Building Future Generations: The Macroeconomic Consequences of Family Policies

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- Policies that support childbearing and child-rearing (e.g., baby bonus, subsidized childcare, child tax benefits...)

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Question: What are the macroeconomic consequences of family policies?

1. Are they effective in achieving stated policy goals?
2. Are long-run effects different from those in transition?
3. How to compare in-cash versus in-kind family policies?

This Paper

A quantitative heterogeneous-agent GE-OLG model that integrates:

- Rich life cycle with childhood, working age, and retirement
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Parameters affect elasticities of quantity and quality responses to policies:

- Disciplined by matching cross-sectional U.S. data and RCT evidence
- Validated using the Alaska Permanent Fund Dividend and other existing policies

Preview of Key Results

- **Stated Policy Goal #1 (Fertility)** Raising aggregate fertility from 1.9 to 2.1 children per women (replacement fertility rate) requires a **$30,000** cash reward to childbirth
- **Stated Policy Goal #2 (Children's Outcomes and Mobility)**: This policy **lowers** both average child human capital and intergenerational income mobility by 2%
- **Welfare (Long-Run and Transition)**: Average welfare **rises by 1.6% (c.e.)** in the long-run as taxes fall by 0.9%. The government needs to finance higher child-related expenditures in transition
- **Compare In-Kind vs. In-Cash Policies**: Subsidized childcare and public education are less cost-effective in raising fertility than cash benefits, but offer **other advantages**

Contribution

Income transfers, Children's Outcomes, and Social Mobility

- Benabou (2002), Heckman and Mosso (2014), Bastian and Michelmore (2018), **Daruich (2019)**, Abbott, Gallipoli, Meghir and Violante (2019), Mullins (2019), **Guner, Kaygusuz and Ventura (2020)**...
- **Contribution: Introducing endogenous fertility choices reverses policy effects on children's outcomes and intergenerational mobility**

Fertility and Family Policies

- **Design-based:** Milligan (2005), Laroque and Salanié (2008), Drago et al. (2011), Luci-Greulich and Thévenon (2013), González (2013), Raute (2019)...
- **Structural:** Erosa, Fuster and Restuccia (2010), Liao (2013), **Kim, Tertilt and Yum (2021)**
- **Contribution: (1) Considering life cycle with retirement significantly changes policy effects on taxes and welfare (2) Adding childcare choices distinguishes in-cash & in-kind policies**

Outline

1. Model
   - Setup and the maximization problem of parents
   - Mechanisms of family policies
2. Calibration (2010 USA)
   - Key parameters that affect quantity/quality elasticities
3. Empirical validation – the Alaska Permanent Fund Dividend (APFD)
4. Counterfactual – Steady-State & Transition
5. Compare In-Cash vs In-Kind Benefits

Model

Model: Life Cycle

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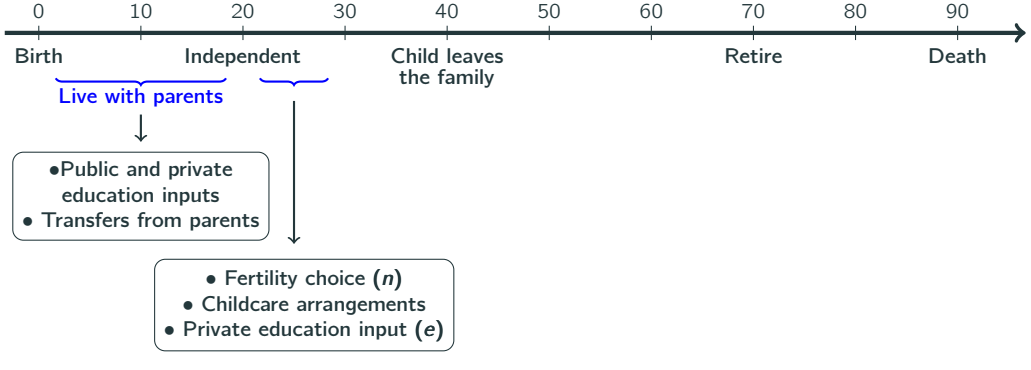

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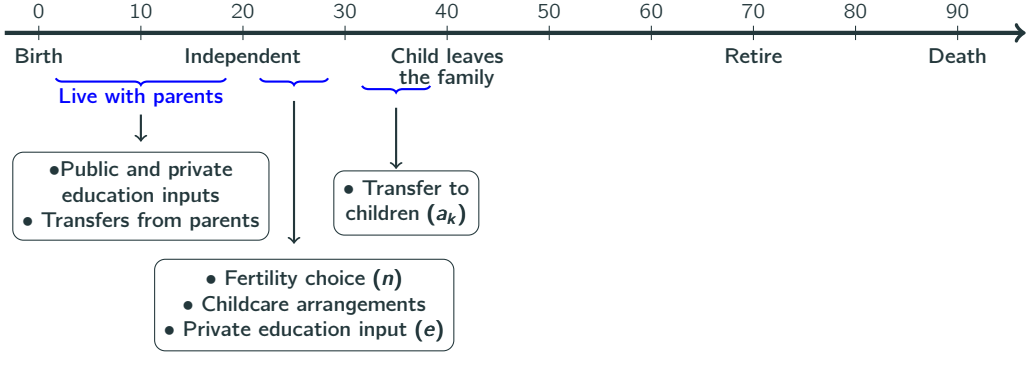

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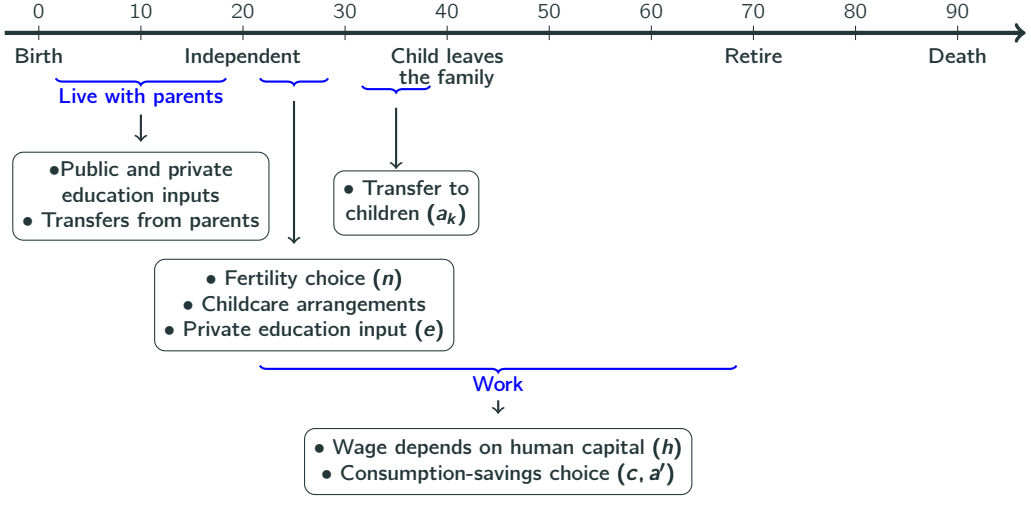

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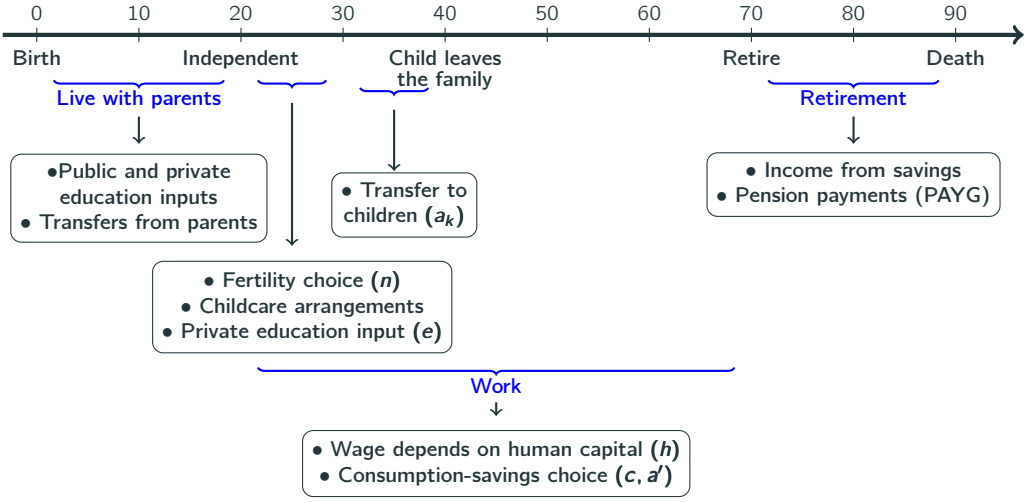

Fertility, Childcare and Skill Formation

$$V_2(h,a) = \max_{c,a',n,e,t_h,m\geq 0} u(c/\Lambda(n)) + \underbrace{\beta \mathbb{E} V_3(h',a',n,\mathbb{E}h_k)}_{\text{includes utility of having children}}$$

h : parents' skills
a : assets
n : fertility (continuous)
t_h : total home care
m : market care
e : private educ. input
χ : care time per child
p_m : market care price
$\Lambda(n)$: equivalence scale
$\mathcal{S}$: childcare subsidy
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$$(1+\tau_c)(c+(p_m\cdot m+e)\cdot n) + a' = (1+r)a + y - \mathcal{T}(y,a,n) + \mathcal{B}\cdot n \qquad \text{[BC]}$$

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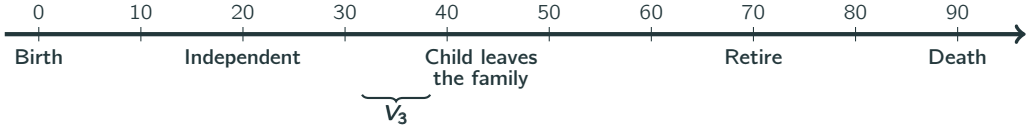
Two simplifying modeling assumptions:

1. $G(h,\mathcal{E},e,\epsilon)$ captures the overall skill formation of children from age 0 to 20
2. Time cost χ is non-educational and parents investments are summarized by e. High-quality public childcare can be implemented by raising $\mathcal{S}$ and $\mathcal{E}$ jointly in the model

Parent-to-Child Transfer



$$V_3(h, a, n, \mathbb{E}h_k) = \max_{c, a', a_k \geq 0} \quad u(c/\Lambda(n)) + \beta \mathbb{E} V_4(h', a') + \underbrace{v(n, \mathbb{E}h_k, a_k)}_{\text{utility from quantity and quality}}$$

$$y = wh$$

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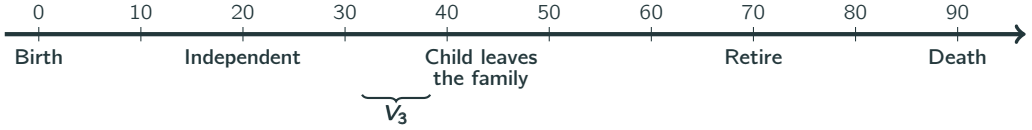

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Child quantity (n) interacts with child quality ($\mathbb{E}h_k, a_k$) in two ways:

1. [BC]: higher n raises marginal costs of ($\mathbb{E}h_k, a_k$) a lá Becker and Lewis (1973)
2. Preferences: complements or substitutes, have the potential to offset effects in [BC] (Mogstad and Wiswall 2016)

► later periods

Quantity-quality Trade-off

- Consider increase in $\mathcal{B}$ on private educational input e (and hence h_k):

$$\underbrace{MU_c \cdot n}_{\text{marginal costs of } e} = \underbrace{\frac{\partial v(n, \mathbb{E}h_k, a_k)}{\partial \mathbb{E}h_k} \cdot \frac{\partial \mathbb{E}h_k}{\partial e}}_{\text{marginal benefits of } e} \qquad \text{FOC } [e]$$

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Composition Effects

- Average child human capital:

$$\underbrace{\overline{h}_k}_{\text{average } h_k} = \iint \underbrace{\frac{n^*(h,a)}{N}}_{\text{fertility weight}} \cdot \underbrace{h_k^*(h,a,\cdot)}_{\text{individual child's } h_k} \; d \underbrace{\mu_2}_{\text{parents' dist.}} \; d\epsilon$$

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- Family policies change the fertility weights, i.e. composition of parents

Firms, Government, and Demographic Structure Effects

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- Government budget where each revenue/expenditure source is **weighted by age dist.**

$$\underbrace{\left(\sum_{j=2}^{6}\omega_j \int \mathcal{T}(y_j^*, a_j^*, n_j^*)\, d\mu_j\right)}_{\text{income taxes / transfers}} + \tau_c \underbrace{\left(\sum_{j=2}^{8}\omega_j \int c_j^*\, d\mu_j + \omega_2 \int n^*(p_m m^* + e^*)\, d\mu_2\right)}_{\text{consumption taxes}} =$$

$$\underbrace{(\omega_0+\omega_1)}_{\substack{\text{mass of children}\\ \text{public education}}}\mathcal{E} + \underbrace{\omega_2\left(\underbrace{\int n^*\mathcal{B}\, d\mu_2}_{\text{baby bonus}} + \underbrace{\int (1+\tau_c)n^* p_m \mathcal{S}\, d\mu_2}_{\text{subsidized childcare}}\right)}_{\text{family policy expenditures}} + \underbrace{\pi\left(\sum_{j=7}^{8}\omega_j \int wh\, d\mu_j\right)}_{\text{pension payments}} + \underbrace{\sum_{j=2}^{8}\omega_j}_{\text{mass of adults}} \underbrace{\mathcal{X}}_{\text{exo.}}$$

► stationary equilibrium ► childcare channel

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- **Demographic Structure Effects**: Family policies change $\{\omega_j\}_{j=0}^{8}$. Effects on fiscal burden depends on relative costs of retired agents versus children

► stationary equilibrium ► childcare channel

Calibration

Model Parameters

Table 1: Model Parameters

	Interpretation	Value	Source
	Preferences		
β	discount rate (annual)	0.98	standard
γ	elasticity of substitution	0.73	CPS
ψ	fertility preference	2.30	CPS
θ	human capital preference	2.85	PSID
ν	transfer preference	0.29	PSID
	Childcare arrangement		
χ	childcare cost	0.18	ATUS
ι	economies of scale at home	0.7	ATUS
υ	substitutability of care	0.38	SIPP
p_m	price of full-time care	\$6,860	NACCRRA
	Taxes and pension		
τ_y^n, λ_y^n	tax levels and progressivity	misc.	TAXSIM
τ_c	consumption tax	0.07	McDaniel (2007)
τ_a	capital income tax	0.27	McDaniel (2007)
π	pension replacement rate	0.40	OECD Database

	Interpretation	Value	Source
	Child human capital production		
Z	normalizing scalar	2.50	median income =1
σ_ϵ	ability shock dispersion	0.58	PSID
ρ	intergenerational spillover	0.30	Chetty et al. (2014)
ξ	substitution of education	0.9	CEX
$\mathcal{E}$	public education	\$12,000	NCES
κ	input productivity	0.13	Gárcia et al. (2020)
	Adults' human capital evolution		
η	learning curvature	1.22	PSID
$\{\zeta\}_{j=2}^5$	learning level	misc.	PSID
μ_z	skill depreciation	-0.23	PSID
σ_z	shock dispersion	0.38	PSID
	Firm production function		
A	total factor productivity	1	normalization
α	capital share	0.33	standard
δ_k	capital depreciation (annual)	0.04	standard

- 14 parameters are calibrated within the model using method of moments

► childcare ► adult skill ► firm and gov.

Model Fit

Parameter	Interpretation	Moment	Data	Model
γ	elasticity of substitution	fertility differential	0.12	0.12
ψ	fertility preference	average fertility	1.92	1.92
θ	human capital preference	average investment as % of income	13.4	13.5
ν	transfer preference	average transfer	\$48,381	\$48,400
ι	economies of scale at home	childcare time by # children	1.5	1.5
υ	substitutability of care	average care spending as % of income	16	16
Z	normalizing scalar	median income = 1	N/A	N/A
σ_ϵ	ability shock dispersion	Gini of earnings at $j = 2$	0.29	0.29
ρ	intergenerational spillover	intergenerational elasticity of earnings	0.34	0.33
ξ	substitution of education	investment by parents' education	misc.	misc.
κ	input productivity	return on per dollar investment (NPV)	\$1.3	\$1.29
η	learning curvature	income growth by initial decile	0.1	0.09
$\{\zeta\}_{j=2}^{5}$	learning level	income growth by age	misc.	misc.
σ_z	shock dispersion	Gini of earnings at $j = 6$	0.39	0.39

Sensitivity of Parameters to Moments

	γ	ψ	θ	ν	υ	σ_ϵ	ρ	ξ	η	σ_z
n Gap	-0.51	-0.28	**-0.53**	-0.40	-0.01	0.00	-0.02	0.02	-0.01	-0.02
TFR	0.56	-0.56	**1.67**	1.05	0.11	-0.07	0.00	0.01	-0.04	0.05
e	0.47	0.48	**1.12**	0.35	-0.45	0.04	-0.10	0.30	0.00	-0.04
a_k	-0.02	-0.06	-0.04	**0.75**	0.00	0.00	0.00	0.00	0.00	0.00
m	-0.43	-0.33	-0.28	-0.29	**1.02**	-0.10	-0.06	0.05	-0.03	0.06
Gini_2	0.47	0.20	0.14	0.02	-0.12	**1.21**	0.19	-0.23	0.88	0.53
IGE	-0.20	-0.27	-0.83	-0.19	-0.18	-0.05	**1.13**	-0.23	0.16	0.21
e_{low}	-0.07	-0.08	**-0.19**	-0.05	-0.01	0.00	0.02	-0.15	0.01	0.01
h Profile	0.08	-0.01	-0.14	-0.14	-0.17	0.03	0.07	-0.03	**0.37**	-0.23
Gini_6	0.04	0.03	0.06	0.02	-0.03	0.01	-0.06	0.00	0.14	**0.29**

- Sensitivity matrix "Λ" defined in Andrews, Gentzkow, and Shapiro (2017)
- Bold entries (row max): most sensitive parameter to moment changes
- Highlights identification and sensitivity of the model parameters

Preferences

Utility from child quantity and quality:

$$v(n, \mathbb{E}h_k, a_k) = \underbrace{\Psi(n)}_{\text{child discounting}} \cdot \underbrace{(\theta \cdot u(\mathbb{E}h_k) + \nu \cdot u(a_k))}_{\text{utility from child quality}}$$

$$\underbrace{\Psi(n) = 1 - \exp(-\psi n)}_{\text{increasing \& concave in } n} \qquad u(x) = \frac{x^{1-\gamma}}{1-\gamma} \qquad \gamma \in (0,1) \quad x \in \{\mathbb{E}h_k, a_k, c\}$$

- Results robust to dynastic altruism and separable preferences

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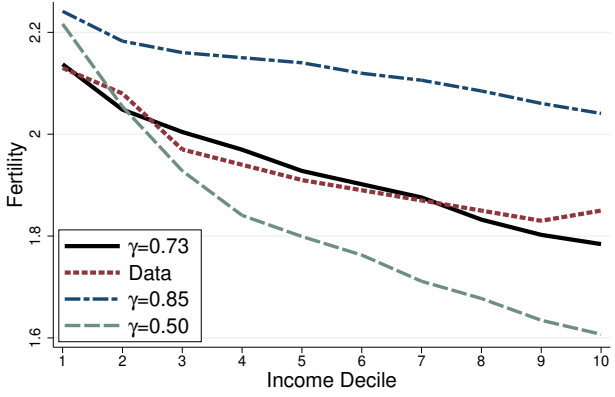
- Results robust to dynastic altruism and separable preferences
- $\{\psi, \theta, \nu\}$ matches aggregate fertility and average spendings on quality
- γ - elasticity of intergenerational substitution (EGS) (Córdoba and Ripoll 2019)
- Conditional on other parameters, **γ determines fertility elasticity**. Higher $\gamma \Longrightarrow$ smaller fertility responses, larger quality responses (c.f. Soares 2005) ► intuition
- High γ could reverse the quantity-quality trade-off in budget constraint

Identification of γ

- γ identified by **fertility-income profile** (Córdoba, Ripoll and Liu 2016). Higher $\gamma \Longrightarrow$ Higher MRS of quantity for quality $\Longrightarrow$ flatter profile



- Calibrated γ generates a realistic life-cycle profile of net worth

►net worth

Children's Human Capital Production Function

- **Children's human capital production function**:

$$h_k = \underbrace{Z}_{\text{scalar}} \cdot \underbrace{\epsilon}_{\text{shock}} \cdot \underbrace{h^{\rho}}_{\text{spillover}} \cdot \left(\underbrace{\mathcal{E}^{\xi}}_{\text{public education}} + \underbrace{e^{\xi}}_{\text{private input}} \right)^{\kappa/\xi}$$

$$\log(\epsilon) \sim \mathcal{N}\left(-\frac{\sigma_{\epsilon}^2}{2}, \sigma_{\epsilon}^2 \right)$$

- Highlight of parameters:
  - $\rho = 0.3$ - rank-rank mobility (Chetty, Hendren, Kline and Saez 2014)
  - $\mathcal{E} = 0.16$ - \$12k per pupil per year (NCES)
  - κ governs the elasticity of children's human capital to monetary investments. Calibrate $\boldsymbol{\kappa = 0.13}$ to match **RCT evidence** from García, Heckman, Leaf and Prados (2020)

► mobiltiy fit ► RCT

Validation

Does the model generate responses that match empirical estimates?

External validation using **Alaska Permanent Fund Dividends (APFD)**

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- Ideal setting to test fertility responses:
  1. Large in scale ($\approx$ \$1.5k per year) relative to other family policies
  2. Simple implementation that is not income- or work-tested
- Re-calibrate, then implement APFD in the model: universal basic income (UBI) to parents and children by \$1.5k

Difference-in-Differences Analysis

- CPS June Fertility Supplement 1982-2018, Alaskan women aged 40-55, divided into "not treated", "partially treated" ($T_1 = 1$), and "fully treated" ($T_2 = 1$)

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$$\text{fertility} = \beta_0 + \beta_1 T_1 + \boldsymbol{\beta_2} T_2 + \text{State FE} + \text{Year FE} + \epsilon$$

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- Regression results **confirm model predictions** on fertility effects:

	(1)	(2)	(3)	Model Predictions		
	Full Sample	Low Educ.	High Educ.	Average	Low Educ.	High Educ.
$\boldsymbol{\beta_2}$	**0.172*****	0.296***	0.105***	**0.16**	0.31	0.09
	(0.032)	(0.041)	(0.025)			
# Obs.	146,804	69,511	77,293			

► plot ► Australia ► Spain ► Russia

Counterfactual

Main Counterfactual

- Evaluate **baby bonuses $\mathcal{B}$** of different sizes:
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- Consider two (pragmatic) welfare measures in consumption equivalents:
  1. Long-run average welfare $\mathcal{W} = \int V_2 \, d\mu_2$ – expected utility of a newborn under the Rawlsian veil of ignorance
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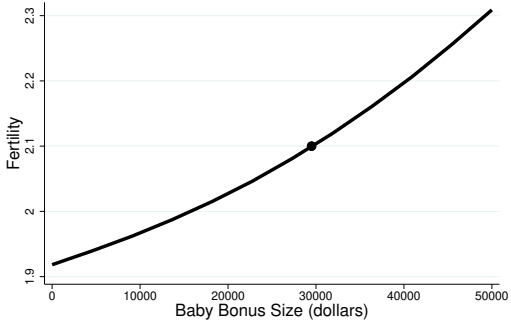
  2. Welfare of existing households and those born in transition
- Roadmap of results:
  - Long-run effects
  - Transition and distributional effects across generations
  - Policy comparisons: subsidized childcare $\mathcal{S}$ and public education $\mathcal{E}$

► role of gov.

Fertility Effects of Cash Rewards to Childbirth

Figure 1: Effects on aggregate fertility



- $\mathcal{B}$ =\$30k raises aggregate fertility rate to the replacement level
  - Similar to changes in the CTC from 2010 to 2021, including ARPA (in NPV)
  - 1.6% of GDP in the new equilibrium

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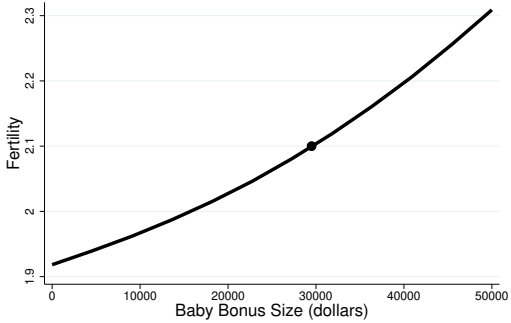
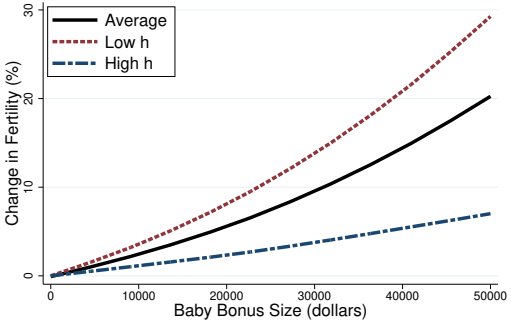


Figure 2: Heterogeneous fertility response



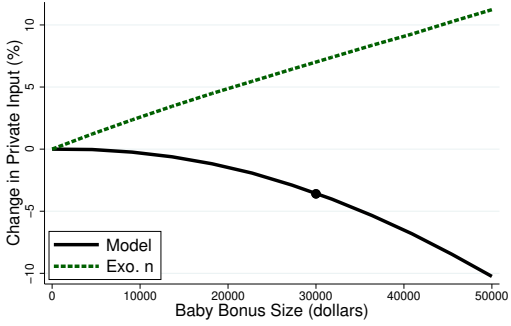
- $\mathcal{B}$ **=$30k** raises aggregate fertility rate to the replacement level
  - Similar to changes in the CTC from 2010 to 2021, including ARPA (in NPV)
  - 1.6% of GDP in the new equilibrium
- Parents with **lower human capital respond more in fertility** – larger proportional change in the shadow price of child ($e^*(h)$ and wh)

Key Results

1. **Fertility**: Raising aggregate fertility from 1.9 to 2.1 children per women (replacement fertility rate) requires a **$30,000** cash reward to childbirth, with larger effects among low-income parents

Effects on Private Input e and Average Human Capital

Figure 3: Average private input e



- Average private input (e) falls by 4% – **quantity-quality trade-off**

Effects on Private Input e and Average Human Capital

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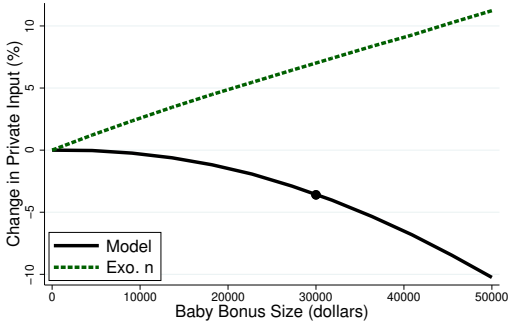
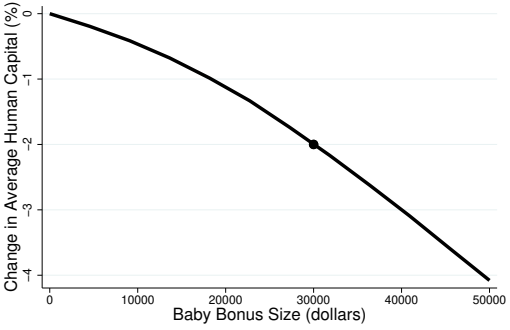


Figure 4: Average human capital

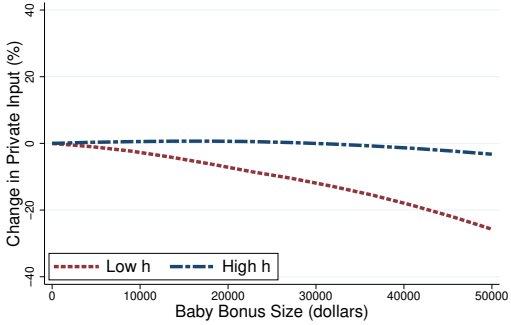


- Average private input (e) falls by 4% – **quantity-quality trade-off**
- Average human capital **falls by 2%** – **composition effects** and reduced e

► Australia

Average Human Capital and Intergenerational Mobility

Figure 5: Heterogeneous response in e



- Larger reductions in e among parents with low h as their n increases more

Average Human Capital and Intergenerational Mobility

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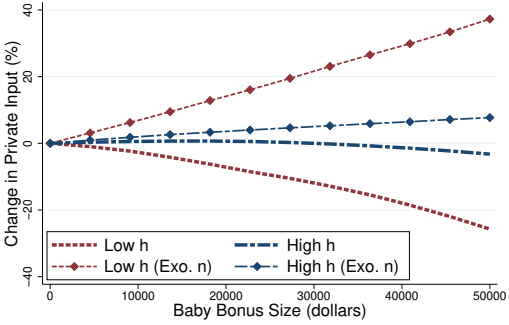

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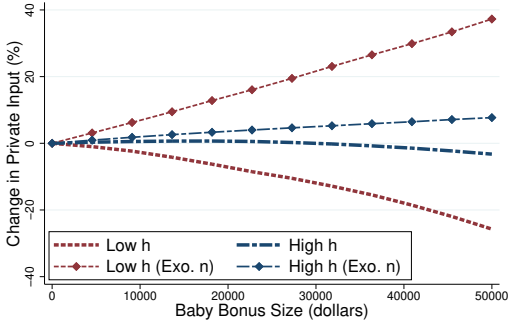
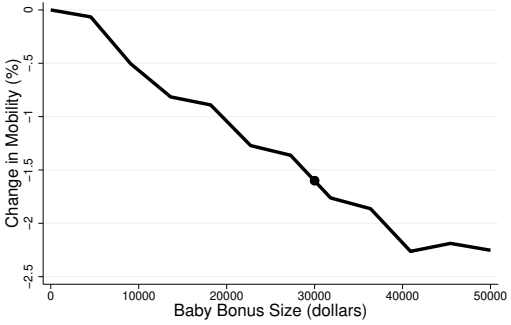


Figure 6: Intergenerational mobility



- Larger reductions in e among parents with low h as their n increases more
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Average Human Capital and Intergenerational Mobility

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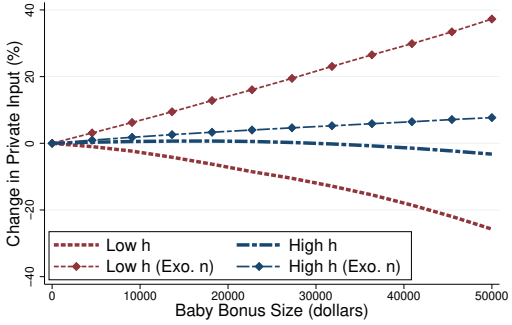

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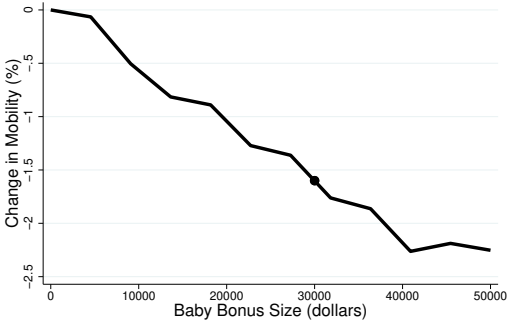


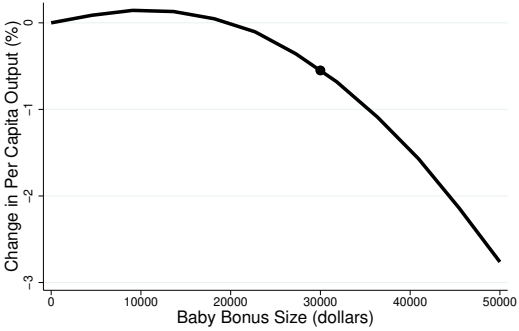
- Larger reductions in e among parents with low h as their n increases more
- Intergenerational mobility **decreases by 1.8%**
- Results will be **stronger** when baby bonus is targeted at low-income households

Key Results

1. **Fertility**: Raising aggregate fertility from 1.9 to 2.1 children per women (replacement fertility rate) requires a **$30,000** cash reward to childbirth, with larger effects among low-income parents
2. **Outcome and Mobility**: This policy **lowers** both average child human capital and intergenerational income mobility by 2% due to quantity-quality trade-off and composition effects

Output and Tax

Figure 7: Per capita output



- Per capita output **falls by 0.6%**

► age structure

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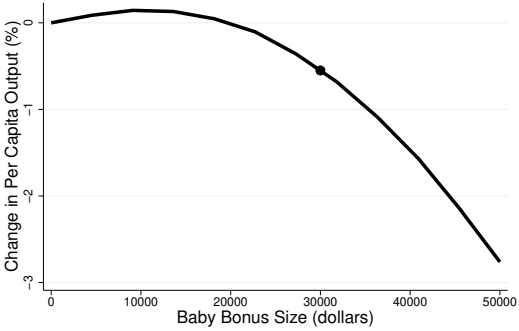
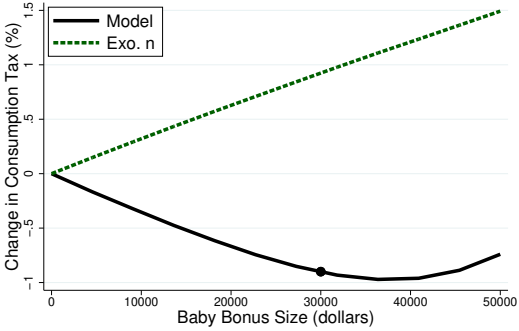


Figure 8: Change in consumption tax

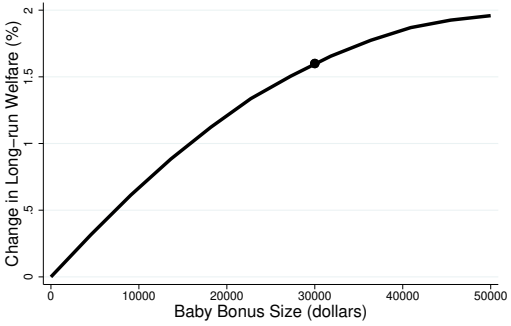


- Per capita output **falls by 0.6%**
- **Demographic structure effects**: consumption taxes **reduces by 0.9%**

► age structure

Welfare Effects

Figure 9: Change in welfare



- Long-run welfare $\mathcal{W}$ **rises by 1.6% (c.e.)**, more than half due to lower τ_c (0.9%)

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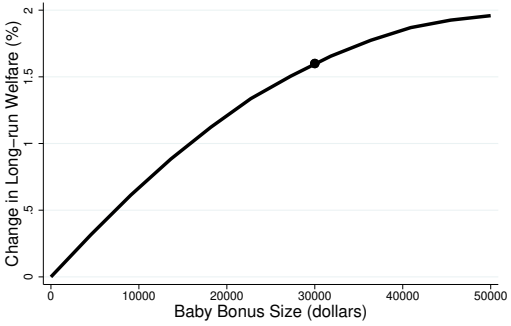

- Long-run welfare $\mathcal{W}$ **rises by 1.6% (c.e.)**, more than half due to lower τ_c (0.9%)
- Observation: "worse" human capital distribution μ is **neither necessary nor sufficient** for better policies - also need to consider age distribution ω

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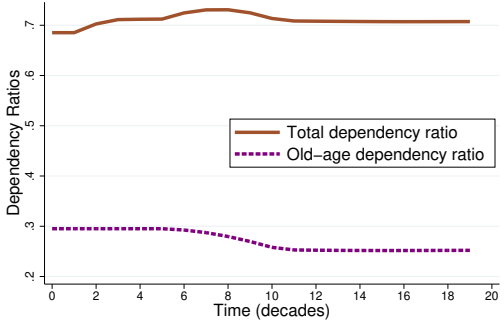
3. **Long-Run Welfare**: Average welfare **rises by 1.6% (c.e.)** in the long-run as taxes fall by 0.9% as old-age dependency ratio drops

Transition Path of $\mathcal{B} = \$30,000$ - Replacement Fertility

Figure 10: Change in dependency ratios



- Higher child-related government expenditures **in the first few decades** beyond the direct policy costs ($\mathcal{E}$ and $\mathcal{T}(n, \cdot)$)

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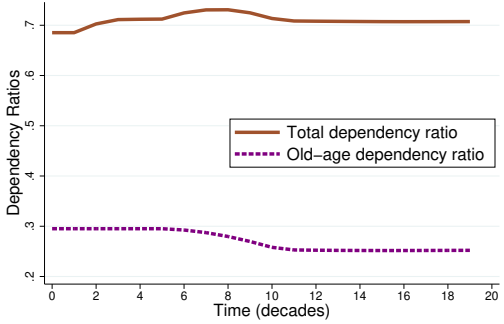
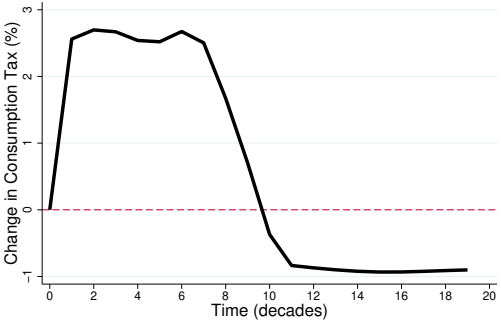


Figure 11: Change in consumption tax



- Higher child-related government expenditures **in the first few decades** beyond the direct policy costs ($\mathcal{E}$ and $\mathcal{T}(n, \cdot)$)
- With τ_c changing to balance the budget, welfare effects for: ► plot
  - Newborns in transition – positive but smaller than 1.6% (c.e.)
  - Existing baby bonus recipients (15% of voters): +1.4% (c.e.), existing non-recipients (85% of voters): -2.4% (c.e.)

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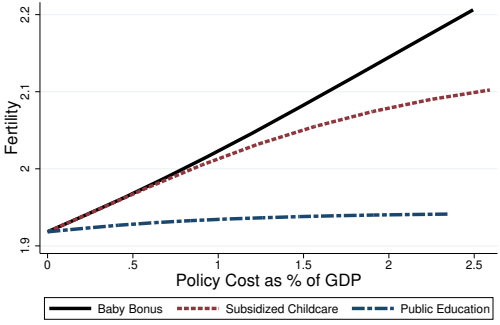
3. **Long-Run Welfare**: Average welfare **rises by 1.6% (c.e.)** in the long-run as taxes fall by 0.9% as old-age dependency ratio drops
4. **Transition**: The government needs to finance higher child-related expenditures in transition, which may hurt existing households' welfare

Highlights of Policy Comparisons

Figure 12: Effects on Fertility



- $\mathcal{S}$ and $\mathcal{E}$ are **less cost-effective in raising fertility** (c.f. Luci-Greulich and Thévenon 2013)
- Higher $\mathcal{E} \Rightarrow$ children are more desirable and parents are more educated in the long-run

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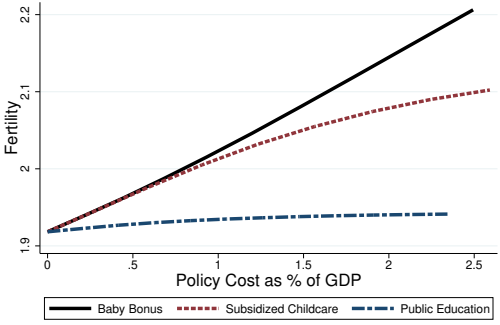
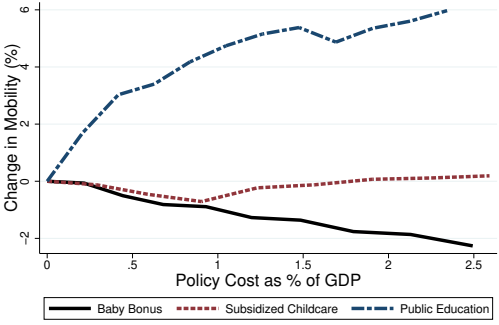


Figure 13: Effects on Mobility



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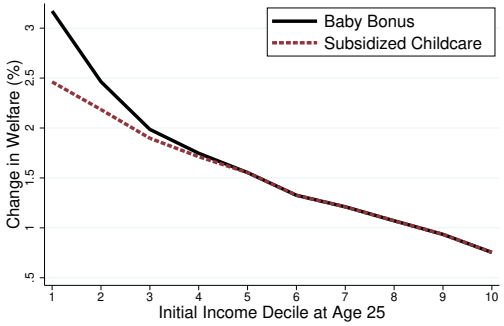
- Higher $\mathcal{E} \Rightarrow$ children are more desirable and parents are more educated in the long-run
- $\mathcal{E}$ is **most effective in improving mobility**. Additional $\mathcal{E} = \$10,000$ in net present value amends the negative mobility effects of $\mathcal{B} = \$30,000$

Baby Bonus versus Subsidized Childcare

Figure 14: Effects on Welfare



- Low-income households prefers cash transfers of the same face value

Baby Bonus versus Subsidized Childcare

Figure 14: Effects on Welfare

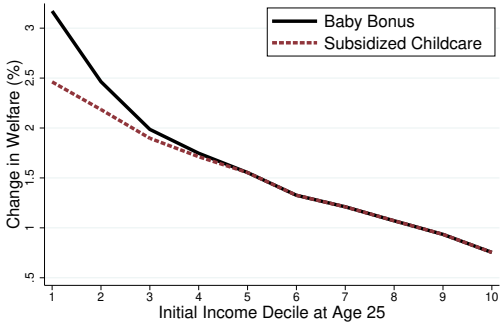
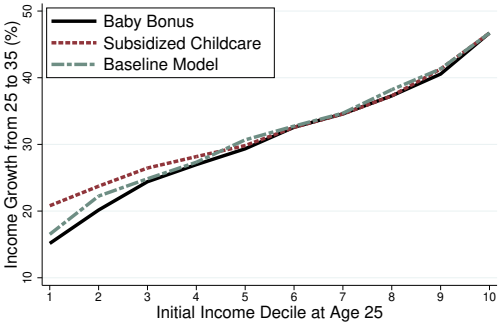


Figure 15: Effects on Income Growth



- Low-income households prefers cash transfers of the same face value
- Subsidized childcare reduces inequality in income growth

Key Results

1. **Fertility**: Raising aggregate fertility from 1.9 to 2.1 children per women (replacement fertility rate) requires a **$30,000** cash reward to childbirth, with larger effects among low-income parents
2. **Outcome and Mobility**: This policy **lowers** both average child human capital and intergenerational income mobility by 2% due to quantity-quality trade-off and composition effects
3. **Long-Run Welfare**: Average welfare **rises by 1.6% (c.e.)** in the long-run as taxes fall by 0.9% as old-age dependency ratio drops
4. **Transition**: The government needs to finance higher child-related expenditures in transition, which may hurt existing households' welfare
5. **Policy Comparison**: Subsidized childcare and public education are less cost-effective in raising fertility than cash benefits, but boosts children's outcomes and mobility

Future Work

1. Alternative policies:
   - Joint usage of several policy instruments
   - Dependency on income, work, or expenditures
   - Gradual introduction of policies over time
2. Alternative ways of funding the policies:
   - Capital and labor taxes – implications for distortions and redistribution across households
   - Government deficits – implications for redistribution across generations
3. Alternative sources of inefficiencies of fertility choices:
   - Ideas creation (Jones, 2020)
   - Pollution (Bohn and Stuart, 2015)
   - Firm dynamics (Hopenhayn et al., 2018)
4. Endogenize childcare price – supply and demand of caregivers

Conclusion

What I do:

- Develop a quantitative GE-OLG model to study the macroeconomic consequences of family policies
- Calibrate the model to match U.S. data and validate using empirical evidence
- Flexible framework that can be used in many other contexts

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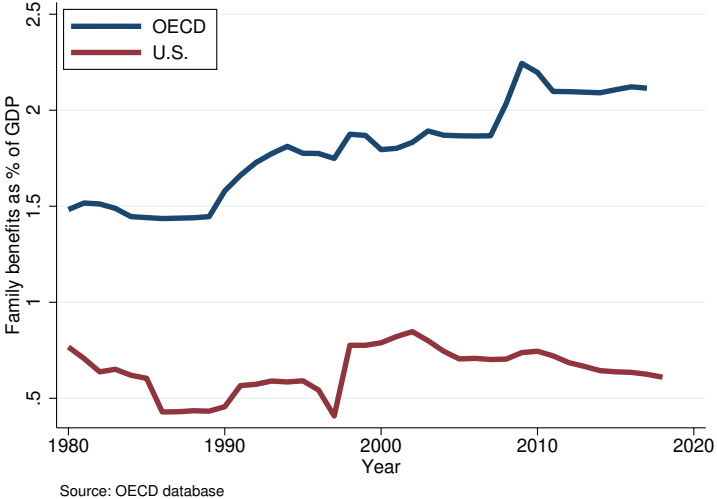
What I find:

1. **$30k** cash benefit at birth raises fertility to the replacement level, but **reduces** average human capital and social mobility by 2%
2. Long-run welfare **rises by 1.6%**, largely due to demographic structure changes
3. Government needs to finance higher child-related expenditures in transition
4. In-kind policies have smaller fertility effects, but offer other advantages

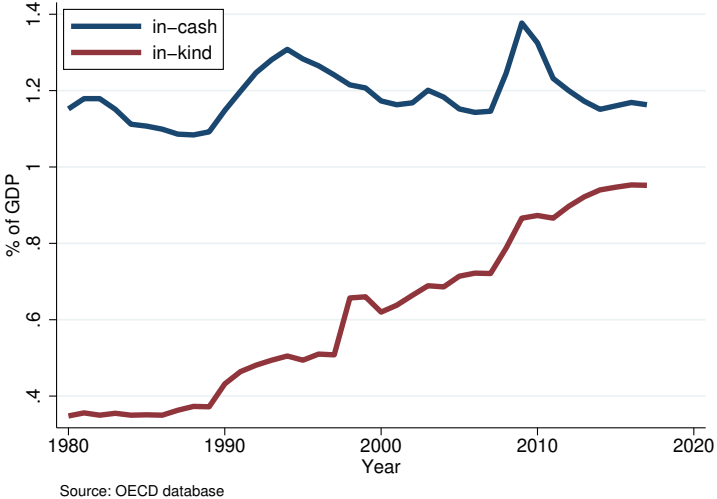
Time Trend of Public Expenditures on Child Benefits



Source: OECD database

► back to intro

Expenditure Breakdown



Source: OECD database

► back to intro

Working Without Children and Retirement

- For households working without children, $j \in \{4, 5, 6\}$:

$$V_j(h, a) = \max_{c, a' \geq 0} \quad u(c/\Lambda(0)) + \beta\delta_j \mathbb{E} V_{j+1}(h', a')$$

$$(1 + \tau_c)c + a' = (1 + r)a + y - \mathcal{T}(y, a, 0)$$

$$h' = L_j(h, 1, z)$$

- For retired households, $j \in \{7, 8\}$:

$$V_j(h, a) = \max_{c, a' \geq 0} u(c/\Lambda(0)) + \beta\delta_j V_{j+1}(h, a')$$

$$(1 + \tau_c)c + a' = (1 + r)a + \pi \cdot wh - \mathcal{T}(0, a, 0)$$

$$V_9(\cdot) \equiv 0$$

where π is pension replacement rate

► back to transfer

Stationary Equilibrium

- Invariant distribution: Demographic structure $\{\omega_j\}_{j=0}^{8}$ and distribution of agents over states $\{\mu_j\}_{j=0}^{8}$ are invariant over time periods
- Households optimize utility and firms maximize profits
- Prices clear markets
- Government balances budget in period to period
- Externalities/incompleteness that government could address:
  1. **Fiscal externalities of childbearing and childrearing**
     - Private returns $\neq$ social returns (i.e. $\{\omega_j\}_{j=0}^{8}$ and $\{\mu_j\}_{j=0}^{8}$)
  2. **Borrowing constraints** (Daruich 2019, Abbott et al. 2019 . . .)

► back to eqm. ► back to counterfactual

Endogenous Childcare Arrangements

- Standard models where a child costs fixed amount of time, total income y:

$$y = wh\underbrace{(1 - \underbrace{(\chi - \mathcal{S})}_{\text{time cost}} \cdot n)}_{\text{labor supply}} + n \cdot \mathcal{B}$$

  which implies $\mathcal{S}$ is equivalent to a baby bonus $\frac{\mathcal{B}}{wh}$

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  - Subsidized childcare: labor supply $\uparrow$ market care enrollment $\uparrow$ (Baker et al. 2008)
  - Baby bonus: labor supply $\downarrow$ market care enrollment $\downarrow$ (González 2013)

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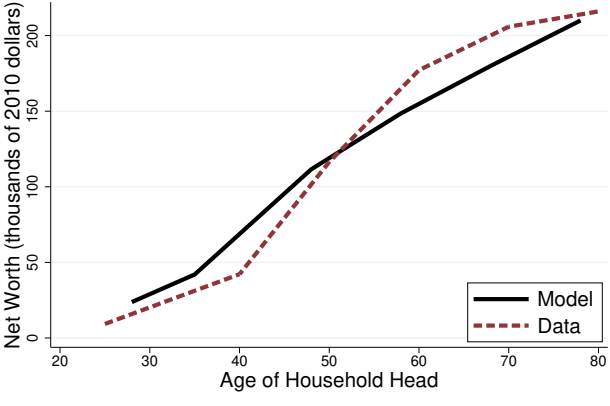
- **Endogenous childcare arrangements**: (in-kind) subsidized childcare induces more labor supply from parents with $m^*(h, a) \leq \mathcal{S}$

- Affects inequalities in wage growth since $h_{j+1} = L_j(\cdot, t_w)$

► back to model ► back to result

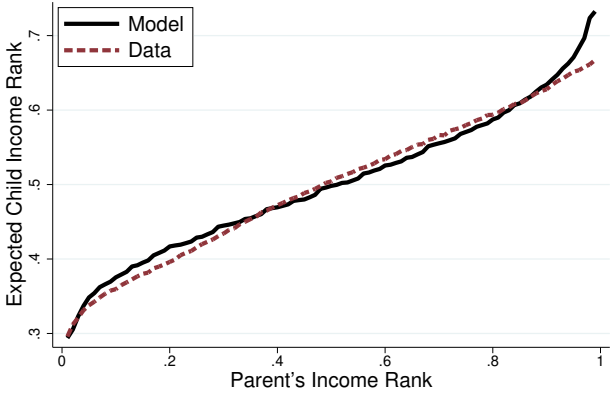
Net Worth by Age: Model and Data



- Net worth by age of household head from SCF summary tables

►back

Intergenerational Mobility: Model vs Data



- Rank-rank slope = 0.34 (Chetty, Hendren, Kline and Saez 2014)

► back

Child's Skill Production Function Cont'd

Use **RCT evidence** to estimate the productivity of inputs κ:

$$h_k = Z \cdot \epsilon \cdot h^{\rho} \left(\mathcal{E}^{\xi} + e^{\xi} \right)^{\kappa/\xi}$$

- García, Heckman, Leaf and Prados (2020)
  - Two US early childhood development programs (ABC, CARE) in 1970s
  - Cost $\approx$ \$13.5k per year for five years - total \$67.5k per child
  - Followed up into adulthood and observe education/income
  - For every dollar invested, children's lifetime labor income increases by **\$1.3**
- Apply similar policy in the model: expand existing $\mathcal{E}$ by \$67.5k
  - **Small scale**: prices and taxes remain unchanged
  - **Target**: children of parents at 10th percentile of earnings
- Comparing labor income changes with program costs gives $\kappa = 0.13$

► back

Costs of Child and Childcare

- OECD equivalence scale:

$$\Lambda(n) = 1.7 + 0.5 \cdot n$$

- **Childcare arrangements**:

$$n \cdot \chi = \left(t_h^{\upsilon/\iota} + (n \cdot m)^{\upsilon} \right)^{1/\upsilon}$$

  Set $\chi = 0.18$ (Folbre 2008). Returns to scale within family calibrated to be $\iota = 0.7$

- Elasticity of substitution: $\upsilon = 0.38$ - average share of income spent on childcare by education (SIPP) (Herbst 2018)

- **Price of full-time childcare**: $p_m = \$6,860$ per year for child aged 0-10 (The National Association of Child Care Resource & Referral Agencies 2011)

► back

Fertility Response

- Consider simplified problem for low-h parents, i.e. quality margin not operative

$$\max_{c,n} \quad u(c) + \Psi(n)u(\mathcal{E})$$

$$c + n \cdot \chi = 1$$

- First-order condition for n:

$$\underbrace{\Psi'(n) \cdot u(\mathcal{E})}_{\text{MB of } n} = \underbrace{\lambda \cdot \chi}_{\text{MC of } n}$$

- Plug in $u(c) = \frac{c^{1-\gamma}}{1-\gamma}$, we have

$$\Psi'(n) = (1-\gamma) \cdot \chi \cdot \frac{\lambda}{\mathcal{E}^{1-\gamma}} \Longrightarrow \boldsymbol{\Delta\Psi'(n) \propto (1-\gamma) \cdot \Delta\chi}$$

Conditional on other parameters, higher $\gamma \Longrightarrow$ smaller n response

► back

Skill Evolution for Adults

- **Human capital of working adults** evolves:

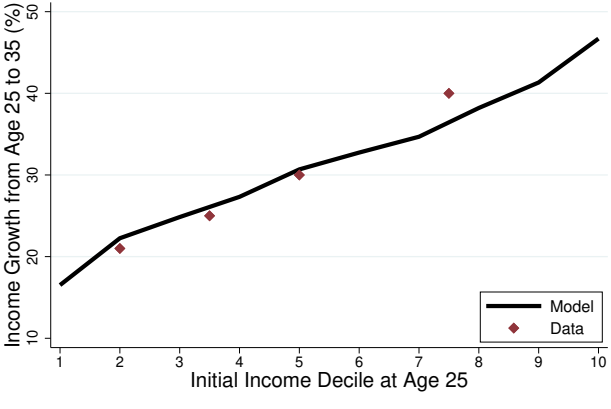
$$h_{j+1} = L_j(h_j, t_w, z') = \exp(z')\left[h_j + \zeta_j(h_j \cdot t_w)^{\eta}\right]$$

$$\log(z) \sim \mathcal{N}(\mu_z, \sigma_z)$$

- $\{\zeta_j\}_{j=2}^{5}$ - age-earnings profile (CPS)
- $\eta = 1.22$ - inequality in wage growth (CPS)
- $\mu_z = -0.23$ - 2% skill depreciation
- $\sigma_z = 0.38$ - life-cycle Gini coefficient of earnings (Huggett, Ventura and Yaron 2011)

► fit ► back

Inequality in Wage Growth: Model vs Data



- Growth rate of average income from age 25 to 35 by education in CPS-ASEC data (2008-2014)

► back

Other Parameters

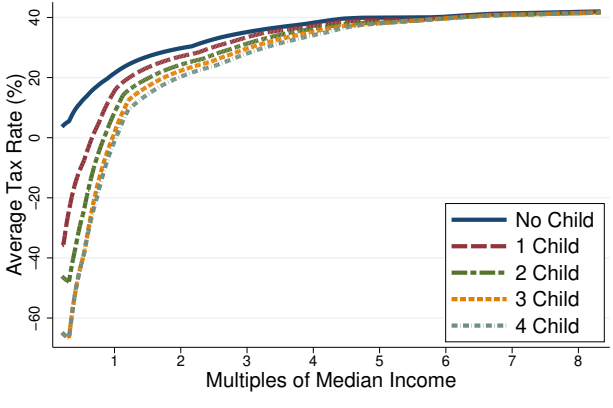
- **Firms' production function**: capital share $\alpha = 0.33$ and 4% capital depreciation
- **Government taxes**
  - **Income taxes**:

$$\mathcal{T}(y, a, n) = y \cdot (1 - \tau_y^n y^{-\lambda_y^n}) + \tau_a r a$$

    where $\{\tau_y^n, \lambda_y^n\}_{n=0}^6$ estimated using TAXSIM
  - **Tax rates** from McDaniel (2014): $\tau_c = 0.07$ and $\tau_a = 0.27$
  - **Pension replacement rate**: $\pi = 40\%$

► tax ► back

Income Taxes: Model vs Data



- Child tax benefits (reduction in tax rates) are larger for low-income households

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APFD and Completed Fertility Rate

Figure 16: Completed Fertility Rate (CFR)

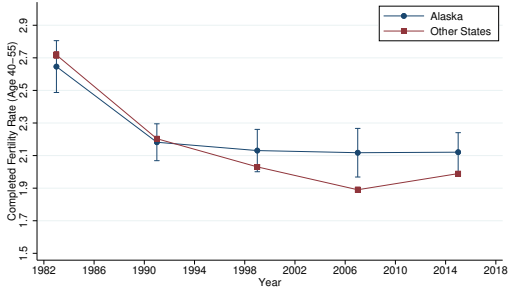
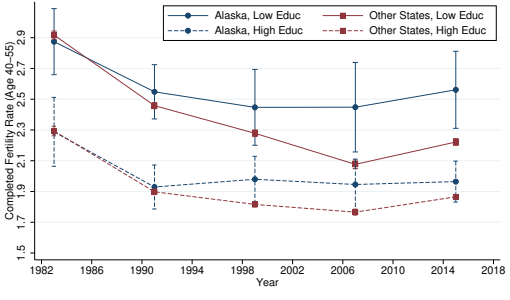


Figure 17: CFR by Education



► back to validation

Australian Baby Bonus

- **A$3,000 baby bonus**[1] to every child born on or after July 1st 2004
- Risse (2010) and Drago et al. (2011) find:
  - Significant fertility responses and evidence for long-term/quantum effects
  - Baby bonus needed for additional birth around A$126,000 $\approx 4\times$GDPPC
  - Larger fertility responses from low-income households
- Gaitz and Schurer (2017) finds that the baby bonus was **ineffective** in boosting learning, socio-emotional or physical health outcomes of pre-school children

[1] More details: (1) Announced on Mar 12th 2004, (2) universal coverage, lump-sum payment, (3) Equivalent to 4 times average weekly earnings, (4) Equivalent to $2,800 in 2010 USD.

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- Results from baby bonus counterfactual are consistent with above findings:
  - Significant fertility effects that are larger among low-income households
  - Baby bonus needed for additional birth = **3.5×GDPPC**

► back to validation ► back to results

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Spanish Baby Bonus

- **€$2,500 baby bonus**[2] to every child born on or after July 1st 2007
- González (2013) finds:
  - Total fertility rate increased
  - Mothers reduced labor supply
  - Fewer children were enrolled in formal childcare

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  - Mothers reduced labor supply
  - Fewer children were enrolled in formal childcare
- Results from model are consistent with above findings:
  - Baby bonus needed for additional birth / GDPPC = **3.6 (data) vs 3.5 (model)**
  - Parents reduce labor supply as fertility raises → more childcare needs
  - Parents demand less market care as relative costs of home care falls due to economies of scale in home production of childcare

► back to validation

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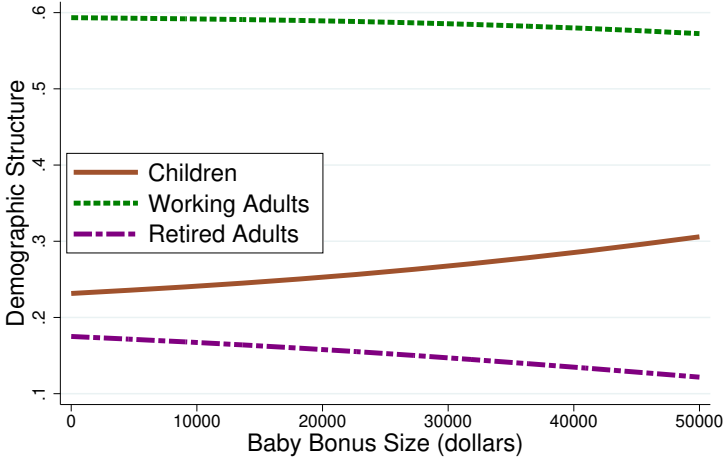
Russian Maternal Capital

- Large-scale cash subsidy for childbirth in Russia
- First wave in 2007 (federal Maternal Capital): approximately $10,000 U.S. dollars (10-year of minimum wage)
- Second wave in 2011 (regional Maternal Capital): additional payments that differ in size
- Sorvachev and Yakovlev (2020) find:
  - Fertility increases both in the short-run and in the long-run
  - Costs for additional birth / GDPPC = **3.5 (data) vs 3.5 (model)**
  - Larger fertility responses from mothers with low education

► back to validation

Change in Demographic Structure



► back to results

Distributional Welfare Consequences

Figure 18: Newborns in Transition

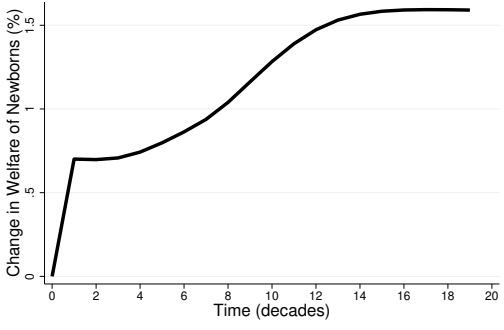
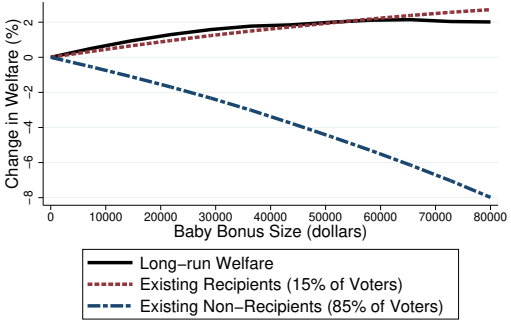


Figure 19: Long-run and Existing Households



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