Intergenerational Occupational Mobility and Routine-biased Technological Change

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Motivation

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- Acemoglu, Autor, Rodrik etc.: Technological change in the 1980s and 1990s (RBTC) had negative consequences for large groups of workers
- Counterargument: It's just creative destruction! Workers should be happy to accept this as their children will grow up in a more prosperous society

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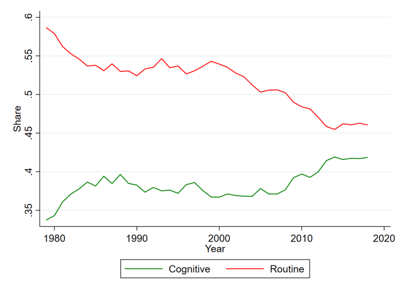
This paper:

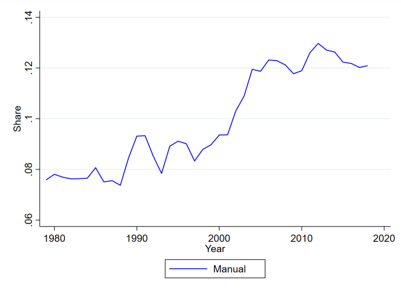
- Aim: Empirically evaluate **welfare consequenses of RBTC**, explicitly accounting for **intergenerational altruism** and **intergenerational occupational mobility**
- How: Estimate an overlapping generations, general equilibrium model using data from PSID, NLSY and CPS
- Perform counterfactual experiments and welfare analysis

Motivating facts

1: Job polarization



(a) **Share of Routine/Cognitive Workers**

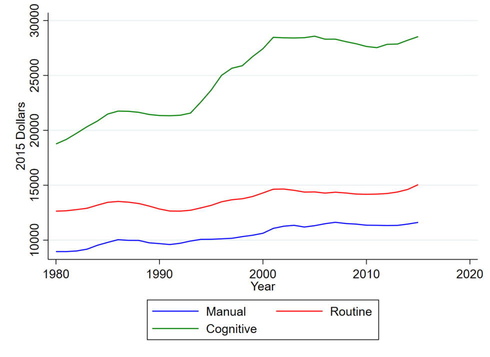


(b) **Share of Manual Workers**

Notes: Average employment share in each occupational group among 40-year-old men in full-time employment. 3-year moving average. Data from CPS. Occupational classes defined as in Cortes (2016)

Motivating facts

2: Increasing cognitive wage premium

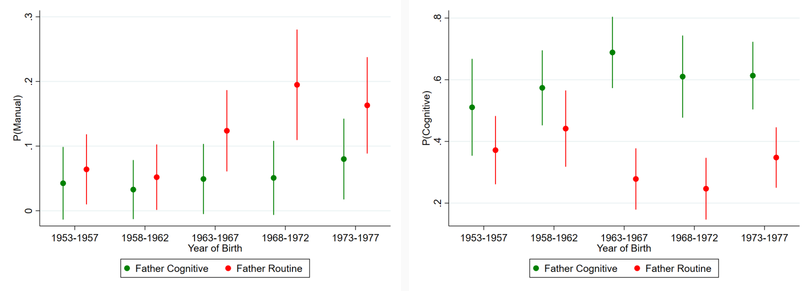


Notes: Average real annual wages and salary in each occupational group among men in full-time employment. 3-year moving average. Calculated using CPS data and deflated by CPI to 2018 dollars.

Motivating facts

3: (NEW) Divergence of intergenerational occupational mobility

(a) P(Manual) by father occupation **(b)** P(Cognitive) by father occupation



Notes: Father's and son's occupation taken at highest observed age between 39-41. Data from PSID.

→ Key 'puzzle': supply response of routine children surprising given increasing cognitive wage premium

Model

Model summary

Households:

- Young: **Draw ability** and **receive transfer**; **discrete choice** of **occupation/education** subject to a **psychic cost**, **monetary cost** with **borrowing constraint** and **idiosyncratic preferences**
- Working age: Earn income according to skills, divide between consumption, savings and **transfer to child**

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Firms:

- Choose input of each worker type as well as **'automation capital'**, which substitutes routine workers and complements cognitive workers

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Dynamics

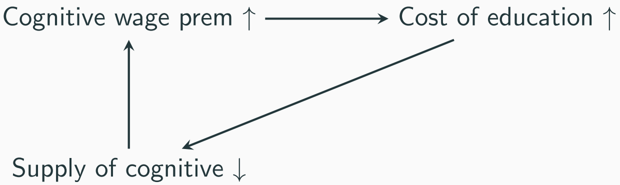
- Assume steady state until 1980, then MIT-style unexpected RBTC transition (fall in price of automation capital) hits

Lifecycle Overview Full Model

Model summary: Cost of education

Allow for endogenous link between cognitive wage premium and financial cost of cognitive skill investment

$\rightarrow$ Stronger poverty trap dynamics



In the data: tuition fees and years of college of cognitive workers increased markedly from 1980 $\implies$ cost of cognitive skills and cognitive wage premium closely correlated

College cost

Taking the model to the data

Estimation

Most parameters estimated without solving the model:

- Monetary skill costs, link cog. wage $\rightarrow$ college cost, share paid by parents, production function parameters...

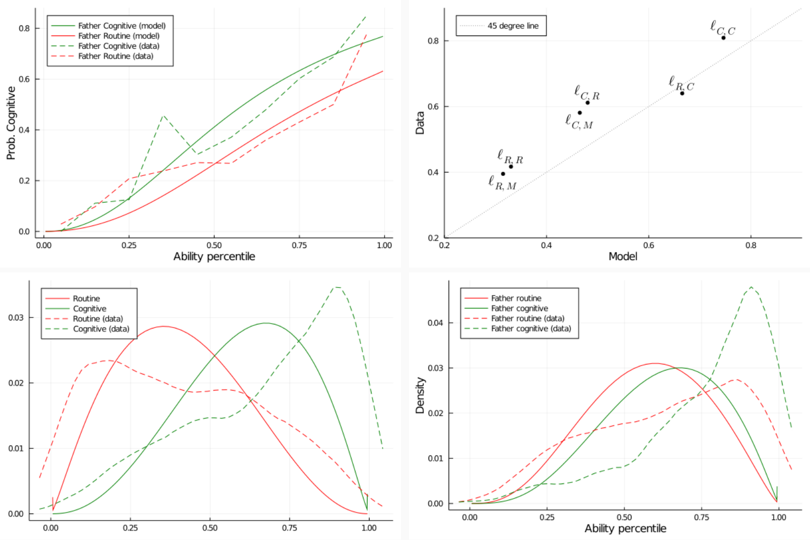
5 parameters in main estimation:

- Altruism factor ($\phi = 0.51$)
- Ability persistence ($\rho = 0.49$)
- Psychic costs of routine & cognitive skill investment ($\gamma_R = 0.02$, $\gamma_C = 0.42$)
- Idiosyncratic preference parameter ($\alpha = 0.17$)

Targets:

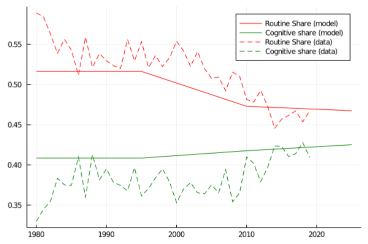
- Initial steady state **joint distribution of occupation, ability and parental occupation** in NLSY79
- Intergenerational occupational mobility and aggregate worker shares over transition in CPS/PSID

Model fit: sorting by ability and parental occupation

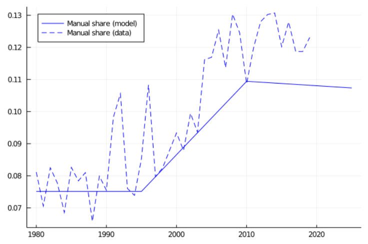


Model fit: Dynamic moments

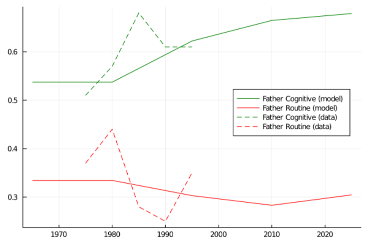
(a) Routine/Cognitive share



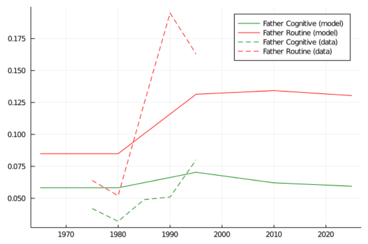
(b) Manual share



(c) P(Cognitive) by father occupation



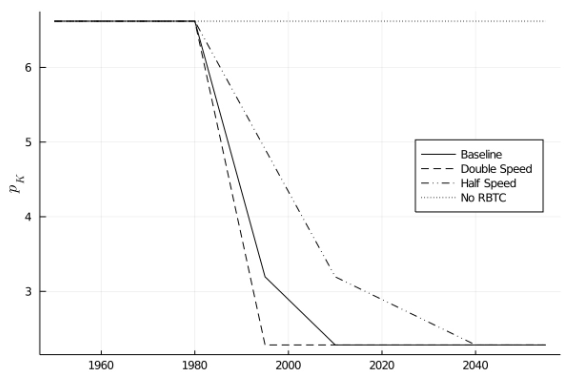
(d) P(Manual) by father occupation



Counterfactual Analyses

Counterfactual 1: Welfare and pace of RBTC

Investigate welfare changes in 3 counterfactual technological growth trends



Counterfactual 1: Welfare and pace of RBTC

Table 1: Causal link cognitive wage premium → education cost

	1950 Cohort			1980 Cohort		
	Man	Rou	Cog	Father Man	Father Rou	Father Cog
No RBTC	1.20%	1.09%	-1.76%	0.37%	-2.09%	-4.07%
Half Speed	1.63%	1.64%	-0.69%	3.16%	0.54%	-1.00%

Table 2: Exogenous education cost

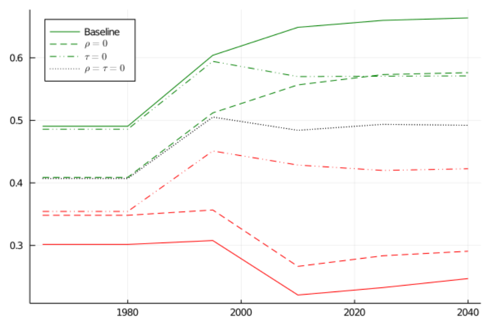
	1950 Cohort			1980 Cohort		
	Man	Rou	Cog	Father man	Father rou	Father cog
No RBTC	-1.72%	-1.2%	-3.38%	-7.08%	-6.61%	-6.84%
Half Speed	-0.32%	0.16%	-1.75%	-2.25%	-2.32%	-2.44%

Full Table

Counterfactual 2: Structural decomposition

Decompose intergenerational mobility by **ability persistence** and **financial friction**

Figure 5: Intergenerational mobility to cognitive, by father occupation

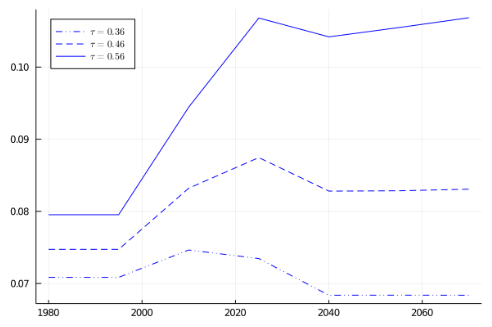


→ Role of borrowing constraint increased from 1/3 of persistence to over half

Counterfactual 3: The rise in manual jobs

Investigate the role of the financial friction for the rise of manual jobs

Figure 6: Transition of manual occupation share under varying degrees borrowing constraint



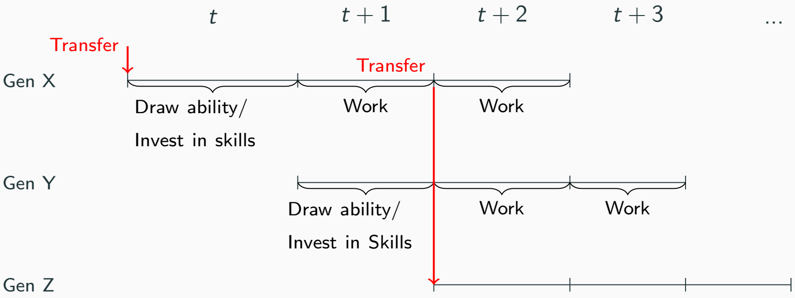
Conclusion

- Build a quantitative model that can capture salient features of the intergenerational response to RBTC
- Find that routine workers in 1950 cohort were 1.09% worse off on average from RBTC, even after taking altruism towards their children into account
- Find that the relative role of financial frictions in explaining intergenerational occupational mobility increased between 1950-1980 cohorts
- Find that rise in manual jobs can partly be attributed to financial frictions

Appendix

Overview of lifecycle dynamics

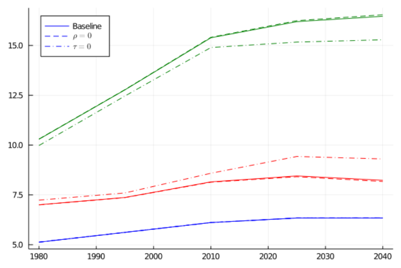
Figure 7: Overview of lifecycle dynamics



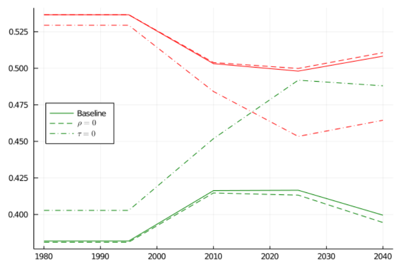
Back

More dynamics decompositions

(a) Wages



(b) Share Routine/Cognitive



Full welfare results

Table 3: Endogenous link cognitive wage → education cost T_C

	Cohort: 1950-1964			Cohort: 1965-1979			Cohort: 1980-1994		
	Man	Rou	Cog	Man	Rou	Cog	Father Man	Father Rou	Father Cog
No RBTC	1.20%	1.09%	-1.76%	1.50%	2.67%	-4.88%	0.37%	-2.09%	-4.07%
Double Speed	-2.13%	-2.64%	-0.17%	-1.14%	-3.08%	2.93%	-7.26%	-3.87%	-1.60%
Half Speed	1.63%	1.64%	-0.69%	1.50%	3.12%	-2.92%	3.16%	0.54%	-1.00%

Table 4: Exogenous education cost

	Cohort: 1950-1964			Cohort: 1965-1979			Cohort: 1980-1994		
	Man	Rou	Cog	Man	Rou	Cog	Father man	Father rou	Father cog
No RBTC	-1.72%	-1.2%	-3.38%	-2.18%	-0.92%	-6.46%	-7.08%	-6.61%	-6.84%
Double Speed	0.0%	-0.62%	1.31%	0.0%	-1.23%	2.85%	0.02%	-0.06%	0.06%
Half Speed	-0.32%	0.16%	-1.75%	-0.43%	1.11%	-3.69%	-2.25%	-2.32%	-2.44%

Back

Steady state justification

Transition matrix of Boomers indicates they were close to steady state:

Boomers			
	M	R	C
M	0.13	0.64	0.23
R	0.06	0.63	0.3
C	0.03	0.45	0.51

$\rightarrow$ Steady state levels: $M_{ss} = 0.05$, $R_{ss} = 0.57$, $C_{ss} = 0.38$

Actual levels in 1980: $M = 0.08$, $R = 0.56$, $C = 0.36$

back

HH's problem – First Period

Endowment:

- Learning ability: ℓ where $\ell' = \rho\ell + \epsilon, \quad \epsilon \sim N(\mu_\ell, \sigma_\ell)$
- Wealth transfer from parent: x
- Idiosyncratic occupation preference: $\nu_s \sim \text{Gumbel}(\alpha)$

Key Choice:

- Skill level $s \in \{M, R, C\}$ (discrete)

Value function:

$$V_t^1(x, \ell, \nu) = \max_{s \in \{M,R,C\}, c} u(c) - \kappa_s(\ell) + \nu_s + \beta E_{\nu', \ell' | \ell} \left[V_{t+1}^2(s, \ell', \nu') \right]$$

$$\text{s.t.} \qquad c = x - \tau \times T_s(w_t)$$

Back

HH's problem: Second and Third Period

Key Choice:

- Give in-kind transfer, x' to child
- $\phi :=$ Altruism parameter

Value function:

$$V_t^2(s,\ell',\nu') = \max_{a',x',c} u(c) + \beta\left[\phi V_{t+1}^1(x',\ell',\nu') + V_{t+1}^3(s,a')\right]$$

$$\text{s.t.} \quad c + a' + x' = w_t^s - (1-\tau)(1+r) \times T_s(w_{t-1})$$

$$a' \geq 0$$

Final period:

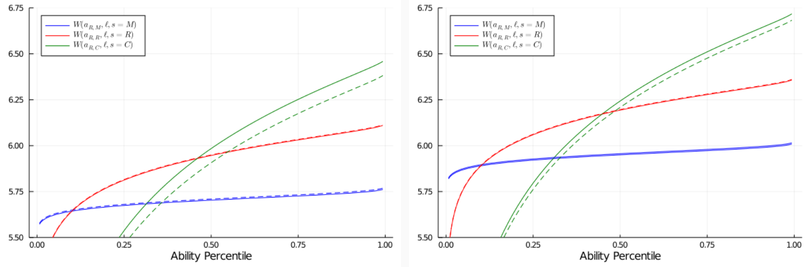
$$V_t^3(s,a) = u(w_t^s + (1+r)a)$$

Back

Occupational choice

Occupational Choice

(a) Father Routine **(b)** Father Cognitive



Notes: Solid lines represent the low-τ specification and dashed lines represent the high-τ specification.

Firm's problem

Production function:

$$
\begin{aligned}
Y &= A(\mu_g Y_g^{\eta} + (1-\mu_g) Y_s^{\eta})^{1/\eta} \\
Y_g &= T_A^{\xi} T_R^{1-\xi} \\
T_R &= (\mu_R R^{\sigma} + (1-\mu_R) K^{\sigma})^{1/\sigma} \\
Y_s &= \alpha_M M
\end{aligned}
$$

Maximization problem:

$$
\max_{M,R,C,K} Y(K,M,R,C) - p_k K - w_M M - w_R R - w_C C
$$

Estimation:

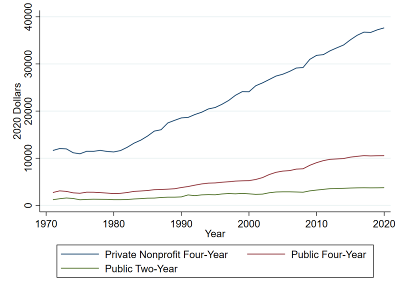
- RBTC Modelled as exogenous $p_K \downarrow$ following ICT capital price
- Elasticities estimated à la Katz, Murphy (1992)

Back

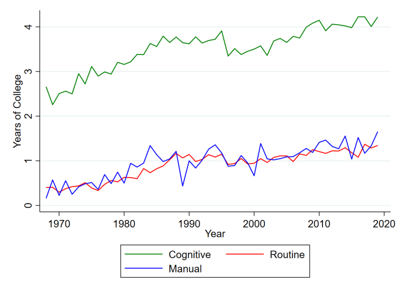
‘Costs’ of skill investment

Average Tuition Fees

(a) Cost of College



(b) Years of College



Notes: Data taken from the College Board and CPS.

Back