Intergenerational Transfers and Education Policy

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ECON 350: Human Capital, Markets, and the Family

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Theoretical Basis - Becker and Tomes

From Becker Tomes (1986)

An analysis that is adequate to cope with the many aspects of the rise and fall of families must incorporate **concern by parents for children as expressed in altruism toward children, investments in the human capital of children, assortative mating in marriage markets, the demand for children, the treatment by parents of exceptionally able or handicapped children, and expectations about events in the next or in even later generations**. Although these and other aspects of behavior are incorporated into a consistent framework based on maximizing behavior, we do not pretend to handle them all in a satisfactory manner. However, our approach indicates how a more complete analysis can be developed in the future.

Becker and Tomes 1986

Model of transmission of earnings, assets and consumption from parents to children

- Basic Idea: What are the determinants of intergenerational mobility:
  - Do children of rich (poor) parents tend to be worse (better) off than their parents?
- Framework for studying intergenerational mobility by considering the following:
  - Altruism of parents
  - Investment in human capital
  - Credit constraints

Becker and Tomes 1986

- Endowments are transmitted by a stochastic-linear process:

$$E_t^i = \alpha_t + hE_{t-1}^i + \nu_t^i$$

where h is the degree of ″inheritability″

- h $< 1 \Rightarrow$ Endowments regress to the mean
- Assuming that parents know ν_t prior to making investment in children $\Rightarrow$ rate of return on investment is known to parents
- $\Rightarrow$ if there are no credit constraints then, rate of return, r_m, will be equal to interest rate r_t

Becker and Tomes 1986

- Earnings are related directly to human capital, H, by

$$
\begin{aligned}
&Y = H + \text{luck} \\
&H = \phi(E, h, x_t, s_t)
\end{aligned}
$$

human capital H depends on endowments, E;
inheritability, h; and expenditure by parents, x_t
and government, s_t

- Dynamic complementarity between endowments and expenditure
- Marginal return on expenditure, r_m, decreasing in stock of H
- Under no credit constraints, earnings of children only depend on parents' earnings through endowments and it's "inheritability"

Becker and Tomes 1986

Under credit constraints:

- Assume investment in human capital of children come at the cost of selling assets, reducing consumption, or increasing labor force activities
- Cost of expenditure on children now depend directly on parent's earnings in addition to indirect effect through endowments and heritability

$$\uparrow \text{expenditure} \Rightarrow \downarrow \text{ consumption } \Rightarrow$$
$$\uparrow \text{shadow cost of funds (subjective discount rates)}$$
$$\Rightarrow \text{Smaller cost of investing for higher income parents}$$

- Effect of endowment on investment is ambiguous
- Being poor sucks: lower endowment and lower investment

Becker and Tomes 1986

Non-human capital or assets

- Return on assets assumed to not depend on earnings and endowments
- Till $r_m > r_t$, parents will invest in human capital
- When $r_m \leqq r_t$ higher parents' earnings will lead to increase in bequest of assets

Becker and Tomes (1986) to Abbott et al. (2016)

- Quick summary of Becker and Tomes (1986)
  - Heritability of skills matters for H
  - Altruism on the behalf of utility maximizing parents leads to investment in H
  - Role of credit constraints is important
- From Becker and Tomes (1986) to Abbott et al. (2016)
  - Heterogeneity
  - Accounts for both altruism and paternalism
  - Explicit treatment of psychic costs - role of cognitive and non-cognitive skills
  - Assortative matching on education
  - General equilibrium effects

Abbott et al. Introduction

Abbott, Brant, Giovanni Gallipoli, Costas Meghir, and Giovanni Violante. (2016). "Education Policy and Intergenerational Transfers in Equilibrium," Under revision, Journal of Political Economy.

- Estimate an intergenerational lifecycle general equilibrium human capital investment model
- Conduct policy experiments using the model to study the welfare impact of financial aid policies

Abbott et al. Introduction

Life cycle model of heterogeneous agents facing incomplete financial markets and credit constraints

- Model earnings by education and gender
- Allow heterogeneity in returns and costs
- Explicitly account for psychic costs
- General equilibrium framework. In equilibrium:
  - Households choose education, consumption, labor supply, and IVT to maximize expected utility
  - Firms maximize profits
  - All markets clear

Abbott et al. Introduction

Preview of Results

- Current financial aid system is welfare improving
  - Removal of federal grants and loans would result in reduction of GDP of 4-5%
- Additional loans or grants would not be welfare improving because of crowd out
  - Additional dollar of government grants would crowd out parental transfers and reduce student's labor supply while in school
  - However, expansion would benefit small group of high ability, low income, especially girls.

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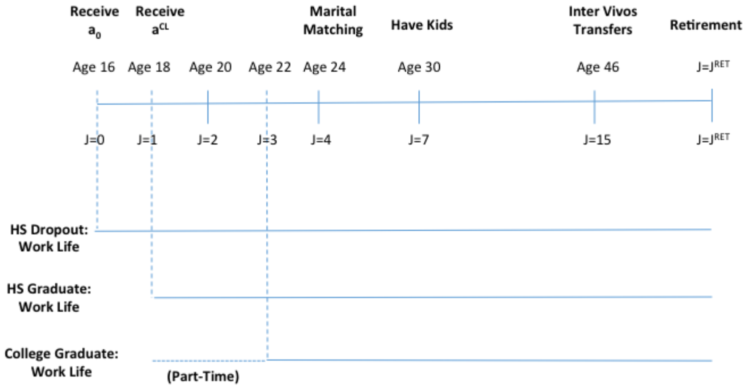
Timeline of Decisions



Preferences

- Individual of gender g at age j has the following preferences over consumption c and leisure ℓ:

$$u_{gj}(c, \ell) = \frac{c^{1-\gamma}}{1-\gamma} + \vartheta_j^g \frac{\ell^{1-\nu_j^g}}{1-\nu_j^g},$$

  where γ is the coefficient of relative risk aversion, ν reflects elasticity of labor supply, and ϑ reflects weight placed on c versus ℓ

- Married couples have the following household preferences:

$$u_j(c^m, c^f, \ell^m, \ell^f) = u_{mj}(c^m, \ell^m) + u_{fj}(c^f, \ell^f) + x^m + x^f,$$

  where x^g denotes utility transfers between spouses, with $x^m + x^f = 0$

Production

- Representative firm uses physical capital K and human capital $\mathcal{H}$ to produce $Y = F(K, \mathcal{H})$, where F is Cobb-Douglas
- Aggregate labor input $\mathcal{H}$ is modelled as a CES aggregator of six types of labor inputs $H^{e,g}$ indexed by gender g and educational attainment $e \in \{LH, HS, CL\}$ (a la Katz and Murphy, 1992; Heckman et al., 1998)

Government

- Levies flat taxes τ_w, τ_k, and τ_c on labor income, asset income, and consumption, respectively
- Refunds a lump-sum amount of tax revenue φ to each individual (parameterized to reflect progressive tax system)
- Runs a public pension system which pays an education-specific benefit p^e to retirees
- Excess tax revenues (net of education and pension systems) spent on non-valued government consumption G

Education: Psychic Costs

- Psychic costs (i.e., taste for education) are an important component of schooling decisions (see Cunha et al., 2005; Heckman et al., 2006)
- The utility (psychic) cost κ^e of attaining education level e is linearly characterized as:

$$\kappa^e = \varsigma_0^e + \varsigma_1^e \mathbf{1}_{\{g=f\}} + \varsigma_2^e \log(\theta_{non}) + \varsigma_3^e \log(\theta_{cog}) + \varsigma_4^e \kappa_\epsilon,$$

  which depends on gender, cognitive skills θ_{cog}, non-cognitive skills θ_{noncog}, and an indiosyncratic preference shock κ_ϵ
- Let $\boldsymbol{\theta} = (\theta_{noncog}, \theta_{cog})$

Psychic Cost of Education

Education: High School Continuation Decision (1)

- At $j = 0$, this decision is implicitly defined by:

$$V^*_{g0}(\hat{\mathbf{a}}, \boldsymbol{\theta}, q, \kappa_\epsilon) = \max\left\{ V_{g0}(\hat{\mathbf{a}}, \boldsymbol{\theta}, q, \kappa_\epsilon) - \kappa^{HS}(g, \boldsymbol{\theta}, \kappa_\epsilon), \right.$$
$$\left. \mathbb{E}_z\left[V^{LH}_{g0}(\hat{a}_0, \boldsymbol{\theta}, z_0) \right] \right\},$$

- $V^e_{gj}(\cdot)$ denotes the value of entering the workforce with education e
- $V_{gj}(\cdot)$ denotes the value of continuing in school, which includes all costs and benefits except for κ^e
- Parental wealth classes are indexed by $q = \{1, 2, 3\}$, which determines qualifications for federal financial aid

Education: High School Continuation Decision (2)

- Individual who enters labor force at age j with education e solves:

$$V^e_{gj}(a_j, \boldsymbol{\theta}, z_j) = \max_{c_j, \ell_j, a_{j+1}} u_g(c_j, \ell_j) + \beta \mathbb{E}_z \left[V^e_{g,j+1}(a_{j+1}, \boldsymbol{\theta}, z_{j+1}) \right]$$

subject to

$$(1+\tau_c)c_j + a_{j+1} = (1-\tau_w) w^{g,e} \varepsilon^{g,e}_j(\boldsymbol{\theta}, z_j)(1-\ell_j) + \varphi + [1 + r(1-\tau_k)]a_j,$$

$$a_{j+1} \geq 0, \; c_j \geq 0, \; \ell_j \in \left[0, 1\right], \; z_{j+1} \sim \Gamma^{g,e}_z(z_{j+1}|z_j).$$

- Here, a_j denotes assets at age j, φ is the government transfer, $w^{g,e}$ is the price for a unit of human capital.
- $\varepsilon^{g,e}_j$ is the labor production function and is a function of skills and productivity shock z_j

Education: High School Continuation Decision (3)

- The value of completing high school is defined by:

$$V_{g0}(\hat{\mathbf{a}}, \boldsymbol{\theta}, q, \kappa_\epsilon) = \max_{c_0, a_1} u_g(c_0, 1 - \bar{t}) + \beta V^*_{g1}(a_1, \hat{a}^{CL}, \boldsymbol{\theta}, q, \kappa_\epsilon)$$

subject to

$$c_0(1 + \tau_c) + a_1 = [1 + r(1 - \tau_k)]\hat{a}_0,$$

$$a_1 \geq 0, \; c_0 \geq 0.$$

- High school students are neither permitted to borrow or work and study for a fraction $\bar{t}$ of their time endowment

Education: College Attendance Decision

- The continuation value $V_{g1}^{*}(\cdot)$ is the maximum of the value of attending college and the value of entering the labor market as a high school graduate:

$$V_{g1}^{*}(a_1, \hat{a}^{CL}, \boldsymbol{\theta}, q, \kappa_\epsilon) = \max\big\{ V_{g1}(a_1 + \hat{a}^{CL}, \boldsymbol{\theta}, q) - \kappa^{CL}(g, \boldsymbol{\theta}, \kappa_\epsilon) \\ \mathbb{E}_z\big[V_{g1}^{HS}(\hat{a}_1, \boldsymbol{\theta}, z_1)\big]\big\}, \}$$

- The values of being in college in period $j = 1$ and $j = 2$ are:

$$V_{g1}(a_1 + \hat{a}^{CL}, \boldsymbol{\theta}, q) = \max_{c_1, \ell_1, a_2, b_2} u_g(c_1, \ell_1) + \beta V_{g2}(a_2, b_2, \boldsymbol{\theta}, q),$$

$$V_{g2}(a_2, b_2, \boldsymbol{\theta}, q) = \max_{c_2, \ell_2, a_3, b_3} u_g(c_2, \ell_2) + \beta V_{g3}^{CL}(a_3, b_3, \boldsymbol{\theta}, q),$$

where b_j is borrowing at age j, $c \geq 0$ and $\ell_j \in \big[0, 1 - \bar{t}\big]$.

Education: Budget Constraints (1)

Wealth group	Loan Eligibility
$q = 3$	Private and Unsubsidized Loans
$q = 2$	Unsubsidized Loans
$q = 1$	Subsidized and Unsubsidized Loans

- Unsubsidized student loans available up to a limit $\underline{b}$ at an interest rate r^u
- Subsidized loans available up to a limit $\underline{b}^s$ at no interest
- Private loans available at an interest rate r^p, where $r^p < r^u$
  - Assume the credit limit on private loans $\underline{a}^p$ is sufficient for wealthy students to fully fund college through private credit, meaning they always choose this option
- Federal grants $g(q, \boldsymbol{\theta})$ can be both need- and merit-based
- Let $\phi(q, \boldsymbol{\theta})$ be tuition fees net of grants
- In contrast with the endogenous borrowing constraints in Hai and Heckman (2017), these are fixed limits at *ad hoc* values

Education: Budget Constraints (2)

- Each student faces the following budget constraint:

$$(1+\tau_c)c_j + a_{j+1} + \mathbf{1}_{\{q=1,2\}} b_{j+1} - (1-\tau_w) w^{g,HS} \varepsilon_j^{g,HS}(\boldsymbol{\theta}, 0) \\ \times (1 - \bar{t} - \ell_j) + \phi(q, \boldsymbol{\theta}) = A_j$$

where A_j takes on the following values:

Wealth group	A_j	If
$q = 3$	$[1 + r(1-\tau_k)]a_j$	$a_j \geq 0$
	$(1 + r^p)a_j$	$a_j < 0$
$q = 2$	$[1 + r(1-\tau_k)]a_j$	$a_j \geq 0,\ b_j = 0$
	$(1 + r^u)b_j$	$a_j = 0,\ b_j < 0$
$q = 1$	$[1 + r(1-\tau_k)]a_j$	$a_j \geq 0,\ b_j = 0$
	b_j	$a_j = 0,\ -\underline{b}^s < b_j < 0$
	$-\underline{b}^s + (1 + r^u)(b_j + \underline{b}^s)$	$a_j = 0,\ b_j < -\underline{b}^s$

Marital Matching

- Assume that probabilistic matching between men and women is based only on education
- Given education levels e^f and e^m of the female and male, the ex-post value of the match is just:

$$W_3(a_3^f + a_3^m, z_3^f, z_3^m, \boldsymbol{\theta}^f, \boldsymbol{\theta}^m, e^f, e^m)$$

- Letting $Q^f(e^f, e^m) \in \left[0, 1\right]$ be the probability that a woman with education e^f meets a man with education e^f, the expected value of marriage for a college-educated female is:

$$V_{f3}^{CL}(a_3^f, \boldsymbol{\theta}^f) = \frac{1}{2} \sum_{k \in \{LH, HS, CL\}} Q^f(CL, k)$$
$$\times \mathbb{E}_{a^m, z^f, z^m, \boldsymbol{\theta}^m} \big[W_3(a_3^f + a_3^m, z_3^f, z_3^m, \boldsymbol{\theta}^f, \boldsymbol{\theta}^m, e^f = CL, e^m = k)$$

Intergenerational Linkages: Transmission of Abilities

- Cognitive and non-cognitive skills of children are unknown until the stage when parents make inter vivos transfers their children
- Inter vivos transfers take place at $j = 0$ (age 16), just before education choices are made
- Assume that cognitive skills are drawn from a discrete distribution dependent on the mother's cognitive skills
- Assume that non-cognitive skills are drawn from a distribution dependent on the mother's education and the child's own cognitive skills

Inter Vivos Transfers

- Transfers from parents to children arise from altruism and paternalism
- The additional value that parents obtain from their children when they are about to start making their own choices is:

$$\omega_{\hat{g}} V^*_{\hat{g}0}(\hat{\mathbf{a}}, \hat{\boldsymbol{\theta}}, \hat{q}, \hat{\kappa}_\epsilon) + \xi \cdot \mathbf{1}_{\{\hat{e}=CL\}},$$

  where $\hat{g}$ is the child's gender, $\omega_{\hat{g}}$ is the altruistic weight placed on the child's expected lifetime utility $V^*_{\hat{g}0}$, and ξ is the parents' utility gain associated with their child going to college
- Note that altruism, but not paternalism, depends on gender

Retirement

- After inter vivos transfers have been made, parents continue working until retirement period $j^{RET} - 1$
- After retirement, they solve a simplified problem with zero labor supply
- Income is augmented by social security payments (which depend on the level of education)

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Data and parameters

- Data Sources
  - Current Population Survey (CPS) for 1968-2001.
  - NLSY79 - National Longitudinal Surveys of Youth, year 1979
  - NLSY97 - National Longitudinal Surveys of Youth, year 1997
  - Panel Study of Income Dynamics (PSID) [Age and education]
  - National Center for Education Statistics (NCES)
  - National Accounts
- Parameters
  - Estimated separately from the model: production function and the income process.
  - Estimated within the model using the method of moments: costs of education, some preference parameters (including altruism and paternalism) and several others. Method of moments Production
  - Some parameters fix based on the literature. Externally Set 1 Externally Set 2

Impact of Ability on Earnings

Income Details

Table 1: Estimated ability gradient $\lambda^{g,e}$ (NLSY79)

Education group	Male gradient	Female gradient
Less than HS	0.428	0.184
HS graduate	0.516	0.601
College Graduate	0.797	0.766

- Ability gradient for wages increases with education: implies complementarity between the two of them.
- Returns to ability increase by more for women than for men, particularly at lower education levels (notice jump from 0.184 to 0.601). Probably because at lower education, a few women working.

Income Process

Income Details

- Shocks are very persistent (between 0.85 and 0.98), close to random walk for all but females with less than HS (ϱ).
  - Higher than Chiappori et al (2016) in which persistence is between 0.83 and 0.91.
- Variance of innovation (σ_η): increases (very little) with education for males, but decreases for women.
  - Opposite pattern in Chiappori et al (2016), also Chiappori estimates are higher (0.05-0.07 for women versus 0.018-0.025 in Abbott).
- Variance of initial productivity (σ_{z0}) increases with education for women, and more for men. Uncertainty difficult to insure against, since at young ages individuals tend to be wealth-poorer.
  - Opposite pattern in Chiappori et al (2016), in which this variance decreases with education (also here much higher than in Chiappori).

Intergenerational Transmission of Cognitive and Non Cognitive Skills

- Cognitive: Great upward and downward mobility in the middle of the distribution, but less at the top and the bottom (diagonal element larger). Is this driven by education mostly? Transmission
- Non Cognitive.
  - Data limitation: influenced by parental education and by one's own cognitive skills but not directly by parent's non cognitive skills. Transmission
  - Rotter scale and the Pearlin Mastery Scale scores. Use first principal component factor.
  - Similar to previous results, more mobility in the middle of the distribution.

Psychic Cost of Education

Table 2: Parameters of the Psychic Costs of Education

Parameter	High School	College
ς_0^e Constant	1.697	1.872
ς_1^e Female Dummy	-0.134	0.610
ς_2^e $\log(\theta_{non})$	-0.605	-0.239
ς_3^e $\log(\theta_{cog})$	-0.233	-0.779
ς_4^e κ_ϵ	0.213	0.408

Notes: Simulated Method of Moments estimates of psychic costs loadings.

- Consumption value of psychic costs is substantial, especially when abilities are low. For the very high skilled these costs can even be negative.
- Most of the variance in psychic cost is explained by θ_{non} and θ_{cog}, the former being more important for college and the latter for HS. **Misleading and wrong**.

Psychic Costs in the literature

Table 3: Psychic cost in the Literature

Source	Comments
Abbott et al (2016)	\$1.35 on average, (units of \$100,000 in year 2000 consumption terms) Costs are 3.2% of discounted lifetime utility for HS and 4.1% for college students.
Eisenhauer, Heckman, Mosso (2014)	HS Finishing -2.38, Late College Graduation 1.13. (units of \$100,000)
Cunha, Heckmant, Navarro (2005)	Average around 5 (units of \$100,000). Density from -10 to 20

Eliminating Cross-Sectional Variation in Psychic Costs

Transmission

- Dispersion remains. Model variation in schooling is not exclusively due to the estimated psychic costs.
- 60% of co-variation between schooling attainment and cognitive skills is explained by other model elements, such as the fact that returns to college rise with cognitive ability (productivity equation).
- Just 23% of the association between non-cognitive skills and college attainment is driven by other elements (average parental education and hence income/wealth is greater among children in higher non-cognitive skill groups).

Altruism, Paternalism and Inter vivos Transfers

- Paternalistic preference for college, as well as altruism, may motivate wealth transfers, as parents use conditional transfers to induce their children to attend college.
- Estimate altruism parameters: $\omega_{\hat{m}} = 0.29$ for males and $\omega_{\hat{f}} = 0.25$ for females. Small preference for boys. In data: yearly transfer to college graduate differs by gender ($7,506 for women and $8,203 for men, in 2000 dollars)
- Paternalism $\xi = 0.201$. It does not vary by gender.

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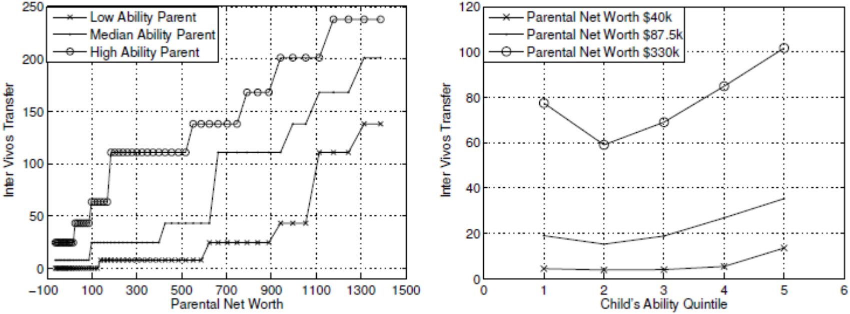
Model's behavior

- Analyze Cross sectional age profiles for hours worked, earnings, consumption, and wealth (None of these moments is explicitly targeted in the parameterization, just wages are).
  Profile 1 Profile 2
- Study the determinants of parental transfers to children.
- Measure the degree of intergenerational persistence of educational attainment and income in the model (also, not targeted).
- Examine the role of parental wealth in determining educational achievement
- Reinforce the empirical plausibility of the model. Extrapolation

Determination of Inter Vivos Transfers

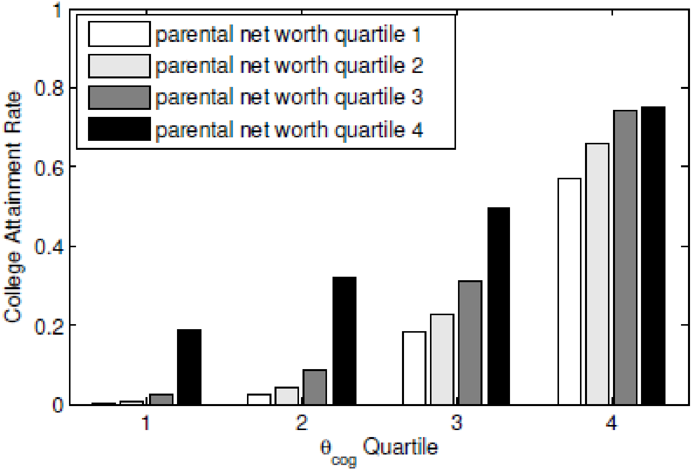


Note: Parental transfers to children as a function of: children's ability and parental wealth (left panel); parental wealth and parent's ability (right panel)

Intergenerational Persistence of Education and Income

- In the model 46.4% of those whose mother is a college graduate become college graduates themselves (similar in NLSY79 data).
  - Non-cognitive skills are important because parental education leads to improvements in these skills, which in turn reduces the psychic costs.
  - Paternalism increases the tendency for rich parents to send their child to college.
- Chetty et al. (2014) use IRS tax data to study the relationship between the mean child income rank and parents income rank for cohorts of children born between 1971-1986, and estimate a linear regression slope between 0.25 and 0.35 for male children. The model finds a slope of 0.315 using the same definition of pre-tax income averaged over ages 31-46 for both children and parents.

Parental Wealth and Educational Achievement



Note: College attainment rate by cognitive ability and parental wealth: model simulations

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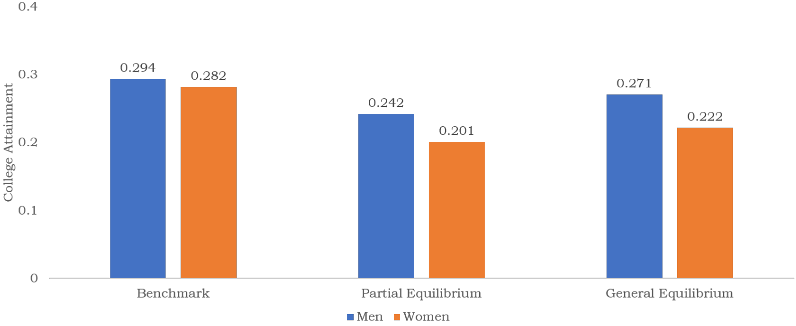
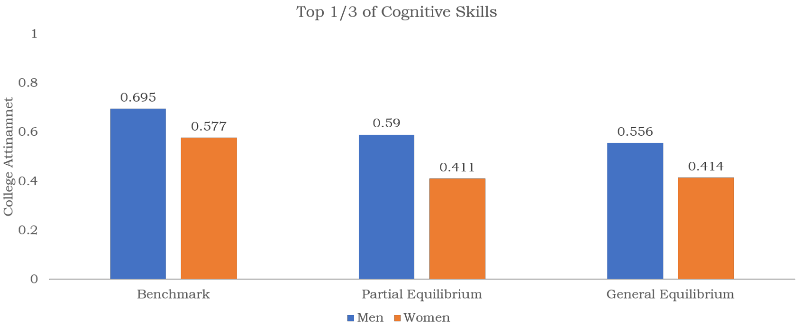
Model Estimates Used for Policy Experiments

- Estimates two sets of policy experiments
  - *Randomizes* policies on high school graduates
  - Examines the role of *existing* federal financial aid
  - Examines the role of *marginal expansions* in financial aid
- Short-run partial equilibrium effects
  - Affects only a single cohort
  - Policy announced just before inter vivos transfers ($j = 15$)
  - Incorporates parent transfers and child's labor supply in college
- Long-run general equilibrium effects
  - Endogenous response of factor prices and alternative funding
  - Budget balancing adjustments made by fiscal authority
  - Estimates welfare changes expressed as percentage of lifetime consumption for a *newborn* agent ($j = 0$) with respect to initial conditions

Removing Grants Reduces College Attainment



Removing Grants Alters Composition of Ability



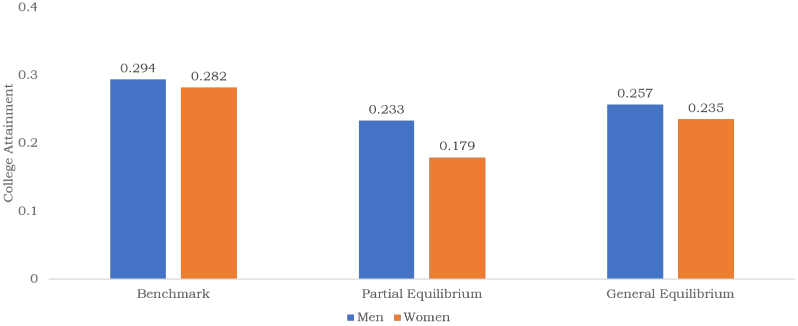
Removing Grants Increases Importance of Family Wealth

Labor lead to a decrease in output and welfare. and Transfers Increase

Removal of Public Tuition Grants				
		Benchmark	P.E. Short-run	G.E. Long-run
Other Statistics	Crowding out of IVTs - Male	–	+$596	-$2,723
	Crowding out of IVTs - Female	–	+$253	-$3,157
	Student labor supply	–	+13.4%	+4.47%
	Aggregate output	–	–	-1.95%
	Welfare gain	–	–	-0.68%

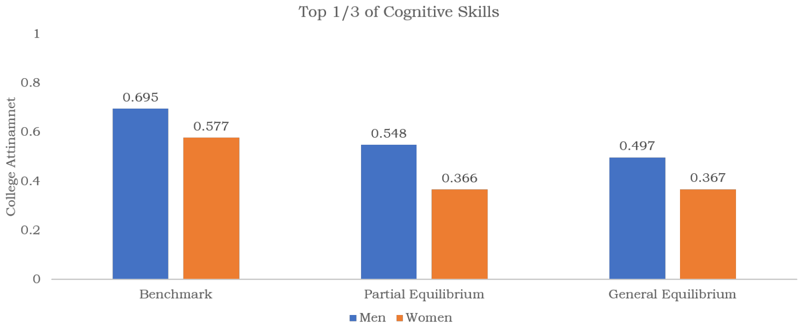
- Crowd out is the average change in IVTs given to children who are college graduates in both cases.
- IVTs increase in PE as families make up for grants
- Transfers lower in GE due to lower lifetime wealth
- Model does not allow for reductions in schooling effort associated with working while in college

Removing Loans also Reduces Attainment



Only the richest group (q = 3) is able to borrow to finance college

Worsening of Selection on Ability



Worsening of Selection on Wealth

Larger Crowd out of IVT's from Loans in Long Run

	Estimated Policy Effects in Long-Run	
	Removal of Grants	Removal of Loans
Crowd out of IVTs - Male	-\$2,723	+\$3,740
Crowd out of IVTs - Female	-\$3,157	+\$2,199

Both Experiments Reduce Welfare

	Estimated Policy Effects		
	Grant Removal	Loan Removal	Removing Both
Output	-1.95%	-2.95%	-4.5%
Welfare Gain	-0.68%	-0.65%	-1.85%

- Welfare and output effects are driven by changes in sorting
- Cumulative effects of removing both policies is greater
- Reinforcing patterns emerge through the intergenerational transmission of skills
    - When the fraction of college educated women declines, cumulative psychic costs of going to college rise

Considers Four Possible Expansions

1. Remove credit constraint ('unconstrained economy')
   - All debts must be repaid at r^- by retirement.
   - Federal grant program is left unchanged
2. Increase grants by $1,000 per year
3. Increase grants proportionally with means.
4. Increase grants proportionally to cognitive skills.

Unconstrained Economy has Modest Effects

“Unconstrained” Economy			
		Benchmark	G.E. Long-run
College Graduation Rates	Men	0.294	0.303
	Women	0.282	0.292
	Men - top 1/3 of cognitive skills	0.695	0.708
	Women - top 1/3 of cognitive skills	0.577	0.644
	Total - top 1/3 of parental wealth	0.414	0.362
	Total - bottom 1/3 of parental wealth	0.205	0.288
Other Statistics	Crowding out of IVTs - Male	–	-$3,932
	Crowding out of IVTs - Female	–	-$3,774
	Student labor supply	–	-33.7%
	Aggregate output	–	+1.16%
	Welfare gain	–	+0.42%

Similar Pattern from All Grant Expansions

		Long-run General Equilibrium Response		
	Benchmark	Flat Expansion	Means-Tested	Merit-Based
Men	0.294	0.320	0.325	0.303
Women	0.282	0.293	0.297	0.296
Top 1/3 of Cog Skills	0.637	0.647	0.659	0.681
Top 1/3 of Parental Wealth	0.414	0.401	0.379	0.399
Bottom 1/3 of Parental Wealth	0.205	0.239	0.283	0.237

Efficiency Gains Driven by Selection and Enrollment

	Long-run General Equilibrium Response		
	Flat Expansion	Means-Tested	Merit-Based
Aggregate Output	+0.46%	+0.66%	+0.57%
Welfare Gain	+0.32%	+0.40%	+0.31%

Heterogeneous Welfare Effects from Means-tested Grants

Distribution of Welfare Changes

	θ_{cog} tercile		
	1	2	3
q = 1	0.71%	2.91%	5.57%
q = 2	-5.22%	-5.43%	-2.19%
q = 3	-7.64%	-4.90%	-2.14%

Policy Experiment Conclusions

- The authors corroborate the results from Heckman et al (1998), Lee (2005), and Lee and Wolpin (2006)
- In the long-run prices adjust and the aggregate effects of policies are mitigated
  - Throughout all of their experiments, changes in college attainment in the long-run GE are roughly half the size of the the short-run PE case.
  - They do find sizable benefits for certain groups such as high ability/low income girls
- Welfare changes are associated with changes in sorting
- Significant heterogeneity in crowd-out

Contents

Contribution

- General equilibrium life cycle model to estimate the effects of the federal financial aid system:
  - Parents display altruism and paternalism towards children
  - Importance of cognitive and non-cognitive skills for psychic costs
  - Imperfect substitution between gender and education groups in production function
- Policy experiments:
  - The current financial aid system improves welfare. Removing current financial aid system would reduce GDP by 4-5%.
  - Further expansions of loans or grants would not increase welfare.

Our conclusions (1/2)

The model is extremely complicated making the impact of particular features of the model hard to interpret. Does it need to be?

- General equilibrium vs partial equilibrium framework
  - Abbott shows that PE effects are moderated in the GE setting because decision makers respond to changes in prices over time
  - Consistent with earlier work, eg. Heckman, Lochner and Taber (1998)
- Multiple generations vs single generation models
  - Keane and Wolpin (2001) and Johnson (2011) model single generation models (with parent transfers conditional on parent education and child schooling decision) and reach similar conclusions
  - Possible that, if taking states at age 16 as given, modeling intergenerational relationships does not add much to the analysis

Our conclusions (2/2)

- Modeling of Psychic costs is not clear; Using just two measures of skills (cognitive and non-cognitive skills) they are able to account for a much larger portion of variation in the college decision as in the rest of the literature
- How important is gender heterogeneity? It is not modeled in many previous papers.
- Show women having high labor supply elasticity throughout child's first 16 years but Blundell (2017) showed us this high elasticity is mostly during the child's early years, prior to entering school
- How would including variation in college quality and college tuition (or schooling quality - cost in general) affect the results?

Briefly discuss two additional recent papers on intergenerational transfers between parents and children

- Lee, Sang Yoon and Ananth Seshadri. (2015). "On the Intergenerational Transmission of Economic Status." Working Paper, University of Wisconsin.
- Caucutt, Elizabeth, Lance Lochner and Youngmin Park. (2015). "Correlation, Consumption, Confusion, or Constraints: Why do Poor Children Perform so Poorly?" Scandinavian Journal of Economics, 119:102-147.

Contents

Lee and Seshadri (2016)

- Similar to Abbott et al. in that they create a complex multi-generation model with incomplete markets and government transfers.
- Goal is to model both intergenerational mobility and cross-sectional inequality
- Focus on the impact of early childhood investments on income inequality as a primary mechanism for inequality
- Use PSID - CDS data
- Run policy experiments, make welfare predictions

Lee and Seshadri (2016)

Differences from Abbott et al. (1/2):

- Model human capital formation
  - Multiple periods of child investment (6 year periods; childhood lasts 4 periods) Timeline
  - Allow for both time and consumption goods investments in children
  - Convert time to opportunity cost using parent's hourly wage rate
  - Childcare goods: related to cognitive skill development; drop observations with no spending reported; include public school costs
  - Ben Porath model (OJT) skill formation while working
  - Test scores as a proxy for child skills when enter the labor market. No measure of non-cognitive skills.

Lee and Seshadri (2016)

Differences from Abbott et al. (2/2):

- No marriage or gender, single parent-single child
- One main result from Abbott is that child work during college responds to the policy; this is omitted in this paper because they assume children do not work while attending college
- Altruism for children modeled but not paternalism (there are no conditional on education level transfers)
- Model government consisting of: progressive taxes on income which subsidize welfare payments; education subsidies; social security

Lee and Seshadri (2016) - Findings

- Decompose variance in child lifetime earnings and lifetime wealth:
  - 74%, 73% explained by age 24 (whether or not went to college, learning ability and human capital accumulated, parent transfer) and omitting the college decision does not change this estimate meaning college decision is not very important in independently explaining earnings/wealth variance
  - 71%, 72% explained at child's birth (age 0-5)
  - 22%, 49% explained by parents' states age 24-29
  - 19%, 34% explained by grandparents' states age 24-29

Variable	Compared to group:	Change in *LFE* percentile
College S	-	-6.38
Learning ability a	Low	-18.62
	High	24.98
Human capital h_4	Low	-20.35
	High	23.41
Transfers s_4	Low	-1.35
	High	-2.15

Table 11: Average Lifetime Earnings Differences Across Groups

Lee and Seshadri (2016) - Findings

- Model dynamic complementarity in early childhood education. Parents cannot fully substitute later investments with early investments.
- Reducing borrowing constraints of families with young children, rather than policies focused on constraints during college, would have large impact in increasing economic mobility across generations.
- Evidence that while model from Abbott shows that current college financial aid system is optimal, focusing on college ignores the potential to reduce IGC through investments in early childhood education.

Contents

Caucutt et al (2017)

Uses a dynamic human capital investment model to study four investment based mechanisms driving income based skill gaps

- Ability correlation: High ability parents might have high ability children
- Consumption value of investment: Parents derive utility from investing in children
- Information Frictions: Poor parents might have incorrect beliefs about returns on child investment
- Credit constraints: Limits on capacity to borrow might decrease investment

Caucutt at al (2017)

Focus on the mechanisms to explain the following findings from literature:

- Higher returns on investment in children compared to savings for poor children
- Returns on marginal investment decreasing in income
- Increase in income lead to increase in investment
- Timing of this income increase matters - higher returns at early age

Caucutt et al (2017): Role of information frictions

- In Abbott et al, parents have perfect information about child's ability before making transfers.
- Caucutt et al looks at how uncertainlty and bias affect (early childhood) investment
- Uncertainty about ability
  - Uncertainty about returns to human capital will lead to lower investment if households are risk averse
  - Decreasing absolute risk aversion implies lower investment for poor households under uncertainty
- Bias in beliefs
  - Systematic bias about productivity of investment leads to underinvestment.
  - Non-systematic bias leads to misallocation across human capital and other inputs. This could potentially lead to lower returns.

Contents

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Externally Set Parameters

Return

Parameter	Value	Description
γ	2.0	Determines intertemporal elasticity of substitution (0.5)
ν_j^m	5.5	Determines avg Frisch elast. of labour supply for men and non-mother women (0.33)
ν_{30-45}^f	5.7	Determines avg Frisch elast. of labour supply for mothers (0.67)
ζ_j	varies	Mortality rates for retired hh based on US Life Tables 2000.
$\underline{a}^{CL}$	1.36	Limits borrowing of CL households to \$75,000
$\underline{a}^{HS}$	0.45	Limits borrowing of HS households to \$25,000
$\underline{a}^{LH}$	0.27	Limits borrowing of LH households to \$15,000
$\underline{b}^s$	0.312	Limits subsidized loans to \$17,250 for $q = 1$ students
$\underline{b}$	0.416	Limits total student loans to \$23,000 for $q = 1$ and $q = 2$ students.
$\underline{a}^p$	0.416	Limits private loans to \$23,000 for $q = 3$ students
$\bar{t}$	0.30	Requires students to study for 30% of time endowment
ι^u	0.053	Interest premium on Stafford loans (0.026 annually)
$\phi(q)$	0.070, 0.109, 0.118	Tuition fees for $q = 1, 2, 3$ students
α	0.35	Capital share of GDP
δ	0.07	Depreciation rate of capital
τ_w	0.27	Labor income tax rate
τ_c	0.05	Consumption tax rate
τ_k	0.40	Capital income tax rate

Table G.1: Externally Set Parameters. Sources listed in the main text. Other externally set parameters whose estimation is discussed in Appendices B,C, and D are: production function, income processes, and transition matrices for cognitive and non-cognitive skills

Externally Set Parameters

Return

Parameter	Description	Value	(s.e.)
β	Time discount factor	0.944	(0.006)
ϑ_j^g	Male and non-mother female leisure preference	0.240	(0.004)
ϑ_{30-45}^f	Female with children leisure preference	0.505	(0.005)
ω^m	Altruism towards sons	0.289	(0.008)
ω^f	Altruism towards daughters	0.250	(0.005)
ξ	Paternalistic utility from a child's college going	0.201	(0.041)
a^*	Wealth upper limit for subsidized loans (group q=1)	2.07	(0.202)
a^{**}	Wealth lower limit for private student loans (group q=3)	2.68	(0.499)
ι^p	Interest premium for private student loans	0.048	(0.006)
ι	Basic borrowing wedge that applies to all debt	0.097	(0.010)
ψ	Redistributive transfer	0.44	(0.008)

Other estimates by Method of moments

Return

Moment Matched	Target Value	Model Value
Capital-output ratio	2.0	2.1
Average male labour supply	0.350	0.349
Average labour supply of mothers	0.210	0.211
Average IVT to female child	$29,096	$29,044
Average IVT to male child	$33,164	$33,012
Ratio of college grad. rate in fourth (top) quartile of parental wealth to grad. rate in third quartile	1.63	1.56
HS Fraction of Female Population (cross-section)	0.584	0.584
HS Fraction of Male Population (cross-section)	0.567	0.567
CL Fraction of Female Population (cross-section)	0.282	0.282
CL Fraction of Male Population (cross-section)	0.294	0.294
Fraction of students with subsidized loans	0.525	0.516
Fraction of students with any gov't loans	0.621	0.633
Fraction of students with private loans	0.083	0.086
Fraction of workers with negative net worth	0.077	0.071
Var(log post-tax income)/Var(log pre-tax income)	0.61	0.61

Table G.2: Top Panel: Parameters Estimated by Method of Moments. Bottom Panel: Equal Number of Moments Matched.

Aggregate Production Function

Return

- Current Population Survey (CPS) for 1968-2001. Sample includes the adult universe.
- Perfect competition. Total wage bill (billions of dollars for the three education groups, as well as for their subsets by gender) divided by the (normalized) marginal product of human capital estimated from PSID data (The Panel Study of Income Dynamics).
- Assumption of iso-elasticity (tested in Appendix).
- Share parameters vary over time. Shares are normalized to sum to one at every t.
- Gender-specific parameters: $log(\frac{\bar{\omega}_t^{fe}}{\bar{\omega}_t^{me}}) = log(\frac{s_t^{fe}}{s_t^{me}}) + \chi log(\frac{H_t^{fe}}{H_t^{me}})$. This equation holds for all groups of education.
- Education-specific parameters: $log(\frac{\bar{\omega}_t^{CL}}{\bar{\omega}_t^{HS}}) = log(\frac{s_t^{CL}}{s_t^{HS}}) + \rho log(\frac{H_t^{CL}}{H_t^{HS}})$.

Aggregate Production Function

Table 4: Production estimates

Parameter	Estimation	Comments
ρ	0.7	Elasticity of substitution between education aggregates to 3.3
χ	0.45	Education-conditional elasticity of 1.8 between men and women
s^{LH}	0.16	Year 1999
s^{HS}	0.38	Year 1999
s^{CL}	0.46	Year 1999
$s^{f,LH}$	0.34	Gender weights for different education groups, Year 1999
$s^{f,HS}$	0.40	Year 1999
$s^{f,CL}$	0.38	Year 1999

- Log college/high-school wage differential of 0.58
- Log high-school graduate/dropout wage differential of 0.37, consistent with literature.
- Education-conditional elasticity of 1.8 between men and women
- Elasticity of substitution between education aggregates to 3.3

Income Process and the Impact of Ability on Earnings

Return

- Individual wage dynamics depend on age, gender, education and abilities (only cognitive). Correct for selection into work.
- Idiosyncratic labor productivity process:
  $\epsilon_j^{g,e} = \lambda^{g,e} log\theta_{cog} + z_j^{g,e}$
- $z_j^{g,e} = \varrho^{g,e} z_{j-1}^{g,e} + \eta_j^{g,e}$, where $\eta_j^{g,e} \sim^{iid} N(0, \sigma_\eta^{g,e})$
- $\lambda^{g,e}$: impact of cognitive skills on wages, $\varrho^{g,e}$: persistence of idiosyncratic productivity shocks, $\sigma_\eta^{g,e}$: variance of the shock that vary across gender and education.
- Heterogeneity in returns to schooling will in part drive differences in education choices between men and women and across ability groups.

Intergenerational Transmission of Cognitive Skills

Return

Table 5: Ability transition matrix across skill quintiles

	Children				
Mother	1	2	3	4	5
1	0.455	0.238	0.197	0.065	0.047
2	0.258	0.242	0.242	0.157	0.110
3	0.160	0.223	0.271	0.190	0.157
4	0.114	0.171	0.257	0.209	0.249
5	0.072	0.076	0.195	0.242	0.415

Notes: Ability transition probabilities, by quintile (NLSY79). Quintile 1 is the lowest ability, quintile 5 is the highest.

Intergenerational Transmission of Cognitive and Non-Cognitive Skills

Return

Table 6: Non-cognitive Ability Transitions

Mothers Edu	1	2	3	4	5
Children Conditional Probabilities of Non-Cognitive Tercile 1 Childs Cognitive Quintile					
HSD	0.585	0.453	0.350	0.311	0.189
HSG	0.527	0.418	0.266	0.235	0.178
CLG	0.578	0.388	0.289	0.201	0.139
Children Conditional Probabilities of Non-Cognitive Tercile 2 Childs Cognitive Quintile					
HSD	0.297	0.367	0.339	0.316	0.347
HSG	0.362	0.330	0.386	0.333	0.318
CLG	0.283	0.343	0.353	0.356	0.337
Children Conditional Probabilities of Non-Cognitive Tercile 3 Childs Cognitive Quintile					
HSD	0.118	0.180	0.311	0.372	0.464
HSG	0.111	0.252	0.348	0.432	0.504
CLG	0.139	0.270	0.358	0.443	0.525

Income Process and the Impact of Ability on Earnings

Return

Table 7: Estimated parameters of the process for individual efficiency units $\epsilon_j^{g,e}$ (NLSY79)

Parameter	Less than HS	HS graduate	College graduate
ϱ^m	0.955	0.952	0.966
σ_η^m	0.015	0.017	0.017
σ_{z0}^m	0.037	0.059	0.094
ϱ^f	0.852	0.953	0.983
σ_η^f	0.025	0.019	0.018
σ_{z0}^f	0.035	0.041	0.076

- Shocks are very persistent, close to random walk for all but females with less than HS (ϱ).
- Variance of initial productivity (σ_{z0}) increases with education for women, and more for men. Uncertainty difficult to insure against, since at young ages individuals tend to be wealth-poorer.

Eliminating Cross-Sectional Variation in Psychic Costs

Return

Table 8: Sensitivity of Enrollment to Psychic Costs Variation

Baseline Model

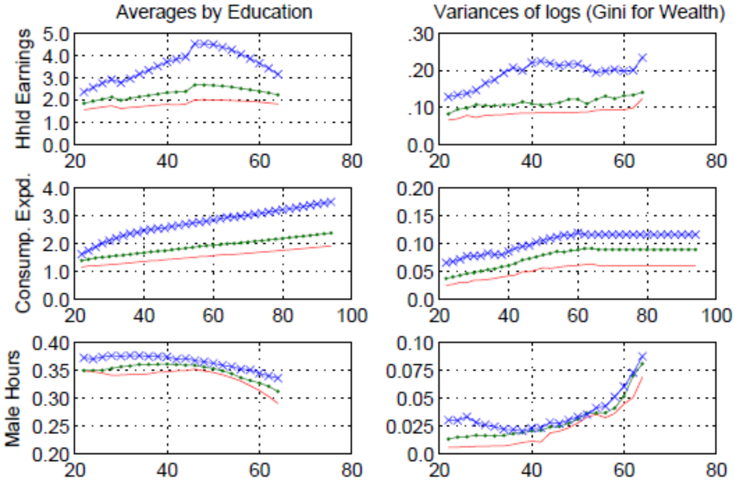
	Cognitive quintile				
Non cognitive tercile	1	2	3	4	5
1	0.087	0.114	0.166	0.298	0.648
2	0.094	0.125	0.177	0.334	0.725
3	0.106	0.142	0.193	0.399	0.806

No Psychic Cost Variation

	Cognitive quintile				
Non cognitive tercile	1	2	3	4	5
1	0.125	0.168	0.248	0.355	0.512
2	0.140	0.190	0.262	0.391	0.525
3	0.155	0.201	0.266	0.400	0.530

Life-Cycle Profiles

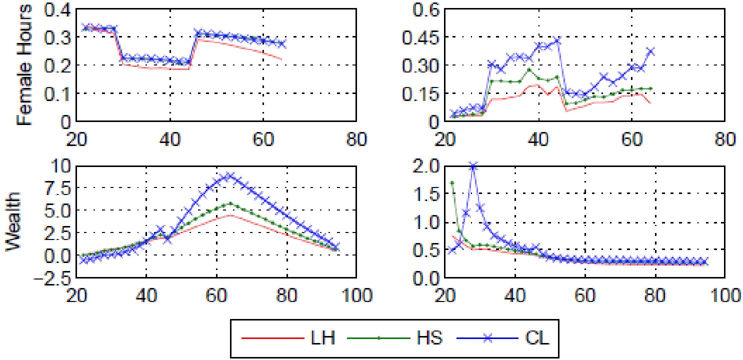
Return



Note: Statistics are presented by education. For family level variables (consumption and wealth) the education of the head (male) is used for classification. For wealth we use the absolute Gini coefficient as a measure of dispersion. Red: LH, Green: HS, Blue: CL

Life-Cycle Profiles

Return



Note: Statistics are presented by education. For family level variables (consumption and wealth) the education of the head (male) is used for classification. For wealth we use the absolute Gini coefficient as a measure of dispersion.

Extrapolating the model

Return

- Authors extrapolated its equilibrium implications to a different time period.
- They set the following parameters to those prevailing in the year 2010: (i) share parameters of different human capital in production; (ii) tuition costs and value of other education expenditures; (iii) credit limits for both subsidized and unsubsidized college loans.
- Keeping all other parameters unchanged, authors computed a new equilibrium allocation to test how the model behaves in terms of enrollment rates and education/gender premia in 2010.
- Very reasonable job approximating outcomes ten years out of sample.

Lee Seshadri sequence of events

Return

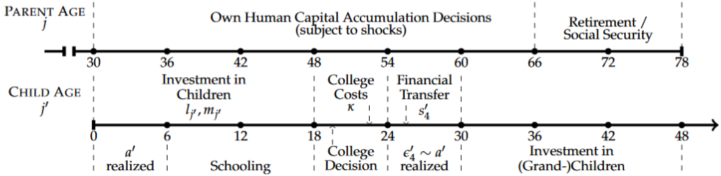


Figure 1: Sequence of Events