# Intergenerational Effects of Child-Related Tax Benefits in the US

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# Introduction

- Very low fertility rates in developed countries
  - 1.2 in ESP & ITA, 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 generous in the US
  - Average benefits of $3,400 per family w/ children (Maag, 2013)
  - Poor families may save up to 70% on taxes from having 2 kids
  - Rich ones may save up to 16%

▷ TFR ▷ Benefits ▷ Benefits in the US

# What I do

- Quantify the impact of tax benefits on fertility and intergenerational mobility

  GE life cycle model with overlapping generations and child-dependent taxes

  - Heterogeneous households have children
  - Parents invest on their children's human capital

- Why to study effects on intergenerational mobility?
  - Family Economics *meets* Macro: *who* have the children matters
  - CG parents have 19% fewer children and invest 12% and 30% more time and money on their kids

- Why to use a GE framework?
  - Today's children will be tomorrow's parents: intergenerational effects
  - Demographic structure has GE implications

# What I find

- Tax benefits increase fertility by 16%...

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

- Mechanism:
  - Tax benefits reduce the “price” of children, increasing fertility
  - More children increase the cost parental investments lowering human capital
  - Benefits are progressive: low income families are more affected

- 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

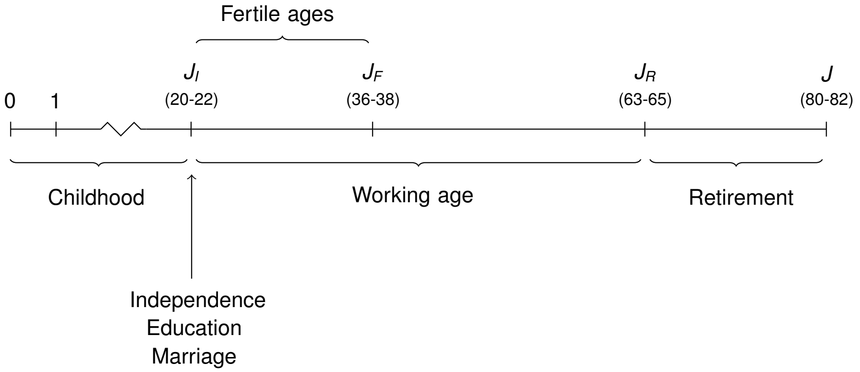
1. Model economy
2. Calibration
3. Policy evaluation
4. Conclusions

# The Model

# Main features

- Life-cycle economy with overlapping generations of married households
  - Households are heterogeneous: age, education, labor productivity, assets
- Endogenous fertility and initial conditions
  - Children human capital accumulation: parental investments
  - Parental transfers when children move out
  - College choice at independence $\rightarrow$ depends on human capital
  - After college, random matching with marital sorting
- Government taxes income to finance some (exogenous) expenditures
  - Tax rate: $t(y, n)$, where $y$ is hh income and $n$ is the number of children
  - Social security runs an independent budget and pays pensions
- GE: Aggregate firm combines capital, low- and high-educated labor

# Life-cycle structure



# Adults – Preferences


- Standard LC problem: consumption, savings and labor supply of spouses
- Wage rates given by age, gender, education and productivity: $\omega(g, e, z, j)$
- Household utility: $U_m(c, l_m + \alpha_m t) + U_f(c, l_f + \alpha_f t) + U_k(n, q, b)$
  - $U_g(c, l)$ is the utility from consumption and leisure:

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

  - $\alpha_g \in [0, 1]$ captures the fraction of $t$ spent by gender-$g$ parent
  - $U_k(n, q, b)$ is the utility derived from children

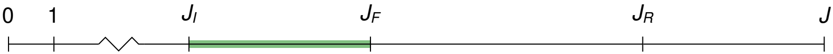
# Adults – Preferences


- $U_k(n, q, b)$ is the utility derived from children

$$U_k(n,q,b) = \underbrace{\eta_n \left(\frac{n^{\sigma_n}}{\sigma_n}\right)}_{\text{Kids}} + \underbrace{\eta_q n^{\varphi} \left(\frac{q^{\sigma_q}}{\sigma_q}\right)}_{\text{Human capital}} + \underbrace{\eta_b \left(\frac{b^{\sigma_b}}{\sigma_b}\right)}_{\text{Transfers}} - \underbrace{\eta_0 \mathbf{1}\{n > 0\}}_{\text{Fixed cost}}$$

  - where $b$ is the amount of transfer to independent children
  - $\eta_0$ is a fixed cost (example: quality of leisure) $\rightarrow$ % childless

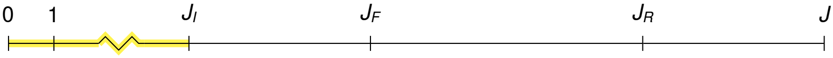
# Fertile ages




- Fertile households make a pregnancy choice: $k \in \{0, 1\}$
  - Fertility risk: pregnant females have a newborn ($n_0 = 1$) next period w.p. $p_0(j)$
  - Labor productivity loss from childbirth: $z_f$ falls by $\delta_0 \in (0, 1)$
- Children stay at home until $J_I$:
  - Stochastic independence: $n_I = 1$ with probability $p_I(n, j)$
  - Parents make a transfer $b$ to independent children

▷ Dynamic Problem

# 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)

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

where $\mathcal{I}(n,m,t)$ is the investment function

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

$m$: money; $t$: time; $\psi_1 \in (0,1)$; $\psi_2 \in (0,1)$

# Independence & college choice

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

- Initial state given by (gender, human capital, assets) $\equiv (g,q,a)$.
  - $g$ from random draw with $p(\text{male}) = p(\text{female}) = 0.5$
  - $q$ from parental investments
  - $a$ from parental transfer
- Effort cost of college $\xi_E$, decreasing in human capital:

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

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

# 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

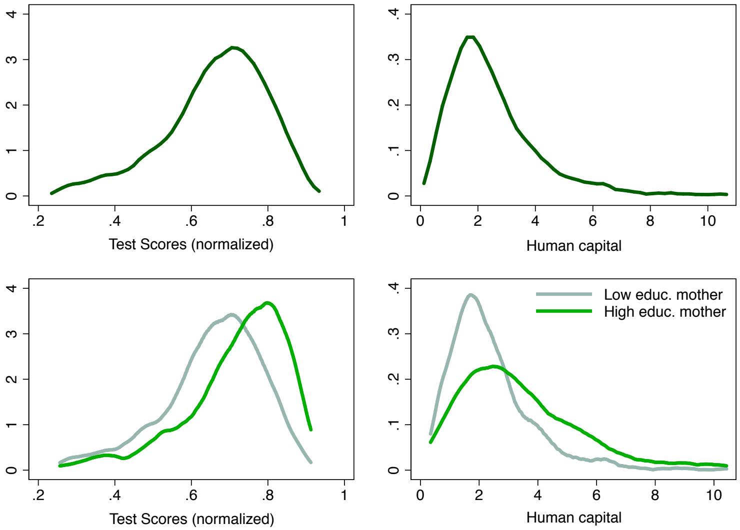
- Measurement with CDS data: children's human capital & time investment
- Estimate directly from data:
  - Tax function: standard parametric function estimated with CPS data.
  - Income process: age profiles and labor productivity process from PSID.
  - Fertility risk as in Sommer (2016)
  - Children's independence: estimate transition probabilities from PSID.
- Set some parameters to standard values or from related papers.
- Calibrate remaining parameters internally.
- Validation: non-targeted moments, and replication Spanish universal transfer policy (González, 2010)

# 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.
  - Mothers spend 1h 6 min and fathers 30 min, $+$ 1h 1m together.
- 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): $q = d/(1-d)$, where $d \in [0, 1]$ is the test score.
  - Informative about college graduation: $\text{Corr}(e, q) = 0.482$

▷ Sample ▷ Density $t$ ▷ Stats $q$ ▷ Age profile

# Children's human capital



# Tax function

- Parametric tax function:
  Heathcote, Storesletten, and Violante (2017)

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

Table: Parameters of the tax function

| Number of children | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| Level, $\lambda$ | 0.858 | 0.880 | 0.893 | 0.910 |
| Progressivity, $\tau$ | 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

▷ Summary ▷ Maag (2013) ▷ Sample ▷ Functions ▷ Model Fit

# Exogenous parameters

| Parameter | | Description | Source |
|---|---|---|---|
| $\beta$ | 0.98 | Discount factor (annual) | Standard value |
| $\sigma_c$ | 0.80 | Curvature utility from consumption | Córdoba et al (2016) |
| $\psi$ | 0.50 | Frisch elasticity of labor supply | Standard value |
| $\alpha_m$ | 0.54 | % time invested by fathers | CDS |
| $\alpha_f$ | 0.82 | % time invested by mothers | CDS |
| $\psi_1$ | 0.92 | Economies of scale, money investments | Sommer (2016) |
| $\psi_2$ | 0.54 | Economies of scale, time investments | Sommer (2016) |
| $q_0$ | 1.42 | Initial level of human capital | 25th percentile of $q$ |
| $\delta_0$ | 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 |

▷ Income profiles ▷ Fertility risk ▷ Children independence ▷ Aggregate Prod. Function

# 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 |
|---|---|---|---|---|---|
| $\kappa_m$ | 4.74 | Disutility labor, males | Average labor supply, male | 0.36 | 0.35 |
| $\kappa_f$ | 4.32 | Disutility labor, females | Average labor supply, female | 0.24 | 0.23 |
| $\eta_n$ | 1.05 | Utility $n$, weight | Completed fertility, HS mother | 2.41 | 2.52 |
| $\sigma_n$ | 0.51 | Utility $n$, slope | % of households with $2+$ children | 0.53 | 0.52 |
| $\eta_q$ | 0.96 | Utility $q$, weight | Average human capital, HS mother | 2.75 | 2.67 |
| $\sigma_q$ | 0.76 | Utility $q$, slope | Differential $q$ by maternal educ. | 0.44 | 0.56 |
| $\varphi$ | 0.16 | Utility $q$, fam. size param. | Differential fertility by maternal educ. | -0.26 | -0.23 |
| $\eta_b$ | 0.40 | Utility from $b$, weight | Rel. wealth at age $J_l$, HS mother | 0.11 | 0.11 |
| $\sigma_b$ | 0.51 | Utility from $b$, slope | Rel. wealth at age $J_l$, CG mother | 0.16 | 0.17 |
| $\eta_0^0$ | 2.70 | Fixed cost, HS mothers | % of childless HS mothers | 0.08 | 0.08 |
| $\eta_0^1$ | 2.80 | Fixed cost, CG mothers | % of childless CG mothers | 0.12 | 0.13 |

# Calibrated Parameters

## Human capital, Investment and College choice

| Parameter | | Description | Moment | Model | Data |
|---|---|---|---|---|---|
| *Law of motion of human capital:* | | | | | |
| $\mu$ | 0.30 | Share parameter, $q$ | Slope: $\Delta q = \alpha + \beta q + u$ | 0.22 | 0.25 |
| $\theta$ | -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 |
| $\varsigma$ | 0.58 | Share parameter, $m$ | Time investment, HS mothers | 0.23 | 0.25 |
| $\gamma$ | -0.31 | Elasticity parameter | Time investment, CG mothers | 0.25 | 0.28 |
| *College choice:* | | | | | |
| $\mu_E^f$ | 0.96 | Fixed effort cost, females | Share of high educated females | 0.27 | 0.26 |
| $\mu_E^m$ | 11.6 | Fixed effort cost, males | Share of high educated males | 0.29 | 0.27 |
| $\mu_E^1$ | 0.23 | Variable cost of education | Slope of $e = \alpha + \beta q + u$ | 0.11 | 0.12 |

# 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) |

| 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
  - Benefits reduce the cost of children
  - GE: $\uparrow$ Fertility $\rightarrow$ $\uparrow$ Labor $\rightarrow$ $\downarrow$ Wages $\rightarrow$ $\uparrow$ Fertility

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

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- But they decrease children's human capital...
  - Families are now larger: lower productivity of parental investments
  - 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 $J_I$ | 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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- HS mothers are relatively more affected: 18.8% vs. 8.7%
  - Tax benefits are highly progressive
  - Wage of low educated fall relatively more (13% vs. 7%)

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- 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:
  - 25% of the effects on fertility of mothers
  - More than 50% of the effects on children's human capital

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- GE and intergenerational effects ("Prices") are quantitatively important:
  - 25% of the effects on fertility of mothers
  - 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 children's human capital

- 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:

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

where $\tau$ is such that the policy is revenue-neutral

# 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 independence | 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 |

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- Effective at increasing fertility: 62% of the increase with tax benefits
  - 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

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- 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 (reducing the cost), 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: increases the gap in initial conditions
  - Both relative price distortion and GE effects are important
  - Education subsidies increases fertility without damaging intergenerational mobility
- **Main take-aways**:
  - Evaluation of pronatalist policies should go beyond their effects on fertility
  - Subsidies to the rich: short-run vs. long-run inequality

Thanks for your attention

# Some references


- Caucutt, Guner and Knowles (2002). "Why Do Women Wait? Matching, Wage Inequality, and the Incentives for Fertility Delay", Review of Economic Dynamics, 5, 815?855
- Cunha, Heckman and Schennach (2010). "Estimating the Technology of Cognitive and Noncognitive Skill Formation". Econometrica, 78(3), 883–931.
- Daruich and Kozlowski (2016). "Explaining Income Inequality and Intergenerational Mobility: The Role of Fertility and Family Transfers". Mimeo.
- Daruich (2018). "The Macro Consequences of Early Childhood Development Policies". Mimeo.
- Del Boca, Flinn and Wiswall (2014). "Household Choices and Child Development", The Review of Economic Studies, 81(1), 137–185,
- González (2013). "The Effects of a Universal Child Benefit on Conceptions, Abortions and Early Maternal Labor Supply". American Economic Journal: Economic Policy 5(3), 160–188

  Guvenen, Kuruscu, and Ozkan (2013). "Taxation of Human Capital and Wage Inequality: A Cross-country Analysis". The Review of Economic Studies 81(2), 818–850.
- Guner, Kaygusuz and Ventura (2014). "Income taxation of U.S. households: Facts and parametric estimates", Review of Economic Dynamics 17, 559?581
- Huggett, Ventura and Yaron (2011). "Sources of Lifetime Inequality". American Economic Review 101(7), 2923–2954.
- Kleven, Landais and Sazgaard (2018). "Children and Gender Inequality: Evidence from Denmark". forthcoming in American Economic Journal: Applied Economics.

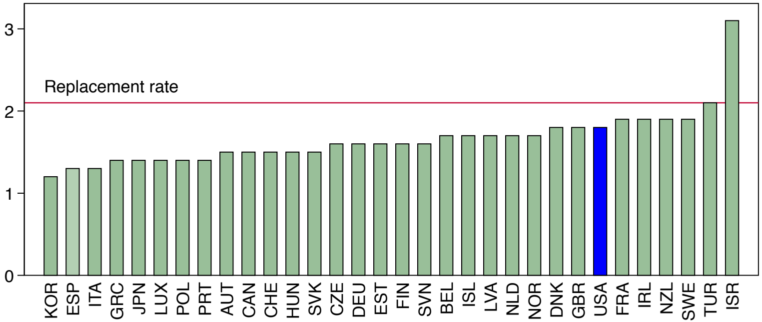
# Some references (cont.)


- Lee and Seshadri (2018). “On the Intergenerational Transmission of Economic Status”, forthcoming in Journal of Political Economy.
- Maag (2013). “Child-Related Benefits in the Federal Income Tax”. Brief 27, Urban Institute.
- Milligan (2005). “Subsidizing the Stork: New Evidence on Tax Incentives and Fertility”. The Review of Economics and Statistics 87(3), 539–555.
- Neyer, Caporali, and Sánchez-Gassen (2017). “EU-Policies and Fertility: The Emergence of Fertility-Related Family Policies at the Supra-National Level”. Families & Societies WP 79.
- Restuccia and Urrutia (2004). “Intergenerational Persistence of Earnings: The Role of Early and College Education”. American Economic Review 94(5), 1354–1378.
- Sommer (2016). “Fertility Choice in a Life Cycle Model with Idiosyncratic Uninsurable Earnings Risk”. Journal of Monetary Economics 83, 27–38.

# Additional material

# Low fertility rates

Figure: Total Fertility Rate (2016)

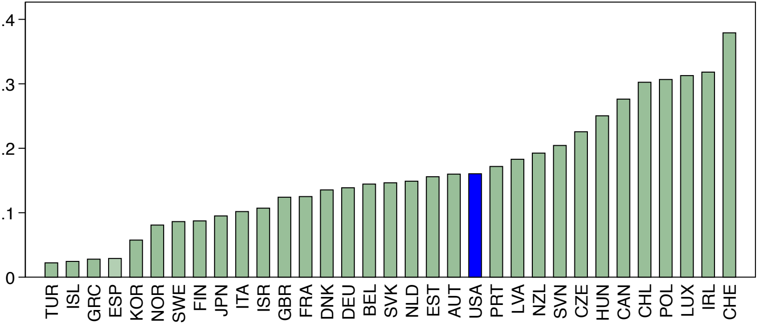



*Source*: OECD Family Database.

▷ Back

# 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.

▷ Back

# Tax Benefits in the US

Table: Average tax rate, married couples

| HH Income | Tax rate by # of children | | | | Benefits (2 kids) | |
|---|---|---|---|---|---|---|
| (× 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.

- Maag (2013): average benefits of \$3,400 per family w/ children
- 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

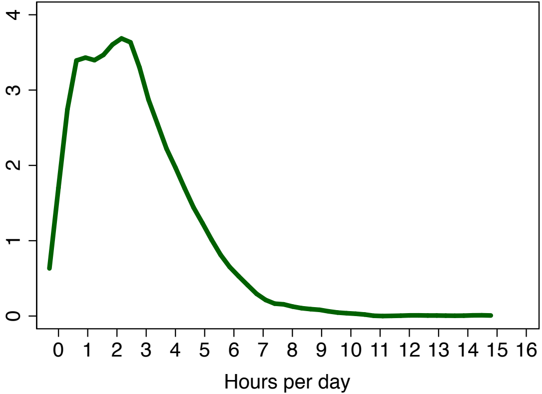
▷ Back

# 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

# Time Investments




▷ Back

# 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

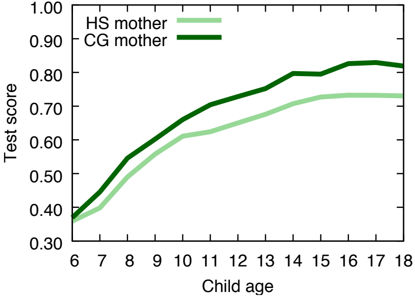
# Children's Human Capital

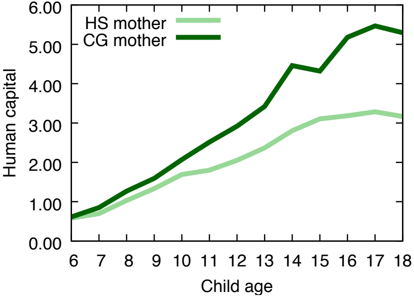
Table: Summary statistics, children's human capital measures

| | 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 |

▷ Back

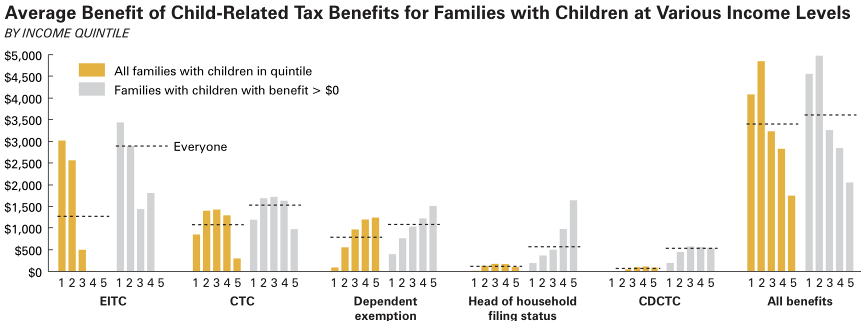
# Income taxes in the US

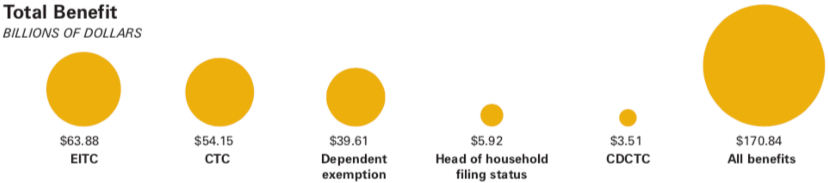
## Sources of child-depdendencies

- 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.

▷ Back

# Maag (2013)




▷ Back

# CPS Sample

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

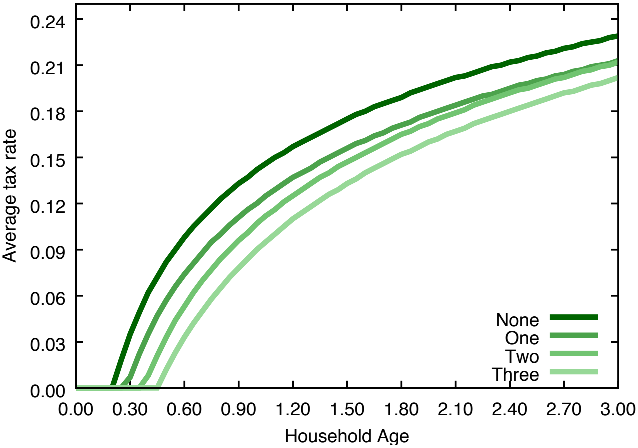
    Allows for clustering by the number of children in the household.
- Tax-related variables from the Census Bureau's tax model
  - Using info from: IRS, the American Housing Survey, and the State Tax Handbook.
- Sample selection:

  Keep married households filling joint returns and positive income.

▷ Back

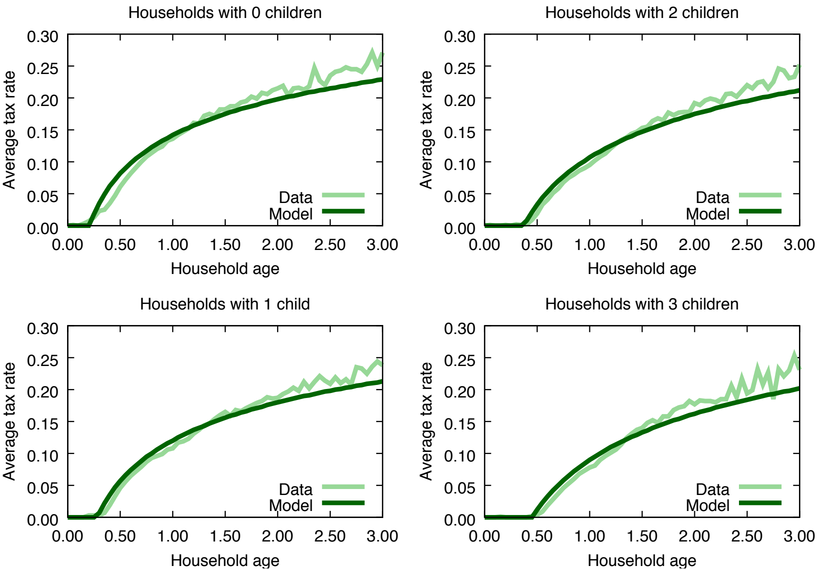
# Tax function

Figure: Estimated Tax Functions



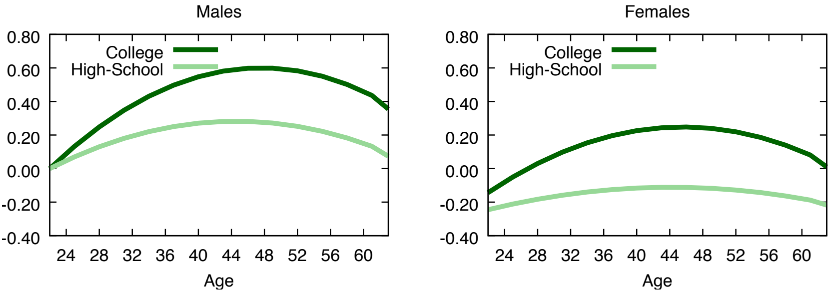

▷ Back

# Tax function




▷ Back

# Income profiles




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

▷ Back

# 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

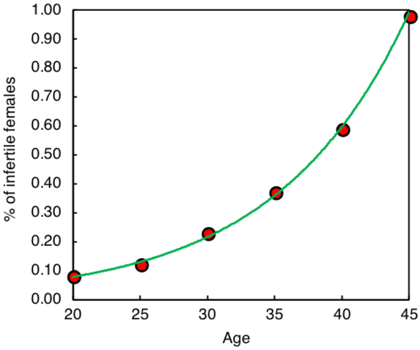
| | Low educated | High educated |
|---|---|---|
| Autocorrelation, $\rho_e$ | 0.824 | 0.902 |
| Std of innovations, $\sigma_e$ | 0.406 | 0.392 |

▷ Back

# Fertility risk

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

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




▷ Back

# 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):

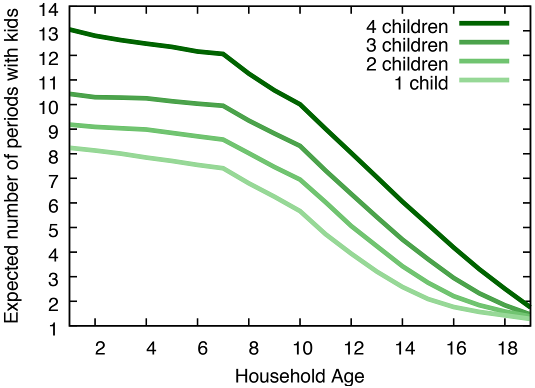
Table: Children ageing process

| | 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 |

▷ Back

# Children independence

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




▷ Back

# Dynamic program

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

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

$$+ \beta E_j \left[ V(e_m, e_f, z'_m, z'_f, a', n', q', n'_0, n'_l, j+1) \right]$$

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

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

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

- 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 $n_l = 0$

▷ Back

# 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)

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

▷ Back

# 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

▷ Back