Shaping Inequality and Poverty Persistence Across Generations: Free College, Better Schools or Generous Transfers?

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ASSA 2024 Conference
San Antonio

January 2024

Motivation

- In international comparison, low intergenerational earnings and education mobility and high child poverty in the US
- Recent *policy proposals* in response:
  - Biden administration: free college
  - UBI proposal by Andy Young during 2020 election campaign
- *Empirical evidence* on short-run effects of small-scale reforms:
  - Impact of social safety net, early childhood interventions & school funding on child achievement and later-life outcomes (Bastian & Lochner 2020, Garcia et al. 2020, Jackson & Mackevicius 2023)
  - Impact of college grants on college enrollment and completion (Deming & Dynarski 2009)
- But: *little evidence* on long-run effects of economy-wide reforms.

Research Question and Approach

- Assess short- and long-run welfare and distributional impact of three (fiscally comparable) economy-wide reforms:
  1. Eliminating college tuition fees ("free college" reform)
  2. Expanding per pupil school spending ("better schools" reform)
  3. Expanding welfare programs ("cons. floor" reform) *(not today)*
- Develop a rich modelling framework suitable for dynamic analysis of both ex-ante "pre-distribution" and ex-post "redistribution".
  - OLG model with intergenerational links: innate ability transmission, parental human capital investment (Cunha-Heckman'07), wealth transfers
  - Discrete higher education choice (4 edu. levels: hsd, hs, cod, co)
  - Incomplete markets: idiosyncratic uninsurable risk, borrowing constraints
  - General equilibrium: endogenous skill premia
- Ultimate goal: characterize optimal education- and fiscal policy mix, allowing for time-varying policies along the transition

Main Findings

- Both education reforms have significant long-run welfare gains:

  3-4% of lifetime consumption for newborns. Take time to materialize.

- "Better schools" looks better than "Free College"
  - 0.6% larger long-run welfare gains
  - Substantially self-financing
  - Welfare gains more equally distributed

- Complementarities between pre-college and college spending:

  50/50 mix reform appears to be even better.

- "Cons. floor reform": Short-run redistribution, but Long-run losses.

Life-Cycle Stage 2: From Being a Parent to Death

Life Cycle: Stage 2

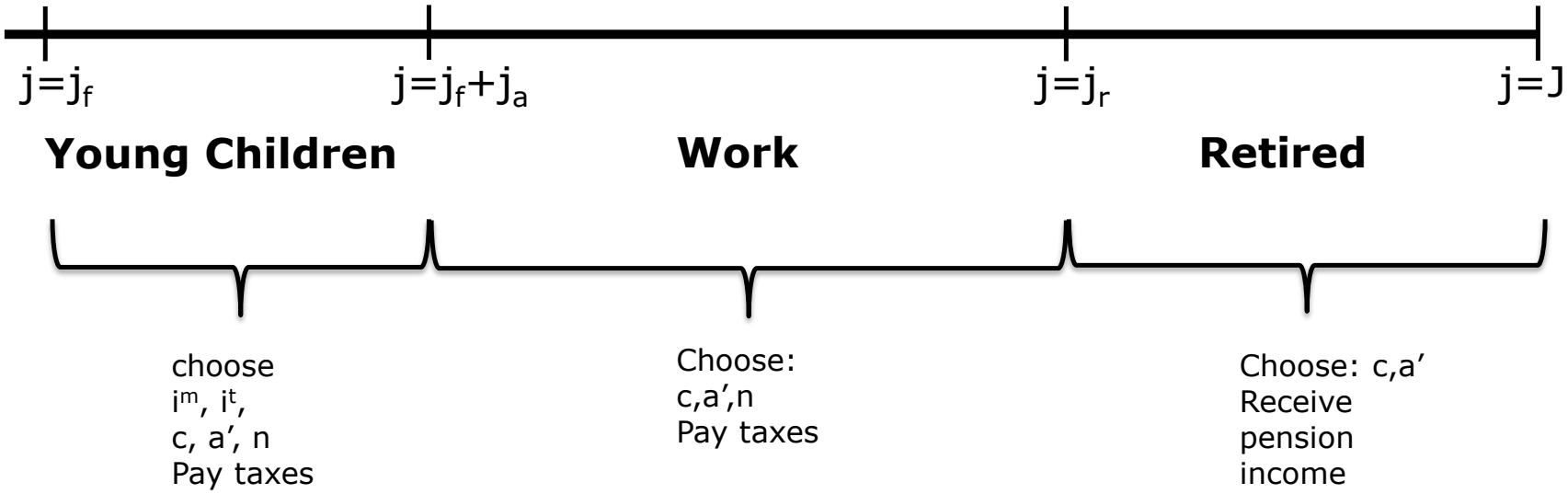
Have Kids
$\Phi(h_0|s^p)$

Children Leave Household

Pay inter-vivos transfers b

Earnings while Working
wage w γ e η until retirement

γ = fixed effect (discrete)
e = age and educ. specific wage profile
η = persistent productivity shock, 2-state Markov



Life-Cycle Stage 1: Being a Child to Becoming a Parent

Life Cycle: Stage 1

Birth

Innate ability: $h=h_0(s^p)$

Higher Education?

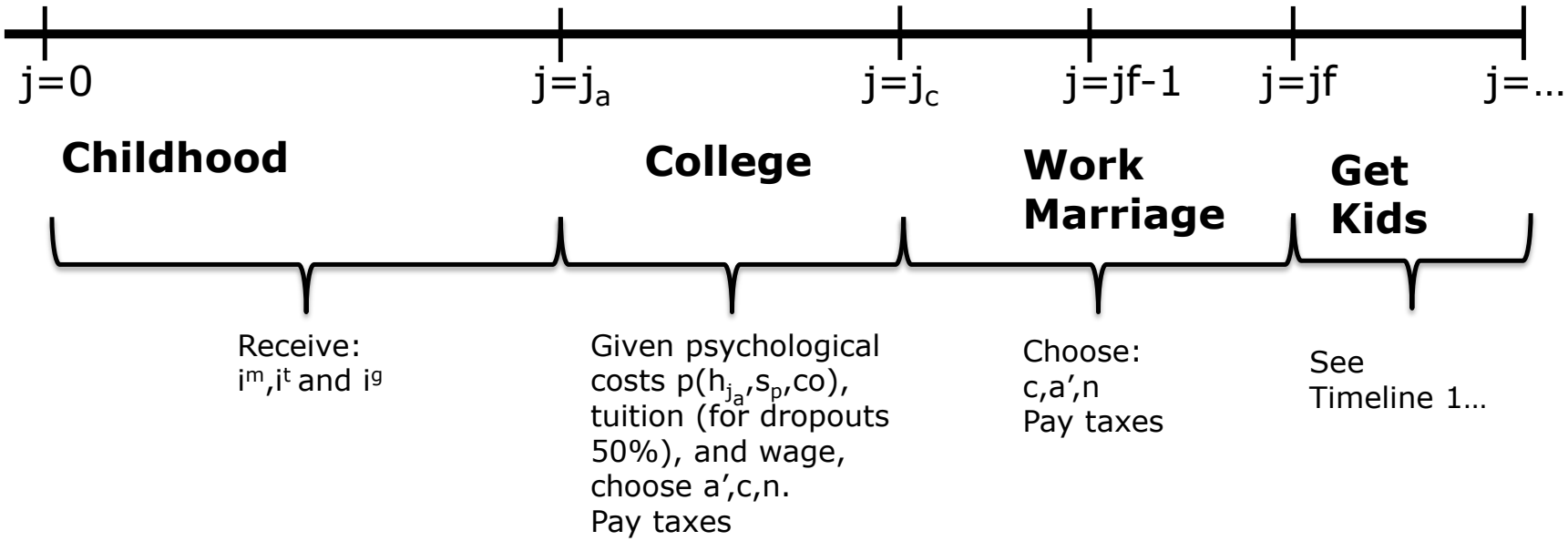
Given h_{j_a}
i) parents pay inter-vivos transfers
ii) children make higher education decision, with psychological costs $p(h_{j_a}, s^p)$

HS compl-n shock: s=(hsd,hs)?
Choice: s=(hs,ce)?
College compl-n shock: s=(cod,co)?

Earnings while Working

wage w γ e η
Max hours constraint during education

$\gamma(h_{j_a})$ = fixed effect (discrete)
e = age and educ. specific wage profile
η = persistent productivity shock, 2-state Markov



Dynamic Programming: Example (Single Mothers)

$$V(j, si, wo, s, \gamma, \eta; a, h) = \max_{c, i^m, i^t, a', h', \ell} \Big\{ u\left(c, \ell, i^t\right) - \mathbb{1}_{\{\ell > 0\}} F(wo) + \beta \sum_{\eta'} \pi(\eta'|\eta) V(j+1, si, wo, s, \gamma, \eta'; a', h') \Big\}$$

subject to

$$a' + c(1+\tau^c) + \varsigma(s) \cdot i^m + T(y(1-0.5\tau^p)) = (a + Tr_j)(1 + r(1-\tau^k)) + y(1-\tau^p)$$

$$y = w(s)\gamma(s)\epsilon(s, g, j)\eta\ell$$

$$a' \geq -\underline{a}(j, s)$$

$$c \geq 0$$

$$\ell + \varsigma(s) \cdot i^t + \xi(j - j_f + 1, si, s) \leq \Gamma^{si}$$

$$h' = g(j, h, i(i^m, i^t, i^g))$$

Dynamic program IVT

Human Capital Production Function for Children

- Human capital accumulation during childhood

$$h' = g(j, h, i)$$

$$i = i(i^m, i^t, i^g)$$

j: age; h: human capital; i^m: parental money investment; i^t: parental time investment; i^g: government education investment.

- Three-level nested CES: imperf. subst. between h, i^m, i^t, i^g.
- Properties of $g(\cdot)$ (Cunha and Heckman, 2007)
  - Self-productivity of human capital: $\frac{\partial h'}{\partial h} = \frac{\partial g(j,h,i)}{\partial h} > 0$.
  - (Dynamic) complementarity between h and i: $\frac{\partial^2 g(j,h,i)}{\partial h \partial i} > 0$.

Production and General Equilibrium

- Aggregate production function:

$$Y_t = F(K_t, L_t) = K_t^{\alpha}(A_t L_t)^{1-\alpha}$$
$$A_t = A_0(1+\mu)^t$$

  where A is the total factor productivity, and α determines the elasticity of output with respect to capital.

- College and non-college labor imperfectly substitutable:

$$L_t = ([L_{t,hs} + L_{t,sco}]^{\rho} + L_{t,co}^{\rho})^{\frac{1}{\rho}}$$

- $\Rightarrow$ Endogenous college wage premium

Government

- Government budget constraint (in per capita terms):

$$E + E^{CL} + G + (1+r)B = (1+\mu)(1+n)B' + T + \tau_c C + \tau_k r(K+B)$$

  - E and E^{CL}: pre-college and college education expenditures
  - G: exogenous stream of government expenditures
  - B: government debt
  - T, $\tau_k r(K+B)$, $\tau_c C$: tax revenues (labor, capital inc., consumption)
  - All items vary with time along the transition

- Labor income tax schedule for labor market participants ($\ell > 0$) defined by net income:

$$y - T(y) = (1-\tau)y^{1-\xi}$$

- Consumption floor (for non-participants): ω

Calibration

- Two subsets of parameters:
  1. Calibrated exogenously (outside the model)
  2. Calibrated endogenously (exactly identified GMM)
     - ⋆ HK production function parameters and preference parameters disciplined by observed time & resource investments
- Datasets:
  - PSID 1968-2012 (Estimation of earnings processes)
  - PSID 2013-2017 (Cross-sectional moments)
  - CDS PSID 1999-2007 (Child human capital (investment) moments)
  - NLSY 1979 (Complementarity of (h, s) for wages, Abbott et al. '19)
- Model Implied Elasticities (not targeted) consistent with empirical estimates:
  - Response of college enrollment & completion & wages to college subsidies (Deming & Dynarski 2009)
  - Response of high school completion, college enrollment, wages to high school spending (Jackson & Mackevicius 2023)

More on elasticities

Human Capital Production: Ages 4-14

$$h'(h,i;j) = [\mathbf{h}]^{\kappa_j^h} \, [\mathbf{i}]^{(1-\kappa_j^h)}$$

$$\mathbf{i}(\mathbf{i^s},\mathbf{i^p};\mathbf{j}) = \bar{A}\left(\kappa_j^s \, [\mathbf{i^g}]^{1-\frac{1}{\sigma^s}} + (1-\kappa_j^s) \, [\mathbf{i^p}]^{1-\frac{1}{\sigma^s}}\right)^{\frac{1}{1-\frac{1}{\sigma^s}}}$$

$$\mathbf{i^p}(\mathbf{i^m},\mathbf{i^t};\mathbf{j}) = [\mathbf{i^m}]^{\kappa_j^m} \, [\mathbf{i^t}]^{(1-\kappa_j^m)}$$

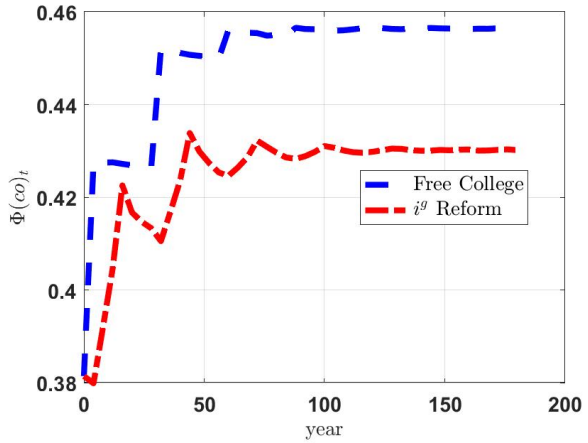
Elasticities taken from the literature:

- $\sigma^h = 1$ (Cunha et al. 2010)
- $\sigma^s = 2.43$ (Kotera/Seshadri 2017)
- $\sigma^m = 1$ (Lee/Seshadri 2019)

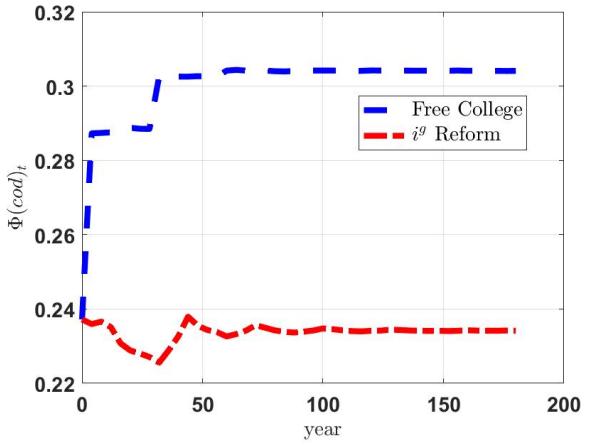
"Free College" and "Better Schools" Thought Experiments

- All reforms start at steady state calibrated to 2013-2017.
- MIT shock education reforms induce transition to new steady state
- "Free College":
  - 100% subsidy of college tuition
  - Financed by permanent increase in labor income tax rate τ
  - Endogenous path of government debt along the transition
- "Better Schools":
  - Increase in public (primary and secondary) school spending i_g
  - Same PDV of extra expenditures as "Free College" reform

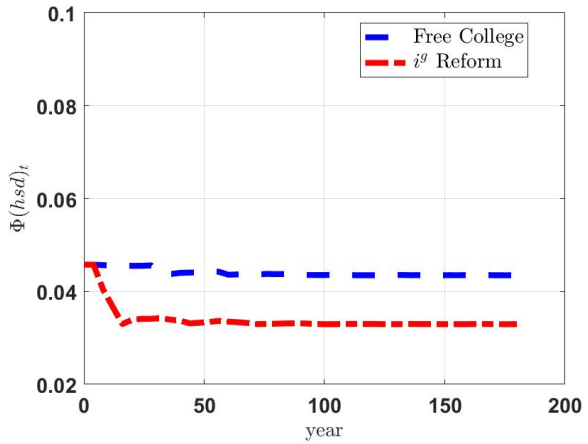
Transitional Dynamics: Free College & Better Schools



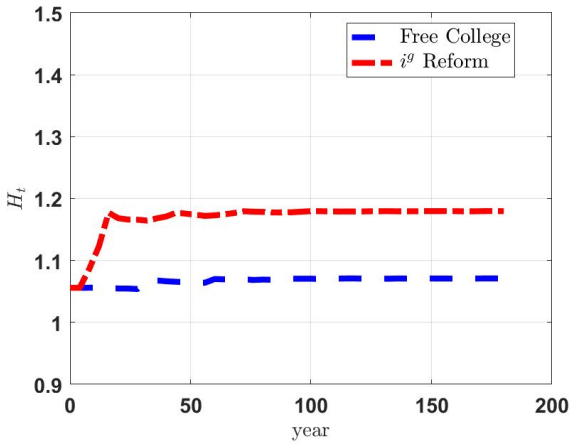
(a) College Share



(b) College Dropout Share

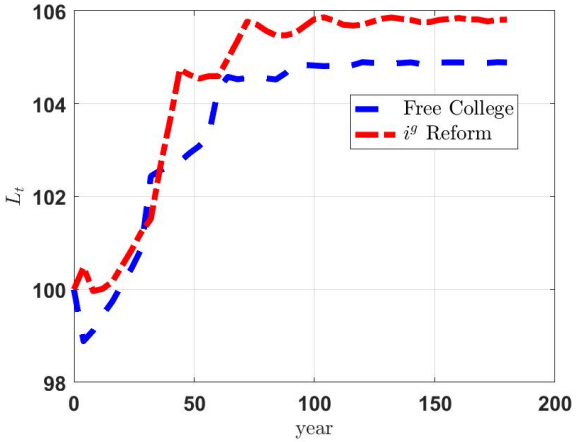


(c) High School Dropout Share

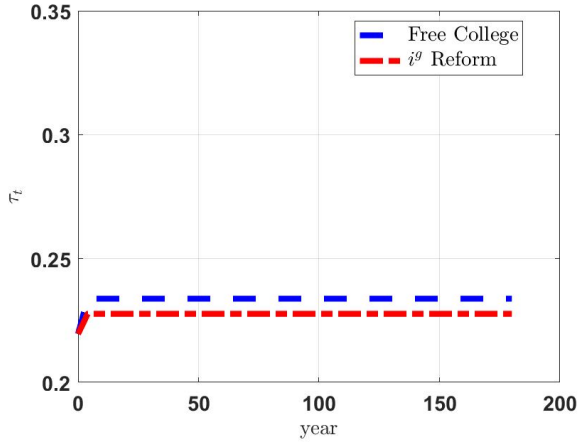


(d) Human Capital Age 18

Transitional Dynamics: Free College & Better Schools



(e) Labor



(f) Tax Level Parameter τ

More results1

More results2

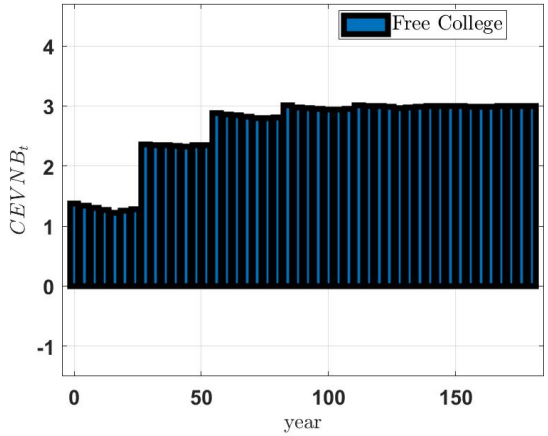
Main Lessons:

- *Aggregates*: Larger long-run human capital gains from "better schools" (and close to fiscally self-financing). But take longer to materialize
- *Distributions*:
  - "free college": Little benefits for poor kids. HS dropout rate $\approx$ unchanged
  - "better schools": Upward mobility at the bottom $\Uparrow$

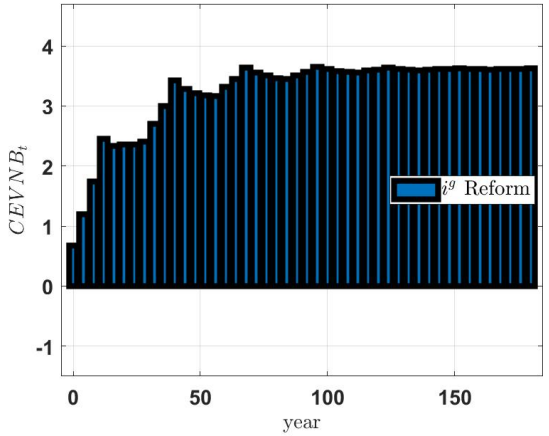
Steady State Comparison: Free College vs. Better Schools (i^g)

Variable	Initial SS	GE FC	PE FC	GE i^g	PE i^g
$\Phi(j_a, s = co)$	38.14%	7.49%p	8.36%p	4.87%p	8.81%p
$\Phi(j_a, s = cod)$	23.72%	6.69%p	7.17%p	-0.30%p	1.81%p
$\Phi(j_a, s = hs)$	33.56%	-13.95%p	-15.19%p	-3.29%p	-9.15%p
$\Phi(j_a, s = hsd)$	4.58%	-0.22%p	-0.34%p	-1.28%p	-1.47%p
HK	1.06	1.42%	2.27%	11.71%	13.81%
L	9.56	4.89%	6.52%	5.81%	10.45%
C	8.29	5.09%	2.81%	5.40%	5.29%
K	12.50	0.34%	-19.39%	1.54%	-21.67%
B	3.65	44.03%	51.32%	54.45%	85.03%
Y	14.27	3.06%	-3.20%	4.44%	0.17%
r (point change)	3.8%	0.22%	0	0.2%	0
w^n	1.03	2.05%	0%	1.91%	0%
w^c	0.97	-3.96%	0%	-3.68%	0%
$\frac{w^c}{w^n}$	1.86	-5.88%	0%	-5.49%	0%
τ	0.22	6.51%	9.59%	3.73%	3.90%
CEV NB	0	3.00%	1.66%	3.63%	3.63%

Newborn Expected Welfare (CEV)

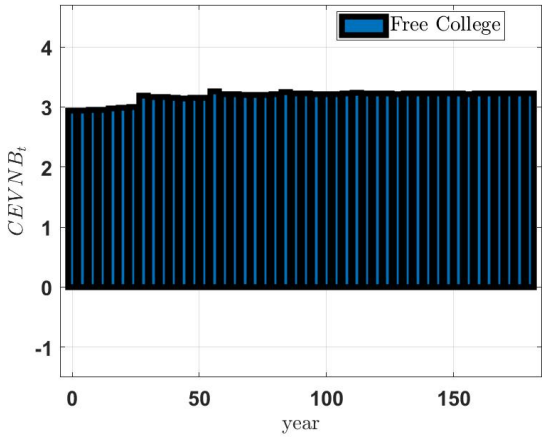


(g) "Free College": Under $\Phi_t(\cdot, j_a)$

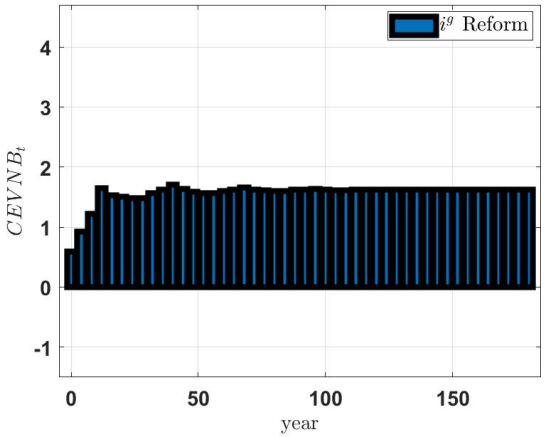


(h) i^g Reform: Under $\Phi_t(\cdot, j_a)$

- Now: isolate importance of policy-induced changes in the age-j_a-distribution $\Phi_t(\cdot, j_a)$ of (s, h, a).



(i) "Free College": Under $\Phi_0(\cdot, j_a)$



(j) i^g Reform: Under $\Phi_0(\cdot, j_a)$

Intergenerational Education Mobility: Children with Single Mothers

PE table

"Better Schools"		
	$s^p = hsd,\ q = si$	$s^p = hs,\ q = si$
$s = hsd$	0.051[-0.019]	0.048[-0.018]
$s = hs$	0.791[+0.051]	0.735[+0.005]
$s = cod$	0.056[-0.019]	0.078[-0.001]
$s = co$	0.102[-0.013]	0.139[+0.015]
"Free College"		
	$s^p = hsd,\ q = si$	$s^p = hs,\ q = si$
$s = hsd$	0.070[+0.001]	0.065[-0.001]
$s = hs$	0.505[-0.235]	0.503[-0.227]
$s = cod$	0.197[+0.121]	0.197[+0.117]
$s = co$	0.227[+0.112]	0.235[+0.111]

- Most disadvantaged children:
  - HS dropout rates do not change under "free college" reform, but are cut by more than 1/3 under "better schools" reform. High-school graduation rate up.
  - "Free college" reform draws more children into college, but also raises college dropout rates.

Intergeneration Education Mobility of Children with Single Mothers: 50/50 Mix

- Split same education expenditure equally between "better schools" and "cheaper college"

Increased School Funding + College Subsidy		
	$s^p = hsd,\ q = si$	$s^p = hs,\ q = si$
$s = hsd$	0.055[-0.014]	0.052[-0.014]
$s = hs$	0.527[-0.213]	0.542[-0.189]
$s = cod$	0.182[+0.107]	0.173[+0.094]
$s = co$	0.235[+0.120]	0.233[+0.109]

- Complementarities b/w pre-college and college funding for most disadvantaged children:
  - HS dropout rates fall $\approx$ as much as under "better schools" alone
  - Both college enrollment and graduation increase

Conclusion: What We Did

- Studied "better schools" and "free college" reforms in model with childhood human capital accumulation and higher education.
- Aggregates and Welfare:
  - High school financing reform - almost self financing in the long-run, highest welfare gains (CEV of almost 4%)
  - "Free college" reform requires raising labor income taxes by more, smaller welfare gains (CEV of 3%)
  - Cons. floor reform - most expensive in the long run (5.4% tax increase), welfare losses (CEV of -1%)
- Distributional effects:
  - Gains from high school reform are more equally distributed - also upward mobility at the very bottom is improved
  - "Free college" reform benefits mostly middle class
  - Cons. floor reform: only very short-run redistribution
- Strong complementarities between pre-college and college funding at the bottom

Conclusion: What We Will Do

- Optimal policy mix (three instruments) - once-and-for-all reforms
  - Why: there appears to be strong policy complementarity, especially for poorest children
- Optimal policy mix (three instruments) - time-varying policies
  - Why: Full impact of the reforms take time. Scope for Pareto-improving reforms?

THANK YOU FOR ATTENDING AND LISTENING

FROHE WEIHNACHTEN

APPENDIX

Dynamic Program: Children Leaving the Household

$$V_t(j_a + j_f, si, wo, s, \gamma, \eta; a, h) = \max_{c,b,a',\ell} \{u(c, \ell) - F(g)_{\ell>0}$$
$$+\beta \sum_{\eta'} \pi(\eta'|\eta) V_{t+1}(j_a + j_f + 1, si, wo, s, \gamma, \eta'; a')$$
$$+\nu\varsigma(s) E_{g^{ch}} V_t \left(j_a, g^{ch}, s; \frac{b}{1 + r(1 - \tau^k)}, h \right) \Big\},$$

where $V_t \left(j_a, g^{ch}, s; \frac{b}{1+r(1-\tau^k)}, h \right)$ denotes the pre-education decision value function of children. Maximization is subject to

$$a' + c(1 + \tau^c) + \varsigma(s) \cdot b + T(y(1 - 0.5\tau^p)) = (a + Tr_{t,j})(1 + r(1 - \tau^k)) + y(1 - \tau^p)$$
$$y = w(s)\gamma(s)\epsilon(s, g, j)\eta\ell$$
$$a' \geq -\underline{a}(s, j)$$
$$c \geq 0$$
$$\ell \in [0, \Gamma^{si}].$$

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Validation: Model Implied Elasticities & Empirical Estimates (Meta-Studies)

- \$1,000 increase in college subsidies:
  - Empirical: 3-6%p increase in college enrollment (Deming & Dynarski 2009)
  - Model: 5.1%p increase in college enrollment (PE)
- \$1,000 increase in high school funding (for four years):
  - Empirical: 0.07-3.99%p increase in high school completion, 0.90-5.51%p increase in college enrollment (Jackson & Mackevicius 2023)
  - Model: 0.2%p increase in high school completion, 0.55%p increase in college enrollment (PE)

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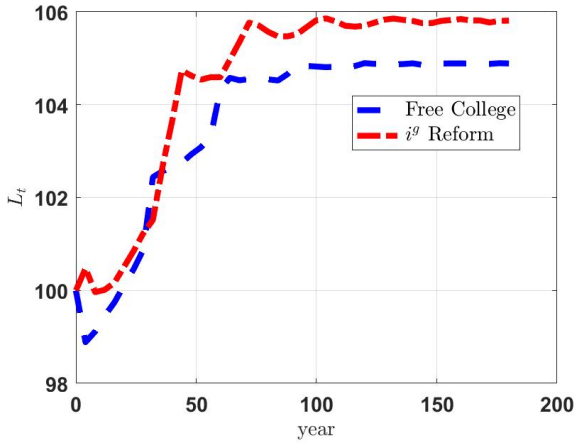
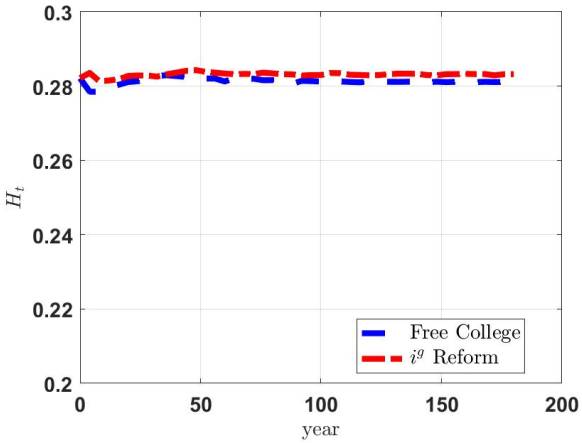
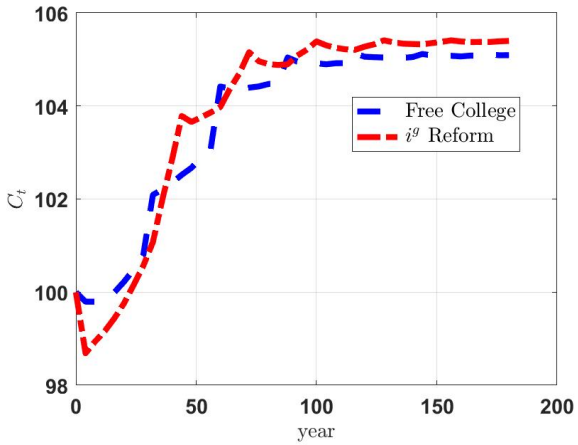
Transitional Dynamics: "Free College" and "Better Schools"



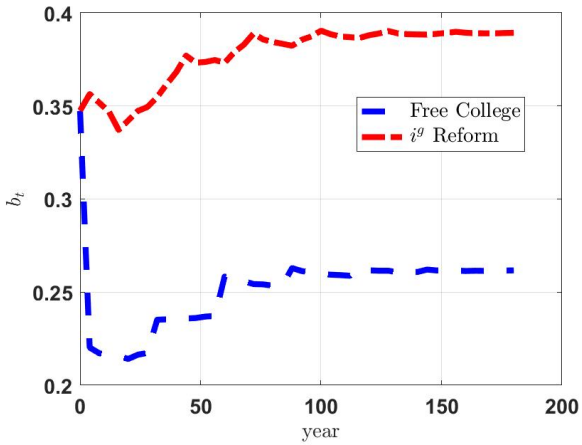
(k) Labor



(l) Hours



(m) Consumption



(n) IVT

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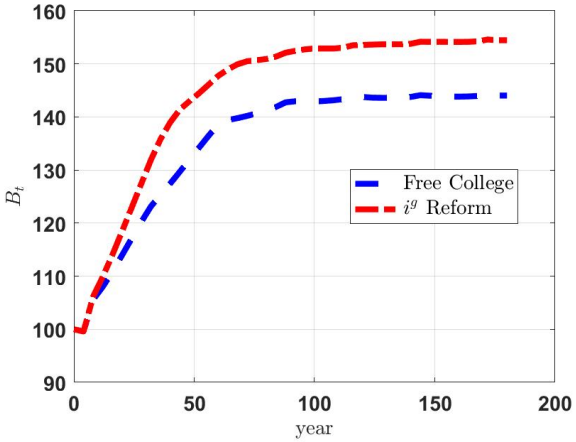
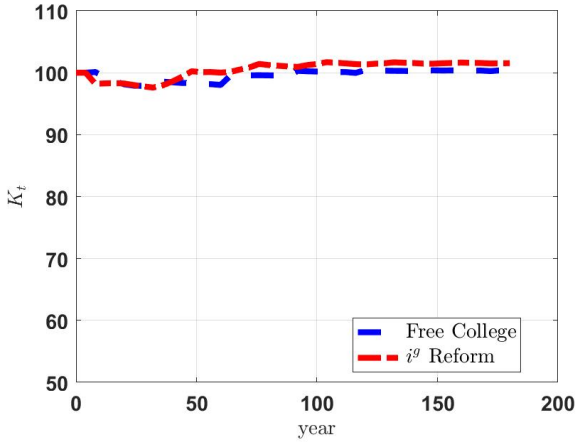
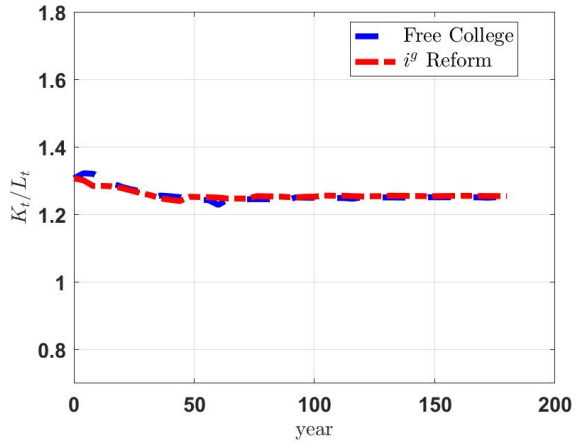
Transitional Dynamics: "Free College" and "Better Schools"



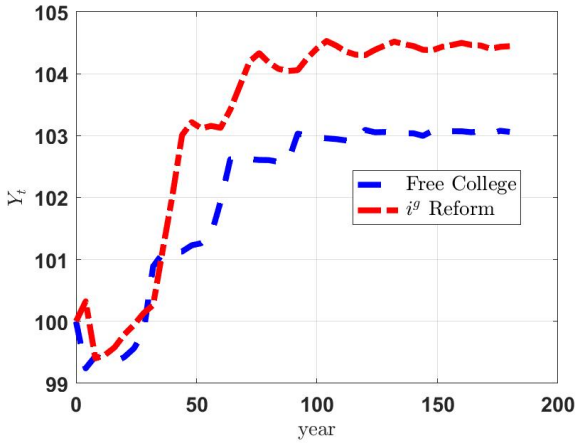
(o) Debt



(p) Capital



(q) Capital Labor Ratio



(r) Output

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Interg. Edu. Mobility: "Free College" and "Better Schools", PE

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Table: Interg. Education Transition Matrix: Non-College Single Mothers, GE

Increased School Funding		
	$s^p = hsd,\ q = si$	$s^p = hs,\ q = si$
$s = hsd$	0.050[-0.019]	0.047[-0.019]
$s = hs$	0.706[-0.034]	0.681[-0.050]
$s = cod$	0.090[+0.014]	0.100[+0.020]
$s = co$	0.154[+0.039]	0.172[+0.048]
Free College		
	$s^p = hsd,\ q = si$	$s^p = hs,\ q = si$
$s = hsd$	0.069[+0.000]	0.064[-0.002]
$s = hs$	0.499[-0.241]	0.502[-0.229]
$s = cod$	0.200[+0.124]	0.197[+0.118]
$s = co$	0.231[+0.116]	0.237[+0.113]

- Most disadvantaged children:
  - HS dropout rates do not change under "free college" reform, but are cut by more than 1/3 under "better schools" reform
  - "Free college" reform draws more children into college, but also college dropout rates go up; "better schools" reform increases college enrollment and graduation

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