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

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Motivation

o Important distributional consequences of trade

Autor, Dorn & Hanson (2013), Pierce & Schott (2016), Burstein & Vogel (2017),...

- Potential losses from greater import competition

- *Current* workers' industries, regions, occupations, firms, *skills*. . .

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o Several margins of adjustment to overcome **initial** losses

- Regional migration
Caliendo, Dvorkin & Parro (2019), Dix-Carneiro & Kovak (2018), Lyon & Waugh (2019), Rodriguez-Clare, Vazquez & Ulate (2022),...

- Switching industries and/or occupations
Dix-Carneiro (2014), Traiberman (2020), Dix-Carneiro, Pessoa, Reyes-Herles & Traiberman (2022), ...

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o Margin of adjustment for **new** generations of workers?

This paper

o Skill acquisition/college as a margin of adjustment

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o Two questions:

+ Do trade shocks affect college decisions?

+ What are the welfare consequences in the short- and long-run?

What we do

o **Evidence:** effects of trade shocks on college enrollment

   + Effects on labor market outcomes for college/non-college

   + Effects on college enrollment for future workers

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o Dynamic trade **model** with heterogeneous households

  + Incomplete-markets OLG structure with costly education choice & intervivos transfer

  + Multi-region model with HO-type comparative advantage

  + Costly switching across local labor markets

What we find

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    F1 Trade shocks are more detrimental for less educated workers . . .

    F2 Younger cohorts respond by increasing college enrollment, mostly in wealthier families

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 F2 Younger cohorts respond by increasing college enrollment, mostly in wealthier families

o **Model:**

 + Short-run:
   - Higher wage premium and increased college enrollment . . . for wealthy households
   - Uneven welfare gains/losses determined by region, sector, and wealth.

 + Long-run:
   - All welfare gains and higher college enrollment
   - Endogenous skill acquisitions makes long-run welfare gains more equal

Literature Review

o Trade shocks and labor market adjustment
  - Autor, Dorn & Hanson (2013), Pierce & Schott (2016), Artuç, Chaudhuri, & McLaren (2010), Dix-Carneiro (2014), Traiberman (2020), Caliendo, Dvorkin & Parro (2019),...

o Macroeconomics and skill acquisition
  - Charles, Hurst & Notowidigdo (2016)
  - Abbott, Gallipoli, Meghir & Violante (2019), Daruich (2020)
  - Adao, Beraja & Pandalai-Nayar (2020)

o Trade, human capital, and inequality
  - Findlay & Kierzkowski (1983), Blanchard & Willmann (2016), Danziger (2017), Ghose (2019)
  - Atkin (2016), Greenland & Lopestri (2016), Blanchard & Olney (2018), Tuhkuri (2021)
  - Katz and Murphy (1992), Autor, Katz and Kearney (2008), Keane and Wolpin (1997), Huggett, Ventura and Yaron (2011), Guner, Ruggieri and Tybout (2022)
  - Helpman et al. (2010, 2017), Antràs et al. (2017), Burstein et al. (2016), Burstein & Vogel (2017)

o *Heterogeneous-agents trade-spatial macro models*
  - Lyon & Waugh (2018, 2019), Carroll & Hur (2020,2022), Giannone et al. (2020), Greeney (2020), Waugh (2022)

Evidence

Measuring trade shocks – Autor, Dorn, & Hanson (2013)

- **Import penetration** in region (market) r in period t

$$\Delta IPW_{rt} = \sum_i \frac{L_{rit}}{L_{rt}} \frac{\Delta M_{it}}{L_{it}}$$

i: sector, M_{it}: Chinese imports, L_{rit}: workers sector i and region r,

$$L_{rt} = \sum_i L_{rit}, \text{ and } L_{it} = \sum_r L_{rit}$$

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o Data overview:

+ 722 commuting zones (regions)

+ Two waves

- Period 1990-2000: ΔIPW_{rt} *Median*: \$1,000, *IQR*: \$600
- Period 2000-2007: ΔIPW_{rt} *Median*: \$2,000, *IQR*: \$1,500

o Effect of *import competition* on variable y_{it}

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

Estimating regional effect of trade shocks

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+ y_{rt}: labor income, employment, and college enrollment
+ effect on different groups
    - working age 30-55 $\rightarrow$ by education levels
    - education decisions for ages 18-25

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o Instrument ΔIPW_{it} by Chinese imports in other high-income countries

Effect on labor market opportunities: Income

Δy_{rt}: log change in labor income by education, ages 30-55					
	All	High School	Some Coll	2-y program	Bachelor
ΔIPW_{rt}	-0.92^{**}				
	(0.40)				

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; $^{***}p < 1\%$, $^{**}p < 5\%$, $^{*}p < 10\%$

o A \$1,000 increase in imports per worker

  + Decreases average labor income by 0.92%

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- o A \$1,000 increase in imports per worker
    - + Decreases average labor income by 0.92%
    - + Larger decline for less educated workers
    - + No effect for workers with bachelor degree or more

Effect on labor market opportunities: Employment

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

	All	High School	Some Coll	2-y program	Bachelor
ΔIPW_{rt}	-0.73**				
	(0.20)				

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	(0.20)	(0.30)	(0.13)	(0.18)	(0.12)

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- A \$1,000 increase in imports per worker
  - Decreases average employment by 73bps
  - Larger decline for less educated workers
  - Smallest effect for workers with bachelor degree or more

Effect on education: Dealing with migration

o Individuals age 18-25 often migrate to attend college and in response to trade shock

   → ≈ 50% of freshmen in colleges > 100 mi away from perm home ▸ Migration

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+ PSID provides longitudinal data
- can follow individuals over time
- can link to family wealth and original CZ (restricted geocode data)
- small sample but can use individual level regressions

o Strategy 1: Link to previous CZ using ACS data

Effect on education: Enrollment

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Δy_{rt}: change in enrolled in any year of college ages 18-25

	Enrollment$_t$	Enrollment$_{t+1}$
ΔIPW_{rt}	0.88**	
	(0.19)	

Notes: $^{***}p < 1\%, ^{**}p < 5\%, ^{*}p < 10\%$

o A \$1,000 increase in imports
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ΔIPW_{rt}	0.88**	1.30*
	(0.19)	(0.4)

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o A \$1,000 increase in imports
  + Increases college enrollment by 88 bps
  + Significantly strong delayed effect on enrollment of 130 bps

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o Similar results for high school completion in Greenland & Lopresti (2016)

o Strategy 2: individual level regressions with PSID data

Effect on education: Enrollment by wealth level

○ Strategy 2: individual level regressions with PSID data

Linear prob model on college enrollment, $e_{nrt} \in \{0,1\}$

$$e_{nrt} = \sum_q \beta^q \mathbb{I}_{\{Y_{h(n)rt} \in q\}} \Delta IPW_{rt} + \theta_Y Y_{h(n)rt} + \theta_e e^p_{h(n)rt} + \delta X_{rt} + u_{nrt}$$

$+$ Quartiles by households' wealth Y_{nrt}:
  - groups: $< 25\%, 25\% - 50\%, 50\% - 75\%, > 75\%$

$+$ controls: family wealth $+$ HH's head education $+$ regional-level

College enrollment increases and wealth matters

College enrollment by wealth quartiles β^q

o Enrollment increases for top-wealth households, decreases for bottom-wealth.

Evidence - main takeaways

1. Trade shocks detrimental labor market outcomes
   → especially for less educated workers

2. Young individuals (HS graduates) adjust by enrolling into college

3. Enrollment increase driven by high school graduates in richest households

Model

Trade model with heterogeneous HHs and skill acquisition

$\rightarrow$ Multiple regions trading goods and assets within and across borders

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+ Technologies: two sectors, services and manufacturing

    o Intermediate goods $\rightarrow$ Tradable
       - Inputs: college workers & non-college workers

    o Final goods $\rightarrow$ Non-tradable
       - Inputs: domestic region-specific & imported intermediate goods

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+ Households/Workers: continuum & finitely-lived

    o Education: one-time decision at age $j = 1 \rightarrow$ preference shock
    o Sector-Region (LLM): switch at any age $\rightarrow$ utility cost + preference shock
    o Intervivos transfer to kid at age $j = J_k \rightarrow$ bequest motive
    o Idiosyncratic labor risk, save in bonds return r^*, retire at J_R

Intermediate goods – tradable – sector $i = s, m$

$$\max_{L_{cri}, L_{nri}} p_{ri} z_{ri} \left(\gamma_{ri} L_{cri}^{\frac{\sigma-1}{\sigma}} + (1 - \gamma_{ri}) L_{nri}^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}} - w_{cri} L_{cri} - w_{nri} L_{nri}$$

+ L_{cri} and L_{nri} denote college and non-college labor in region r and sector i

+ w_{cri} and w_{nri} denote college and non-college wages

+ z_{ri} sector productivity

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Key assumptions:

o college and non-college workers are substitutes: $\sigma > 1$

o Service is more intensive in college workers: $\gamma_{rs} > \gamma_{rm}$ (Cravino and Sotelo, 2018)

Decline in manufacturing *w.r.t.* services $\rightarrow$ lower demand for non-college *w.r.t.* college workers

+ Technology: $Q_{ri} = \left[\omega^{\frac{1}{\eta_i}} D_{ri}^{\frac{\eta-1}{\eta}} + (1-\omega)^{\frac{1}{\eta}} \left(D_{ri}^* \right)^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}}$

  $\rightarrow$ domestic composite $D_i = \left(\sum_{r' \in \mathcal{R}} \alpha_{rr'}^{\frac{1}{\omega}} d_{rir'}^{\frac{\theta}{\theta-1}} \right)^{\frac{\theta-1}{\theta}}$

+ Profits $\max_{\{d_{rir'}\}_{r'}, D_{ri}^*} \left\{ q_{ri} Q_{ri} - \sum_{r' \in \mathcal{R}} \tau_{rir'} p_{r'i} d_{rir'} - p_i^* \tau_i^* D_{ri}^* \right\}$

  $\rightarrow$ price of final good $q_{ri} = \left[\omega \bar{p}_{ri}^{1-\eta} + (1-\omega) \left(\tau_i^* p_i^* \right)^{1-\eta} \right]^{\frac{1}{1-\eta}}$

  $\rightarrow \bar{p}_{ri}$ ideal price index for D_i

+ $\tau_i^* \geq 1$ iceberg cost $\rightarrow$ control *trade openness*

Households

$\rightarrow$ Dynastic framework with three stages: transfers, education, and working

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Value of a worker at age j in labor market $\ell = (r, i)$

$$V_j(a, x, \ell, e) = \max_{c_s, c_m, a'} \left\{ U(c) + \mathbb{E}\left[\max_{\ell'} \left\{ \epsilon_{\ell'} - \psi_{je}(\ell, \ell') + \beta V_{j+1}(a', x', \ell', e) \right\} \right] \right\}$$

$$q_r c + q^a a' \leq w_{e\ell} x \bar{h} + (1 + r^*) q^a a, \qquad a' \geq \underline{a}_{j,e}$$

o consumption $c = \mathcal{C}(c_s, c_m)$, price index $q_r = \mathcal{Q}(q_{rs}, q_{rm})$.

o $\epsilon_{\ell'}$ realized and ℓ' choice at end of period $\rightarrow$ after c and a' chosen
  (Artuc, Chaudhuri, and McLaren, 2010), (Caliendo, Dvorkin, and Parro, 2020)

o education e is fixed

Households

→ Dynastic framework with three stages: transfers, education, and working

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Households

$\rightarrow$ Dynastic framework with three stages: transfers, education, and working

Value of college $e = c$ at age $j = 1, 2$

$$V_j(a, x, \ell, c) = \max_{c_s, c_m, a'} \left\{ U(c) + \mathbb{E} \left[\max_{\ell'} \left\{ \epsilon_{\ell'} - \psi_{je}(\ell, \ell') + \beta V_{j+1}(a', x', \ell', c) \right\} \right] \right\}$$

$$q_r c + q^a a' + q_{rs} \kappa \leq w_{n\ell} x \frac{\bar{h}}{2} + (1 + r^*) q^a a, \qquad a' \geq \underline{a}_{j,c}$$

o κ cost college

o work part-time and receive non-college wage

o looser borrowing limit for college $\underline{a}_{j,c}$

Newborns and Transfers

$\rightarrow$ Dynastic framework with three stages: transfers, education, and working

+ Value to a newborn who receives a transfer Φ

$$\mathcal{V}_0(\Phi, x_p, \ell_p, e_p) = \mathbb{E}\left[\max_e\left\{-\phi\mathbb{I}_{\{e=c\}} + \max_\ell\left\{\epsilon_\ell - \psi_{0e}(\ell_p, \ell) + V_1(\Phi, x, \ell, e)\right\}\right\} \Big| x_p\right]$$

$\phi \sim F_e(e_p)$, $x \sim F_x(x_p)$, for parental states (e_p, x_p).

(Abbott, Gallipoli, Meghir, and Violante, 2019), (Daruich, 2020)

+ Transfer at age $j = J_k$

$$\max_{\Phi \geq 0}\left\{V_{J_k}(a - \Phi, x_p, \ell_p, e_p) + \hat{\beta}\mathcal{V}_0(\Phi, x_p, \ell_p, e_p)\right\}$$

Education Policy

Prob of college education

Education Policy

Prob of college education

parents x low
parents x med
parents x high

Transfers distribution (%)

Parents Transfer Φ
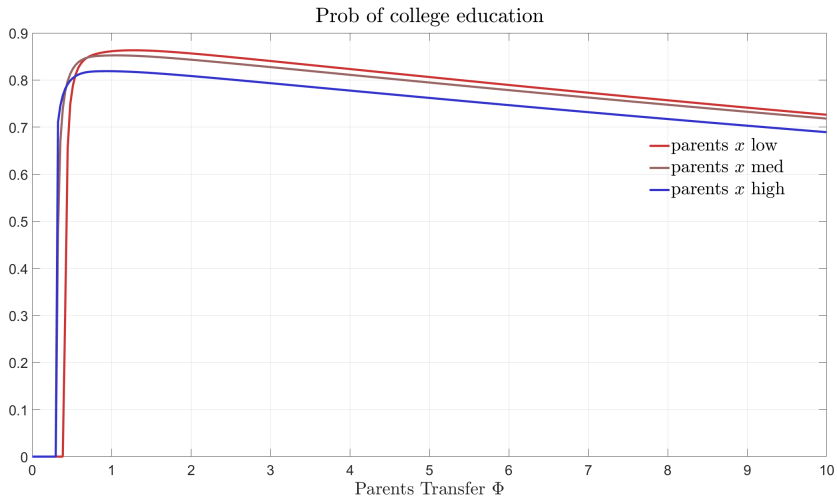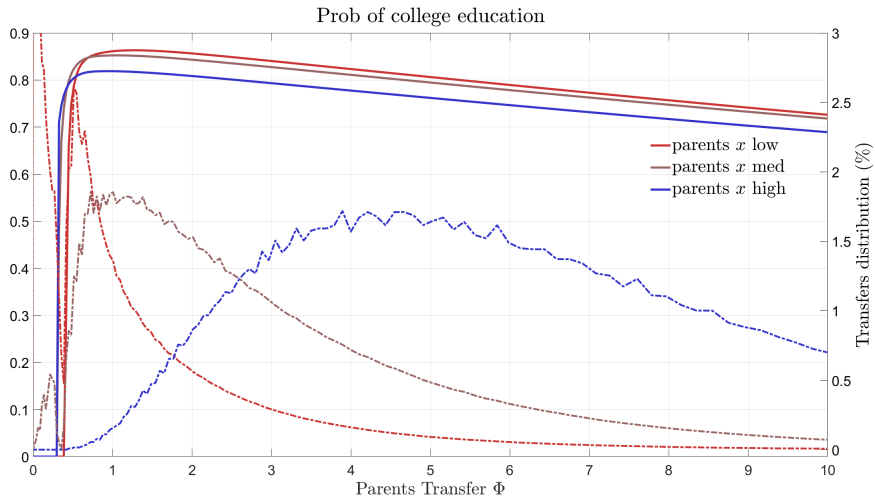
Calibration

Calibration - key nationwide parameters

o Household: period $= 2$ years, $J_k = 15$, $J_R = 25$

+ $\beta = 0.98 \rightarrow$ wealth/income $\approx 3.5\text{-}4$

+ $\hat{\beta} = 0.85 \rightarrow$ transfer/income ≈ 0.5

o College decision

+ $\kappa \rightarrow$ college $\approx 36\%$ of workers

+ $\ln \phi \sim \mathcal{N}(m_{e_p}, \sigma^2)$, for $e_p = c, n$

- inter-generational education persistence $\approx 77\%$

+ $\underline{a}_c \rightarrow$ borrow 50% of college (for 14 years)

o Sectors: $\psi_{je}(\ell, \ell') = \psi_r + \psi_i$

+ $\varepsilon_i \sim Gumbel(-\rho\gamma, \gamma)$

+ ψ_i: sector persistence $\approx 94\%$

(Artuc, Chaudhuri, and McLaren, 2010)

+ ψ_r: migration rate $\approx 0.50\%$

+ $\psi_c^{j=0} = 0$: newborn college

o Consumption bundle:

+ $c = \left(\sum_i \nu_i^{\frac{1}{\rho}} c_i^{\frac{\rho-1}{\rho}} \right)^{\frac{\rho}{\rho-1}}$

+ $\rho = 0.5$

+ $\nu_s = 0.81$ and $\nu_m = 0.19$

+ match aggregate labor share by sector

Calibration - Three regions

+ Three regions
    - differ only in productivities, z_{rs} and z_{rm} , same factor intensities, γ_s and γ_m

+ Match employment share + skill compensation by regions in 1990
    - West $\rightarrow$ low exposure (low manufacturing labor share)
    - Midwest $\rightarrow$ high exposure (high manufacturing labor share)
    - North-East $\rightarrow$ mid exposure (average manufacturing labor share)
    $\rightarrow$ choose z_{rs} and z_{rm} keeping income per-worker across regions approx constant

+ Choose domestic trade costs, $\tau_{rmr'}$, to match domestic trade shares (CFS for 1993)

Modeling trade openness - nationwide

Main Exercise:

- o At $t = 0$ the economy is at a steady state with high τ_m^*, and τ_s^*

    + "Closed economy" calibrated to 1990
    + home-bias: services $\approx 98\%$, and manuf $\approx 90\%$

- o At $t = 1$, τ_m^* unexpectedly decrease   (τ_s^* as well)

    + Large decline in the cost of importing manufacturing goods
    + A sudden and permanent shock
    + The economy slowly converges to the new steady-state
    + "Open economy" calibrated to the 2010s $\rightarrow$ manuf h-b $\approx 75\%$

The dynamic effects of trade openness

The dynamic effects of trade openness

1. Cross-regional differences

2. Who goes to college more?

3. The welfare consequences of trade openness

4. Skill acquisition as margin of adjustment

Real wages: winners and losers

College wages w_{crit}/q_{rt}

Non-college wages w_{nrit}/q_{rt}
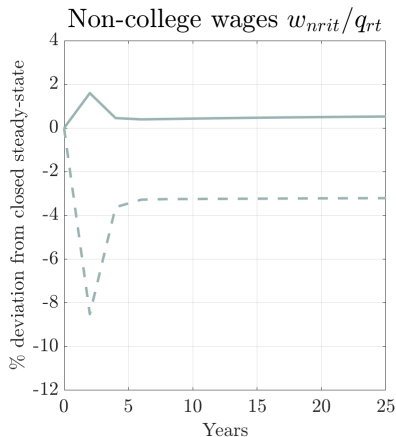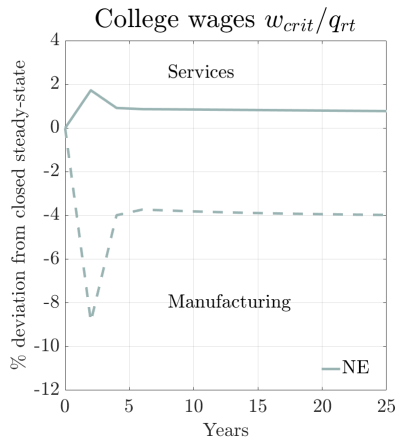
- Services expand and manufacturing contracts

- Wages respond accordingly

Real wages: winners and losers

College wages w_{crit}/q_{rt}

Non-college wages w_{nrit}/q_{rt}

o Services expand and manufacturing contracts

o Wages respond accordingly

o Effect depends on exposure to the shock

Real wages: winners and losers

College wages w_{crit}/q_{rt}

Non-college wages w_{nrit}/q_{rt}

% deviation from closed steady-state

Years

Services

Manufacturing

WE
MW
NE

o Services expand and manufacturing contracts

o Wages respond accordingly

o Effect depends on exposure to the shock

o Persistent effects

College premium: $\mathbf{E}[\text{college wage}]/\mathbf{E}[\text{non-college wage}]$

o Expansion in services leads to higher wage premium

Wage premium increases ...

College premium: $\mathbf{E}$[college wage]/$\mathbf{E}$[non-college wage]
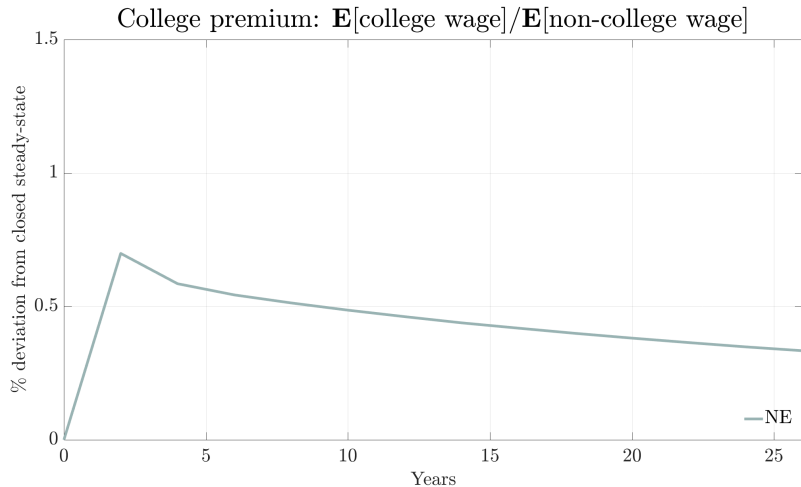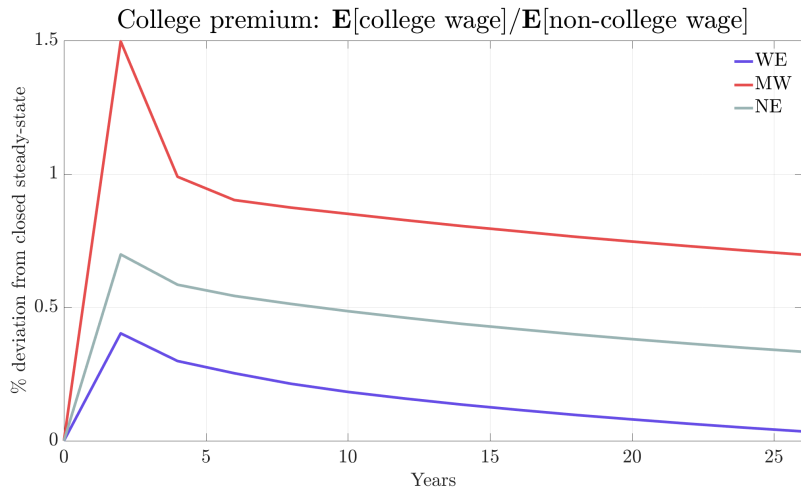
- Expansion in services leads to higher wage premium

- Effect is larger for the highly exposed region

Wage premium increases ...

College premium: $\mathbf{E}$[college wage]/$\mathbf{E}$[non-college wage]

Legend: WE, MW, NE

o Expansion in services leads to higher wage premium

o Effect is larger for the highly exposed region

o Larger increase on impact than in the long-run

... and college enrollment increases as well

College measure μ_{ct}
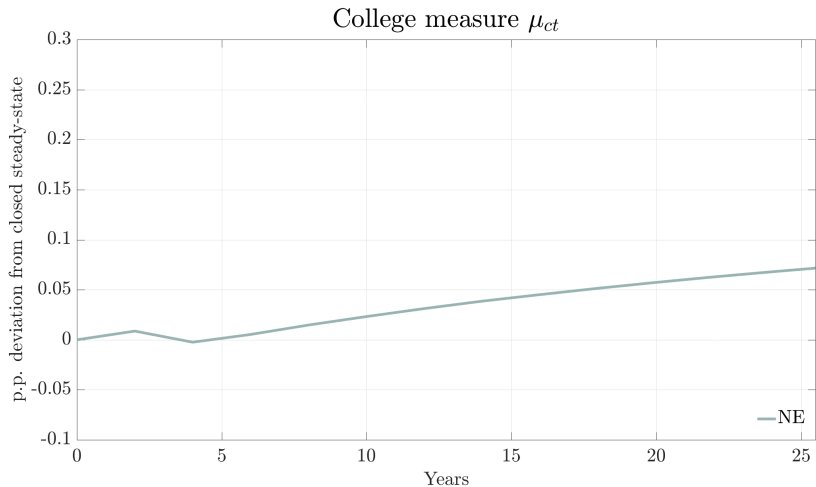
- Increased wage premium leads to higher college enrollment

... and college enrollment increases as well

College measure μ_{ct}

p.p. deviation from closed steady-state

Years

WE
MW
NE
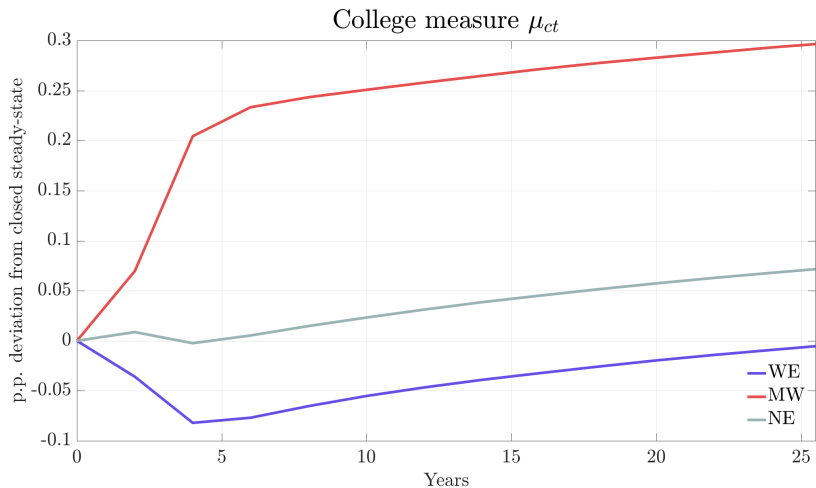
○ Increased wage premium leads to higher college enrollment

○ Effect is larger for the highly exposed region

Cross-Regional Regression: model vs data

Change in college enrollemnt
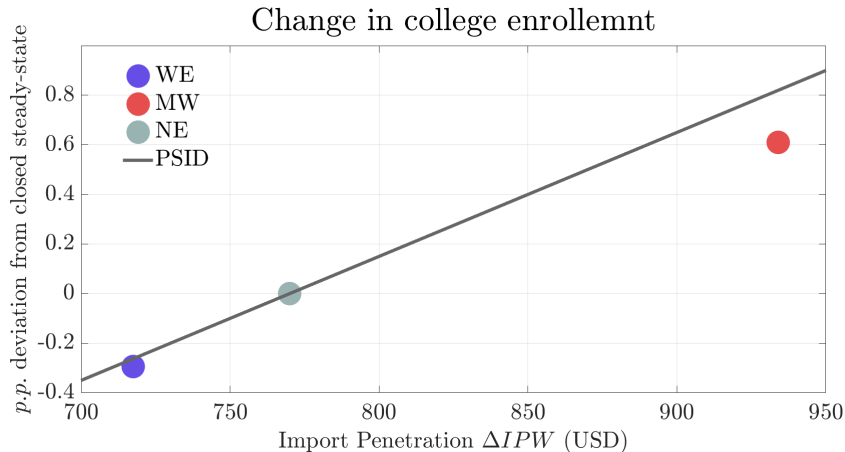
- Model matches college enrollment regression

- ...small variation in ΔIPW

The dynamic effects of trade openness

1. Cross-regional differences

2. Who goes to college more?

3. The welfare consequences of trade openness

4. Skill acquisition as margin of adjustment

Who goes more to college?

College enrollment across regions
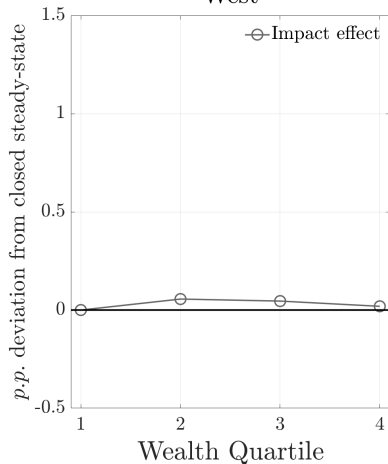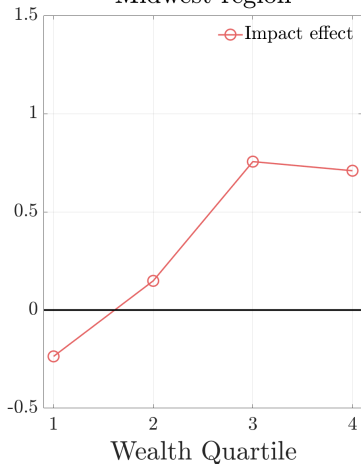
o College enrollment increases mostly in the high exposure region.

o As in data, the increase is concentrated in wealthy household.

Who goes to college more?

College enrollment by sector - Midwest (high exposure) region
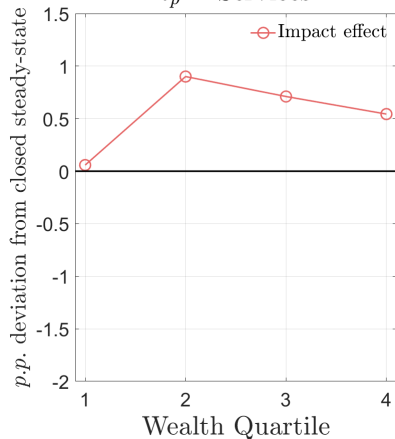
$i_p = $ Services
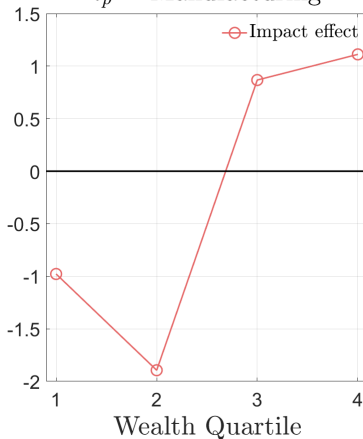
$i_p = $ Manufacturing

- Decline in wealth-poor manufacturing households.

- Sectoral differences as in data.

Who goes to college more?

College enrollment by sector - Midwest (high exposure) region
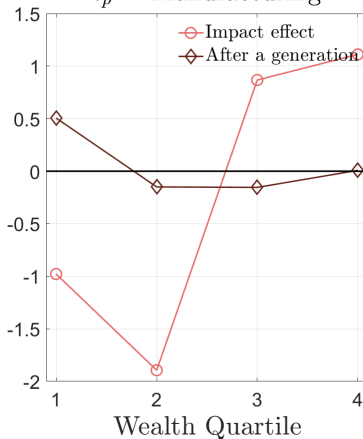
- Decline in wealth-poor manufacturing households.

- Sectoral differences as in data.

- More than reverts after a generation.

CPS (income)

Large changes in transfers for households in manufacturing

Transfers by sector - Midwest (high exposure) region
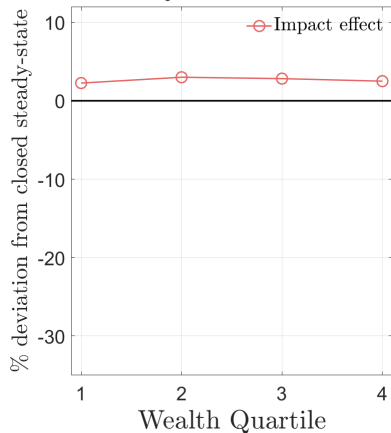
$i_p =$ Services
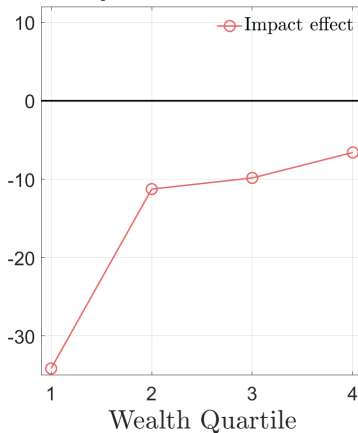
$i_p =$ Manufacturing

- Transfers decline sharply in manufacturing

- Explains the differential in college enrollments

Large changes in transfers for households in manufacturing

Transfers by sector - Midwest (high exposure) region

o Transfers decline sharply in manufacturing

o Explains the differential in college enrollments

o More than reverts after a generation.

The dynamic effects of trade openness

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Uneven welfare gains of trade

Consumption Equivalents by region
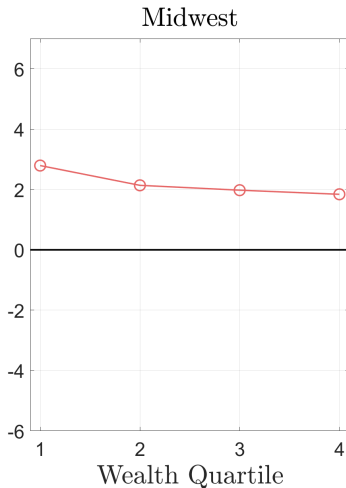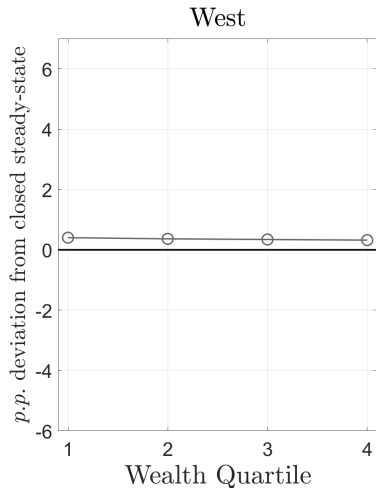
o Welfare gains:
small for low-exposure
large for high-exposure.

Uneven welfare gains of trade
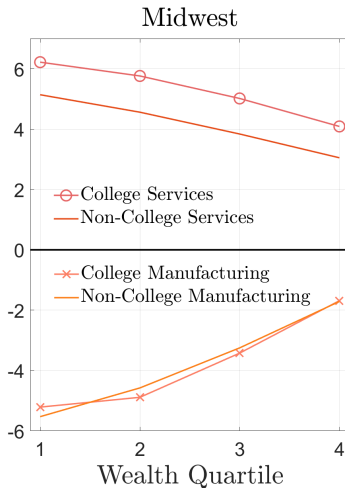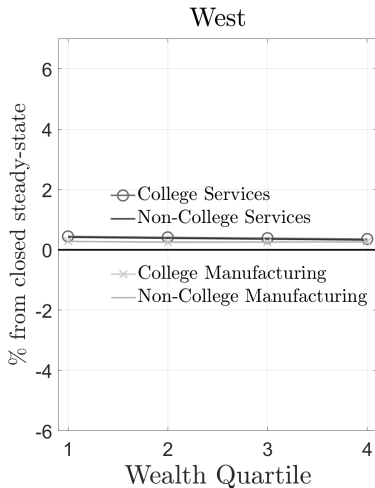
Consumption Equivalents by region

- o Welfare gains: small for low-exposure large for high-exposure.

- o Gains in high exposure region are very hetero-geneous

- o Short run effects largely driven by sector.

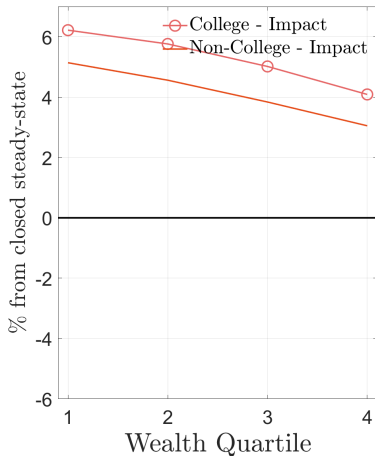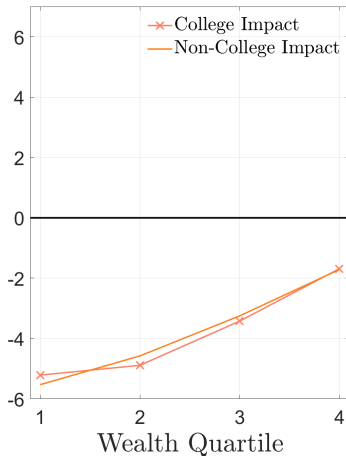# Uneven welfare gains of trade

Consumption Equivalents by region
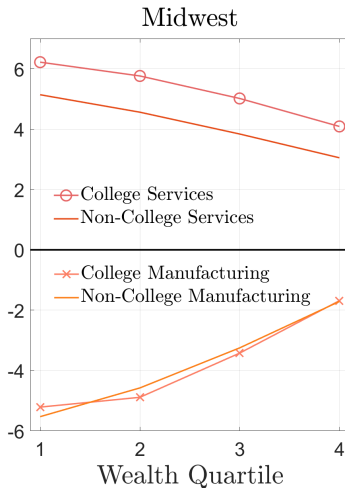
Midwest

- o Welfare gains:
  small for low-exposure
  large for high-exposure.

- o Gains in high exposure region are very heterogeneous

- o Short run effects largely driven by sector.

Uneven welfare gains of trade

Consumption Equivalents by region
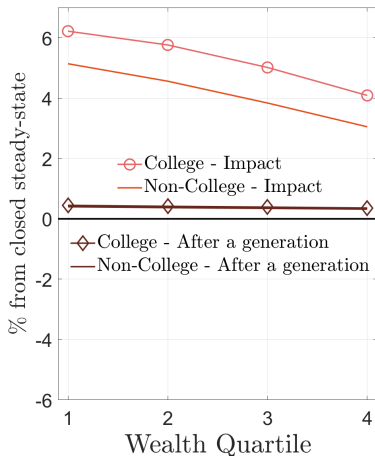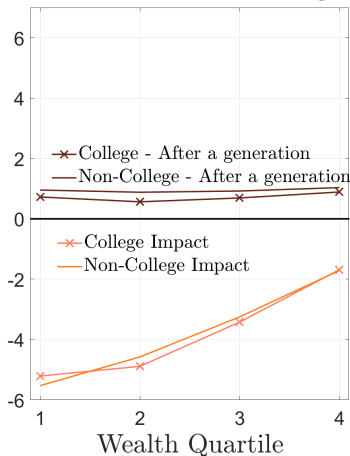

Midwest Services

Midwest Manufacturing

o Welfare gains:
small for low-exposure
large for high-exposure.

o Gains in high exposure
region are very hetero-
geneous

o Short run effects largely
driven by sector.

▸ CE × Education

Uneven welfare gains of trade

Consumption Equivalents by region

o Welfare gains:
  small for low-exposure
  large for high-exposure.

o Gains in high exposure region are very hetero-geneous

o Short run effects largely driven by sector.

o Welfare differentials disappear after a generation

CE x Education

# The dynamic effects of trade openness

1. Cross-regional differences

2. Who goes to college more?

3. The welfare consequences of trade openness

4. Skill acquisition as margin of adjustment

A Fixed Education Model

o Education is a type inherited from parents

    + Constant over a life-time

    + Still have to pay for college

    + Parents choose transfers optimally

    + Sectoral choice as before

$\rightarrow$ education is not a margin of adjustment any more
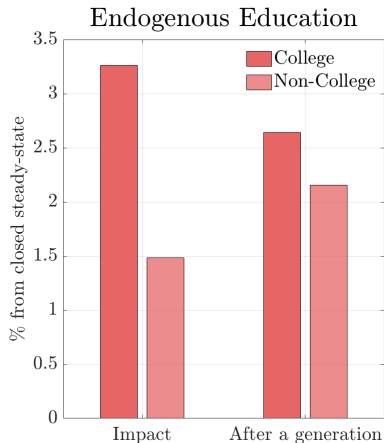
Fixed Education induces larger wage premium

College wage premium $\mathbf{E}$[college wage]$/\mathbf{E}$[non-college wage]
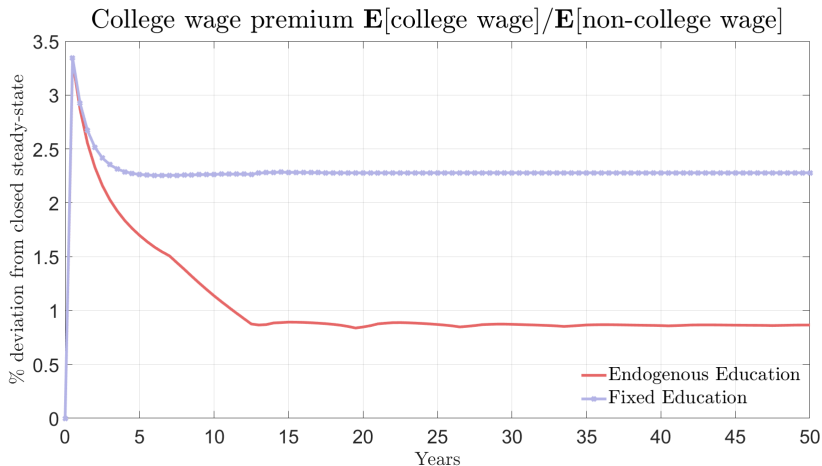
o Wage premium permanently higher

o Part of wage of premium comes form sectoral composition

▸ by sector

Welfare gains differences persist with Fixed Education

Consumption Equivalent with Endogenous and Fixed education
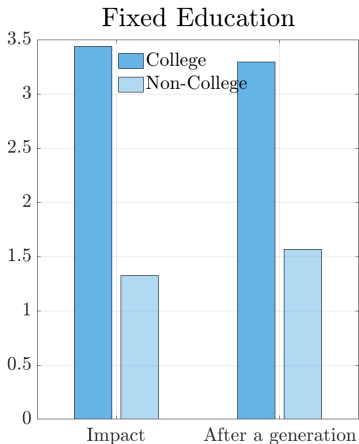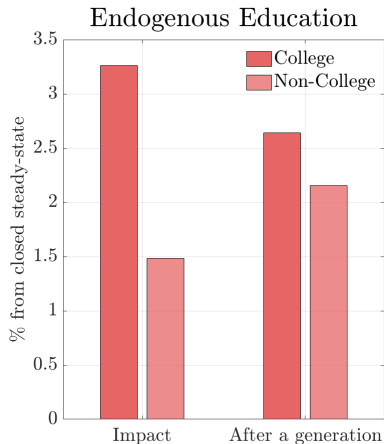

Endogenous Education

+ Welfare gain differentials lessen with endogenous education after a generation ...

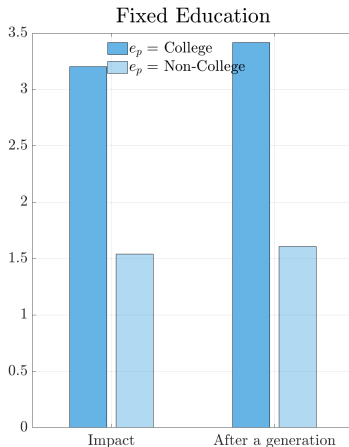# Welfare gains differences persist with Fixed Education

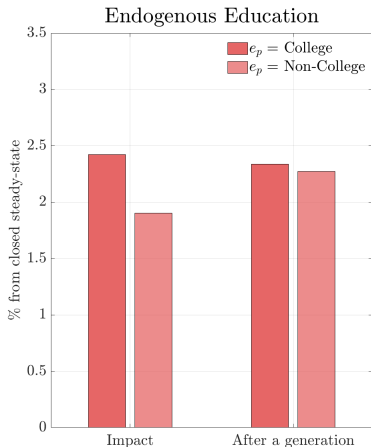Consumption Equivalent with Endogenous and Fixed education

Endogenous Education

Fixed Education

+ Welfare gain differentials lessen with endogenous education after a generation ...

+ but they persist with fixed education.

Welfare gains differences persist with Fixed Education

Newborn's CEV with Endogenous and Fixed education

Endogenous Education

- e_p = College
- e_p = Non-College

Fixed Education

- e_p = College
- e_p = Non-College

+ Welfare gain differentials lessen with endogenous education after a generation ...

+ but they persist with fixed education.

+ For new generations, the redistributive effects of endogenous education are key on impact.

Model - main takeaways

o Trade openness has very different effects across regions

o Services expand $\rightarrow$ wage premium increases $\rightarrow$ college enrollment increases
   + Effect concentrated in wealthier households and/or in services

o Welfare implications:
   + Short-run: uneven gains and losses driven by region and sector
   + Long-run: only gains, more even due to endogenous skill acquisiton

Conclusions

Conclusions:

- o *Evidence:* trade shocks
    - + more detrimental for less educated workers
    - + increase college enrollment, especially for wealthier families.

- o *Model:* Consistent with evidence.
    - + Endogenous education alters the long-run distribution of welfare gains

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Next steps:

o *Model:*
   + Improve calibration: target changes over time, regressions,...
   + Policy exercises: college subsidies, transfers,...

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Next steps:

- ○ *Model:*
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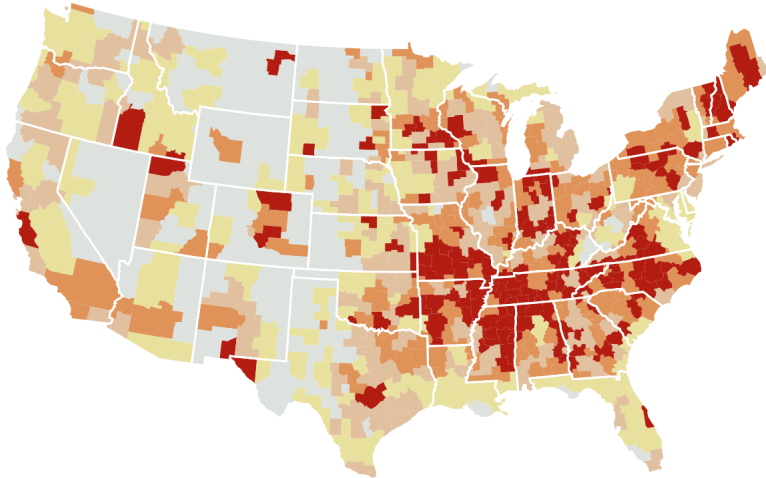 - + Policy exercises: college subsidies, transfers,...

Thank you!!

Appendix

Measuring trade shocks – Autor, Dorn, & Hanson (2013)

Most-affected 20% · Second-highest 20% · Middle 20% · Second-lowest 20% · Least-affected 20%

return

Effect on labor market opportunities: Employment

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

	All	High School	Some Coll	2-y program	Bachelor
ΔIPW_{rt}	-0.73^{**}				
	(0.20)				

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;* $^{***}p < 1\%$, $^{**}p < 5\%$, $^{*}p < 10\%$

o A \$1,000 increase in imports

+ Decreases average employment by 73bps

Effect on labor market opportunities: Employment

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

	All	High School	Some Coll	2-y program	Bachelor
ΔIPW_{rt}	-0.73^{**}	-1.06^{***}	-0.46^{***}		
	(0.20)	(0.30)	(0.13)		

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; $^{***}p < 1\%$, $^{**}p < 5\%$, $^{*}p < 10\%$*

- o A \$1,000 increase in imports
  - + Decreases average labor income by 73bps
  - + Larger decline for less educated workers

Effect on labor market opportunities: Employment

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

	All	High School	Some Coll	2-y program	Bachelor
ΔIPW_{rt}	-0.73^{**}	-1.06^{***}	-0.46^{***}	-0.45^{**}	-0.31^{**}
	(0.20)	(0.30)	(0.13)	(0.18)	(0.12)

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;* $^{***}p < 1\%$, $^{**}p < 5\%$, $^{*}p < 10\%$

o A \$1,000 increase in imports

+ Decreases average labor income by 73bps

+ Larger decline for less educated workers

+ Smallest effect for workers with bachelor degree or more

Effect on migration

Δy_{rt}: change in migration number

	ages 18-25 college	ages 18-25 no college	ages 30-55
ΔIPW_{rt}	0.026**	0.008	0.012
	(0.01)	(0.02)	(0.01)

Notes: $^{***}p < 1\%$, $^{**}p < 5\%$, $^{*}p < 10\%$

o A \$1,000 increase in imports per worker

+ Increases migration for ages 18-25 if enrolled in college by 2.6%

+ Migration doesn't respond for other groups

▸ Back

Foreign Economy (W) and market clearing

o Linear preferences and endowments Y_{it}^W

$$\sum_t (\beta^W)^t C_t^W, \qquad C_t^W = \mathbb{C}(Q_{mt}^W, Q_{st}^W)$$

$$\sum_i q_{it}^W Q_{it}^W + q_t^a A_{t+1}^W \leq \sum_i p_{it}^* Y_{it}^W + q_t^a (1 + r^*) A_t^W$$

o Final goods

$$Q_i^W = \left[\left(\omega^W \right)^{\frac{1}{\eta^W}} \left(D_i^W \right)^{\frac{\eta^W - 1}{\eta^W}} + (1 - \omega^W)^{\frac{1}{\eta^W}} \left(D_i^{W,US} \right)^{\frac{\eta^W - 1}{\eta^W}} \right]^{\frac{\eta^W}{\eta^W - 1}}$$

$$D_i^{W,US} = \prod_r \left(D_{r,i}^{W,US} \right)^{\alpha_r^W}$$

o Market clearing

$$Y_{rit} = \sum_{\tilde{r}} d_{\tilde{r}ir} + D_{ir}^{W,US}, \;\; Y_{it}^W = \sum_r D_{rit}^* \tau_{rit}^* + D_{it}^W, \;\; A_t^W + A_t = 0$$

Effect on education by income level
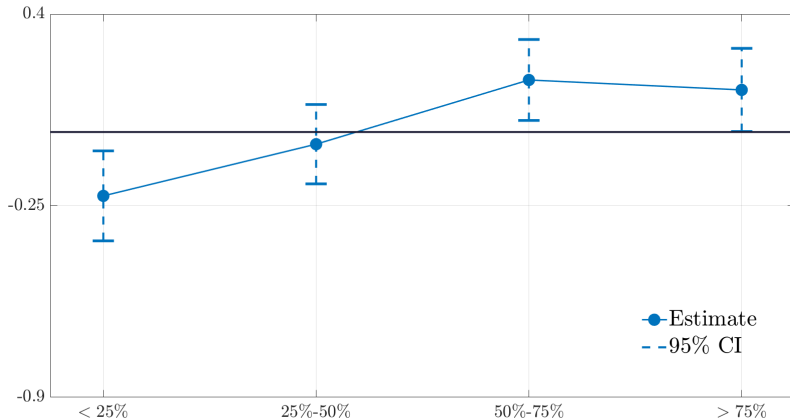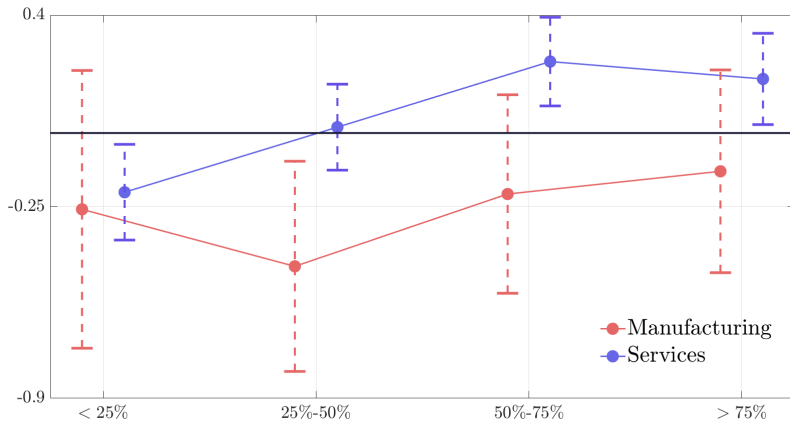
College enrollment by income quartiles β^q

o Enrollment increases for top-income households

o Results by income quartile similar to wealth quartile

PSID (wealth)   Model

Effect on education by income level

College enrollment by income quartiles β^q: effect by sector

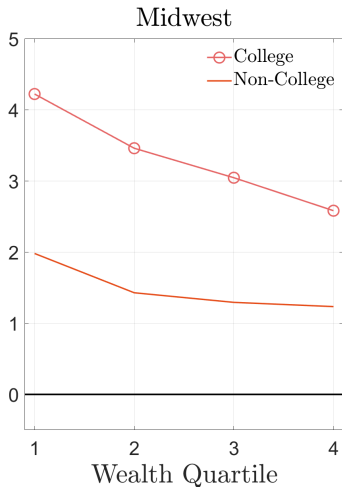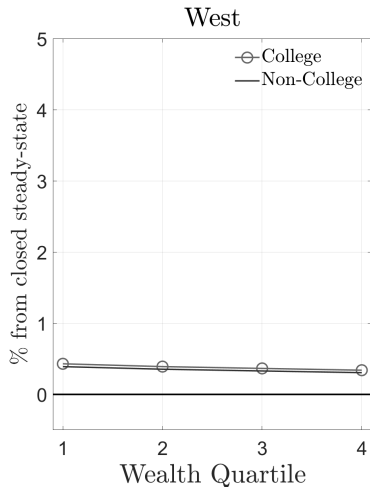- o Enrollment increases for top-income households

- o Results by income quartile similar to wealth quartile

- o Effect is larger for households working in services
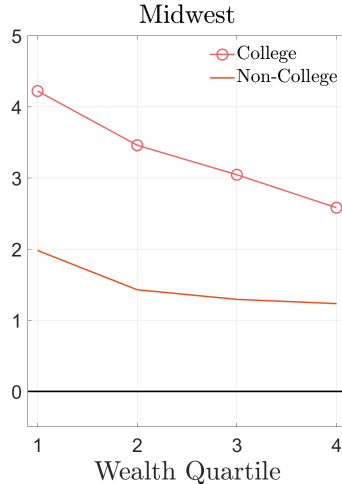
▸ PSID (wealth) ▸ Model

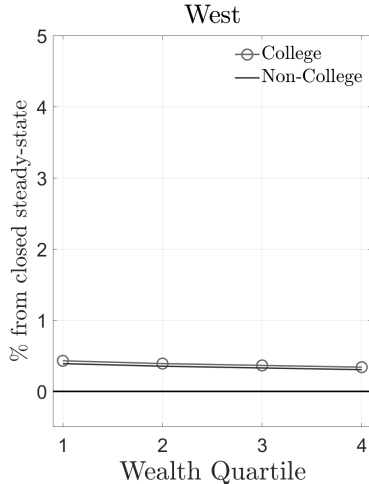# Uneven Welfare gains of trade

West

Midwest

% from closed steady-state

Wealth Quartile

- College
- Non-College

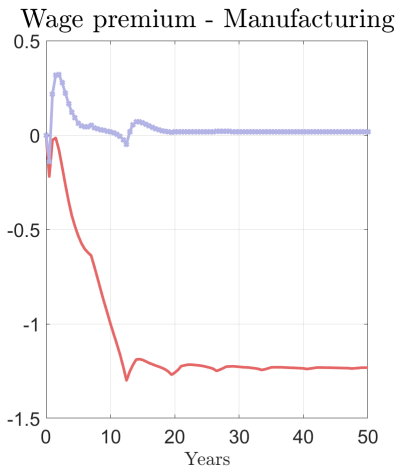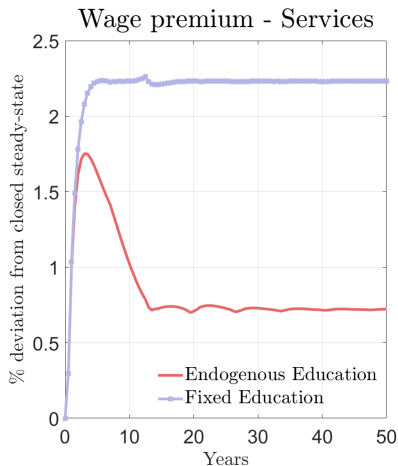o Workers with and without a college education gain on impact

Uneven Welfare gains of trade

West

Midwest

o Workers with and without a college education gain on impact

o Poor households with a college education gain the most.

Fixed Education induces larger wage premium

Wage premium - Services

Wage premium - Manufacturing

% deviation from closed steady-state

Years

- Endogenous Education
- Fixed Education

+ Higher wage premium with fixed education in both sectors

+ No decline for manufacturing

Migration responds to trade shocks, only for the young

Δy_{rt}: change in migration by age group

	Age $18-25$	Age $30-55$
ΔIPW_{rt}	0.021***	0.001
	(0.01)	(0.01)

Notes: ***$p < 1\%$, **$p < 5\%$, *$p < 10\%$