Intergenerational Effects of Child-Related Tax Benefits in the US

Borja Petit

CEMFI

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Introduction

- Very low fertility rates in developed countries
  - 1.2 in ITA & ESP, 1.4 in AUT, 1.7 in NOR, 1.8 in US, 1.9 in FRA & SWE
  - Increasing attention to pronatalist policies

    Neyer et al (2017) show that EU activities related to fertility relevant family policies have increased over time
  - Examples: paid parental leaves, subsidized childcare, tax benefits, transfers

    Björklund (2006), Erosa et al. (2010), González (2013), Bick (2016)
- Tax benefits are very extended across countries...

  ... and very generous in the US: $3,400 per family w/ children (Maag, 2013)
- Little work on their effects

▷ TFR ▷ Benefits

Tax Benefits in the US

Table: Average tax rate, married couples

HH Income	Tax rate by # of children				Benefits (2 kids)	
($\times$ avg. income)	0	1	2	3	$, 2005	%
0.50	0.06	0.05	0.02	0.00	1,791	0.68
1.00	0.14	0.11	0.09	0.08	3,536	0.30
1.50	0.18	0.16	0.15	0.14	3,778	0.16

Source: CPS data, 2000-2010.

- Lower and more progressive taxes for larger families
- Where are benefits coming from:
  - Specific programs: Child Tax Credit, Child and Dependent Care Tax Credit
  - Others: Standard deduction, Personal Exemption, Earned Income Tax Credit

▷ More

This Paper

- Quantify the impact of child-related tax benefits in the US tax system on fertility and intergenerational mobility within a GE framework
  - Life cycle model with overlapping generations of heterogeneous households
  - Fertility decisions and parental investments in children's human capital
  - Children's skill formation as in Cunha et al (2010)
  - Progressive taxes with child-related benefits

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  - Today's children will be tomorrow's parents: intergenerational effects
  - Demographic structure has GE implications

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- Why to use a GE framework?
  - Today's children will be tomorrow's parents: intergenerational effects
  - Demographic structure has GE implications
- Why to study effects on intergenerational mobility?
  - Family Economics *meets* Macro $\rightarrow$ *Who* have the children matters

Who have the children matters

- Parents in the US face a quantity-quality trade-off
  - Juhn, et al. (2015, 2018): arrival of a sibling decreases performance on cognitive tests, and the quantity-quality trade-off is stronger among low income mothers
- As a result, high educated parents...
  - Have less children: 1.7 children, while HS mothers have 2.1 children (CPS)
  - Spend more time with their children: 12% more time (PSID-CDS)
  - Spend more money with their children: 30% more money (Daruich, 2018)

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- Therefore:

(a) If tax benefits increase fertility, do they decrease children's human capital?

(b) Are poor families more or less affected?

(c) How do differences in initial conditions change?

Keane and Wolpin (1997), Hugget, et al. (2011): Large share of inequality explained by differences in initial conditions

Preview of results

- Tax benefits increase fertility by 16%...

  ... but they increase intergenerational persistence of education by 30%

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  - Number of children increases cost of human capital
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- Can we foster fertility without damaging mobility?

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- Mechanism:
  - Number of children increases cost of human capital
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- Results decomposition: long-run effects are quantitatively important
- Can we foster fertility without damaging mobility? Education subsidies
  - Cheaper education breaks (to some extend) the quantity-quality trade-off
  - Regressive transfer: high-educated are more affected

Related Literature

- Macro models with quantity-quality:

  Caucutt et al. (2002), Restuccia and Urrutia (2004), Córdoba et al. (2016), Daruich and Kozlowski (2016), Sommer (2016), Lee and Seshadri (2018), Daruich (2018)

  Contribution: policy & endogenous fertility, parental investments and transfers

- Fertility and Public Policy:

  Milligan (2005), Björklund (2006), Baughman and Dickert-Conlin (2009), Azmat and González (2010), González (2013)

  Contribution: macro framework (GE & intergenerational effects)

  Erosa et al. (2010), Bick (2016)

  Contribution: evaluation of tax benefits, parental investments

Today's talk

1. Model economy
2. Calibration
3. Policy evaluation
4. Conclusions

The Model

Main features

- Life-cycle economy with overlapping generations of married households
  - GE: Aggregate firm combines capital, low-educated labor and high-educated labor
  - LC: childhood, working age (fertile & infertile ages), and retirement

+ Endogenous fertility and initial conditions (investments and transfer)
  - College choice at independence $\rightarrow$ depends on human capital
  - After college, random matching with marital sorting

- Individual heterogeneity: age, gender, education and productivity
  - Spouses share assets, children and children's human capital

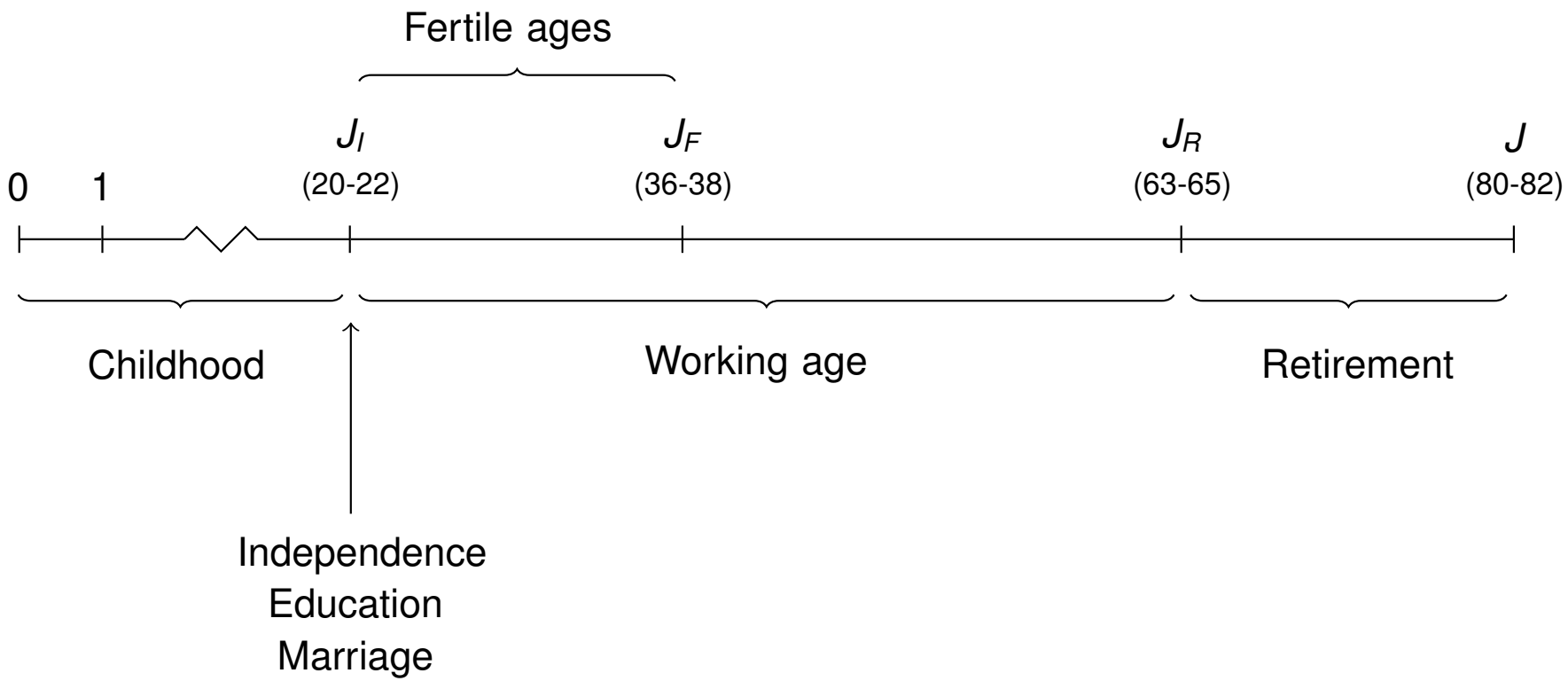
Main features

- Government taxes income to finance some (exogenous) expenditures
  - Tax rate function depends on income, y, and number of kids, n: Heathcote, Storesletten, and Violante (2017)

$$T(y,n) = t(y,n)y \quad \Rightarrow \quad t(y,n) \;=\; 1 - \lambda(n)\left(\frac{y}{\bar{y}}\right)^{-\tau(n)}$$

  - $\lambda(n)$ drives the level of taxes
  - $\tau(n)$ drives the degree of progressivity of taxes

Life-cycle structure



Childhood

- Children are born with an exogenous level of human capital q_0

▷ Age profile

- Children's human capital exhibits dynamic complementarities
  Cunha et al. (2010), del Boca et al. (2014), Attanasio et al. (2017)

$$q' = \left[\mu \bar{q}^{\theta} + (1-\mu)\mathcal{I}(n,m,t)^{\theta} \right]^{\frac{1}{\theta}}$$

  - $\bar{q}$ is the average human capital of children in the hh: $\bar{q} = q + (q_0 + q)\frac{n_0}{n}$.
  - μ controls the persistence of human capital $\rightarrow$ $\Delta q' = \alpha + \beta q + \epsilon$
  - θ drives how parental investments affect human capital $\rightarrow$ $\Delta q' = \alpha + \beta \ln y + \epsilon$

Childhood

- Parents invest time and money/goods, (t, m):

$$\mathcal{I}(n, m, t) = A_{\mathcal{I}} \left[\varsigma \left(\frac{m}{n^{\psi_1}} \right)^{\gamma} + (1 - \varsigma) \left(\frac{t}{n^{\psi_2}} \right)^{\gamma} \right]^{\frac{1}{\gamma}}$$

  - $A_{\mathcal{I}}$ is a productivity parameter $\rightarrow$ average growth of human capital
  - ς controls the relative weight of money investments $\rightarrow$ ave. time investment
  - γ drives the ES between time and money $\rightarrow$ diff. in time investment
  - ψ_1 and ψ_2 captures economies of scale in time and money investments

Independence

- Initial state given by (gender, skills, assets) $\equiv (g, q, a)$.
  - q from parental investments
  - a from parental transfer
- College choice:

$$E(g,q,a) \;=\; E_{\xi_E|q,a} \max \left\{ \overbrace{M(g,\overline{e},a)}^{\text{Value of CG}} - \underbrace{\xi_E(g,q)}_{\text{Effort cost}} , \overbrace{M(g,\underline{e},a)}^{\text{Value of HS}} \right\}$$

  effort cost ξ_E, decreasing in human capital:

$$\ln \xi_E(g,q) \sim N(\mu_E(g,q),1), \quad \mu_E(g,q) = \mu_E^g \exp(-\mu_E^q q) \geq 0$$

- Then, meet spouse and begin adult life $\rightarrow$ sorting: $\text{Prob}(e_m = e_f) = p_M$

Adults

- Standard LC problem: consumption, savings and labor supply of spouses
- Wage rates given by age, gender, education and productivity:

$$\ln \omega(g, e, z, j) \;=\; \ln w(e) \;+\; \mu(g, e, j) \;+\; z_g$$

  - $w(e)$: wage rate per efficiency unit of time
  - $\mu(g, e, j)$: deterministic age-profile
  - z_g: labor productivity $\rightarrow$ education-specific AR(1)
- Retirees: receive a pension and solve consumption-savings problem

Adults

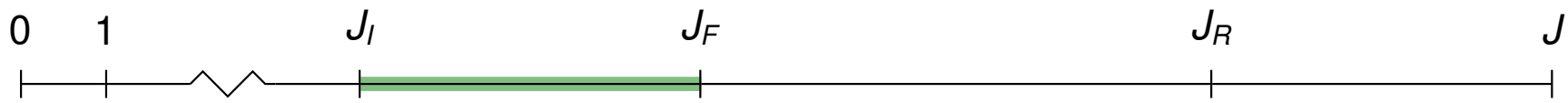
- Gender-specific utility function:

$$U_g(c, l_g, t) = \frac{c^{1-\sigma_c}}{1-\sigma_c} - \kappa_g \frac{(l_g + \alpha_g t)^{1+\frac{1}{\psi}}}{1+\frac{1}{\psi}}$$

  - ψ is the Frisch elasticity
  - $\alpha_g \in [0, 1]$ captures the fraction of t spent by gender-g parent

- Household maximize joint utility: $U_m(c, l_m, t) + U_f(c, l_f, t)$

Fertile ages



- Fertile households make a pregnancy choice: $k \in \{0, 1\}$
  - Fertility risk: pregnant females have a newborn next period w.p. $p_0(j) \in [0, 1]$
  - Labor productivity loss from childbirth: z_f falls by $\delta_0 \in (0, 1)$
- Children stay at home until J_I:
  - While at home, parents invest time and money on their children's human capital
  - Stochastic independence: probability $p_I(n, j) \in [0, 1]$

    $\Rightarrow$ Parents make a transfer b to independent children
- But... why do parents want to have children?
  - Parents derive utility from having kids, and from their kids' human capital

Why do parents have children?

$$U_k(n, q, b) = \eta_n \left(\frac{n^{\sigma_n}}{\sigma_n} \right) + \eta_q n^{\varphi} \left(\frac{q^{\sigma_q}}{\sigma_q} \right) + \eta_b \left(\frac{b^{\sigma_b}}{\sigma_b} \right) - \eta_0 \mathbf{1}\{n > 0\}$$

- Posit a utility function to capture intergenerational altruism:
  - where b is the amount of transfer to independent children
  - η_0 is a fixed cost (example: quality of leisure) $\rightarrow$ % childless
- Marginal utility from q increasing in number of children (if $\varphi > 0$).
  - The lower the value of φ the more costly it is to have another child in terms of q
  - φ controls the magnitude of the q-q trade-off $\rightarrow$ Differential fertility

Dynamic program

$$V(e_m, e_f, z_m, z_f, a, n, q, n_0, n_l, j) =$$

$$= \max_{\mathbf{x}} \; U_m(c, l_m, t) + U_f(c, l_f, t) + U_k(n', q', b) +$$

$$+ \beta E_j \left[V(e_m, e_f, z_m', z_f', a', n', q', n_0', n_l', j+1) \right]$$

with $n' = n - n_l + n_0$ and $\mathbf{x} = (c, a', l_m, l_f, k, m, t, b)$

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- Budget contraint: $a' + \Psi(n')c + m + b = y + (1+r)a - T(y, n') - \tau_{ss} y$

  with labor income given by $y = \omega_m(e_m, z_m, j) l_m + \omega_f(e_f, z_f - \delta_0 n_0, j) l_f$

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- Time constraint: $l_g + \alpha_g t \in [0, 1]$

- Other constraints: $k = 0$ if $j > J_F$, $m = t = 0$ if $n' = 0$ and $b = 0$ if $n_l = 0$

Calibration

Data

- Panel Study of Income Dynamics (PSID)
  - Panel of US households. Use waves from 2001 to 2009 (biannual).
  - Information on education, family structure, income.
- Child Development Supplement (CDS)
  - Supplementary study covering children aged 0 to 12 from 1997 PSID families.
  - I use the 2002 and 2007 waves: children aged 5 to 18.
  - Time diary and child's scores in three of the Woodcock Johnson Tests
- Current Population Survey (CPS)
  - Large cross-section of US households.
  - ASEC Supplement for the years 2000 to 2010
  - Information on tax liabilities and income.

Calibration

- Measurement with CDS data: children's human capital & time investment
- Estimate directly from data:
  - Tax function: standard parametric function estimated with CPS data.
  - Income process: age profiles and labor productivity process from PSID.
  - Fertility risk as in Sommer (2016)
  - Children's independence: estimate transition probabilities from PSID.
- Set some parameters to standard values or from related papers.
- Calibrate remaining parameters internally.

Measurement

- Time investments:
  - CDS data contains a detailed time diary: nature and duration of activity, whether parents participate, etc.
  - I define t as the total time parents actively participate in child's activity.

	Time/day	% Share
Mother	1h 6 min	42%
Father	30 min	19%
Both	1h 1m	39%

▷ Sample ▷ Density t

Measurement

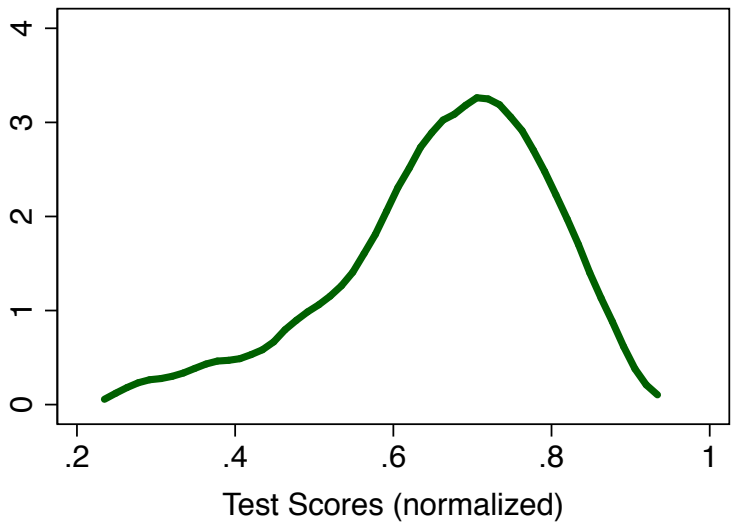
- Children's human capital:
  - CDS data contains children's scores in the Woodcock Johnson Tests.
    - Standard measure of child's skills
      Daruich (2018), Lee and Seshadri (2018), Del Boca et al. (2014)
  - Follow Del Boca et al. (2014): prob. of correct answer, $p_i(q) = q/(1+q)$.
  - Answer to question i is $d_i \in \{0, 1\}$, then:

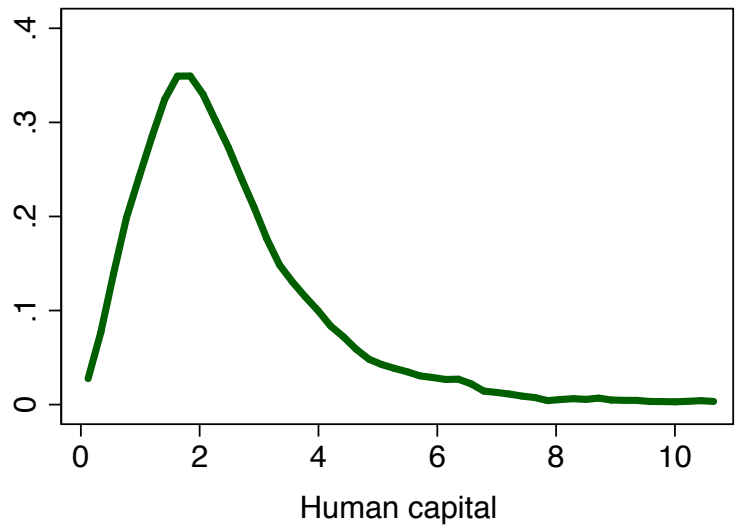
$$\overline{d} = N^{-1} \sum_{i}^{N} d_i \qquad \Rightarrow \qquad q = \frac{\overline{d}}{1 - \overline{d}}$$

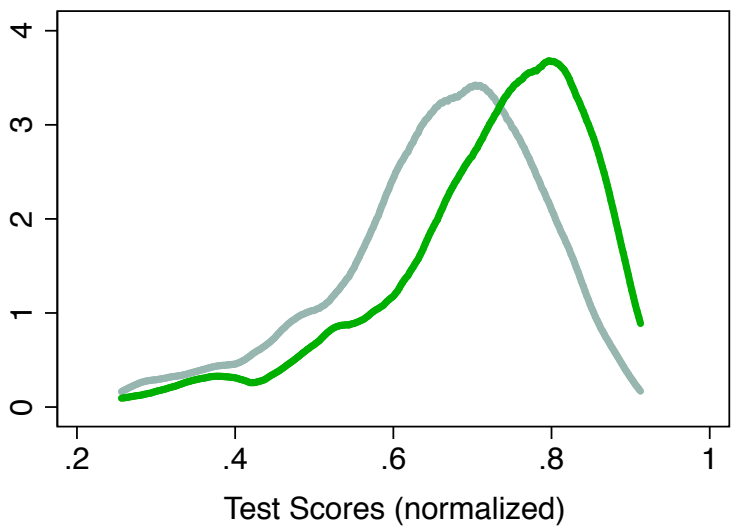
  - Highly correlated with college graduation: $\text{Corr}(e, q) = 0.482$

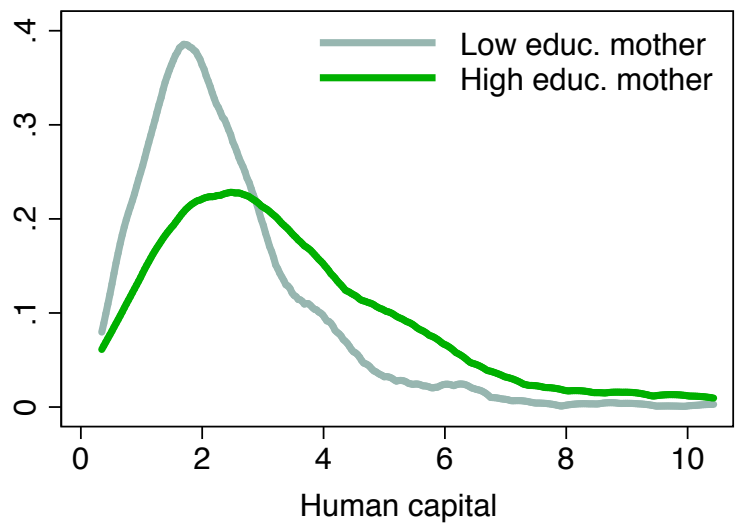
▷ Sample ▷ Stats q ▷ Age profile

Children's human capital









Tax function

Table: Parameters of the tax function

Number of children	0	1	2	3
Level, λ	0.858	0.880	0.893	0.910
Progressivity, τ	0.097	0.101	0.114	0.119
Obs. (1,000)	65.9	40.3	44.9	15.8

Note: standard errors are all less than 0.01. Tax rate computed as total tax liabilities before tax credits over total household income

- Parametric tax function:

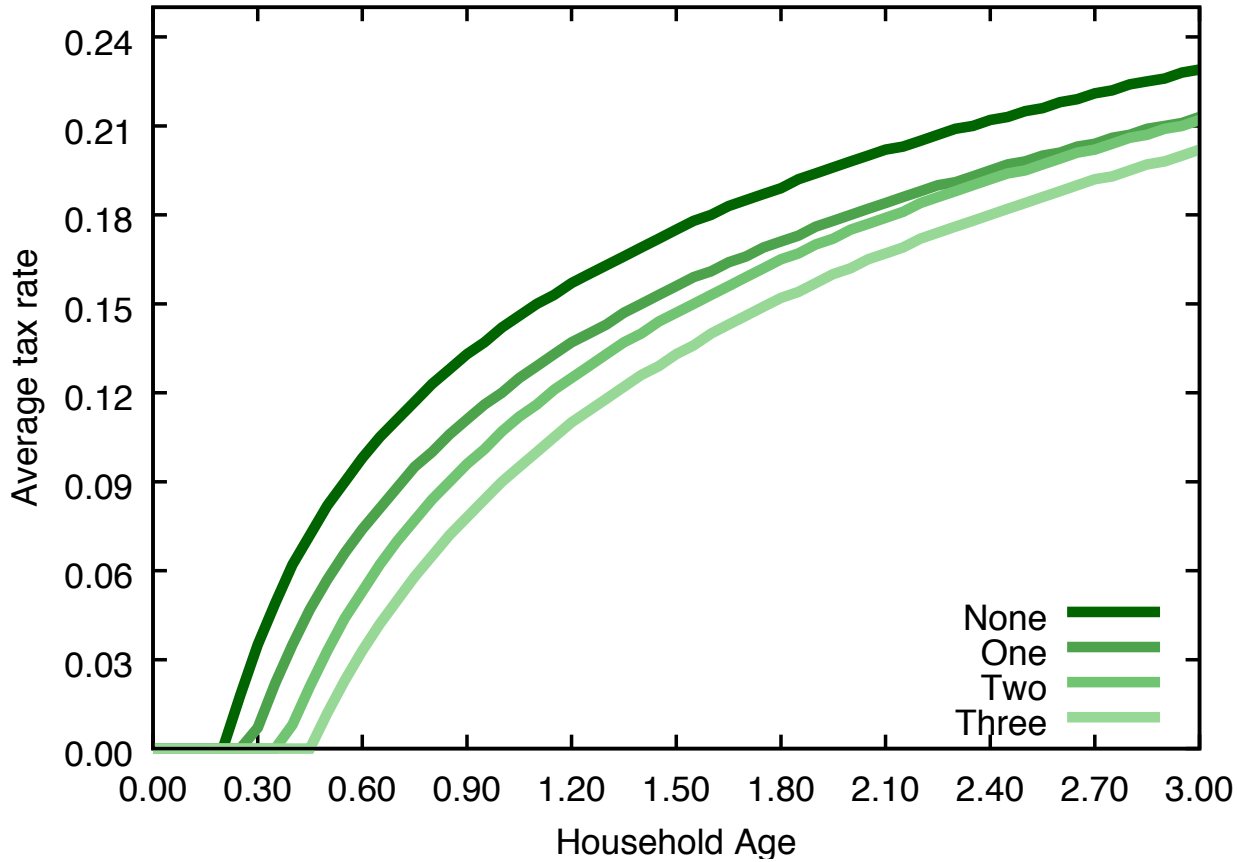
  Heathcote, Storesletten, and Violante (2017)

$$t(y,n) \;=\; 1-\lambda(n)\left(\frac{y}{\bar{y}}\right)^{-\tau(n)}$$

▷ Summary ▷ Maag (2013) ▷ Sample

Tax function

Figure: Estimated Tax Functions



▷ Model Fit

Aggregate production function

- Standard function:

$$Y = AK^{\alpha}L^{1-\alpha}, \qquad \text{with} \quad L = \left[aL_0^b + (1-a)L_1^b\right]^{\frac{1}{b}}$$

  where K is capital, L_0 is low-educated labor and L_1 is high-educated labor

- Set $\alpha = 0.33$ and choose parameters (A, a, b) such that:
  - Interest rate of 3% (annual)
  - Wage of low educated of 10 (normalization)
  - Relative wage of 1.28 (PSID)

- $A = 47.9,\ a = 0.44,\ b = 0.65$

Others

- Income process
  - Fit 2nd order polynomial in age by gender and education
  - Use residuals as measure of labor productivity: fit a AR(1) process.

- Fertility risk
  - Follow Sommer (2016) (% of infertile females by age)

$$p_0(j) = 1 - \exp(\alpha_0 + \alpha_1 j)$$

- Children independence
  - Estimate transition probabilities from the data

$$p_0(n, j) = \text{Prob}(n_{i,t} < n_{i,t-3} | n_{i,t-3} = n, \text{age} = j)$$

▷ Income profiles ▷ Fertility risk ▷ Children independence

Exogenous parameters

Parameter		Description	Source
β	0.98	Discount factor (annual)	Standard value
σ_c	0.80	Curvature utility from consumption	Córdoba et al (2016)
ψ	0.50	Frisch elasticity of labor supply	Standard value
α_m	0.54	% time invested by fathers	CDS
α_f	0.82	% time invested by mothers	CDS
ξ_1	0.92	Economies of scale, money investments	Sommer (2016)
ξ_2	0.54	Economies of scale, time investments	Sommer (2016)
q_0	1.42	Initial level of human capital	25th percentile of q
δ_0	0.10	Child penalty	Kleven et al. (2018)
p_R	0.13	Replacement rate	50% labor supply, ages 62-65
p_M	0.75	Share of household with $e_m = e_f$	PSID

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Calibrated Parameters

- Calibrate 19 parameters using SMM.
  - Preference parameters.
  - Human capital technology and investment function.
  - College effort cost.
- Targets key moments:
  - Fertility, child's human capital and time investments profiles by maternal education.
  - Labor supply by gender.
  - Dynamics of child's human capital.
  - Share of college graduates and elasticity of education to human capital.

Calibrated Parameters

Preferences

Parameter		Description	Moment	Model	Data
κ_m	4.74	Disutility labor, males	Average labor supply, male	0.36	0.35
κ_f	4.32	Disutility labor, females	Average labor supply, female	0.24	0.23
η_n	1.05	Utility n, weight	Completed fertility, HS mother	2.41	2.52
σ_n	0.51	Utility n, slope	% of households with 2+ children	0.53	0.52
η_q	0.96	Utility q, weight	Average human capital, HS mother	2.75	2.67
σ_q	0.76	Utility q, slope	Differential q by maternal educ.	0.44	0.56
φ	0.16	Utility q, fam. size param.	Differential fertility by maternal educ.	-0.26	-0.23
η_b	0.40	Utility from b, weight	Rel. wealth at age J_l, HS mother	0.11	0.11
σ_b	0.51	Utility from b, slope	Rel. wealth at age J_l, CG mother	0.16	0.17
η_0^0	2.70	Fixed cost, HS mothers	% of childless HS mothers	0.08	0.08
η_0^1	2.80	Fixed cost, CG mothers	% of childless CG mothers	0.12	0.13

Calibrated Parameters

Preferences

Parameter		Description	Moment	Model	Data
κ_m	4.74	Disutility labor, males	Average labor supply, male	0.36	0.35
κ_f	4.32	Disutility labor, females	Average labor supply, female	0.24	0.23
η_n	1.05	Utility n, weight	Completed fertility, HS mother	2.41	2.52
σ_n	0.51	Utility n, slope	% of households with 2+ children	0.53	0.52
η_q	0.96	Utility q, weight	Average human capital, HS mother	2.75	2.67
σ_q	0.76	Utility q, slope	Differential q by maternal educ.	0.44	0.56
φ	0.16	Utility q, fam. size param.	Differential fertility by maternal educ.	-0.26	-0.23
η_b	0.40	Utility from b, weight	Rel. wealth at age J_l, HS mother	0.11	0.11
σ_b	0.51	Utility from b, slope	Rel. wealth at age J_l, CG mother	0.16	0.17
η_0^0	2.70	Fixed cost, HS mothers	% of childless HS mothers	0.08	0.08
η_0^1	2.80	Fixed cost, CG mothers	% of childless CG mothers	0.12	0.13

Calibrated Parameters

Preferences

Parameter		Description	Moment	Model	Data
κ_m	4.74	Disutility labor, males	Average labor supply, male	0.36	0.35
κ_f	4.32	Disutility labor, females	Average labor supply, female	0.24	0.23
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Calibrated Parameters

Human capital, Investment and College choice

Parameter		Description	Moment	Model	Data
Law of motion of human capital:					
μ	0.30	Share parameter, q	Slope: $\Delta q = \alpha + \beta q + u$	0.22	0.25
θ	-1.84	Elasticity parameter	Slope: $\Delta q = \alpha + \beta \ln(y) + u$	0.18	0.14
Investment function:					
$A_{\mathcal{I}}$	6.31	Productivity of investments	Average growth rate of q	0.22	0.25
ς	0.58	Share parameter, m	Time investment, HS mothers	0.23	0.25
γ	0.31	Elasticity parameter	Time investment, CG mothers	0.25	0.28
College choice:					
μ_E^f	0.96	Fixed effort cost, females	Share of high educated females	0.27	0.26
μ_E^m	11.6	Fixed effort cost, males	Share of high educated males	0.29	0.27
μ_E^1	0.23	Variable cost of education	Slope of $e = \alpha + \beta q + u$	0.11	0.12

Calibrated Parameters

Human capital, Investment and College choice

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Model evaluation

Nontargeted moments	Data	Model	Source

Model evaluation

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Intergenerational persistence of education	0.16	0.15	PSID

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Income elasticity of fertility, HS mother	-0.21	-0.17	PSID
Income elasticity of fertility, CG mother	-0.02	-0.01	PSID

Model evaluation

Nontargeted moments	Data	Model	Source
Intergenerational persistence of education	0.16	0.15	PSID
Income elasticity of fertility, HS mother	-0.21	-0.17	PSID
Income elasticity of fertility, CG mother	-0.02	-0.01	PSID
Correlation time and goods investments	0.88	0.87	Daruich (2018)
Share of expenditures spent on children ($n = 1$)	0.26	0.22	Lino et al. (2015)
Share of expenditures spent on children ($n = 2$)	0.39	0.39	Lino et al. (2015)

Model evaluation

Nontargeted moments	Data	Model	Source
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Share of expenditures spent on children ($n = 2$)	0.39	0.39	Lino et al. (2015)

Replicating Spanish transfer policy *	Data	Model	Source
Fertility increase (%)	6.32	7.50	González (2013)

(*) A universal transfer of 2.1 median female monthly income per birth. Spain 2007

Policy Evaluation

Policy Evaluation

- Question: what are the effects of child-related tax benefits?
  - Do they increase fertility?
  - If so, do they generate a fall in human capital?
  - How is intergenerational mobility affected?
- Policy implementation: eliminate child-dependent benefits

$$t^*(y,n) \;=\; t(y,0) - \tau_0$$

where $\tau_0 = 0.05$ is such that the policy is revenue neutral

$$\int_{\mathcal{S}} t(y,n)y(\mathbf{s})dF(\mathbf{s}) \;=\; \int_{\mathcal{S}} [t(y,0) - \tau_0]y(\mathbf{s})dF^*(\mathbf{s})$$

Aggregate effects

	No Benefits	Tax Benefits (Baseline)	% Change
Completed fertility	1.81	2.11	16.3
Fertility of mothers	2.08	2.32	12.0
Share of mothers	0.87	0.91	3.82
Human capital at J_l	6.11	5.07	-17.1
College graduation rate	0.37	0.28	-25.0

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- Tax benefits are effective at fostering fertility. Two channels
  - Effect (a): Benefits reduce the cost of children
  - Effect (b): $\uparrow$ Fertility $\rightarrow$ $\uparrow$ Labor share $\rightarrow$ $\downarrow K/L$ $\rightarrow$ $\downarrow$ Wages $\rightarrow$ $\uparrow$ Fertility

    Why? parents cannot afford sufficiently high level of human capital $\rightarrow$ more kids
- Both intensive and extensive margin

Aggregate effects

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- But they decrease children's human capital...
  - Families are now larger: lower productivity of parental investments
    - $\Rightarrow$ Number of children is a key determinant of the cost of human capital
  - Lower income: money investments relatively more expensive
- Reduction in college graduation rate: higher effort cost

Heterogeneous effects

	High School			College Graduate		
	No	Tax	% Chg	No	Tax	% Chg
Completed fertility	1.86	2.21	18.8	1.74	1.90	8.74
Fertility of mothers	2.10	2.41	14.9	2.05	2.14	4.92
Share of mothers	0.90	0.92	3.41	0.86	0.88	3.63
Human capital at J_l	5.54	4.61	-19.1	6.59	6.12	-9.36
College graduation	0.30	0.23	-29.1	0.41	0.39	-12.3

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College graduation	0.30	0.23	-29.1	0.41	0.39	-12.3

- HS mothers are relatively more affected: 18.8% vs. 8.7%
  - Effect (a): Tax benefits are highly progressive
  - Effect (b): Wage of low educated fall relatively more (13% vs. 7%)

Heterogeneous effects

	High School			College Graduate		
	No	Tax	% Chg	No	Tax	% Chg
Completed fertility	1.86	2.21	18.8	1.74	1.90	8.74
Fertility of mothers	2.10	2.41	14.9	2.05	2.14	4.92
Share of mothers	0.90	0.92	3.41	0.86	0.88	3.63
Human capital at J_l	5.54	4.61	-19.1	6.59	6.12	-9.36
College graduation	0.30	0.23	-29.1	0.41	0.39	-12.3

- Consequently, human capital of children with HS mothers fall relatively more
  - Increase in differential human capital
  - Increase in differential college graduation rate
- Intergenerational persistence of education increases from 0.11 to 0.15

Policy Evaluation

- Two forces at play:

  (a) Relative Price Effect:

  Taxes distort relative price between number of children and their human capital.

  (b) Income Effect:

  Decreases in income induce parents to substitute children by children's human capital (quantity-quality trade-off)

- Disentangle relative importance:

  - Taking the economy without tax benefits as starting point...

    1. Add tax benefits without adjusting prices nor taxes $\rightarrow$ effect (a)
    2. Let prices and taxes adjust $\rightarrow$ effect (b)

Results decomposition

	No Ben.		Benefits		Prices		Tax Ben.
Completed fertility	1.81	+	0.62	−	0.32	=	2.11
Fertility mothers	2.08	+	0.18	+	0.06	=	2.32
Share of mothers	0.87	+	0.17	−	0.13	=	0.91
Differential fertility	-0.12	−	0.23	+	0.03	=	-0.32
Human capital at J_l	6.11	−	0.43	−	0.61	=	5.07
Differential human capital	1.05	+	0.30	+	0.16	=	1.51
College graduation rate	0.37	−	0.04	−	0.05	=	0.28

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- GE and intergenerational effects ("Prices") are quantitatively important:
  - Significant reduction in the share of mothers
  - 25% of the effects on fertility of mothers
  - More than 50% of the effects on children's human capital

Results decomposition

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College graduation rate	0.37	−	0.04	−	0.05	=	0.28

- GE and intergenerational effects ("Prices") are quantitatively important:
  - 25% of the effects on fertility
  - More than 50% of the effects on children's human capital
- Most of the inequality effect due to design of benefits

Education subsidies

- Problem:

  Tax benefits foster fertility at the expense of lower interg. mobility

- Question:

  Is there a policy able to foster both fertility and children's human capital?

  - Subsidies to education reduce the cost of children's human capital, which in turn, reduces the cost of children.

- Implementation:

$$\mathcal{I}(n, m, t) = A_{\mathcal{I}} \left[\varsigma \left(\frac{m(1+\tau)}{n^{\psi_1}} \right)^{\gamma} + (1-\varsigma) \left(\frac{t}{n^{\psi_2}} \right)^{\gamma} \right]^{\frac{1}{\gamma}}$$

Key difference: CG parents spend more on children's human capital (regressive transfer)

Education subsidies

	No Benefits	Tax Benefits	Subsidy
Completed fertility	1.82	2.11	2.01
Differential fertility	-0.12	-0.32	-0.10
Share of mothers	0.87	0.91	0.95
Human capital at J_l	6.11	5.07	6.30
Differential human capital	1.05	1.51	1.06
College graduation	0.37	0.28	0.38
Interg. Persist. education	0.11	0.15	0.10

Education subsidies

	No Benefits	Tax Benefits	Subsidy
Completed fertility	1.82	2.11	2.01
Differential fertility	-0.12	-0.32	-0.10
Share of mothers	0.87	0.91	0.95
Human capital at J_l	6.11	5.07	6.30
Differential human capital	1.05	1.51	1.06
College graduation	0.37	0.28	0.38
Interg. Persist. education	0.11	0.15	0.10

- Effective at increasing fertility: 62% of the increase with tax benefits
  - Regressive transfer: 12% increase among CG and 10% among HS
  - Education subsidies reduce the cost of children for CG relatively more.
- More effective than tax benefits at the extensive margin
  - Cost of education is an important barrier for parenthood

Education subsidies

	No Benefits	Tax Benefits	Subsidy
Completed fertility	1.82	2.11	2.01
Differential fertility	-0.12	-0.32	-0.10
Share of mothers	0.87	0.91	0.95
Human capital at J_l	6.11	5.07	6.30
Differential human capital	1.05	1.51	1.06
College graduation	0.37	0.28	0.38
Interg. Persist. education	0.11	0.15	0.10

- As opposed to tax benefits, education subsidies do not reduce human capital
  - Reduce the cost of children by reducing the cost of human capital
  - Parents spend less money, and the government more than compensates
- No cost in terms of intergenerational mobility

Conclusions

Conclusions

- I propose a GE life cycle model with fertility choices and parental investments in children's human capital, estimated with US data
  - Rich degree of heterogeneity
  - Suitable for family-policy analysis
- Evaluate quantitative impact of child-related tax benefits:
  - Significant effects on fertility and parental investments
  - Stronger for low income families: reduces the gap in initial conditions
  - Both relative price distortion and GE effects are important
- Education subsidies increases fertility w/o damaging intergenerational mobility
- **Take-aways**
  1. We should evaluate pronatalist policies beyond their effects on fertility
  2. Short-run inequality *versus* long-run inequality

Thanks for your attention

Some references

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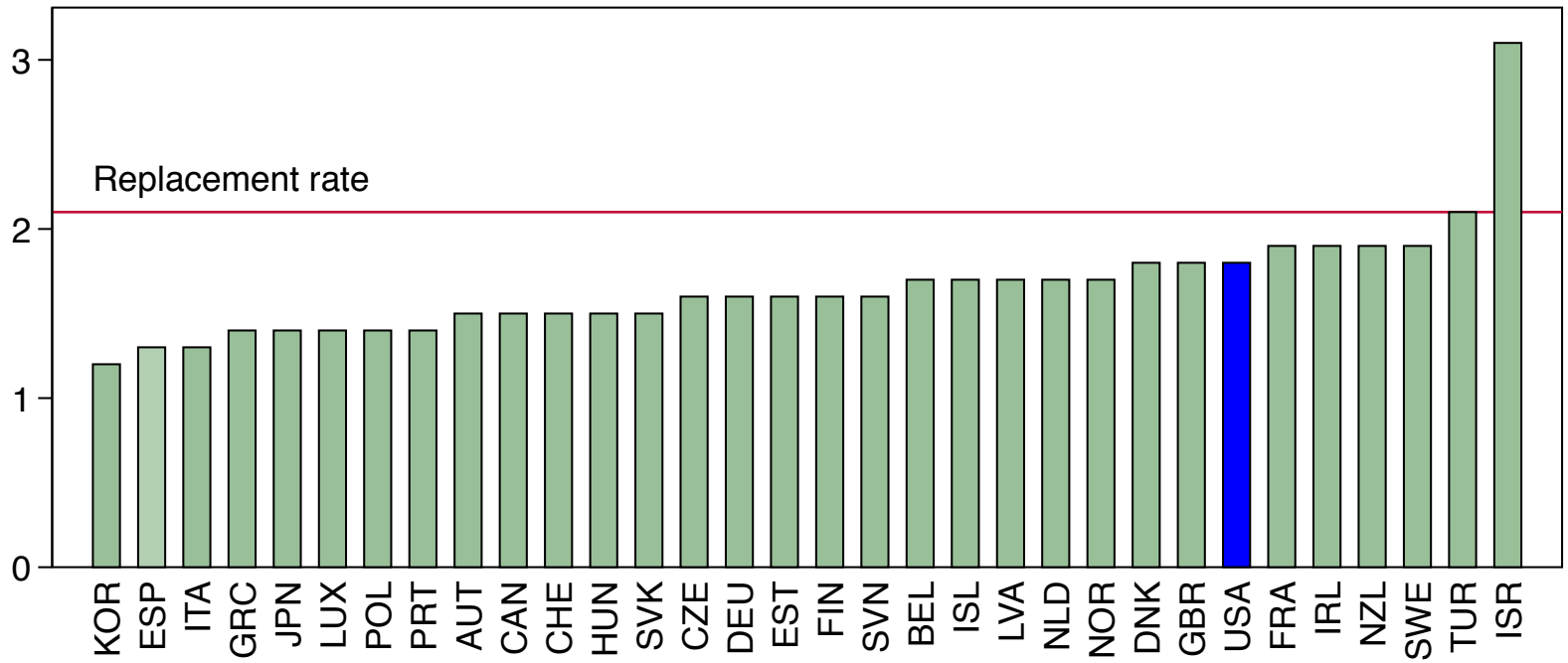
Additional material

Low fertility rates

Figure: Total Fertility Rate (2016)



Source: OECD Family Database.

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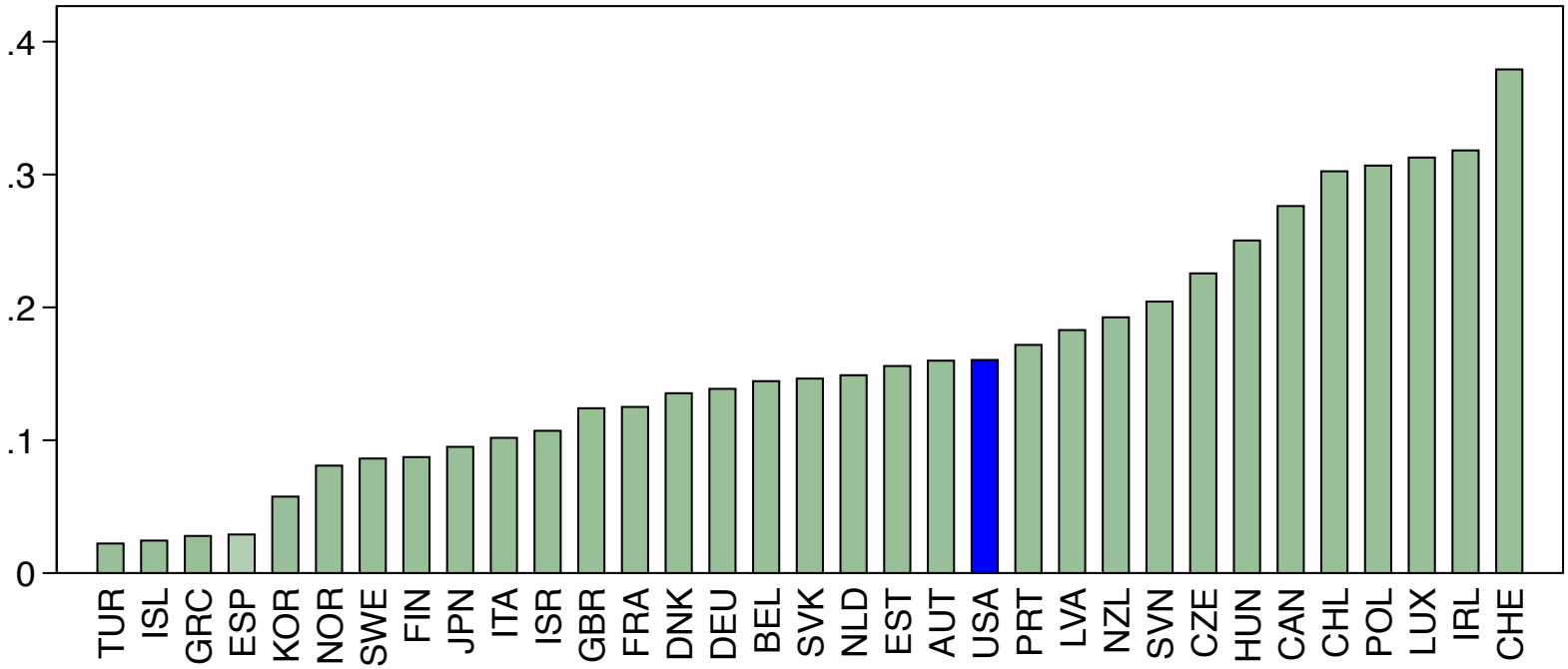
Tax benefits are widely extended

Figure: Tax Benefits for families with 2 children (2017)



Source: OECD Family Database.
Notes: Tax benefits measured as the relative difference in tax rates between a married household with 133% of the average income and 2 children and a family with the same level of income but no children. *Example*: in Italy, the tax benefits are of 10%, meaning that a family with 2 kids and 133% of the average Italian household income pays 10% lower taxes than a family with the same level of income and no children.

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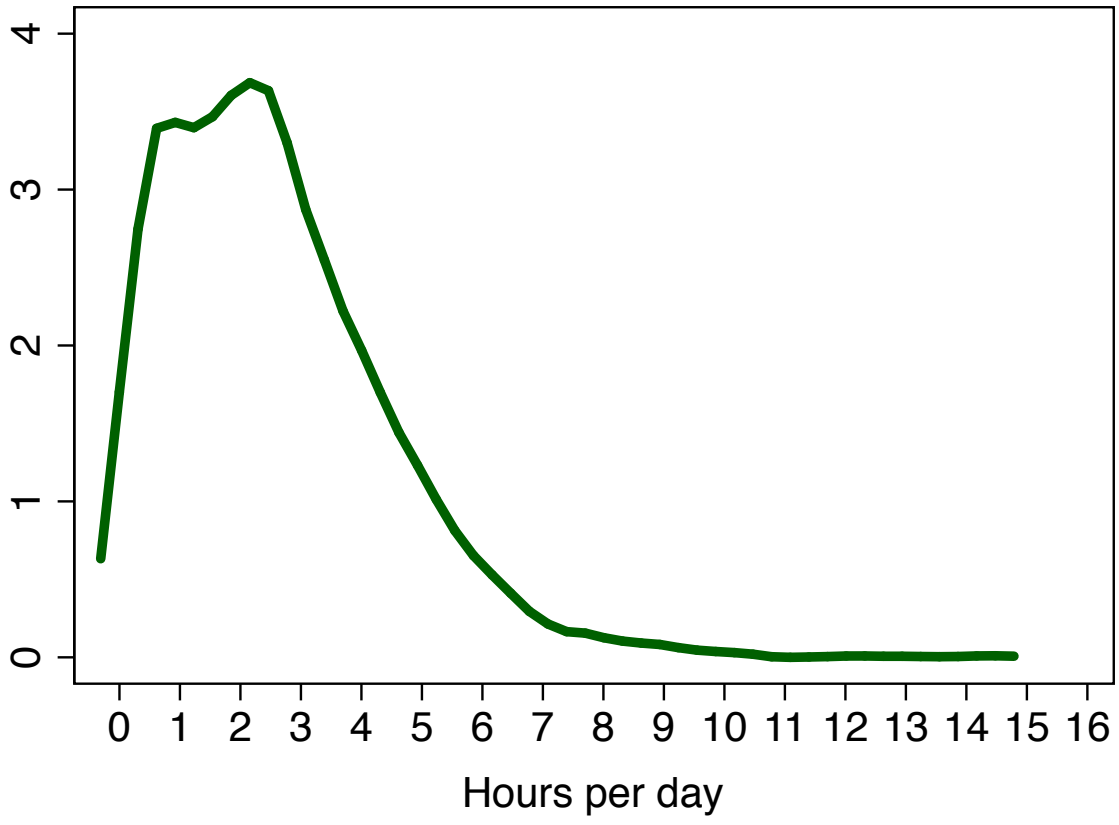
CDS Sample

- Start in 1997 collecting info on children aged 0 to 12 from PSID families, and follow them over time.
- I use the 2002 and 2007 waves (children aged 6 to 18).
- Time diary:
  - Detailed info on child's activities: nature, duration, whether parents participate, etc.
- Test scores (Woodcock Johnson Tests)
  - Standard measure of child's cognitive skills.
  - Large number of yes-or-no questions.
- Includes individual identifiers for children and parents: link with PSID data.
- Information on 4,530 children: 1,892 also in PSID when adult.

▷ Back *t* ▷ Back *q*

Time Investments



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Children's Human Capital

Table: Children's (normalized) scores in the Woodcock Johnson Tests

	Obs.	Mean	Std	Min	Max
Applied Problem Solving	4,125	0.608	0.144	0.050	1.000
Passage Comprehension	4,047	0.590	0.159	0.023	1.000
Letter-Word	4,125	0.741	0.170	0.086	0.983

▷ Back

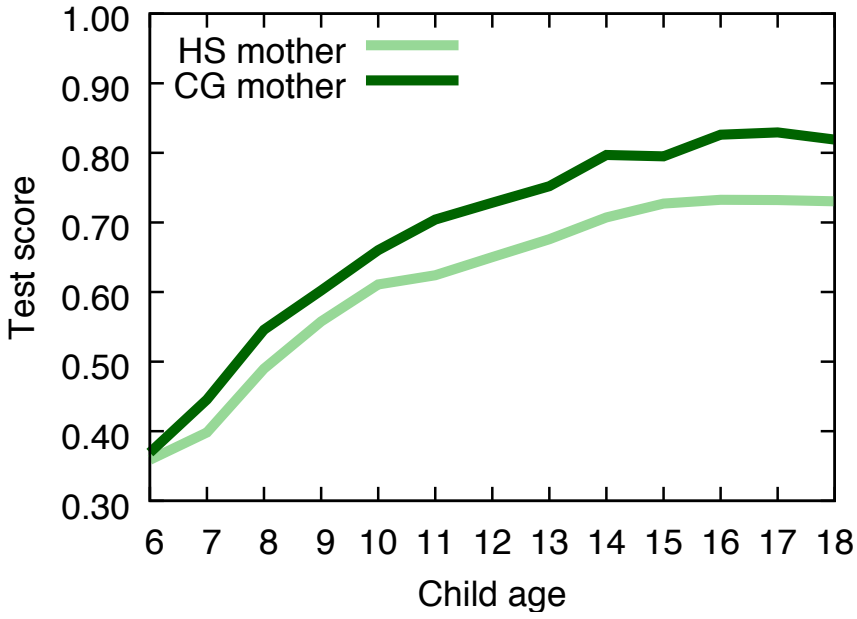
Children's Human Capital

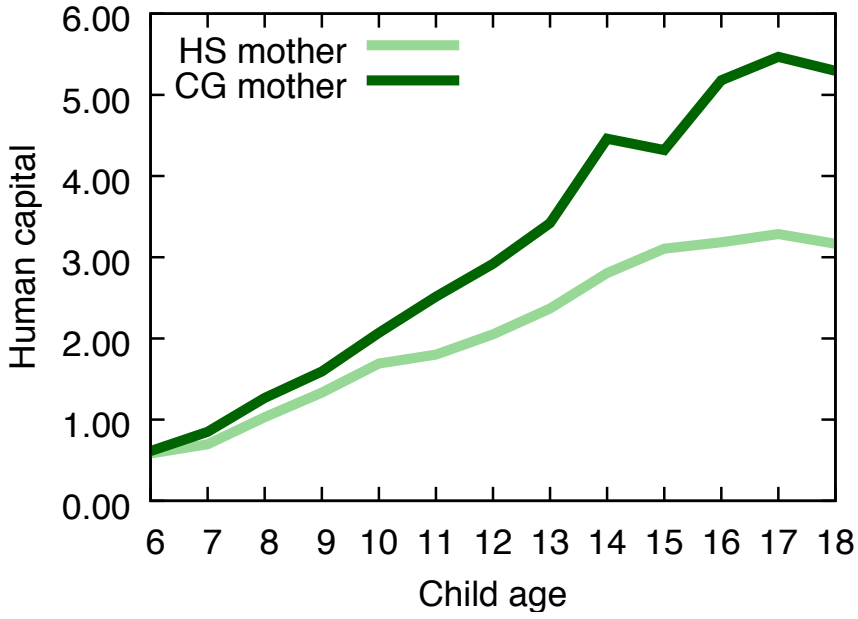
Table: Summary statistics, children's human capital measures

	Obs	Mean	Std	Corr(q,e)
Applied Problem Solving	4,122	2.091	2.358	0.449
Passage Comprehension	4,037	1.875	1.678	0.300
Letter-Word	4,109	6.303	8.274	0.336
All test	4,024	2.590	1.981	0.482

▷ Back

Human capital by age





▷ Back - Model ▷ Back - Calibration

Income taxes in the US

	Gross income
$-$	Adjustments to gross income
$=$	Adjusted gross income
$-$	Standard deduction
$-$	Personal exemptions, or Itemized deductions
$=$	Taxable Income
$-$	Taxes
$=$	Tax imposed
$-$	Nonrefundable credits
$-$	Refundable credits.
$=$	Tax liability after credits

▷ Intro ▷ Estimation

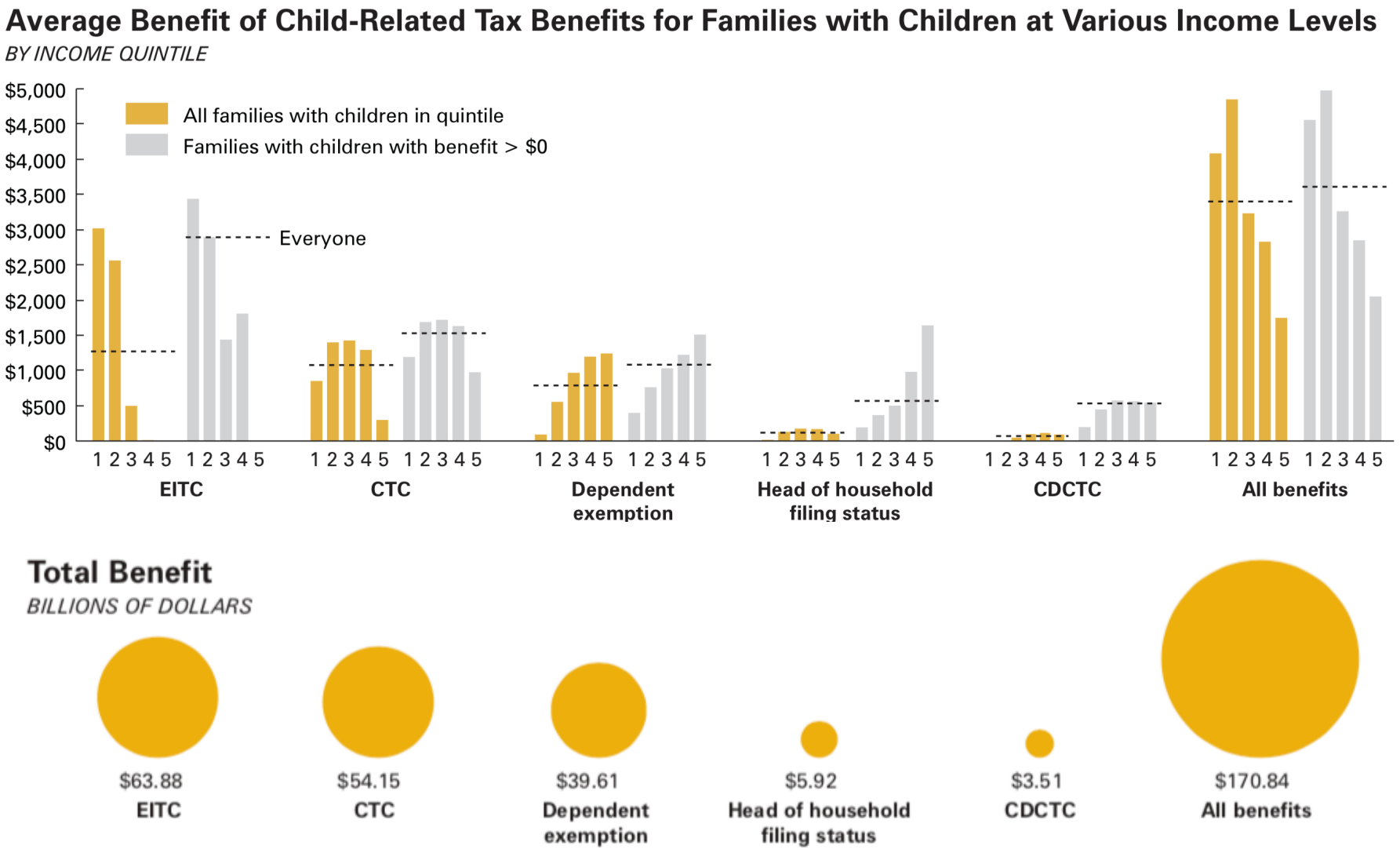
Income taxes in the US

Sources of child-depdendencies

- Standard deduction: singles w/ children can claim “head of household” filling status, who enjoy higher standard deduction.
- Personal exemptions: extra amount per dependent child (phase out)
- Itemized deductions: interests paid on education loans, and higher education expenses (both limited and for higher education).
- Children and dependent care tax credit (CDCTC): non-refundable credit for the care of dependents (phase out)
- Child tax credit (CTC): refundable credit of $1,000 per eligible child (phase out)
- Earned income tax credit (EITC): higher credit rate, maximum credit and phase out threshold.
- Tax rates: heads of households enjoy lower tax rates.

▷ Intro ▷ Estimation

Maag (2013)



▷ Intro ▷ Estimation

CPS Sample

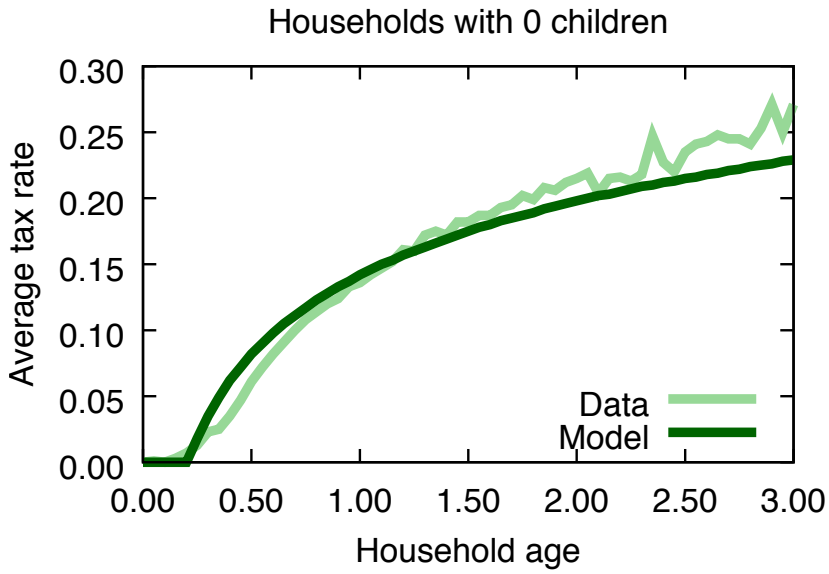
- Annual Survey of Economic Conditions Supplement to the CPS.
  - Years 2000 to 2010.
  - Large sample size:

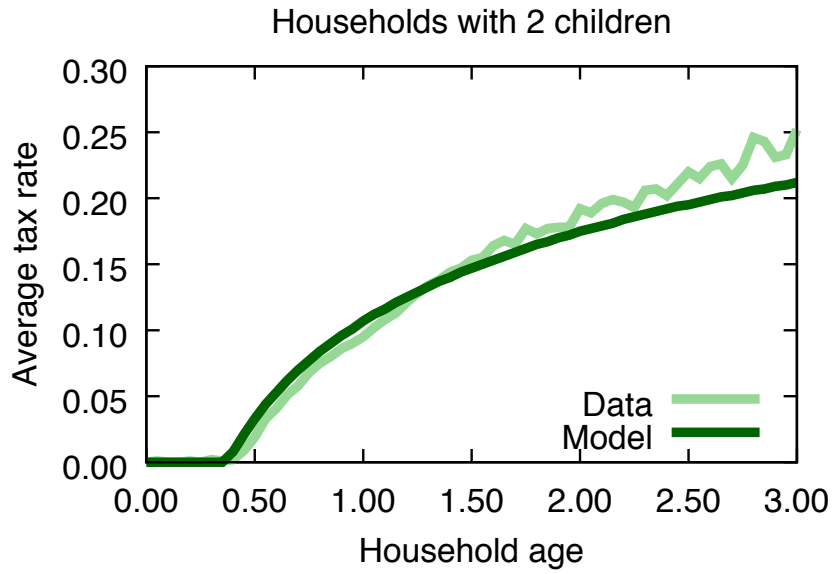
    Allows for clustering by the number of children in the household.
- Tax-related variables from the Census Bureau's tax model
  - Using info from: IRS, the American Housing Survey, and the State Tax Handbook.
- Sample selection:

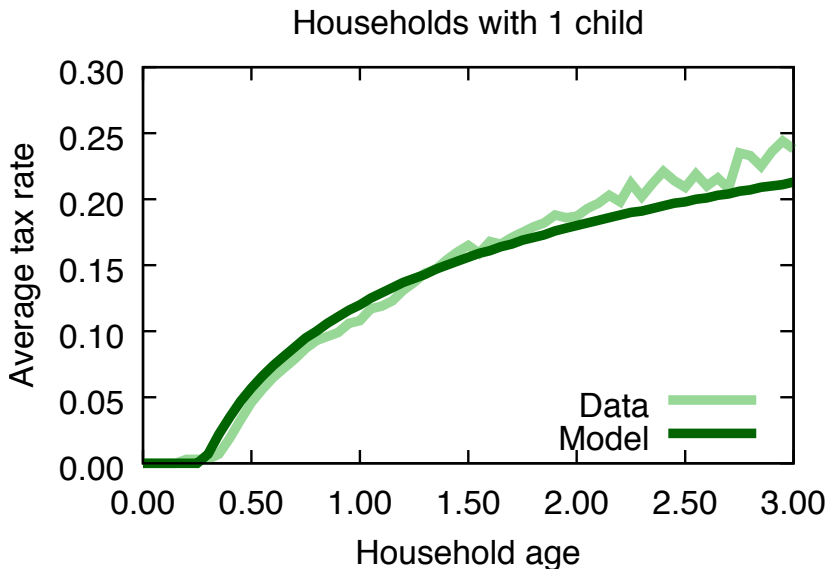
  Keep married households filling joint returns and positive income.

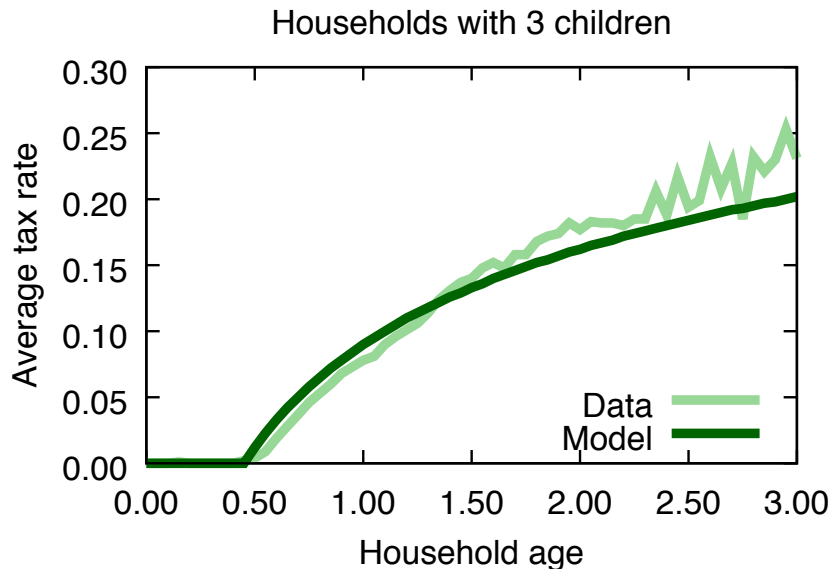
▷ Back

Tax function









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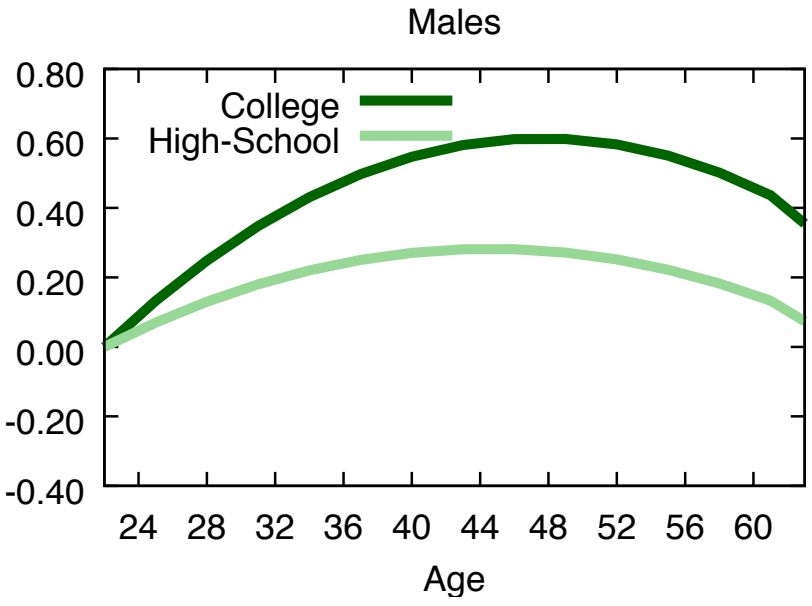
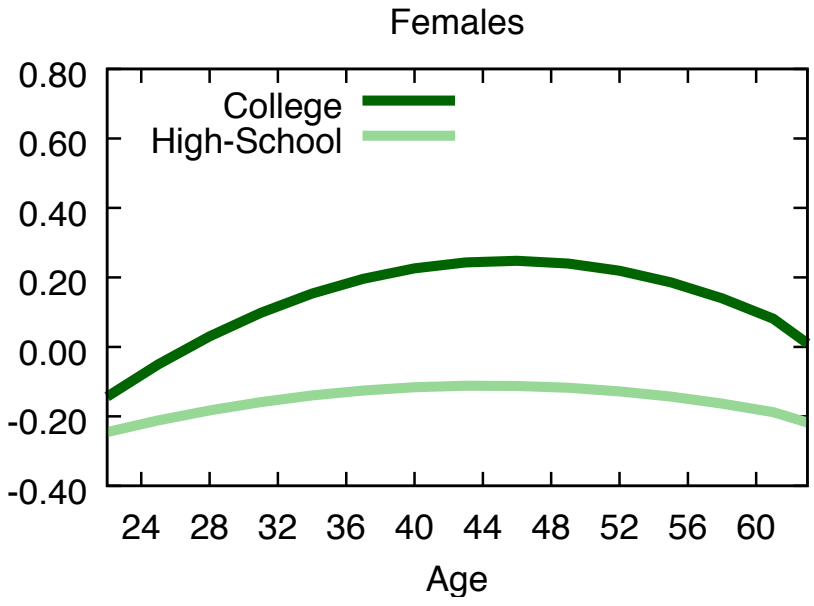
Income profiles





- Construct hourly wages for full-time workers.
- Fit 2nd order polynomial in age, by education and gender.
- Normalize $\mu(m, \overline{e}, J_l) = \mu(m, \underline{e}, J_l) = 0$.

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Income profiles

- Take residuals as our measure of labor productivity. Estimate (by education):

$$z_{i,t} = \alpha + \rho z_{i,t-2} + \epsilon_{i,t}$$

- Measurement error: instrument $z_{i,t-2}$ with $z_{i,t-4}$ (biannual observations)

Table: Labor productivity process estimation

	Low educated	High educated
Autocorrelation, ρ_e	0.824	0.902
Std of innovations, σ_e	0.406	0.392

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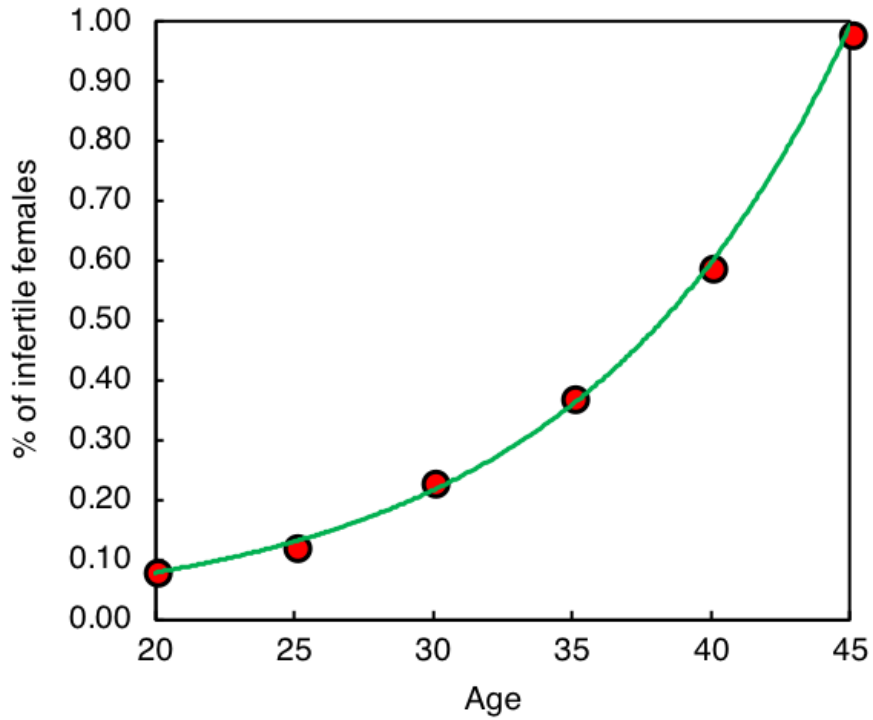
Fertility risk

- Follow Sommer (JME 2016): use data from medical literature on infertility.

$$p_0(b,j) = \begin{cases} 1 - \exp(\alpha_0 + \alpha_1 j) & \text{if } b = 1 \text{ and } j \leq J_F \\ 0 & \text{otherwise} \end{cases}$$



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Children independence

- Probability that a child becomes adult given by:

$$p_l(n,j) = \frac{\sum_{i=1}^{N} \mathbf{1}\{n_{i,t} < n \wedge n_{i,t-3} = n \wedge \text{age} = j\}}{\sum_{i=1}^{N} \mathbf{1}\{n_{i,t-3} = n \wedge \text{age} = j\}}$$

- Results (PSID data):

Table: Children ageing process

	Mother's age			
Age	20-28	29-37	38-46	>46
Model age (j)	1-3	4-6	7-9	>9
$p_l(n=1,j)$	0.029	0.037	0.288	0.501
$p_l(n=2,j)$	0.025	0.041	0.309	0.579
$p_l(n=3,j)$	0.049	0.105	0.399	0.718
$p_l(n\geq 4,j)$	0.125	0.140	0.455	0.720

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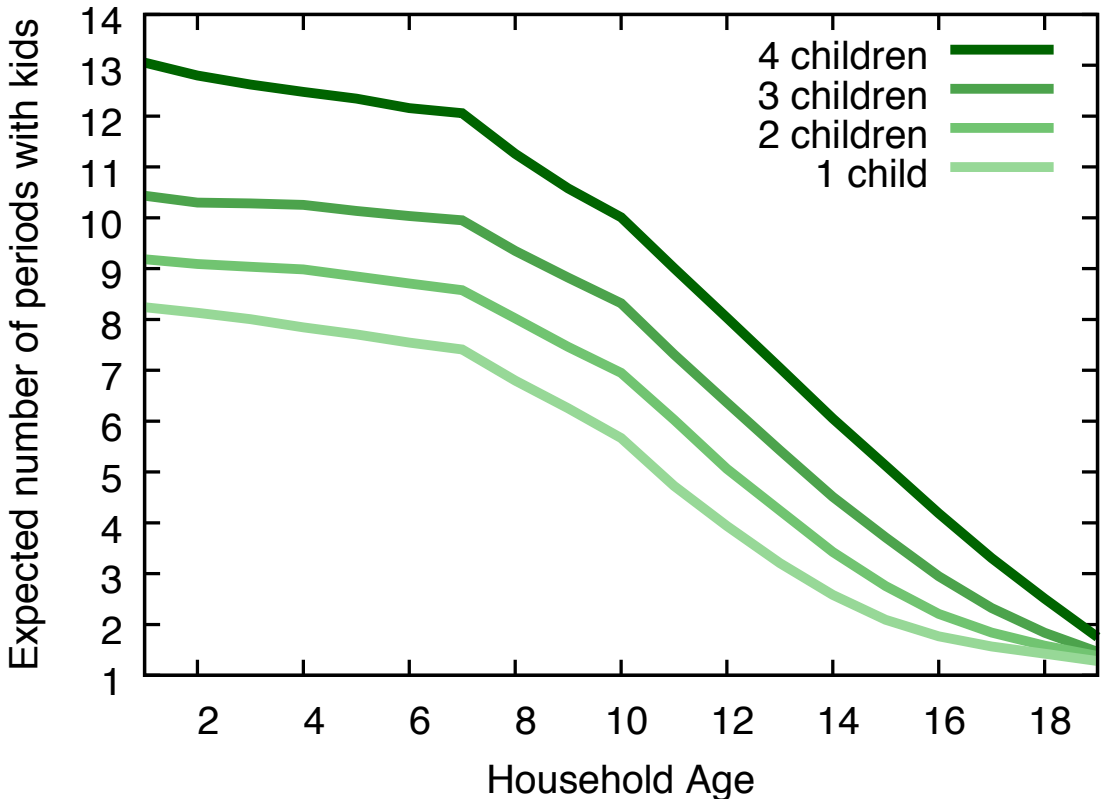
Children independence

Figure: Expected number of years with children, by age and number of children



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Computation

- High dimensional problem: more than 120,000 grid points in the state space
- Choice set depends on the state
  - Young households choose whether to have a kid
  - Parents decide on investments
  - etc.
- Up to 6 continuous choice variables (+1 discrete)
- Value function is not differentiable: solution requires global methods
- Solution:
  - Parallel computing (`OpenMP`)
  - Solve household problem using Nelder–Mead method

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