The Macroeconomic Consequences of Family Policies

Anson Linshuo Zhou
University of Wisconsin-Madison

May 6, 2021

Motivation: Dual Role of Family Policies

Encouraging Childbirth to Combat Population Aging

- Key policy instrument to combat population aging via encouraging childbirth. Prevalent in OECD countries with low fertility (**>2% of GDP**) ► trend ► example

Motivation: Dual Role of Family Policies

Encouraging Childbirth to Combat Population Aging

- Key policy instrument to combat population aging via encouraging childbirth. Prevalent in OECD countries with low fertility (**>2% of GDP**) ► trend ► example
- Evaluate cost-effectiveness and aggregate impacts on population growth, government budget and welfare

Motivation: Dual Role of Family Policies

Encouraging Childbirth to Combat Population Aging

- Key policy instrument to combat population aging via encouraging childbirth. Prevalent in OECD countries with low fertility (**>2% of GDP**) ► trend ► example
- Evaluate cost-effectiveness and aggregate impacts on population growth, government budget and welfare

Boosting Child Outcomes and Social Mobility

- Policy instrument to reduce child poverty, raise children's human capital and boost social mobility (e.g. **$3k+ Child Tax Credit through 2025**, **$1.8 trillion American Families Plan**)

Motivation: Dual Role of Family Policies

Encouraging Childbirth to Combat Population Aging

- Key policy instrument to combat population aging via encouraging childbirth. Prevalent in OECD countries with low fertility (**>2% of GDP**) ► trend ► example
- Evaluate cost-effectiveness and aggregate impacts on population growth, government budget and welfare

Boosting Child Outcomes and Social Mobility

- Policy instrument to reduce child poverty, raise children's human capital and boost social mobility (e.g. **$3k+ Child Tax Credit through 2025**, **$1.8 trillion American Families Plan**)
- Understand whether more generous child benefits are effective policies in achieving stated policy goals

This Paper

What are the macroeconomic consequences of large-scale family policies?

- Suppose the government gives parents a baby bonus
  1. Will it improve children's outcomes and boost social mobility?
  2. How will it affect population growth, output and social welfare?

This Paper

What are the macroeconomic consequences of large-scale family policies?

- Suppose the government gives parents a baby bonus
  1. Will it improve children's outcomes and boost social mobility?
  2. How will it affect population growth, output and social welfare?

- A quantitative GE-OLG model:

$$\textbf{Endogeneous Fertility} \quad + \quad \underbrace{\textbf{Endogenous Intergenerational Linkages}}_{\text{human capital formation + inter-vivos transfers}}$$

This Paper

What are the macroeconomic consequences of large-scale family policies?

- Suppose the government gives parents a baby bonus
  1. Will it improve children's outcomes and boost social mobility?
  2. How will it affect population growth, output and social welfare?

- A quantitative GE-OLG model:

$$\textbf{Endogeneous Fertility} \quad + \quad \underbrace{\textbf{Endogenous Intergenerational Linkages}}_{\text{human capital formation + inter-vivos transfers}}$$

- Family policies affect decisions along both **quality** and **quantity** margins

Overview of Mechanism

- Compared with previous paper that only focused on the quality margin for existing child, **endogenous fertility** incorporates:
  1. **Quality/quantity trade-off**: higher quantity raises the marginal cost of quality, i.e. policies that boost fertility could reduce quality (Becker and Lewis 1973)

Overview of Mechanism

- Compared with previous paper that only focused on the quality margin for existing child, **endogenous fertility** incorporates:
  1. **Quality/quantity trade-off**: higher quantity raises the marginal cost of quality, i.e. policies that boost fertility could reduce quality (Becker and Lewis 1973)
  2. **Composition effects** due to increasing representation of more responsive dynasties

Overview of Mechanism

- Compared with previous paper that only focused on the quality margin for existing child, **endogenous fertility** incorporates:
  1. **Quality/quantity trade-off**: higher quantity raises the marginal cost of quality, i.e. policies that boost fertility could reduce quality (Becker and Lewis 1973)
  2. **Composition effects** due to increasing representation of more responsive dynasties
  3. **General equilibrium effects** on taxes due to changes in population growth

Overview of Mechanism

- Compared with previous paper that only focused on the quality margin for existing child, **endogenous fertility** incorporates:
  1. **Quality/quantity trade-off**: higher quantity raises the marginal cost of quality, i.e. policies that boost fertility could reduce quality (Becker and Lewis 1973)
  2. **Composition effects** due to increasing representation of more responsive dynasties
  3. **General equilibrium effects** on taxes due to changes in population growth
- **Magnitude of fertility responses** disciplined using data moments

Overview of Mechanism

- Compared with previous paper that only focused on the quality margin for existing child, **endogenous fertility** incorporates:
  1. **Quality/quantity trade-off**: higher quantity raises the marginal cost of quality, i.e. policies that boost fertility could reduce quality (Becker and Lewis 1973)
  2. **Composition effects** due to increasing representation of more responsive dynasties
  3. **General equilibrium effects** on taxes due to changes in population growth
- **Magnitude of fertility responses** disciplined using data moments
- Validation using policy variation - Alaska Permanent Fund Dividend

Preview of Key Results

Consider a $30k baby bonus:

(1) $\approx$ expansion of CTC from 2010-2021 in NPV

(2) offsets the average cost of raising one child by 17% (USDA)

Preview of Key Results

Consider a $30k baby bonus:

(1) $\approx$ expansion of CTC from 2010-2021 in NPV

(2) offsets the average cost of raising one child by 17% (USDA)

1. Parents increase fertility by 10% (1.9$\rightarrow$2.1) and **reduce** private education investments by 7.5%

Preview of Key Results

Consider a $30k baby bonus:

(1) $\approx$ expansion of CTC from 2010-2021 in NPV

(2) offsets the average cost of raising one child by 17% (USDA)

1. Parents increase fertility by 10% (1.9$\rightarrow$2.1) and **reduce** private education investments by 7.5%
2. Average human capital falls by 1.4%. Social mobility falls by 2.2%

Preview of Key Results

Consider a $30k baby bonus:

(1) $\approx$ expansion of CTC from 2010-2021 in NPV

(2) offsets the average cost of raising one child by 17% (USDA)

1. Parents increase fertility by 10% (1.9$\rightarrow$2.1) and **reduce** private education investments by 7.5%
2. Average human capital falls by 1.4%. Social mobility falls by 2.2%
3. Long-run welfare **rises by 3.2%** as changes in population growth lead to reduced old-age dependency ratio and tax rates in equilibrium

Preview of Key Results

Consider a $30k baby bonus:

(1) $\approx$ expansion of CTC from 2010-2021 in NPV

(2) offsets the average cost of raising one child by 17% (USDA)

1. Parents increase fertility by 10% (1.9$\rightarrow$2.1) and **reduce** private education investments by 7.5%
2. Average human capital falls by 1.4%. Social mobility falls by 2.2%
3. Long-run welfare **rises by 3.2%** as changes in population growth lead to reduced old-age dependency ratio and tax rates in equilibrium

- Comparing different policies, expanding **public education** is most effective in improving child outcomes and social mobility with mild effects on fertility

Related Literature

Education Policies, Income transfers, and Mobility

- Benabou (2002), **de la Croix and Doepke (2003)**, Heckman and Mosso (2014), Bastian and Michelmore (2018), **Daruich (2019)**, Abbott, Gallipoli, Meghir and Violante (2019), Mullins (2019), **Guner, Kaygusuz and Ventura (2020)**...
- **Contribution: Considering fertility responses could reverse policy effects on child human capital and social mobility**

Family Policies, Fertility and Child Outcomes

- **Empirical:** Milligan (2005), Laroque and Salanié (2008), Drago et al. (2011), Luci-Greulich and Thévenon (2013), González (2013), Raute (2019)...
- **Structural:** Fan and Stark (2008), Liao (2013), Moschini (2020)
- **Contribution: Propose and calibrate a quantitative model that is suitable for analyzing large-scale policies beyond fertility effects**

Outline

1. **Model: Role of endogenous fertility**
2. **Calibration (2010 USA)**
3. **Validation**
4. **Policy Counterfactuals**
5. **Conclusion and Next Steps**

Model

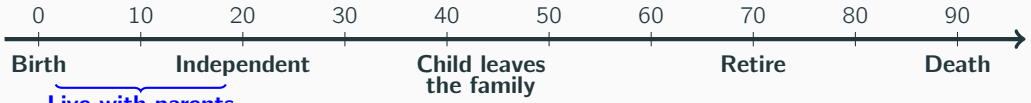
Quantitative Model: Timeline

- Model Period = 10 Years

Key Elements

- Endogenous Fertility
- Endogenous Child Link

Quantitative Model: Timeline



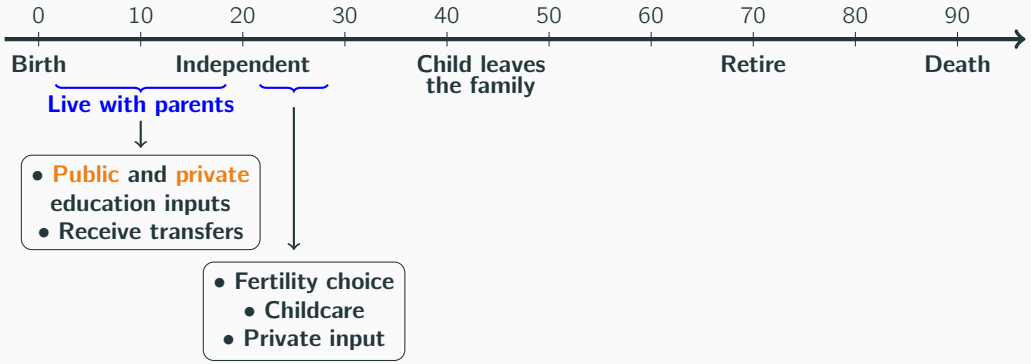
- Public and private education inputs
- Receive transfers

- Model Period = 10 Years

Key Elements

- Endogenous Fertility
- Endogenous Child Link

Quantitative Model: Timeline

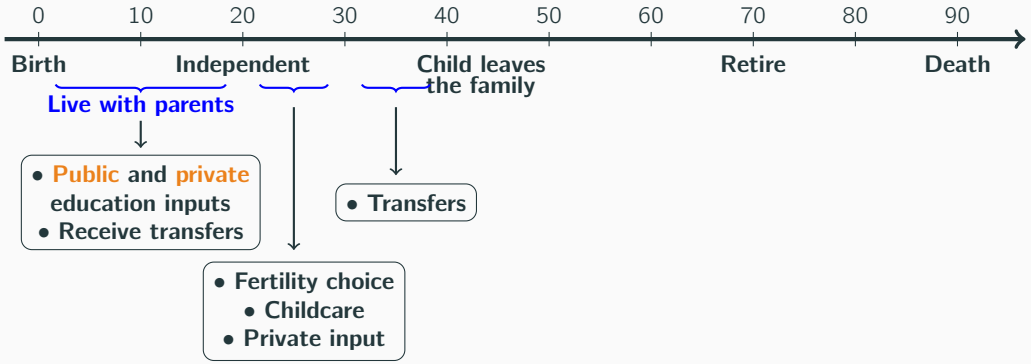


- Model Period = 10 Years

Key Elements

- Endogenous Fertility
- Endogenous Child Link

Quantitative Model: Timeline

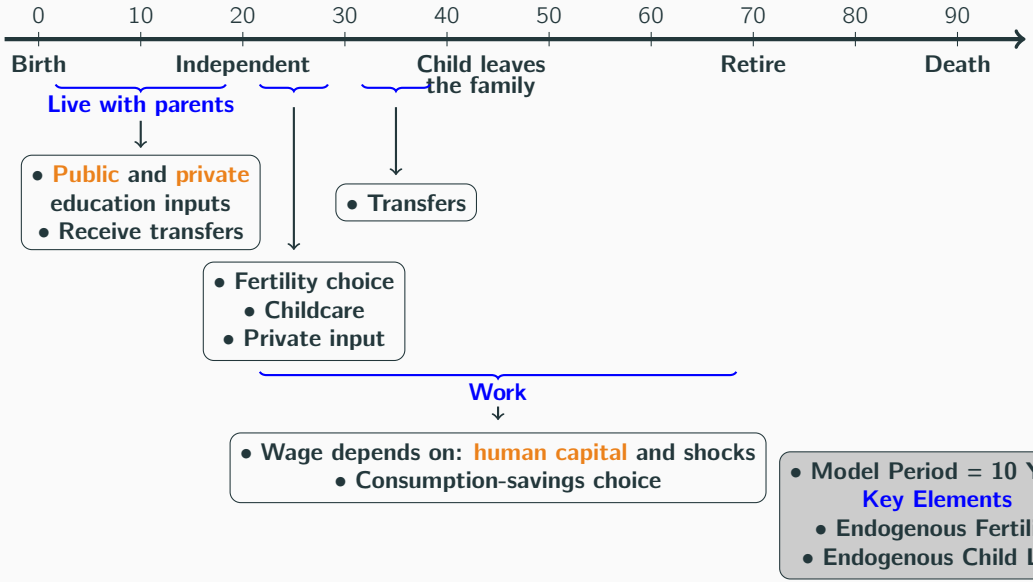


- Model Period = 10 Years

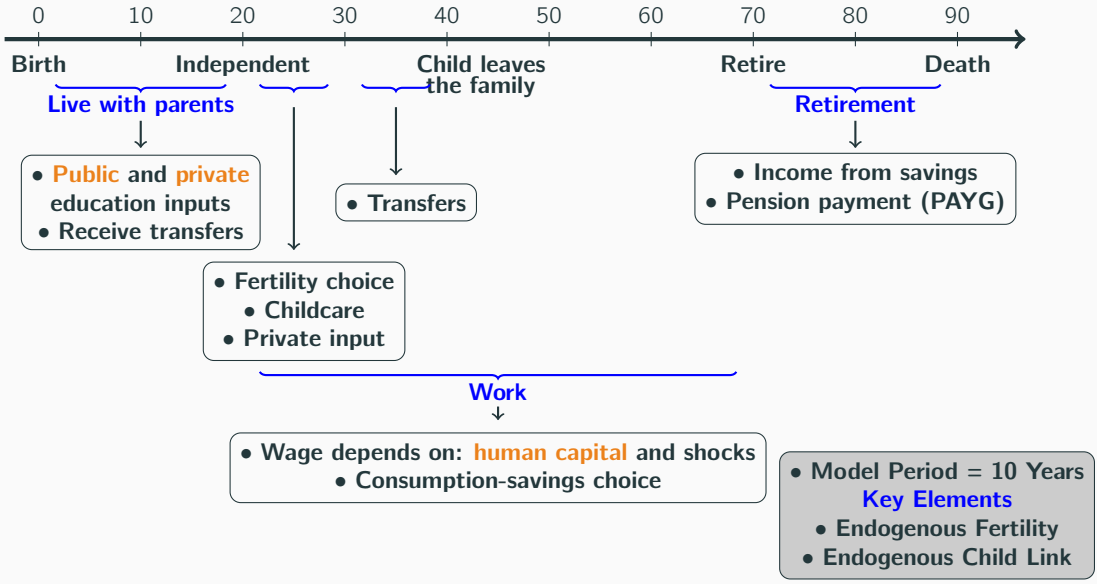
Key Elements

- Endogenous Fertility
- Endogenous Child Link

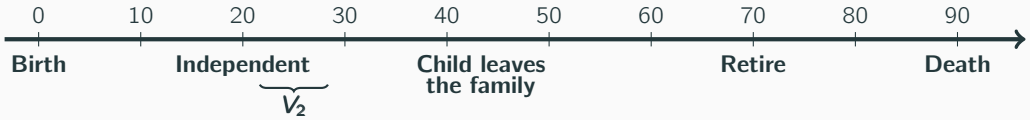
Quantitative Model: Timeline



Quantitative Model: Timeline



Fertility, Childcare and Skill Formation

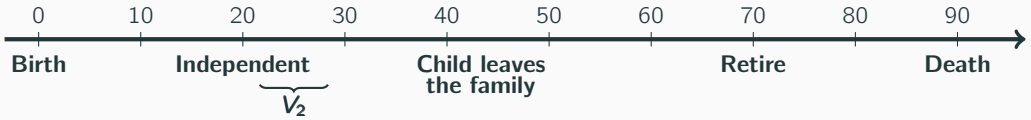


$$V_2(h,a) = \max_{c,a',n,t_h,m,e \geq 0} u(c/q(n)) + \beta \mathbb{E} V_3(h', a', n, \mathbb{E}h_k)$$

---

h : parents' skills	a : assets	n : fertility
t_h : home care	m : market care	e : private educ. input
χ : childcare needs	p_m : market care price	$q(n)$: equivalence scale
$\mathcal{S}$: childcare subsidy	$\mathcal{B}$: baby bonus	$\mathcal{E}$: public education

Fertility, Childcare and Skill Formation



$$V_2(h,a) = \max_{c,a',n,t_h,m,e\geq 0} u(c/q(n)) + \beta \mathbb{E} V_3(h', a', n, \mathbb{E}h_k)$$

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

---

h : parents' skills	a : assets	n : fertility
t_h : home care	m : market care	e : private educ. input
χ : childcare needs	p_m : market care price	$q(n)$: equivalence scale
$\mathcal{S}$: childcare subsidy	$\mathcal{B}$: baby bonus	$\mathcal{E}$: public education

Fertility, Childcare and Skill Formation

$$V_2(h,a) = \max_{c,a',n,t_h,m,e\geq 0} u(c/q(n)) + \beta \mathbb{E} V_3(h', a', n, \mathbb{E}h_k)$$

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

$$y = wh \cdot (1 - t_h) \quad \textbf{[labor income]}$$

---

h : parents' skills	a : assets	n : fertility
t_h : home care	m : market care	e : private educ. input
χ : childcare needs	p_m : market care price	$q(n)$: equivalence scale
$\mathcal{S}$: childcare subsidy	$\mathcal{B}$: baby bonus	$\mathcal{E}$: public education

Fertility, Childcare and Skill Formation

$$V_2(h,a) = \max_{c,a',n,t_h,m,e\geq 0} u(c/q(n)) + \beta \mathbb{E} V_3(h', a', n, \mathbb{E}h_k)$$

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

$$y = wh \cdot (1 - t_h) \quad \textbf{[labor income]}$$

$$(1+\tau_c)(c + mp_m(1-\mathcal{S})n + e \cdot n) + a' = (1+r)a + y - \mathcal{T}(y,a,n) + \mathcal{B} \cdot n \quad \textbf{[BC]}$$

---

h : parents' skills	a : assets	n : fertility
t_h : home care	m : market care	e : private educ. input
χ : childcare needs	p_m : market care price	$q(n)$: equivalence scale
$\mathcal{S}$: childcare subsidy	$\mathcal{B}$: baby bonus	$\mathcal{E}$: public education

Fertility, Childcare and Skill Formation

$$V_2(h,a) = \max_{c,a',n,t_h,m,e\geq 0} u(c/q(n)) + \beta \mathbb{E} V_3(h', a', n, \mathbb{E}h_k)$$

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

$$y = wh \cdot (1 - t_h) \qquad \textbf{[labor income]}$$

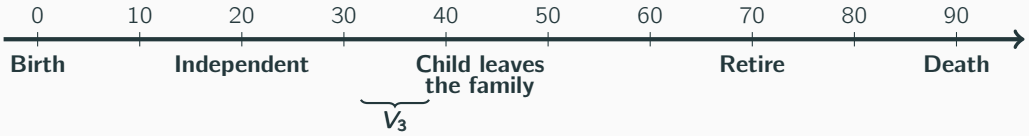
$$(1+\tau_c)(c + mp_m(1-\mathcal{S})n + e \cdot n) + a' = (1+r)a + y - \mathcal{T}(y,a,n) + \mathcal{B} \cdot n \qquad \textbf{[BC]}$$

$$h' = L(h, 1 - t_h, z') \qquad h_k = G(h, \mathcal{E}, e, \epsilon) \qquad \textbf{[technology]}$$

---

h : parents' skills	a : assets	n : fertility
t_h : home care	m : market care	e : private educ. input
χ : childcare needs	p_m : market care price	$q(n)$: equivalence scale
$\mathcal{S}$: childcare subsidy	$\mathcal{B}$: baby bonus	$\mathcal{E}$: public education

Parent-to-Child Transfer



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

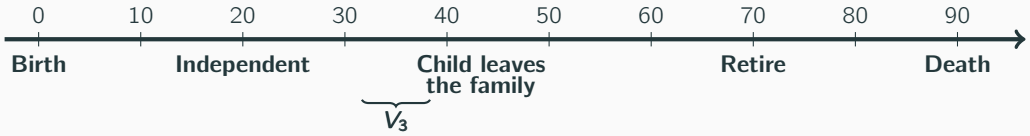
$$y = wh \cdot 1$$

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

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

- Parents choose a_k received by each child when she becomes independent

Parent-to-Child Transfer



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

$$y = wh \cdot 1$$

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

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

- Parents choose a_k received by each child when she becomes independent
- First-order conditions for child "quality" choices e and a_k:

$$v_2(n, \mathbb{E}h_k, a_k) \cdot \frac{\partial \mathbb{E}h_k}{\partial e} = \lambda_2 \cdot (1+\tau_c) \cdot n \qquad \textbf{FOC } [e]$$

$$v_3(n, \mathbb{E}h_k, a_k) = \lambda_3 \cdot n \qquad \textbf{FOC } [a_k]$$

► later periods

Quality/Quantity Trade-off Channel

Consider the effect of an increase in baby bonus $\mathcal{B}$ on transfers a_k (fixing e for now)

Quality/Quantity Trade-off Channel

Consider the effect of an increase in baby bonus $\mathcal{B}$ on transfers a_k (fixing e for now)

When fertility is exogenous:

- Increase in $\mathcal{B}$ is an income transfer, $\boldsymbol{a_k}$ **rises unambiguously** since:

$$v_3(n, \mathbb{E}h_k, a_k \uparrow) = \underbrace{\lambda_3 \downarrow}_{\text{income effect}} \cdot n \qquad \textbf{FOC } [\boldsymbol{a_k}]$$

Quality/Quantity Trade-off Channel

Consider the effect of an increase in baby bonus $\mathcal{B}$ on transfers a_k (fixing e for now)

When fertility is exogenous:

- Increase in $\mathcal{B}$ is an income transfer, $\boldsymbol{a_k}$ **rises unambiguously** since:

$$v_3(n, \mathbb{E}h_k, a_k \uparrow) = \underbrace{\lambda_3 \downarrow}_{\text{income effect}} \cdot n \qquad \textbf{FOC } [\boldsymbol{a_k}]$$

When fertility is endogenous:

- Increase in $\mathcal{B}$ is a price change, n rises $\Longrightarrow$ **effects on $\boldsymbol{a_k}$ is ambiguous** since:

$$\underbrace{v_3(n \uparrow, \mathbb{E}h_k, a_k\textbf{?})}_{\text{interaction in preferences}} = \underbrace{\lambda_3?}_{\text{change in } MU_c \text{ as } n \uparrow} \cdot \underbrace{n \uparrow}_{\text{fertility response}} \qquad \textbf{FOC } [\boldsymbol{a_k}]$$

- a_k could fall when child benefits are more generous - **quality/quantity trade-off**

Heterogeneous Fertility Responses - Composition Effects

- Heterogeneous responses across h: size of transfer relative to income differs
- Dynasties with stronger **fertility response** gain representation
- Intergenerational persistence of $h \Longrightarrow$ **composition effects** on aggregate h.c.

Heterogeneous Fertility Responses - Composition Effects

- Heterogeneous responses across h: size of transfer relative to income differs
- Dynasties with stronger **fertility response** gain representation
- Intergenerational persistence of $h \Longrightarrow$ **composition effects** on aggregate h.c.
- **Insight**: Even when effect on each child's human capital is positive, policy effects on aggregate human capital could still be negative

Firms and the Government

- Representative firm with **Cobb-Douglas production function**:

$$Y = AK^{\alpha}H^{1-\alpha}$$

Firms and the Government

- Representative firm with **Cobb-Douglas production function**:

$$Y = AK^{\alpha}H^{1-\alpha}$$

- Government uses predetermined policy instruments $\{\mathcal{T}(\cdot), \mathcal{B}, \mathcal{S}, \mathcal{E}\}$
- Denote demographic structure as $\{\Omega_j\}_{j=0}^{8}$ (with $\sum_{j=0}^{8}\Omega_j = 1$) and distribution of households across state space as $\boldsymbol{\mu}$. **Government fiscal budget**:

$$\underbrace{\left(\sum_{j=2}^{6}\Omega_j \int \mathcal{T}(y_j^*, a_j^*, n_j^*)\, d\mu\right)}_{\text{labor and capital income taxes}} + \underbrace{\left(\sum_{j=2}^{8}\Omega_j \tau_c c_j^*\, d\mu\right)}_{\text{consumption tax}} = \underbrace{\left(\sum_{j=7}^{8}\Omega_j wh\cdot\pi\, d\mu\right)}_{\text{pension payments}}$$

$$+ \underbrace{(\Omega_0+\Omega_1)\mathcal{E}}_{\text{public education}} + \underbrace{\int \Omega_2 n^*\cdot\mathcal{B}\, d\mu}_{\text{baby bonus}} + \underbrace{\int \Omega_2(1+\tau_c)m^* n^* p_m\cdot\mathcal{S}\, d\mu}_{\text{subsidized childcare}} + \underbrace{\mathcal{X}}_{\text{other spendings}}$$

- **GE Effects: Fertility responses change $\{\Omega_j\}_{j=0}^{8}$** and tax burden

► stationary equilibrium ► results

Role for Government Policies

Why may government policies improve welfare?

Long-run welfare: **average value** of newborn under the veil of ignorance:

$$\mathcal{W} = \int V_2 \, d\mu$$

Welfare of current agents will be discussed in transition path results (in progress)

► policy

Role for Government Policies

Why may government policies improve welfare?

Long-run welfare: **average value** of newborn under the veil of ignorance:

$$\mathcal{W} = \int V_2 \, d\mu$$

Welfare of current agents will be discussed in transition path results (in progress)

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 μ)
2. **Borrowing constraints** (Daruich 2019, Abbott et al. 2019 . . .)

► policy

Calibration

Parametrization

- Magnitude of fertility response determined by:
  1. Costs of children and childcare
     - OECD equivalence scale, time costs, childcare arrangements

► child costs

Parametrization

- Magnitude of fertility response determined by:
  1. Costs of children and childcare — ► child costs
     - OECD equivalence scale, time costs, childcare arrangements
  2. Child's skill production function — ► skill formation
     - mobility, public spendings on pupils, RCT evidence

Parametrization

- Magnitude of fertility response determined by:
  1. Costs of children and childcare — ► child costs
     - OECD equivalence scale, time costs, childcare arrangements
  2. Child's skill production function — ► skill formation
     - mobility, public spendings on pupils, RCT evidence
  3. Parents' preferences on quality and quantity

Parametrization

- Magnitude of fertility response determined by:
  1. Costs of children and childcare — ► child costs
     - OECD equivalence scale, time costs, childcare arrangements
  2. Child's skill production function — ► skill formation
     - mobility, public spendings on pupils, RCT evidence
  3. Parents' preferences on quality and quantity
- **Utility from child quantity and quality**:

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

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

Parametrization

- Magnitude of fertility response determined by:
  1. Costs of children and childcare ► child costs
     - OECD equivalence scale, time costs, childcare arrangements
  2. Child's skill production function ► skill formation
     - mobility, public spendings on pupils, RCT evidence
  3. Parents' preferences on quality and quantity
- **Utility from child quantity and quality**:

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

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

- Assumed $v(n, \mathbb{E}h_k, a_k)$ provides a flexible and conservative benchmark relative to separable preferences and dynastic altruism
- $\{\psi, \theta, \nu\}$ matches aggregate fertility and average spendings on quality

Identification of γ

- Conditional on other parameters, **γ governs magnitude of fertility responses**. Higher $\gamma \Longrightarrow$ smaller fertility responses. Intuition from FOC of n: ► intuition

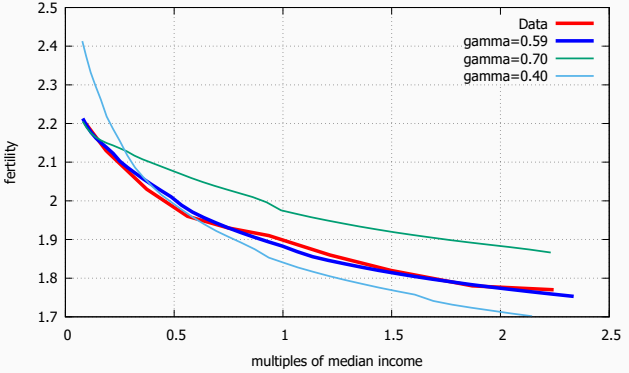
$$\Delta\Psi'(n) \propto (1-\gamma) \cdot \Delta\mathcal{B}$$

Identification of γ

- Conditional on other parameters, **γ governs magnitude of fertility responses**. Higher $\gamma \Longrightarrow$ smaller fertility responses. Intuition from FOC of n: ► intuition

$$\Delta\Psi'(n) \propto (1-\gamma) \cdot \Delta\mathcal{B}$$

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



Model Parameters

Table 1: Model Parameters

	Interpretation	Value	Source
	Preferences		
β	discount rate	0.98^{10}	standard
γ	elasticity of substitution	0.59	CPS
ψ	fertility preference	1.84	CPS
θ	quality preference	2.02	PSID
ν	transfer preference	0.42	PSID
	Childcare arrangement		
χ	childcare cost	0.18	Folbre (2008)
ι	economies of scale at home	0.7	Folbre (2008)
υ	substitutability of care	0.5	SIPP
p_m	price of full-time care	0.13	NACCRRA
	Taxes and pension		
τ_y^n, λ_y^n	tax levels and progressitivity	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	2.45	
σ_ϵ	ability shock dispersion	0.45	PSID
ρ	intergenerational spillover	0.28	Chetty et al. (2014)
ω	substitution of education	0.9	ATUS
$\mathcal{E}$	public education	0.165	NCES
κ	input productivity	0.16	García et al. (2020)
	Adult human capital evolution		
η	learning curvature	0.61	PSID
ζ	learning level	0.72	PSID
μ_z	skill depreciation	-0.23	PSID
σ_z	shock dispersion	0.42	PSID
	Firm production function		
A	total factor productivity	1	normalization
α	capital share	0.33	standard
δ_k	capital depreciation	0.04^{10}	standard

- 13 parameters are calibrated within the model using SMM
- Model matches salient features of fertility profile, childcare, parental investment, inter-vivos transfers, intergenerational mobility and lifecycle earnings profile

► adult skill ► firm and gov.

Validation

Fertility Response to Financial Incentives

Question: Does the model generate responses that match empirical estimates?

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

Fertility Response to Financial Incentives

Question: Does the model generate responses that match empirical estimates?

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

- Established in 1982 after discovery of the petroleum. Equal transfer to **all residents** regardless of income, employment or age
- **Pronatal effects**: allows parent to claim dividend on behalf of a child with no requirements on how parents use a child's dividend.

Fertility Response to Financial Incentives

Question: Does the model generate responses that match empirical estimates?

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

- Ideal policy variation to test fertility responses:
  1. **Similar institution and cultural background**
  2. **Large in scale (≈ $1.5k per year)** relative to other family policies

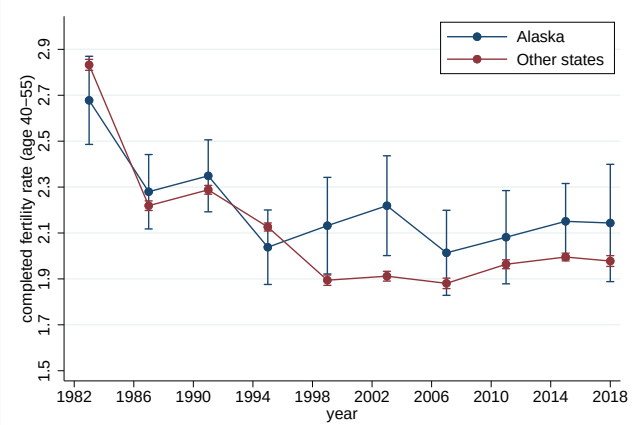
Fertility Response to Financial Incentives

Question: Does the model generate responses that match empirical estimates?

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

- Ideal policy variation to test fertility responses:
  1. **Similar institution and cultural background**
  2. **Large in scale (≈ $1.5k per year)** relative to other family policies
- **Apply same policy in the model: UBI to all household members by $1.5k**
  (normalized by median income in Alaska relative to the rest of U.S. + partial equilibrium)
  1. Completed fertility rises by **4.2%** in the model (Kelly, Timilsina and Yonzan 2020)
  2. **Heterogeneous responses**: Larger responses from households with lower human capital (model) - larger fertility increases among Alaska Natives and women without high school degree (Cowan and Douds 2020)

Evidence from Completed Fertility Rates



- 95% confidence intervals of sample mean
- Predicted 4.2% (0.08) increase in completed fertility rate is consistent, if not conservative, w.r.t. data

► by education ► Australia

Counterfactuals

Baby Bonus Counterfactuals

Evaluate baby bonus $\mathcal{B}$ of different scale

- **Budget balance**: consumption tax adjusts to balance budget each period
- **General equilibrium**: prices and distributions adjust

Baby Bonus Counterfactuals

Evaluate baby bonus $\mathcal{B}$ of different scale

- **Budget balance**: consumption tax adjusts to balance budget each period
- **General equilibrium**: prices and distributions adjust

Outcomes of Interest

- Aggregate fertility, average human capital, per capita income, consumption taxes and intergenerational income mobility $\left(\frac{1}{IGE}\right)$
- Social welfare in consumption equivalence (changes)

► welfare

Baby Bonus Counterfactuals

Evaluate baby bonus $\mathcal{B}$ of different scale

- **Budget balance**: consumption tax adjusts to balance budget each period
- **General equilibrium**: prices and distributions adjust

Outcomes of Interest

- Aggregate fertility, average human capital, per capita income, consumption taxes and intergenerational income mobility $\left(\frac{1}{IGE}\right)$
- Social welfare in consumption equivalence (changes)

Outline

- **Long-run effects** - comparing new steady-state economy to baseline economy
- **Transition, alternative funding methods** (in progress)

► welfare

Fertility Effects

Figure 1: Effects on aggregate fertility

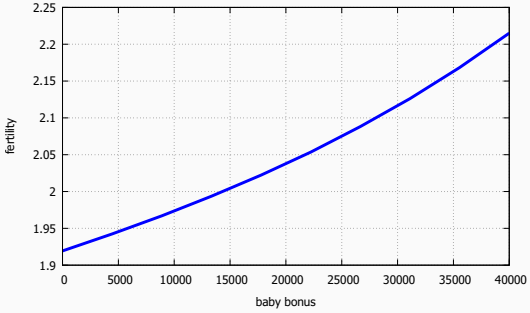
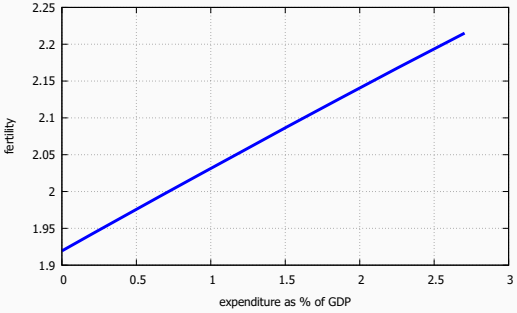


Figure 2: Expenditure share



- Baby bonus needs to be at least **$28k (NPV)** to raise aggregate fertility rate to **replacement level** (2.1, commonly stated long-run policy goal). The policy costs around **1.6%** of GDP in the new equilibrium

Fertility Effects

Figure 1: Effects on aggregate fertility

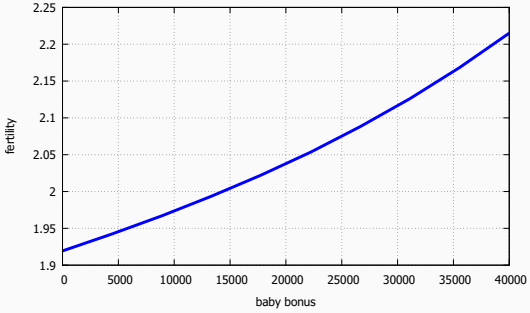
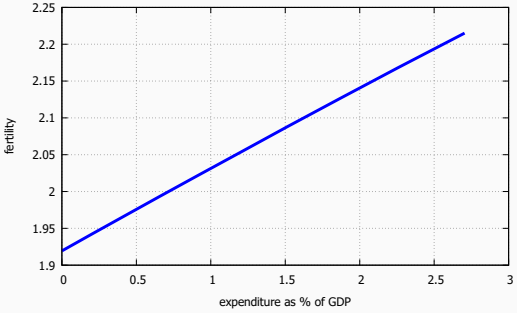


Figure 2: Expenditure share



- Baby bonus needs to be at least **$28k (NPV)** to raise aggregate fertility rate to **replacement level** (2.1, commonly stated long-run policy goal). The policy costs around **1.6%** of GDP in the new equilibrium
- From now on, consider $\mathcal{B} = \$30\text{k}$ as the benchmark policy ($\approx$ expansion of CTC from 2010-2021 in NPV)

Figure 3: Average private investment

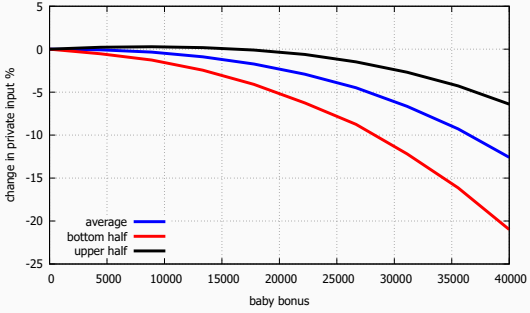
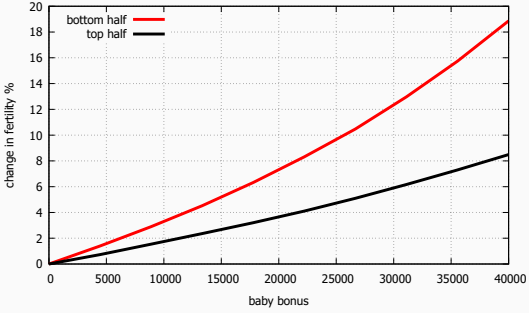


Figure 4: Heterogeneous fertility response



- **Quality/quantity trade-off**: Parents **reduce** private investments by 7.5%

Figure 3: Average private investment

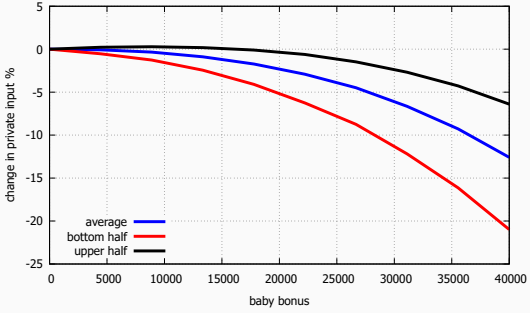
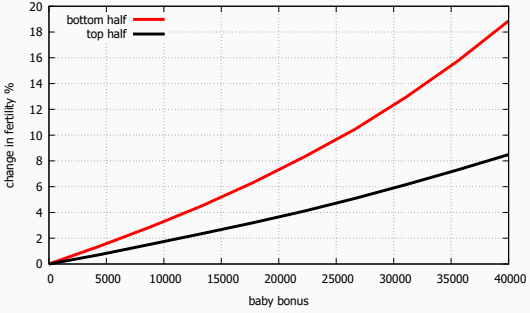


Figure 4: Heterogeneous fertility response



- **Quality/quantity trade-off**: Parents **reduce** private investments by 7.5%
- **Composition effects**: Parents with lower human capital respond more in fertility

Average Human Capital and Social Mobility

Figure 5: Average human capital

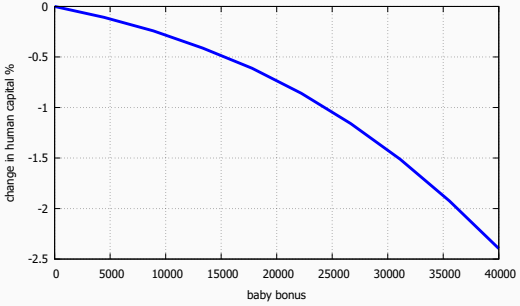
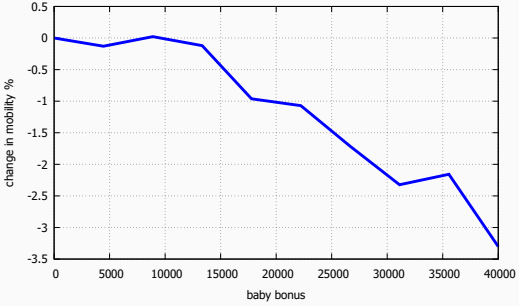


Figure 6: Intergenerational mobility



- Average human capital falls by **1.4%**

► Australia

Average Human Capital and Social Mobility

Figure 5: Average human capital

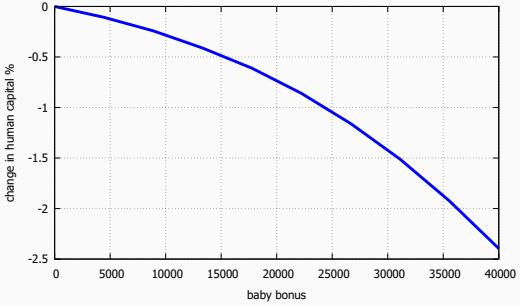
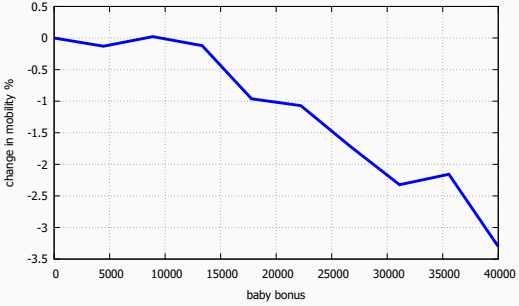


Figure 6: Intergenerational mobility



- Average human capital falls by **1.4%**
- Intergenerational mobility **decreases by 2.2%**

► Australia

Average Human Capital and Social Mobility

Figure 5: Average human capital

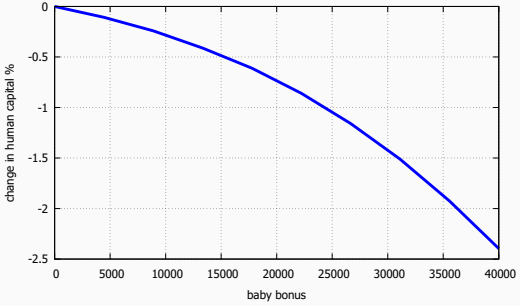
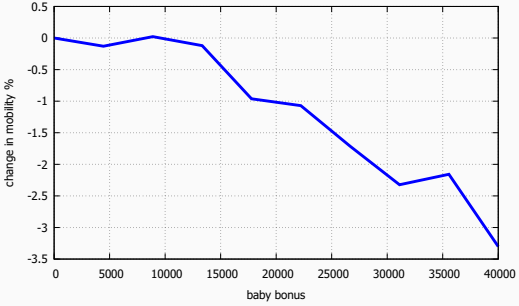


Figure 6: Intergenerational mobility



- Average human capital falls by **1.4%**
- Intergenerational mobility **decreases by 2.2%**
- Results are **stronger** when cash transfers are targeted at low-income households

► Australia

Output and Tax: GE Effects

Figure 7: Per capita output

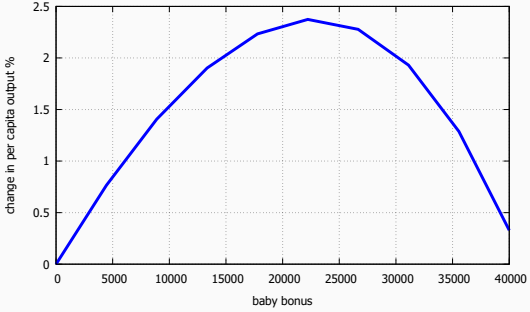
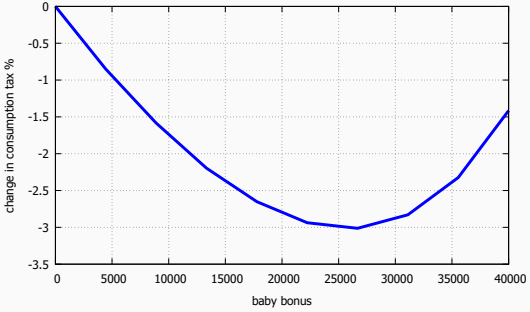


Figure 8: Change in consumption tax



- Per capita output rises initially due to changes in **demographic structure**
- **General equilibrium effects**: consumption tax could be reduced while keeping government budget satisfied

Output and Tax: GE Effects

Figure 7: Per capita output

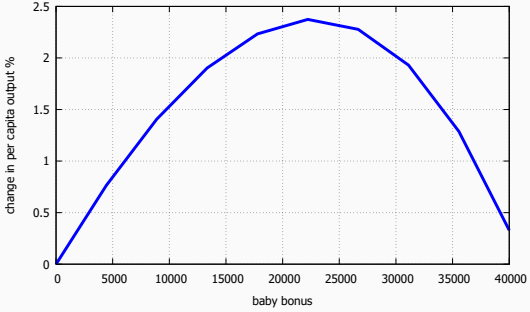
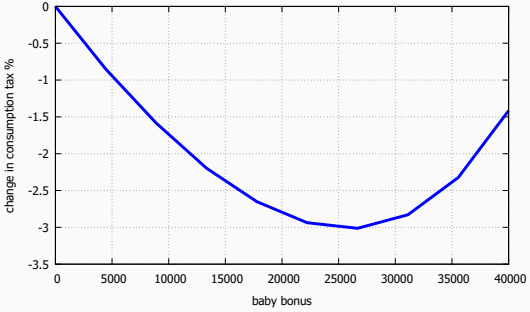


Figure 8: Change in consumption tax



- Per capita output rises initially due to changes in **demographic structure**
- **General equilibrium effects**: consumption tax could be reduced while keeping government budget satisfied
- Larger baby bonus is **not always beneficial** as (1) average human capital worsens, and (2) public education expenditure rises

► budget ► demographic structure

Welfare Effects

Figure 9: Welfare-Fertility Expansion Path

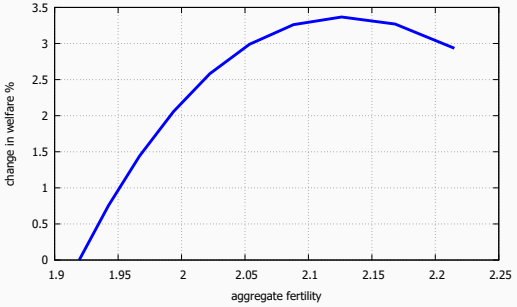
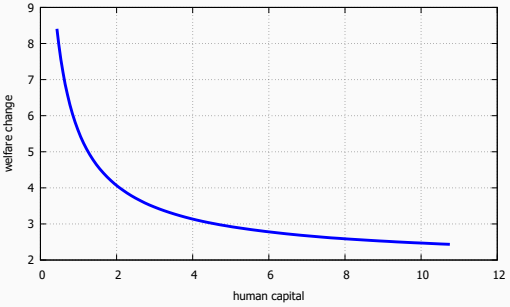


Figure 10: Change in welfare

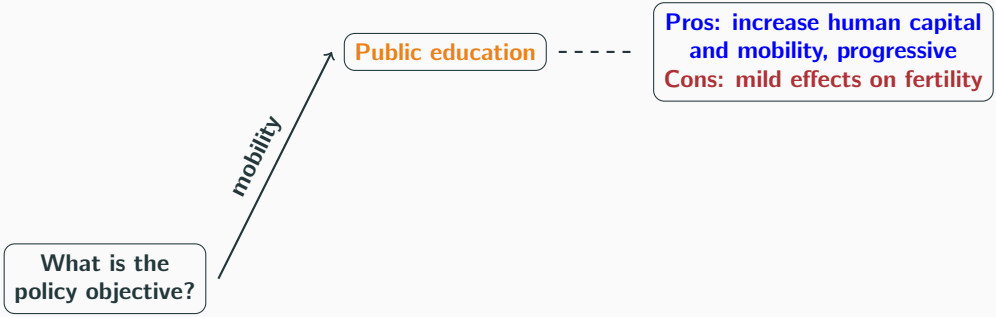


- Welfare maximized around $\mathcal{B} = \$30\text{k}$. Improved by **3.4%** in the long-run
- **Progressive**: large welfare improvement for parents with low human capital

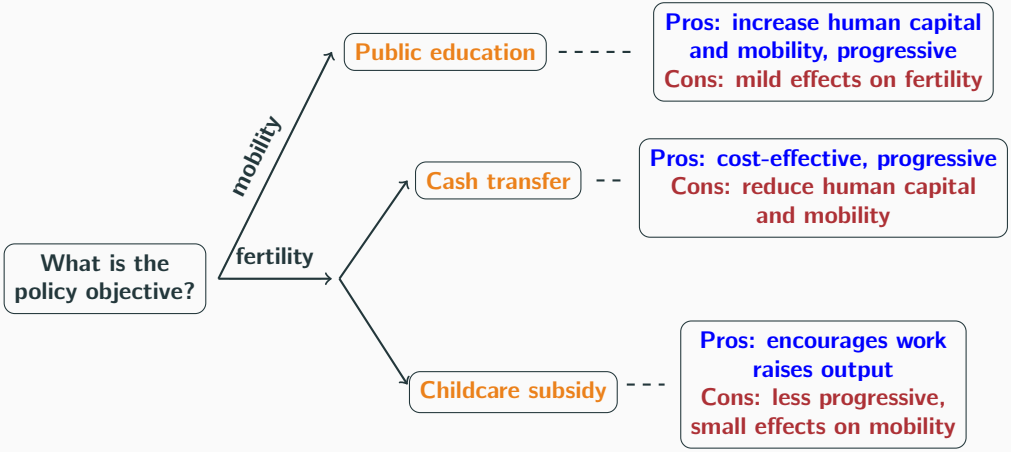
Taking Stock

What is the policy objective?

Taking Stock

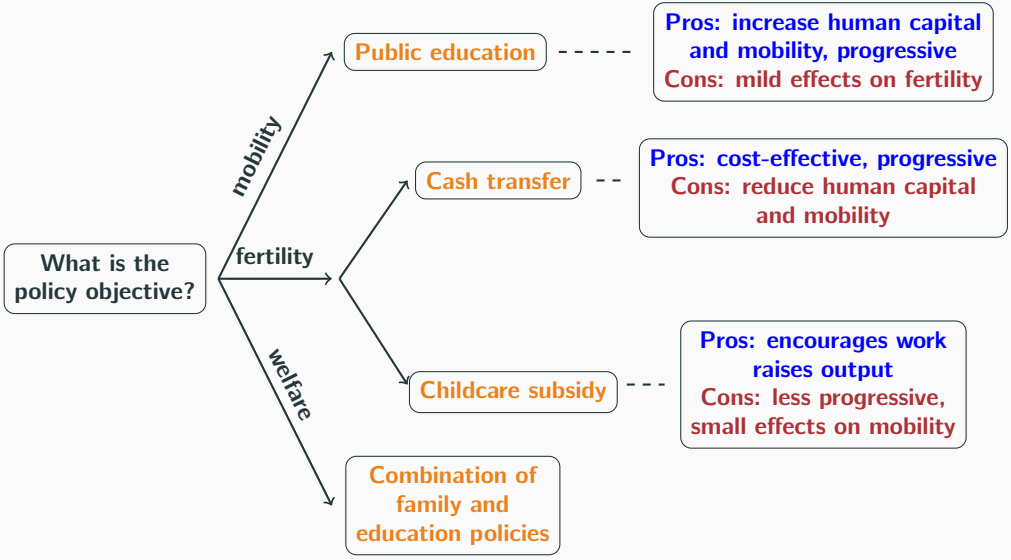


Taking Stock



► public education ► childcare subsidy ► next steps

Taking Stock



► public education ► childcare subsidy ► next steps

Conclusion

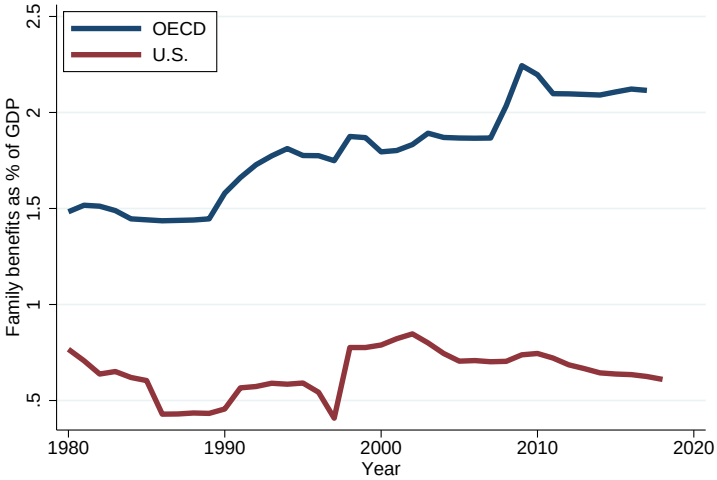
Study macroeconomic consequences of large-scale family policies

- Introduce **endogenous fertility** into a GE-OLG model with incomplete market and distortionary taxes. Model generates reasonable fertility elasticities

Results:

1. Compared with previous research where fertility is fixed, introducing endogenous fertility reverses policy implications on child outcome and social mobility
2. A \$30k baby bonus raises fertility to replacement level and improves welfare by **3.4%** via effects on **population growth** and taxes in the general equilibrium
3. Public education is effective in improving child outcome, social mobility and welfare despite having mild effects on fertility

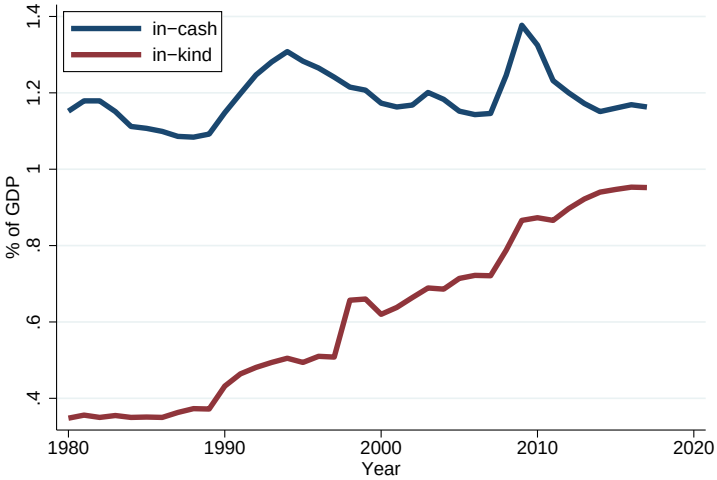
Time Trend of Public Expenditures on Child Benefits



Source: OECD database

► back to intro

Expenditure Breakdown



Source: OECD database

► back to intro

Working Without Children and Retirement

- For households working without children:

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

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

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

- For retired households:

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

$$(1+\tau_c)c + a' = (1+r-r\tau_a)a + \pi \cdot wh$$

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

where π is pension replacement rate

► back to transfer

Stationary Equilibrium

- **Distributions:**
  - Demographic structure $\{\Omega_j\}_{j=0}^{8}$ and distribution of agents over states μ are invariant over time periods
  - Distribution of initial states is determined by older generations and shock processes
- **Households Optimize**: Households choose consumption, savings, fertility, childcare arrangements, child investments and inter-vivos transfers such that utility is maximized
- **Firms maximize profits**
- **Prices clear markets**
- **Government balances budget in period to period**

► back to firm and gov.

Child's Skill Production Function

- **Children's skill production function**:

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

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

- $\rho = 0.28$ - rank-rank mobility (Chetty, Hendren, Kline and Saez 2014)
- $\mathcal{E} = 0.165$ - \$12k per pupil per year (NCES)
- $\kappa = 0.16$ - **RCT evidence** from García, Heckman, Leaf and Prados (2020)

► mobiltiy fit ► RCT ► back

Child's Skill Production Function Cont'd

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

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

- **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 $\kappa = 0.16$**

► back

Costs of Child and Childcare

- OECD equivalence scale:

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

- **Childcare arrangements**:

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

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

- Elasticity of substitution: $\upsilon = 0.5$ - average share of income spent on childcare by education (SIPP) (Malik 2019)

- **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:

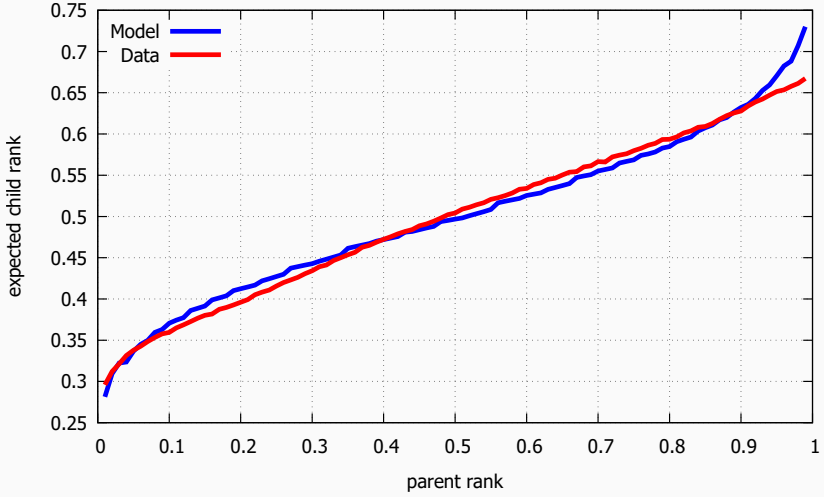
$$h_{j+1} = \exp(z)\left(h_j + \zeta(h_j t)\right)^{\eta}$$

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

- $\eta = 0.61$, $\zeta = 0.72$ - lifecycle earnings (PSID) (Huggett, Ventura and Yaron 2011)
- $\mu_z = -0.23, \sigma_z = 0.42$ - 2% skill depreciation and lifecycle Gini coefficient of earnings (Huggett, Ventura and Yaron 2011)

► fertility ► back

Intergenerational Mobility: Model vs Data



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

► back

Other Parameters

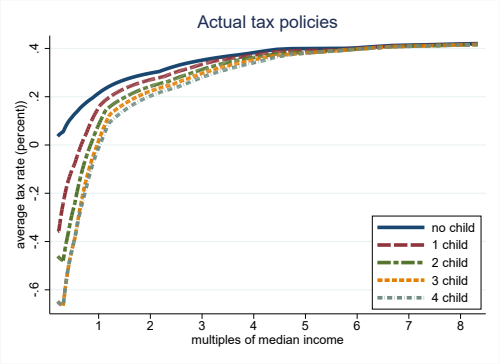
- **Firms' production function**: capital share $\alpha = 0.33$ and 4% capital depreciation
- **Government taxes**
  - **Income taxes**:

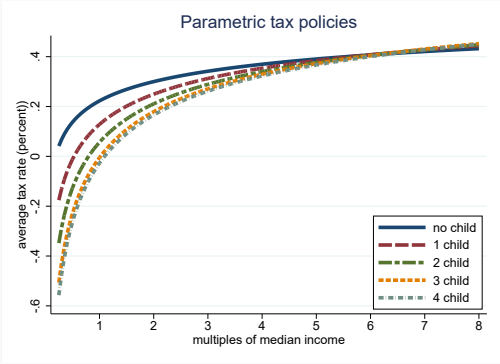
$$\mathcal{T}(y, a, n) = y \cdot (1 - \tau_y^n y^{-\lambda_y^n}) + \tau_a r a$$

    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**: $\pi = 40\%$

► back

Income Taxes: Model vs Data





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

► back

Baby Bonus in Australia

- **A$3,000 baby bonus**[1] to every child born on or after July 1st 2004
- Peter Costello (Treasurer of Australia): “One (baby) for the Mum, one for the Dad, and one for the country"
- $\text{tfr}_{\text{AUS},2004} = 1.77 > 1.73 = \text{tfr}_{\text{USA},2018}$ before the Covid Baby Bust

► other

[2]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.

Baby Bonus in Australia

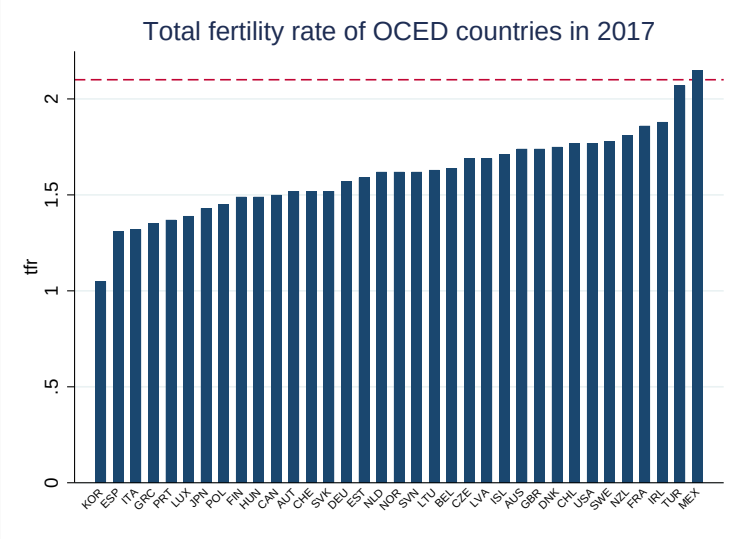
- **A$3,000 baby bonus**[1] to every child born on or after July 1st 2004
- Peter Costello (Treasurer of Australia): "One (baby) for the Mum, one for the Dad, and one for the country"
- $\text{tfr}_{\text{AUS},2004} = 1.77 > 1.73 = \text{tfr}_{\text{USA},2018}$ before the Covid Baby Bust ► other
- Drago et al. (2011) finds:
  - Significant fertility responses and evidence for long-term/quantum effects
  - Cost for an additional birth to be at least A$126,000[2]
  - 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

► back to intro ► back to validation ► back to results

[2]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.

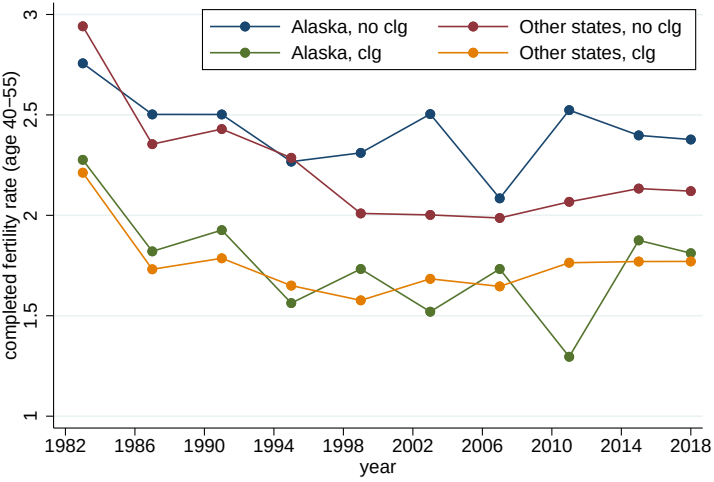
[2]Equivalent to $117,600 in 2010 USD. Quantitative model predicts $130,000 is needed for an additional birth (for the U.S.).

Total Fertility Rate Across Countries



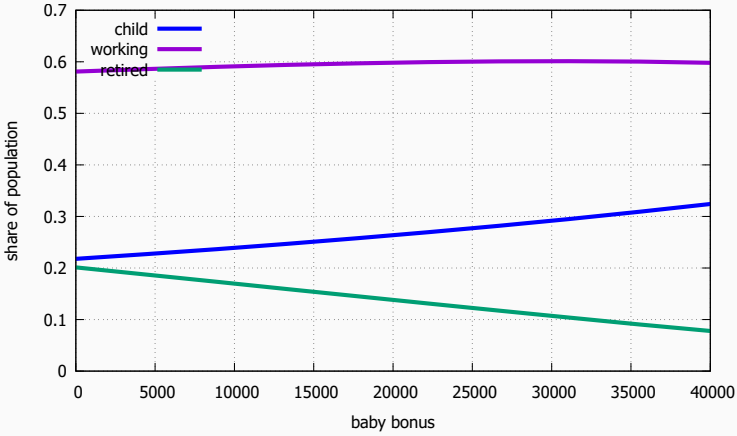
► back

Evidence from Completed Fertility Rates



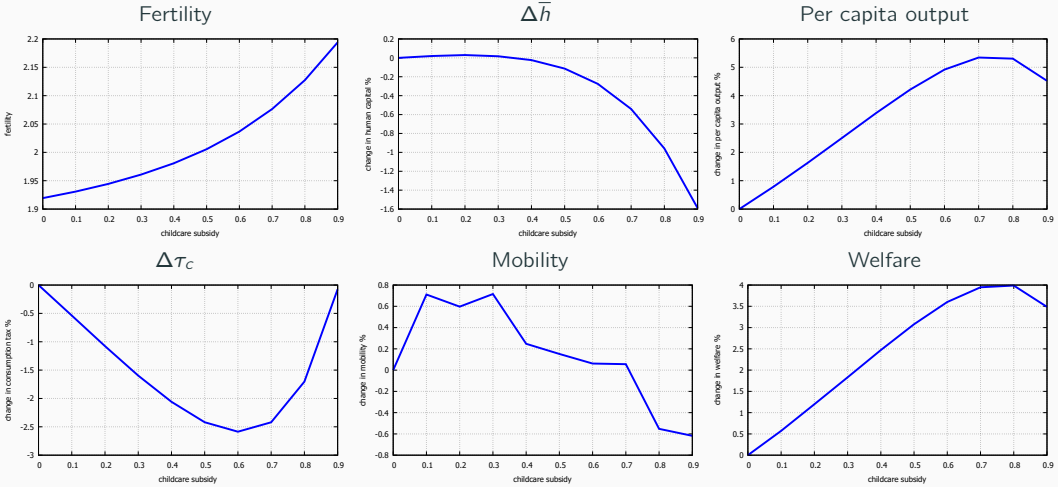
► back to validation

Change in Demographic Structure



► back to results

Highlights for Subsidized Childcare $\mathcal{S}$

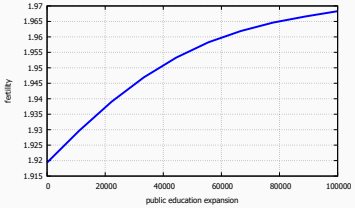


- Need **78%** refund to reach 2.1 fertility, **50%** less cost-effective than baby bonus
- Impacts of subsidized childcare are qualitatively similar to baby bonus except that **it encourages work** (Guner, Kaygusuz and Ventura 2020) and **mobility effect is small**
- **Less progressive** because subsidy amount depends on childcare expenditures

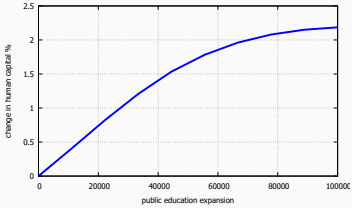
► back

Highlights for Public Education Expansion $\mathcal{E}$

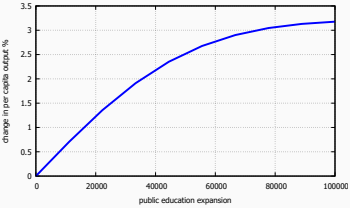
Fertility



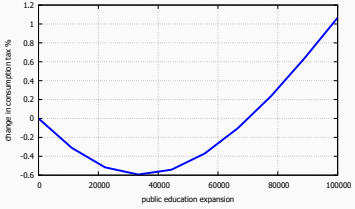
$\Delta \overline{h}$



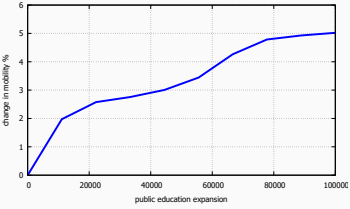
Per capita output



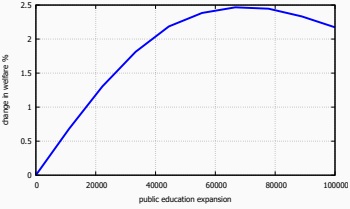
$\Delta \tau_c$



Mobility



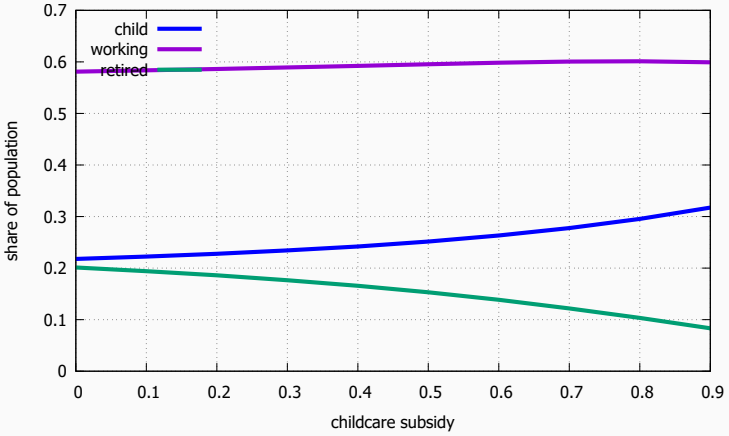
Welfare



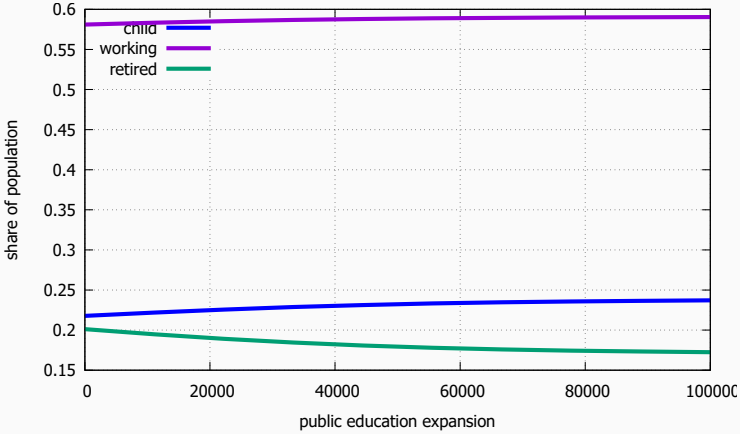
- **Mildest fertility effects** (0.035 boost vs 0.3 boost using $40k baby bonus)
- **Most effective in improving mobility** (4% increase using $65k)
- **Progressive** policy with large welfare improvement for low-income households

► back

Change in Demographic Structure



Change in Demographic Structure



Next Steps

Transition path

- **Question**: How long do we need to wait for aggregate effects to take place? What are the distributional consequences for households in the original steady-state? Majority support for policy reform?
- **Conjecture**: Majority support may requires transfers **within cohorts**

Alternative ways of financing

- **Question**: How will things change if the policy could be funded via government deficits or labor/capital taxes?

Optimal policies

- **Question**: What is the optimal policy combination to maximize welfare?

► back