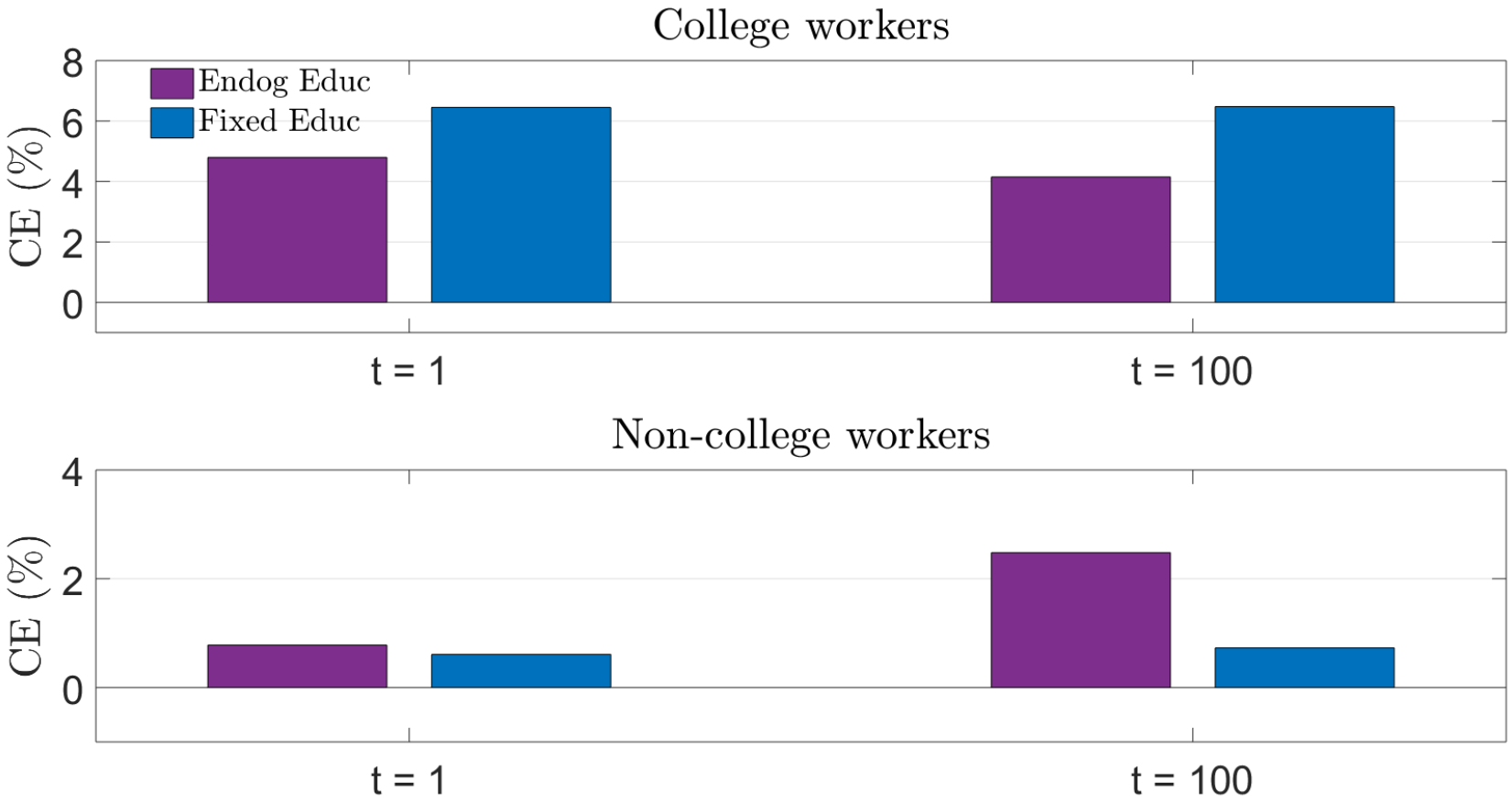
Winners and losers from trade openness...

Consumption Equivalent

Note: *Lowest* and *Top* refer to wealth distribution computed within each age group

Endogenous skill acquisition is crucial for welfare

Consumption Equivalent



Policy Implications

Which fiscal policy in the context of trade openness?

- Should the government subsidize education ?
  - To accelerate the transition
  - A fraction ϕ_t of education cost subsidized by the government
  - Financed with a labor income tax τ_t

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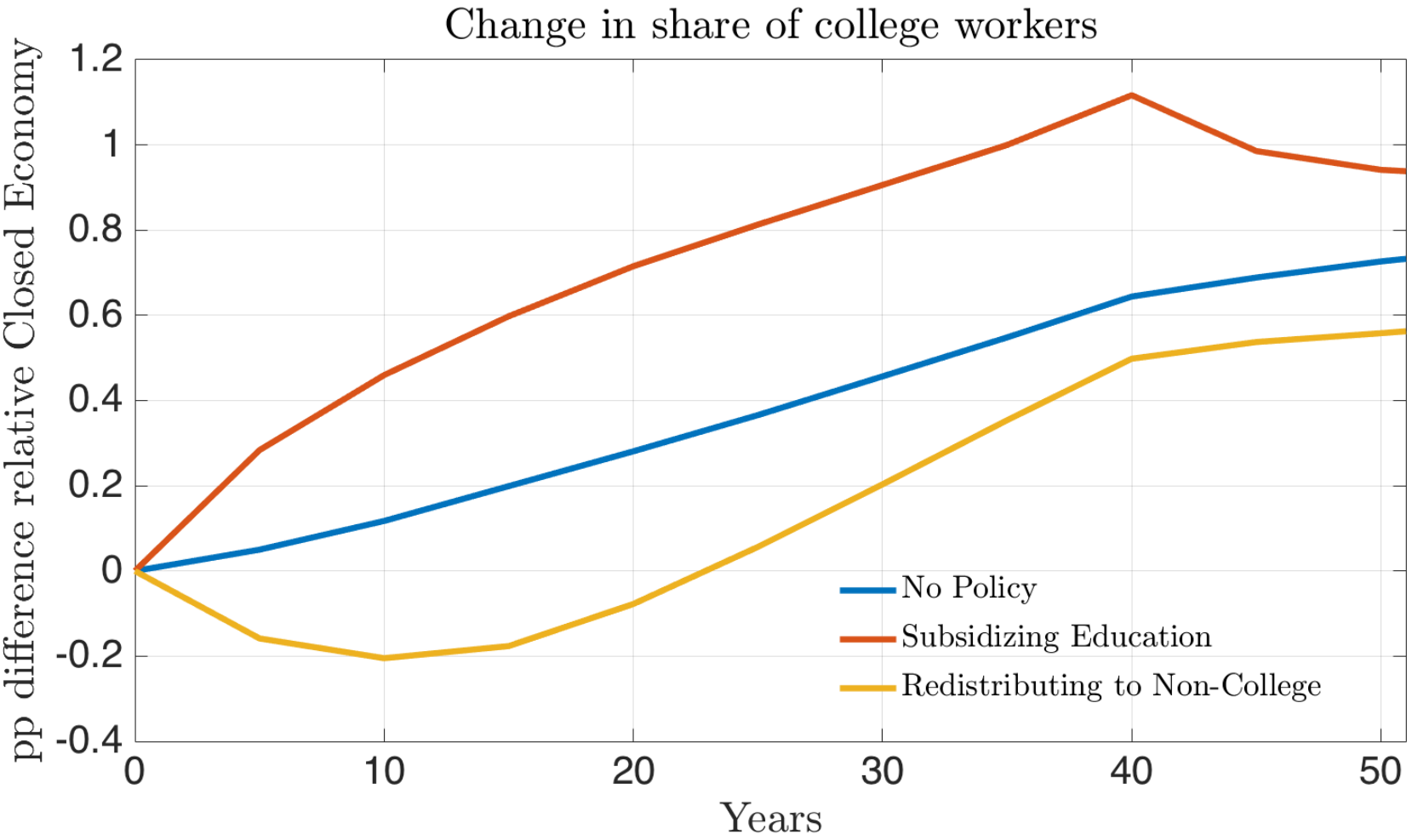
- Should the government subsidize education ?
  - To accelerate the transition
  - A fraction ϕ_t of education cost subsidized by the government
  - Financed with a labor income tax τ_t
- Should the government redistribute to non-college workers?
  - A lump-sum transfer T_t to all non-college with $j \geq 2$ at $t = 0$
  - Financed with a labor income tax τ_t
  - With the risk of slowing down the transition?

Accelerating or slowing down the transition

Caveat: another calibration



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Next steps:

- *Evidence:* linking 18-25 to household income (CPS, PSID, NLSY) $\rightarrow$ heterogeneous effects
- *Model:* Calibration, SOE with trade in financial assets, policy
- *Model:* adding multiple regions and ability to migrate

Appendix

Measuring Trade Shocks – Instrument

- Instrument for region i in period t by

$$\Delta IPW_{oit} = \sum_j \frac{L_{ijt-1}}{L_{it-1}} \frac{\Delta M_{ojt}}{L_{jt-1}}$$

  - j: industry,
  - M_{ojt}: Chinese's imports to *other* countries,
  - L_{ijt}: workers in sector j,
  - $L_{it} = \sum_j L_{ijt}$, and
  - $L_{jt} = \sum_i L_{ijt}$.

Return

Income also decreases more for less educated workers

y_{it}: log change in labor income by sector, ages 30-55

	All	High School	Some Coll	2-y program	Bachelor
All sectors	-0.63^{***}	-1.16^{***}	-0.55^{***}	-0.91^{**}	-0.27
	(0.20)	(0.34)	(0.21)	(0.42)	(0.24)
Manufacturing	-0.65^{*}	-1.00^{***}	-0.56	-1.44	-0.38
	(0.37)	(0.60)	(0.41)	(0.93)	(0.67)
No Manuf	-0.53^{***}	-0.90^{***}	-0.48^{**}	-0.58	-0.27
	(0.18)	(0.25)	(0.21)	(0.40)	(0.26)

Notes: *"Some Coll" are all individuals with some college, "2-y program" are those who graduated from a 2 year program, and "Bachelor" are those with a bachelor degree or more; *** significant at 1%, ** at 5%, * at 10%*

- Larger effects in non-manufacturing (bias problem?)
- Still larger decline for less educated workers
- No effect for workers with bachelor degree or more

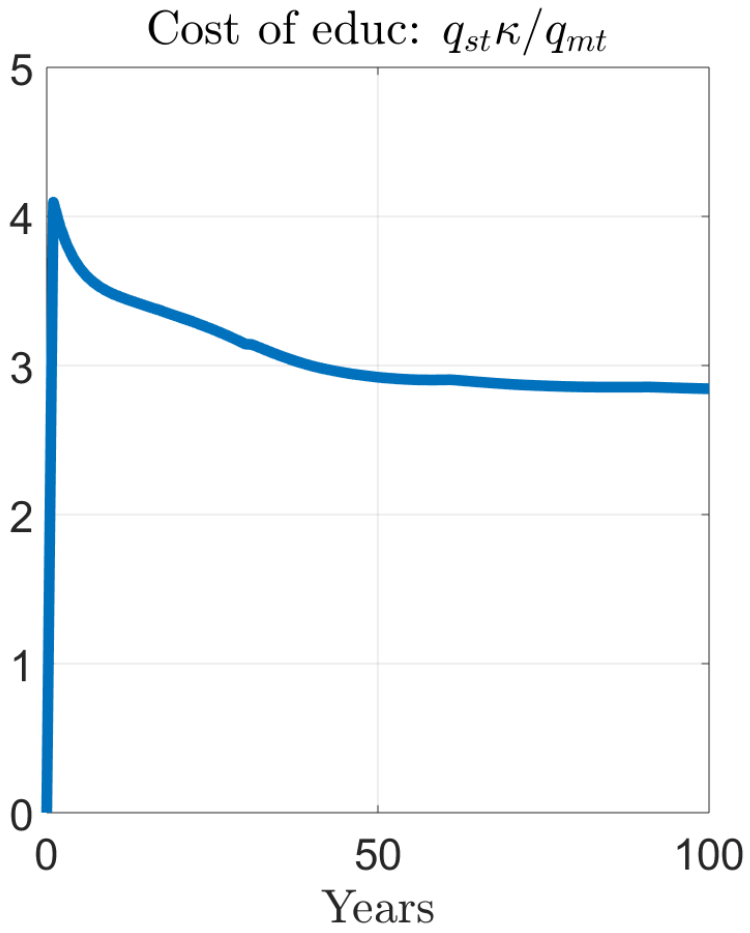
▸ Return

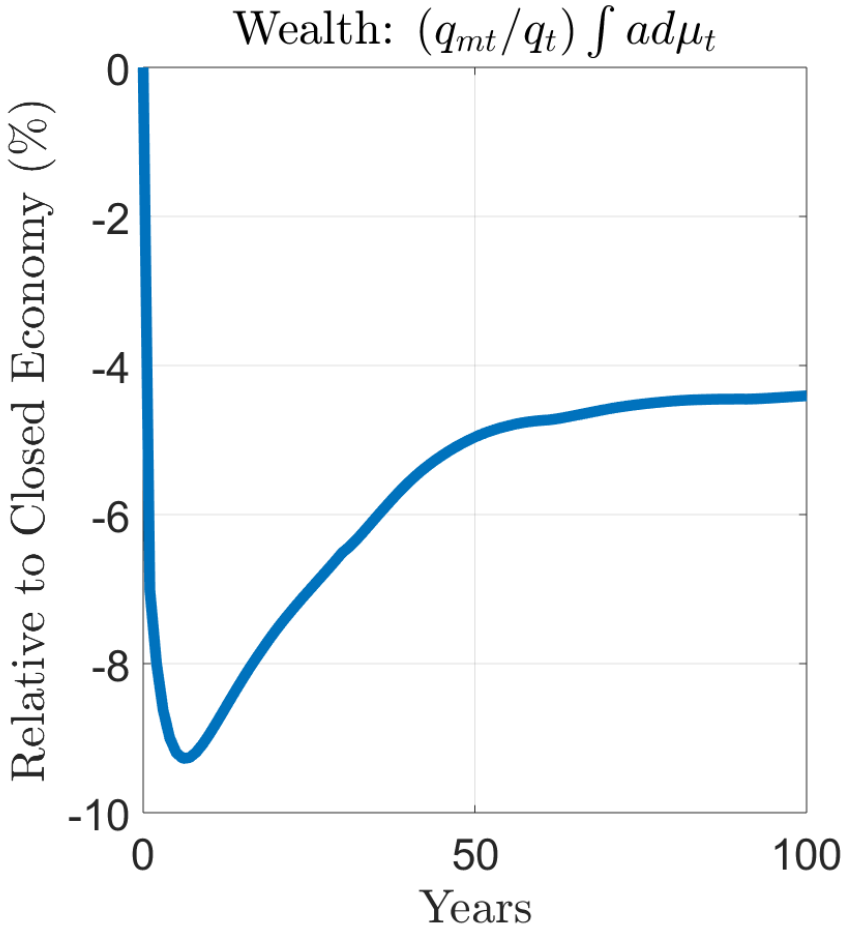
Calibration

- Technology: $3Y_i = K_i^{\alpha} L_i^{1-\alpha}$ with $L_i = \left(\gamma_i L_{ic}^{\frac{\sigma-1}{\sigma}} + (1-\gamma_i) L_{in}^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}$
  - $\alpha = 1/3$, $\sigma = 2$, $\gamma_s = 1 - \gamma_s = 0.7$
- Final good: $Q_i = \left[\omega_i^{\frac{1}{\eta_i}} D_i^{\frac{\eta_i - 1}{\eta_i}} + (1-\omega_i)^{\frac{1}{\eta_i}} (D_i^*)^{\frac{\eta_i - 1}{\eta_i}} \right]^{\frac{\eta_i}{\eta_i - 1}}$
  - $\omega_i = 0.7$, $\eta_i = 4$
- Household
  - $\mathcal{C}(c_s, c_m) = \left(\sum_i \nu_i^{\frac{1}{\rho}} c_i^{\frac{\rho-1}{\rho}} \right)^{\frac{\rho}{\rho-1}}$, $\nu_s = 1 - \nu_m = 0.6$ and $\rho = 0.5$
  - $\ln x \sim AR(1)$ with $\rho_x = 0.85$ and $\sigma_x = 0.25$

▸ Return

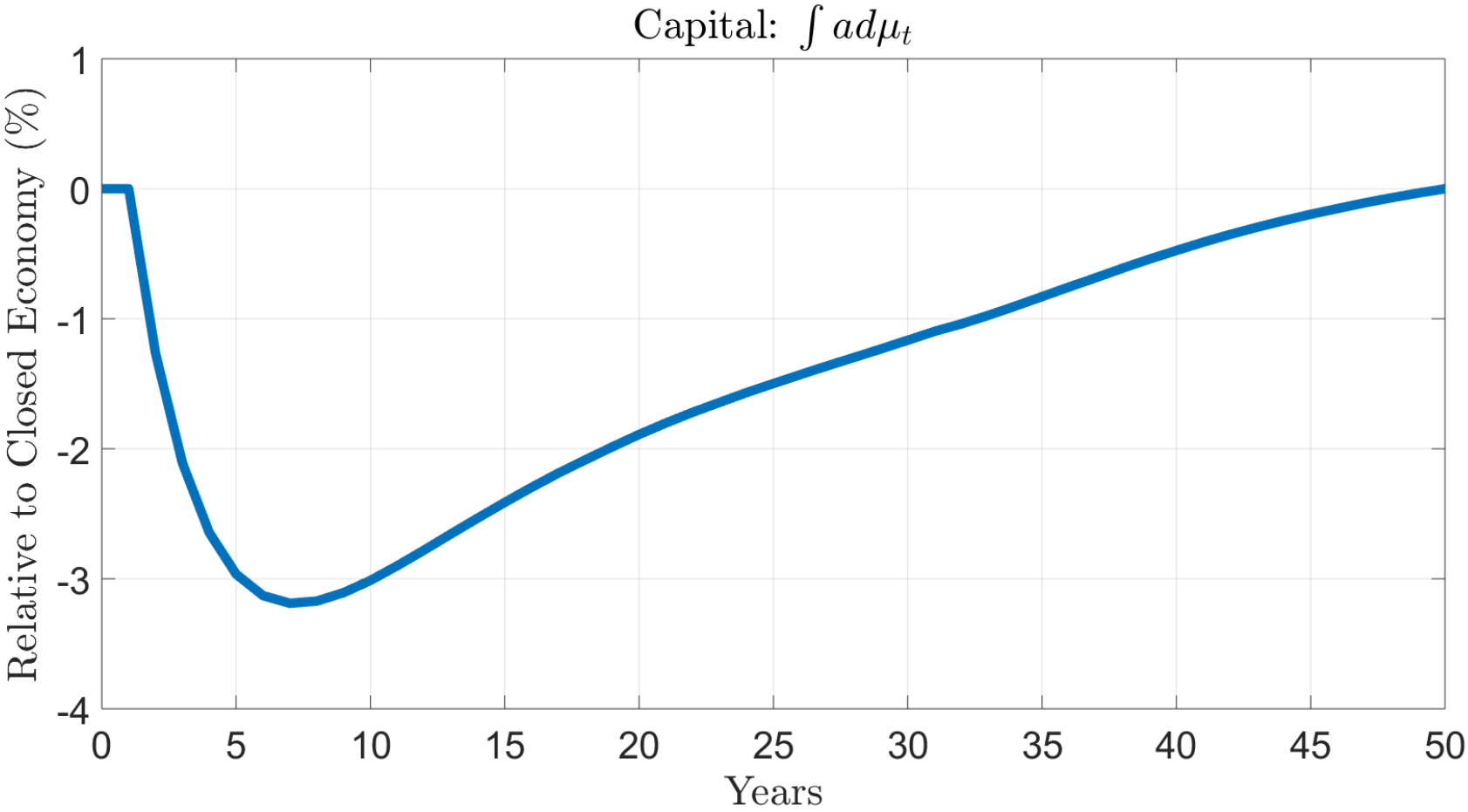
Education becomes more costly and wealth initially decreases





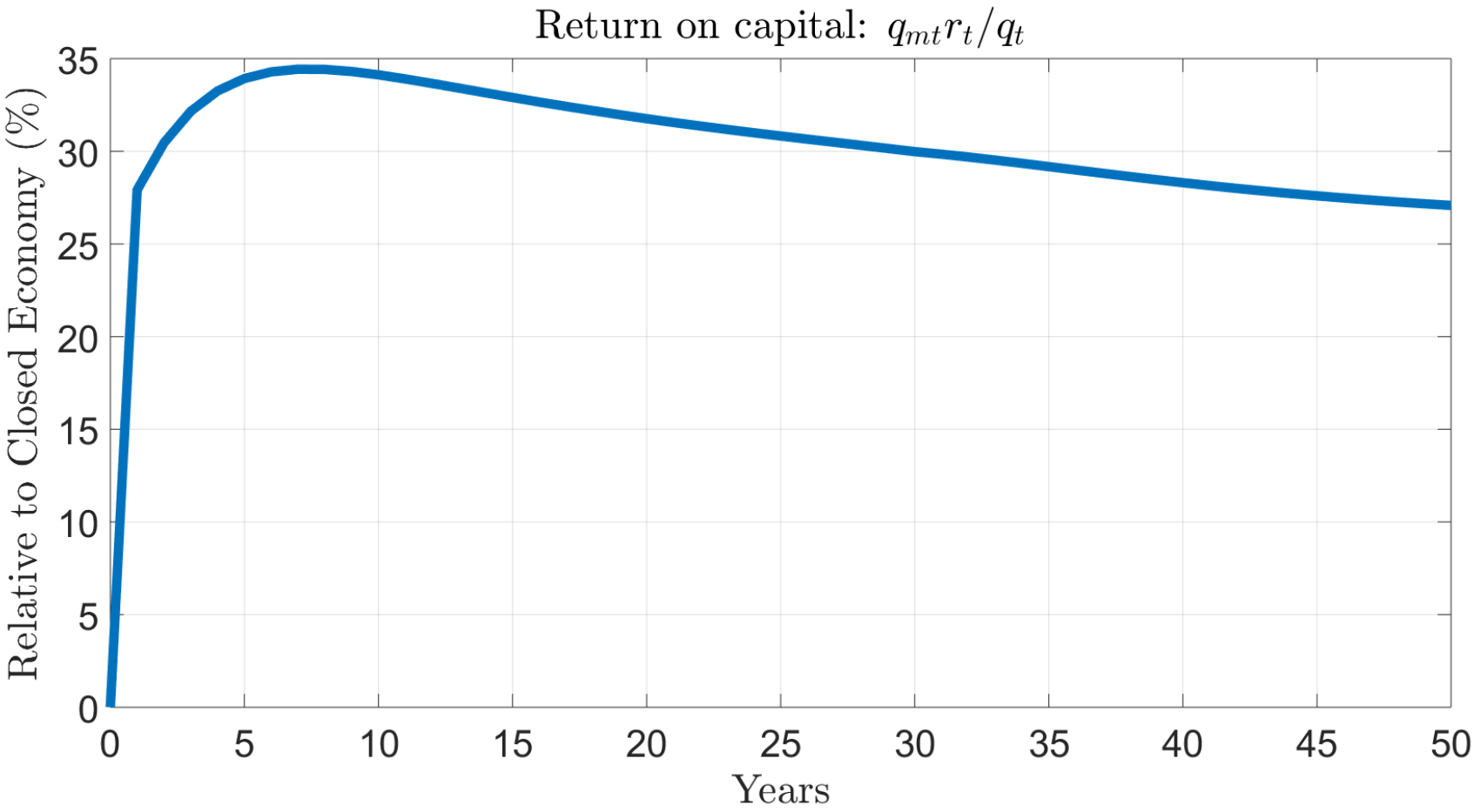
▸ Home Bias ▸ Capital

Capital accumulation



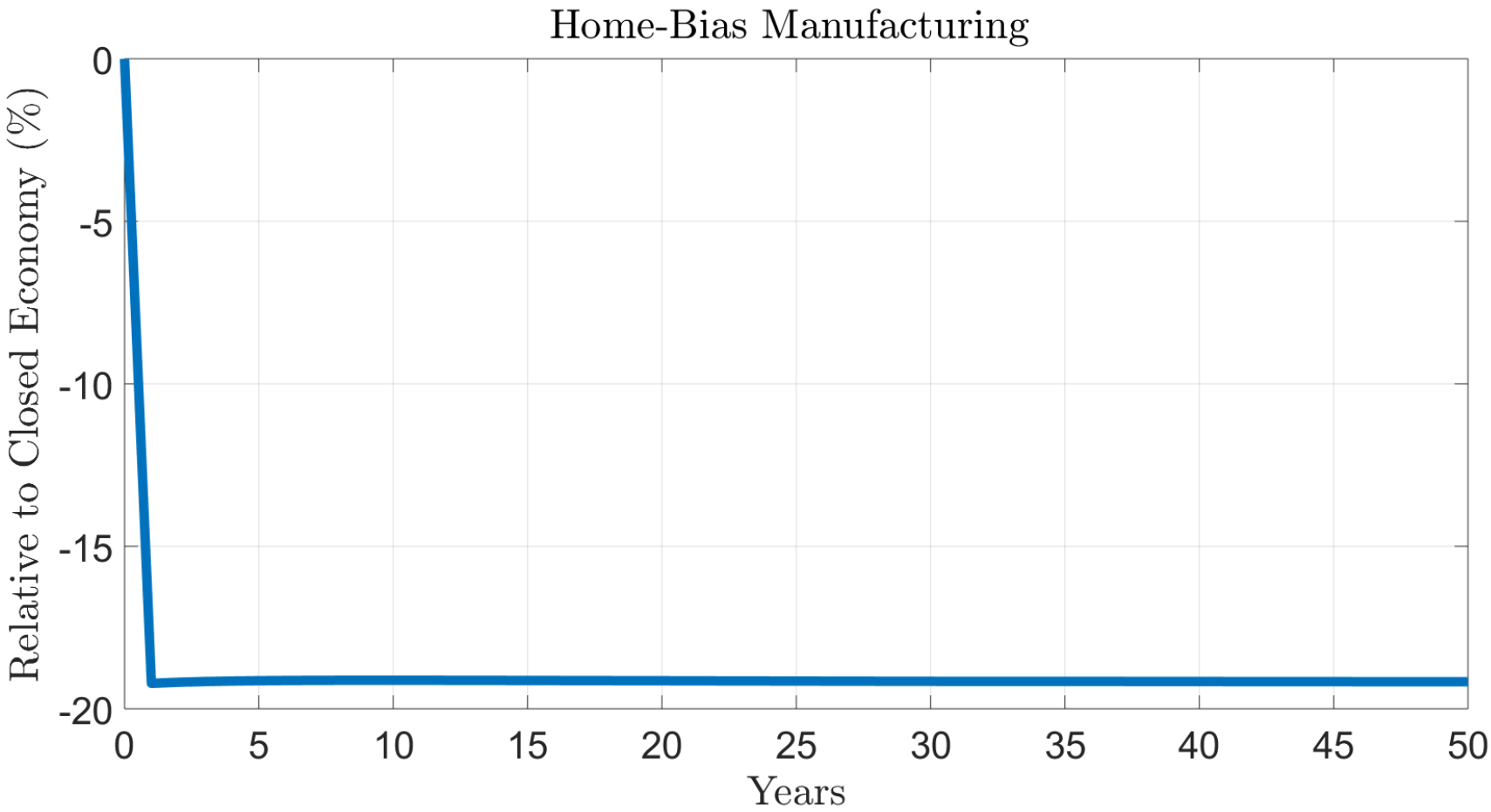
▸ Return

Return on capital increases



▸ Return

Home Bias Manufacturing Sector



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