Status Externalities and Low Birth Rates in Korea

Seongeun Kim Michèle Tertilit Minchul Yum

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Motivation

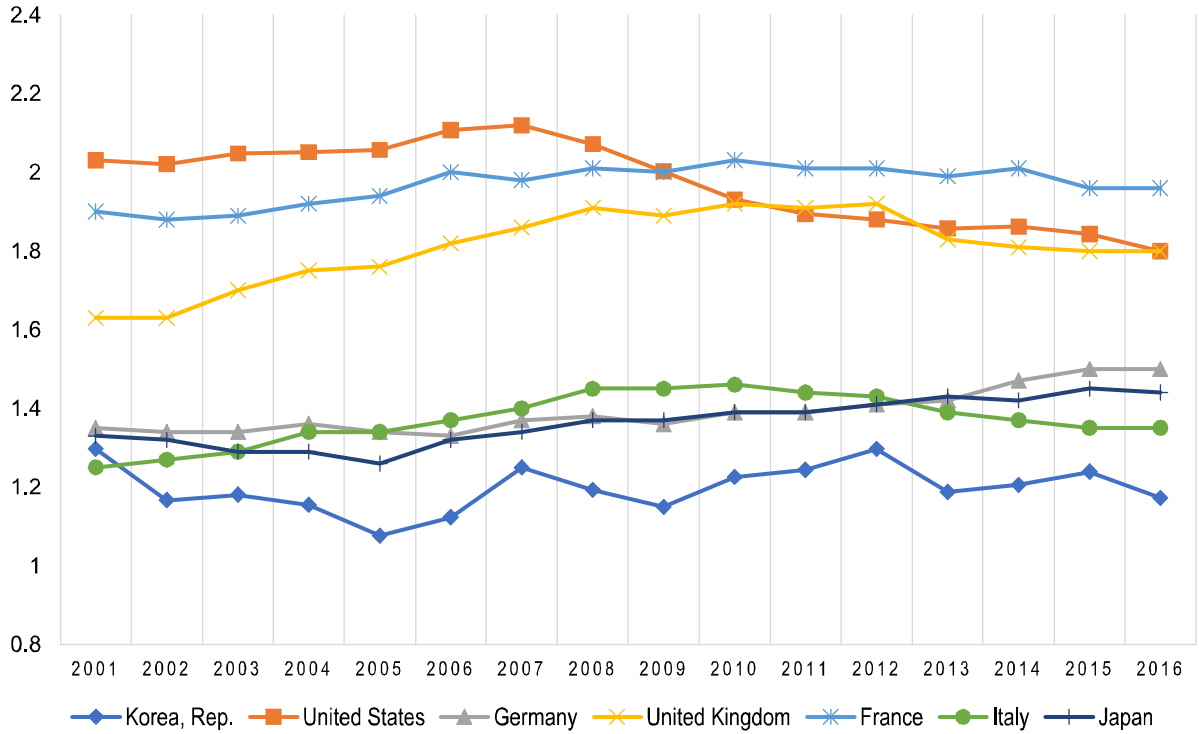
- Education Fever in South Korea (and East Asia more broadly)
- Lowest low fertility rates in these countries.
- Question: Could these two phenomena be related?
  - And if so, what are the policy implications?

Education Fever

- Most Korean children attend extra-curricular classes in the evening (in so-called *hagwons*).
- 70% participate in after-school private education
- Seoul imposed a 10 pm curfew on *hagwons* as of 2016 (and on private tutoring as of 2017).
- Private education expenses per child account for nearly 12% of consumer spending
- Rooted in Confucianism.

Lowest-low fertility

Total Fertility Rate (source: World Development Indicators)



Connection?

- Clearly, through the quantity-quality trade-off, there is a connection.
- But does it mean there is "too much education" $\Longrightarrow$ "too little fertility"?
- Is there a distortion leading to inefficiency?
- There might be due to an obsession with relative education.
  - tons of anecdotal evidence.

Forced to decide between giving her daughter siblings or an expensive education, Hong Sung-ok saw little choice. "I can't afford not to send my child to private tuition, because everyone else does," says the 47-year-old insurance saleswoman. "I spend more than half my income on tutors and childcare expenses - it's really expensive... That's why I decided to have only one child." (*Financial Times*, Jan 2, 2013)

Goal of this paper

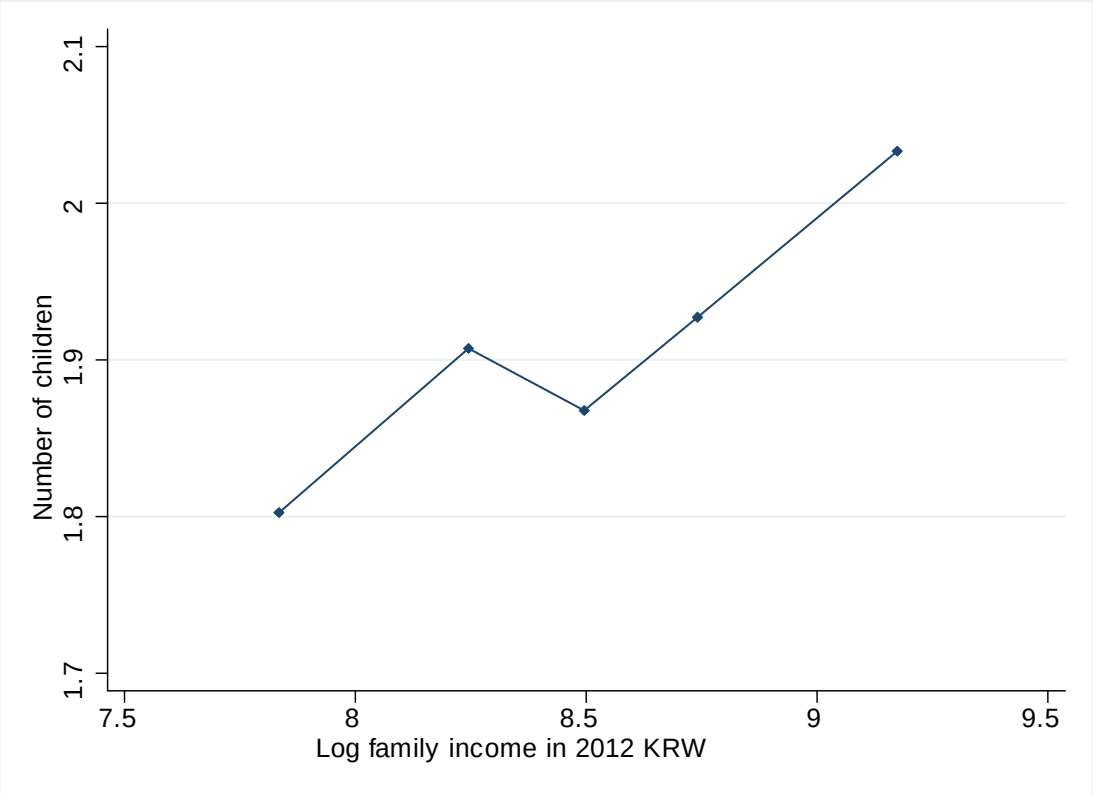
- Document simple stylized facts on
  - education fever and fertility across income dist among recent cohorts in Korea.
- Analyze connection btw education fever & low fertility in structural model.
  - novel ingredient: status externality
    (parents care about relative quality of their children).
- Calibrate model to Korean economy, explore how externality affects parents along the income distribution.
- Explore the role of government policies designed to address the externality
  - effects on macro aggregates, distributions, welfare
  - from both positive and normative perspectives.

(Quick) Stylized facts on private education & fertility in Korea

Data

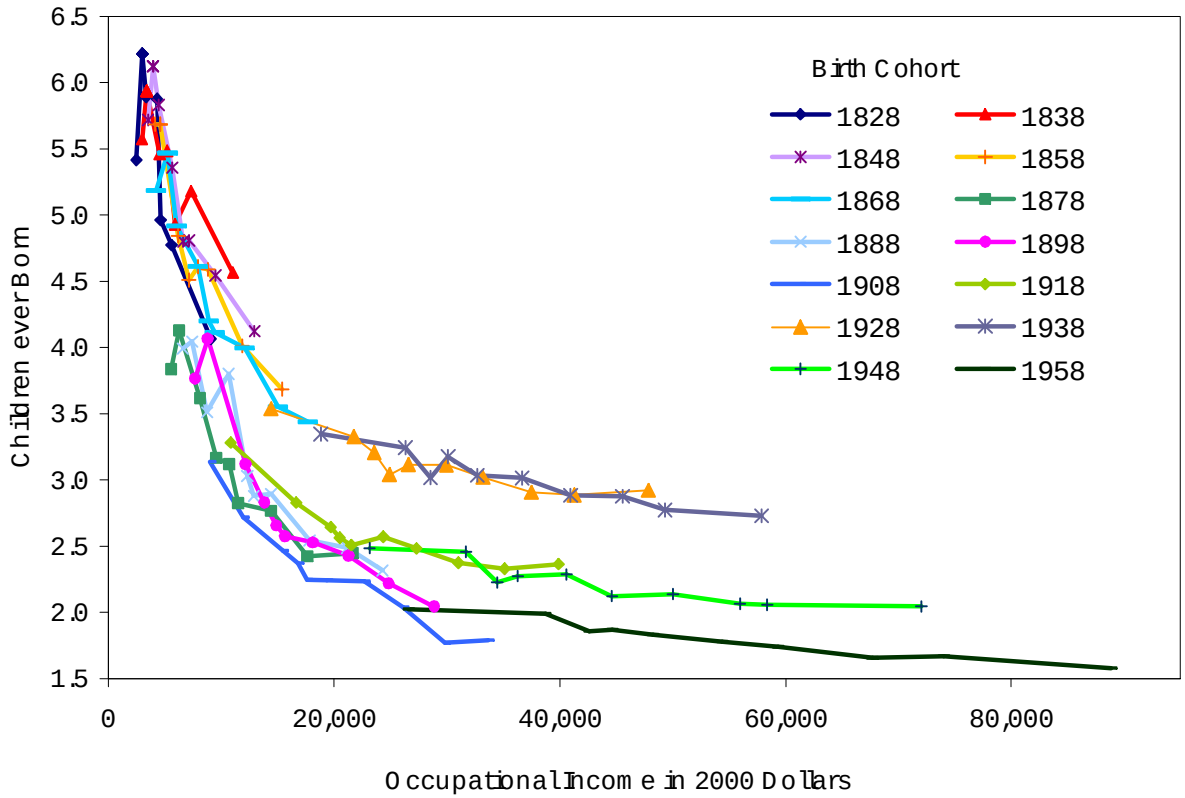
- KLIPS (Korea Labor and Income Panel Study)
  - annually conducted on a sample of 5,000 households and members.
  - pool 20 waves; since 2009, nationally representative
  - we focus on cohorts of women born in 1970-75 (obs = 756)
  - focus on married or cohabiting women.
- **Fertility**: completed fertility; number of children ever born
- **Income**
  - family income: sum of earnings and capital income (financial/real estate income) not including social insurance/transfers
  - average when women's age belongs to 40-43 (similar to Chetty et al. 2014).
- Robustness: cohorts born 1961-66 (obs = 632), urban samples

Income and fertility in Korea



- Poorer families tend to have fewer children in Korea.

Contrast to the US



Source: Jones and Tertilt (2008)

- Richer families tend to have fewer children in the US.

Income and private education spending

Income quintile	Pre-school	Elementary School	Middle School	High School	Weighted Average
1st	8.9	9.0	8.4	5.7	8.4
2nd	6.8	8.0	8.5	6.1	7.4
3rd	6.1	7.7	7.6	6.6	7.0
4th	5.6	6.7	7.4	6.9	6.5
5th	4.6	5.0	5.8	5.8	5.1

Note: This table shows the fraction of expenditures on private education per child at each stage of education (unit: %). The weighted average is based on the number of years in each stage.

- Poor families spend a large fraction of their income in private education.

The Model

Model environment

- OLG model with endogenous fertility
- Fertility: discrete choice (allow for childlessness)
- One-gender model
- Parents and children overlap for one period ($\approx$ 25 yrs) only.
- Parents derive util from cons, leisure, and children's quantity & quality (HK)
  - Status externality: parents care about their child HK relative to others.
- Child HK production. Inputs: parental HK, money, luck.
- Heterogeneity:
  - parental human capital (endogenous)
  - preferences (for consumption vs. kids, leisure)
  - children's learning ability (same for all siblings)
- Production: $Y = AL$ where L : aggregate efficiency units of labor.

Child human capital production

- Children learn through imitation and by being actively taught.
- Children learn at different speeds, determined by nature.
- All children have some baseline human capital, even if they are not taught.

$$h' = \kappa \left(\theta + x^{\alpha_1} h^{\alpha_2} \right)$$

where

  - h : parental human capital (imitation)
  - x : purchased education (private tutoring, etc.)
  - θ : baseline human capital (public education)
  - κ : learning ability (stochastic, persistent)
- similar to de la Croix and Doepke (2003)

Period utility and status externality

- Utility function:

$$U(c, l, n, h', \bar{h}') = b \log\left(\frac{c}{\Lambda(n)}\right) + \nu \frac{l^{1-\gamma}}{1-\gamma} + \underbrace{\phi(n) \log\left(h' - \chi \bar{h}'\right)}_{\text{quantity-quality trade-off}}$$

  - b : preference type
  - $\Lambda(n)$: household equivalence scale
  - ν : relative preference for leisure
  - $\phi(n)$: utility from child numbers

- Status externality
  - $\bar{h}'$: (forecasted) benchmark quality to which parents compare their children
  - χ : strength of externality
  - same functional form as in Ljungqvist and Uhlig (2000)
  - Origin could be aspirations (Genicot and Ray, 2017), Korean school system featuring relative evaluations heavily, etc.

Timing

- Parents start the period endowed with own human capital h and κ_p (parent's learning ability when young).
- Parent's preference type b is realized: $b \in \{b_1, b_2, ..., b_{N_b}\}$ i.i.d.

$$\log b \sim N(0, \sigma_b^2)$$

- Fertility decision $n \in \{0, 1, ..., N_n\}$ is made while taking expectation on children's learning type κ.
- Children's type κ is realized: (same for all siblings) AR(1) in log

$$\log \kappa = \rho_\kappa \log \kappa_p + \varepsilon_\kappa$$

- Parents make decisions on parental investments, leisure and consumption.

Parent's decision problem

- Parent with b chooses fertility, not knowing children's type κ :

$$\max_{n \in \{0,1,\ldots,N_n\}} \mathbb{E}_{\kappa|\kappa_p} V(h, b, \kappa, n; \bar{h})$$

- κ is realized.

$$V(h, b, \kappa, n; \bar{h}) = \max_{c,x,l} \left\{ b \log\left(\frac{c}{\Lambda(n)}\right) + \nu \frac{l^{1-\gamma}}{1-\gamma} + \phi(n) \log\left(h' - \chi \bar{h}'\right) \right\}$$

subject to

$$\begin{aligned} c + xn &\leq wh\left(1 - \lambda n - l\right) \\ h' &= \kappa\left(\theta + x^{\alpha_1} h^{\alpha_2}\right) \\ l &\in [0, 1 - \lambda n] \\ \bar{h}' &= \Gamma(\bar{h}) \end{aligned}$$

- A child costs λ units of time (exogenous) and money (x, endogenous).

Equilibrium

- Aggregate output is given by:

$$Y = A \sum_{j}^{N_\kappa} \pi_{pj}^{\kappa} \sum_{i}^{N_b} \int \left(h(1 - \lambda n(h, b_i, \kappa_p) - l(h, b_i, \kappa_j) \right) F(dh, b_i, \kappa_p)$$

- Stationary equilibrium and perfect-foresight transition equilibrium.
- In both cases, solving model involves finding expectation-consistent distribution across households.
  - Inner problem: given $\bar{h}'$ (+ gov't policies), solve individual's max problem.
  - Outer loop: update distributions (+ gov't policies) and $\bar{h}'$
  - Repeat until (stationary/transitional) distributions (+ gov't policies) converge.

Calibration

Calibrating the model in stationary equilibrium

- Calibrate stationary model to recent Korean samples (KLIPS).
- Parameters set externally:
  - Normalization: $A = \mu_b = 1$.
  - $\lambda = 0.041$ (5.7 hours/week of parental time)
  - $\gamma = 2$ (IES for leisure $= 0.5$)
  - $\Lambda(n)$: OECD modified equivalence scale
- Parameters chosen to match moments internally:
  - utility function: ϕ_1, ϕ_2, ϕ_3 (fertility), ν
  - dispersion & persistence of shocks: $\sigma_b, \sigma_\kappa, \rho_\kappa$
  - human capital function: $\theta, \alpha_1, \alpha_2$
  - externality: χ

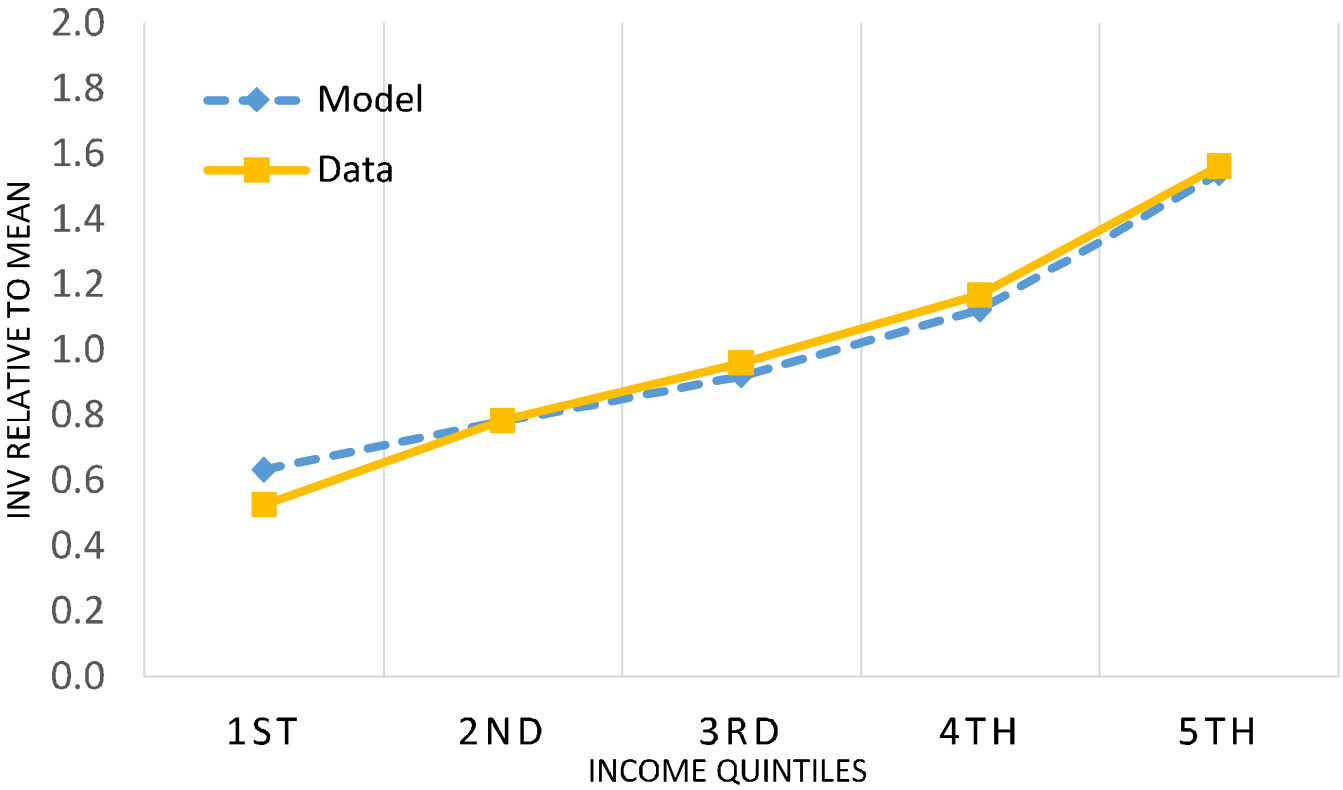
Parameters calibrated internally

Parameter		Target statistics	Model	Data
$\phi_1 =$	1.627	Pr(# child $= 1$)	0.196	0.196
$\phi_2 =$	2.457	Pr(# child $= 2$)	0.631	0.631
$\phi_3 =$	2.857	Pr(# child ≥ 3)	0.143	0.144
$\sigma_\kappa =$	0.338	Gini income	0.252	0.263
$\nu =$	1.661	Avg total hours worked	0.299	0.303
$\sigma_b =$	0.552	Income elasticity of fertility	0.083	0.082
$\chi =$	0.0938	Childless in 1st income quintile	0.053	0.053
$\theta =$	1.797	Avg investment-income ratio	0.091	0.097
$\alpha =$	0.346	Income elasticity of educ spending	0.703	0.698
$\rho_\kappa =$	0.346	Intergenerational elasticity	0.337	0.330

Fertility-income relationship: model vs. data

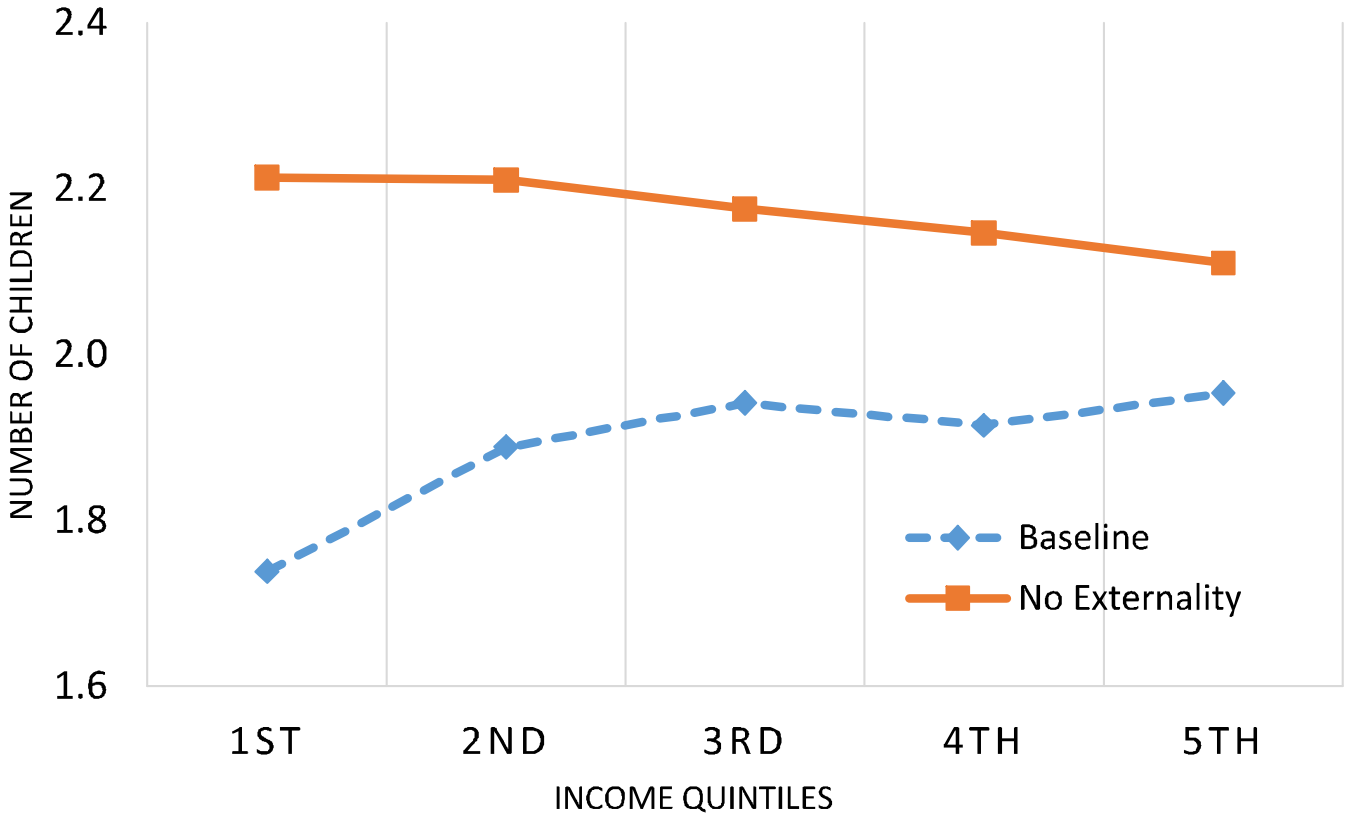
		Income quintile				
	All	1st	2nd	3rd	4th	5th
Completed fertility						
Data (KLIPS)	1.91	1.80	1.91	1.87	1.93	2.03
Model	1.89	1.74	1.89	1.94	1.91	1.95
Childlessness rate (%)						
Data (KLIPS)	2.9	5.3	4.0	2.0	1.3	2.0
Model	3.0	5.3	3.0	2.3	2.3	2.0

Private education spending: model vs. data



Status Externality and Parental Choices

The role of status externality



- Without externality ($\chi = 0$):
  - average fertility rate higher: 2.17 (vs. 1.89)
  - especially for lowest income quintile.
  - sign of income elasticity of fertility flips: -0.039 (vs. 0.083)

The role of status externality

	Income quintile				
	1st	2nd	3rd	4th	5th
Childlessness rate (%)					
Baseline	5.3	3.0	2.3	2.3	2.0
No Externality	0.7	0.6	0.8	0.9	0.9
Investment per child relative to Y					
Baseline	.058	.071	.084	.102	.140
No Externality	.038	.052	.065	.081	.118
Change relative to baseline	-33.7%	-27.1%	-22.6%	-20.8%	-15.9%

- Without externality, childlessness rate becomes nearly flat.
- Households spend less on private education, especially lowest income quintile.

Positive Analysis of Policy Reforms

Pronatal transfers

- Many countries have introduced various policies to fight falling birth rates.
- Korean government initiated "The First Basic Plan for Low Fertility and Aging Society" in 2006.
  - Child allowance for families with young children
  - Cash transfers for a newborn.
  - Universal, income-independent.
- Consider pronatal transfers $T_n(n) = \psi n$

$$c + xn \leq wh(1 - \lambda n - l) + T_n(n) + T$$

T : lump-sum tax to balance government budget

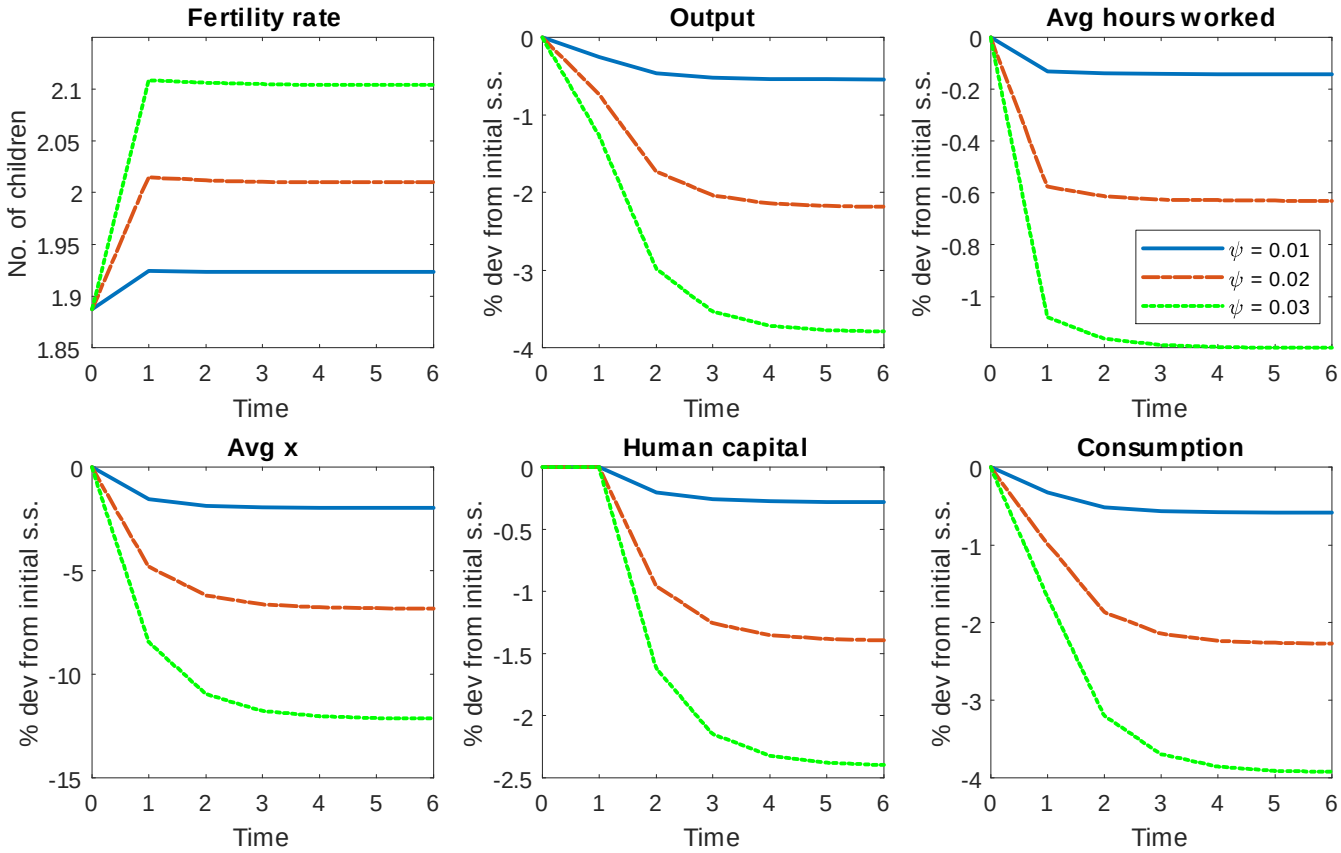
- Both steady-state comparisons (long-run) and transitional dynamics.
  - $t = ..., -2, -1, 0$ is the initial steady state (pre-reform).
  - In the beginning of $t = 1$, policy is introduced *unexpectedly* & *permanently*.

Long-run effects of pronatal transfers

	Benchmark	$\psi = .01$	$\psi = .02$	$\psi = .03$
Fertility rate n	1.887	1.923 (1.9%)	2.010 (6.5%)	2.104 (11.5%)
Avg x per kid/income	9.08%	8.94%	8.61%	8.28%
Income elasticity of n	.083	.070	.013	-.036
Income elasticity of x	.703	.703	.738	.766
Avg labor supply	.299	.298	.297	.295
Avg human capital	2.653	2.645	2.616	2.590
Output per capita	.793	.788	.776	.763
Income Gini	.252	.252	.254	.256
IGE	.337	.333	.329	.323
T/Y	0.0%	-2.4%	-5.2%	-8.3%

- It is somewhat effective in raising fertility (though very costly, T/Y).
- However, negative side effects on macroeconomic aggregates.

Effects of pronatal transfers over time



- All macroeconomic variables decline over time.
- Fertility and labor supply responses are relatively quick.

Private education investment tax

- Note that status externality leads to high investment and low fertility.
- Taking the status externality as given, it seems necessary to limit the equilibrium investment to address this market failure.
- In fact, Korean government has long been struggling to dampen high demands for private education.
  - In 1980, national government completely banned hagwons and private tutoring.
  - Seoul imposed 10 pm curfew on hagwon as of 2016 (private tutoring, 2017).
- To explore the implications of these policy attempts, consider
  - tax on private education investment: τ_x

$$c + (1 + \tau_x)xn \leq wh(1 - \lambda n - l) + T$$

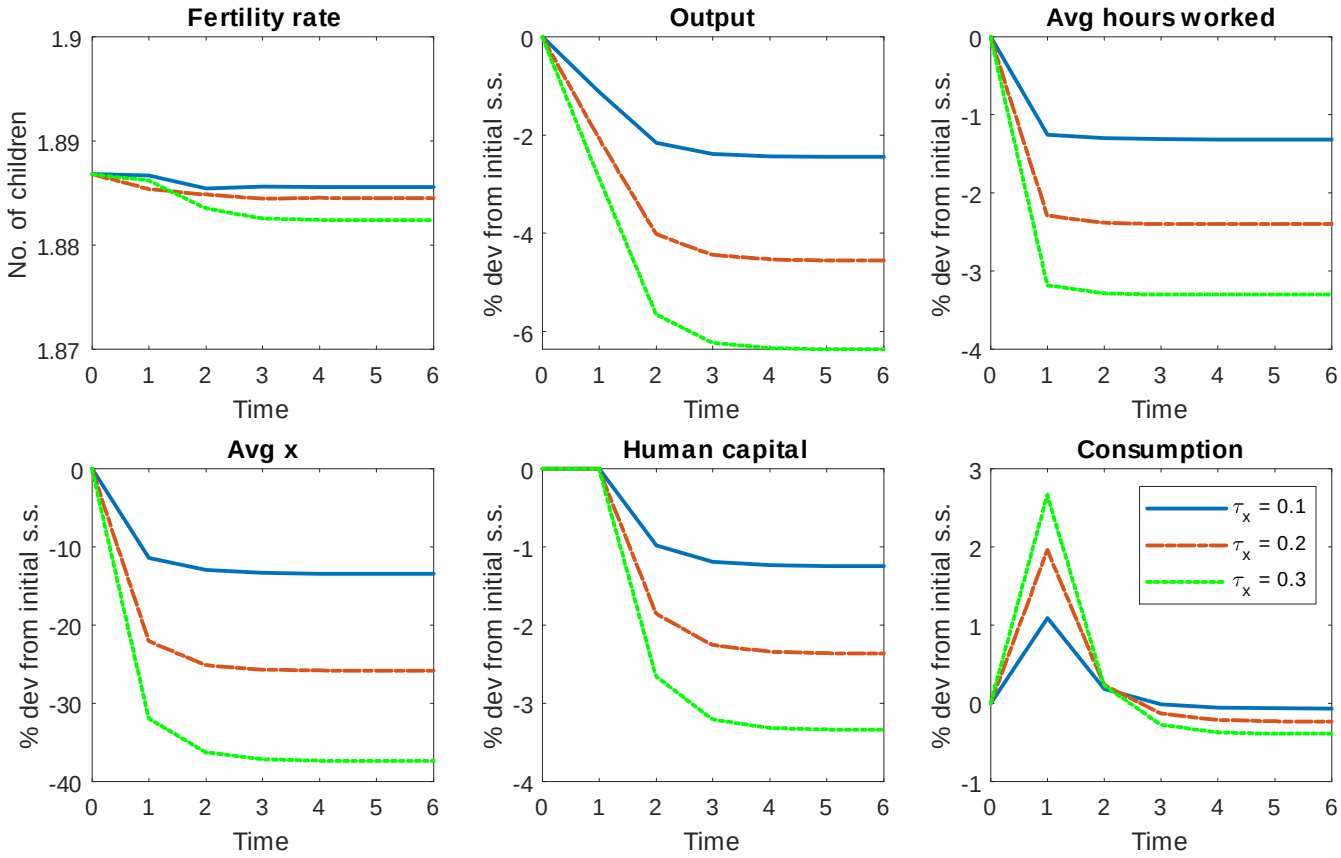
T : lump-sum transfer to balance government budget

Long-run effects of education investment taxes

	Benchmark	$\tau_x = .01$	$\tau_x = .02$	$\tau_x = .03$
Fertility rate n	1.887	1.886 (-0.1%)	1.884 (-0.1%)	1.882 (-0.2%)
Avg x per kid/income	9.08%	8.14%	7.35%	6.68%
Income elasticity of n	.083	.073	.062	.052
Income elasticity of x	.703	.685	.672	.665
Avg labor supply	.299	.295	.291	.289
Avg human capital	2.653	2.620	2.591	2.566
Output per capita	.793	.774	.758	.744
Income Gini	.252	.255	.257	.259
IGE	.337	.330	.323	.317
T/Y	0.0%	1.6%	3.0%	4.0%

- Education expenditures decline substantially.
- However, fertility does not increase (indeed it decreases slightly).

Effects of education investment taxes over time



- Most macroeconomic variables decline over time.
- Taxing intergen investments $\Rightarrow$ parents shift resources toward themselves.

Normative Analysis of Policy Reforms

Normative analysis

- Model with externality: typically equilibrium $\neq$ first best
- Distortion: when choosing education investments, parents do not take into account how this (negatively) affects other parents.
- Room for government intervention to correct distortion?
- If so, which ones? Subsidizing children, taxing private education, or both?

Welfare analysis challenges

- Heterogeneity:
  - Policies may create winners and loses.
  - Redistribution vs. distortion (e.g., Heathcote et al. 2017).

  $\Rightarrow$ Negishi weights Negishi weights
- Intergenerational concerns: externality affects parents only. So "fixing" it (e.g., by taxing education investment) may actually make kids worse off.

  $\Rightarrow$ Transition (not long-run comparisons)
- Pareto efficiency not defined in models with endogenous fertility

  $\Rightarrow$ $\mathcal{A}$-efficiency (based on people alive) A-Efficiency

Optimal policy

- Objective function: (weighted) average welfare of the first generation
  - Negishi weights (equal weights in Appendix)
  - first generation only in accordance with $\mathcal{A}$-efficiency
- We consider both
  - unexpected permanent policy reform
  - unexpected temporary (one-time) policy reform
- We consider both
  - baseline where externality feedback is operative.
  - restricted model where externality feedback is shut down by fixing $\bar{h}'_t = \bar{h}_{ss}$

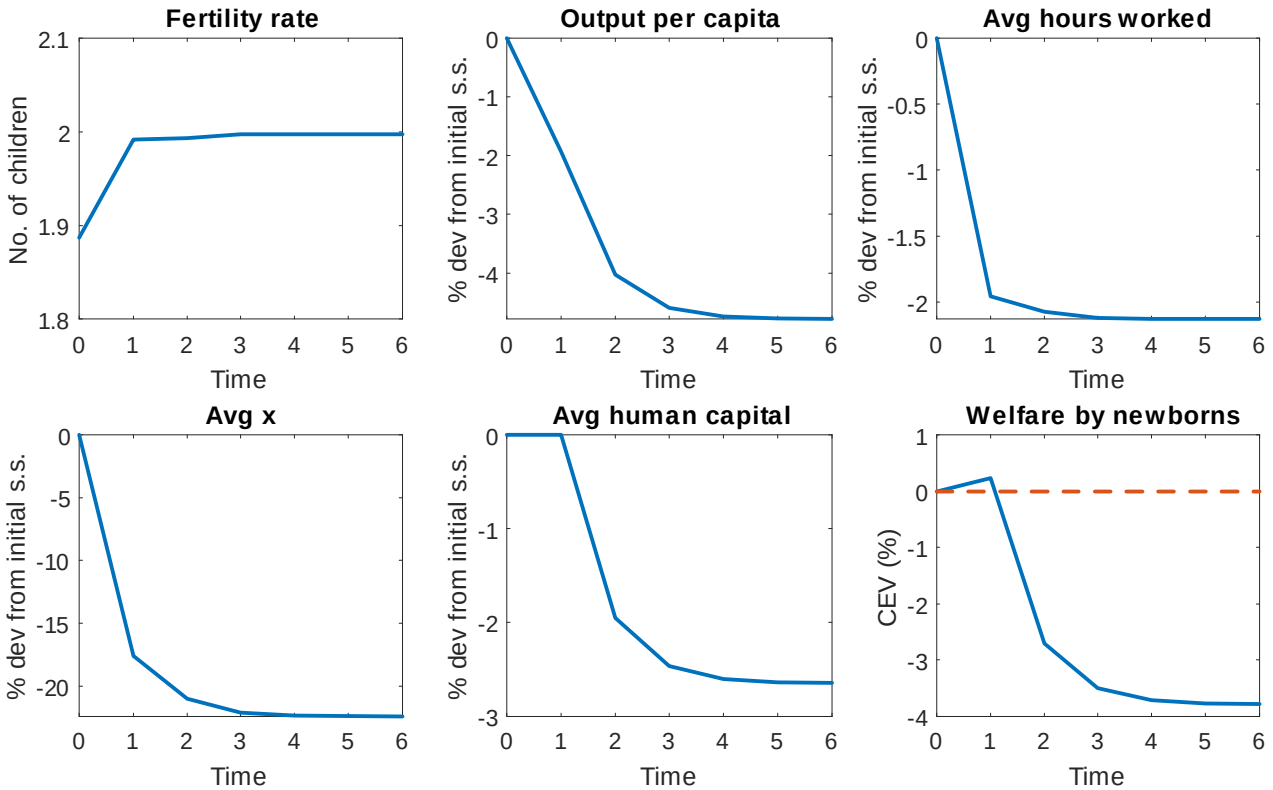
$$\log\left(h'_t - \chi \bar{h}_{ss}\right)$$

Optimal policy

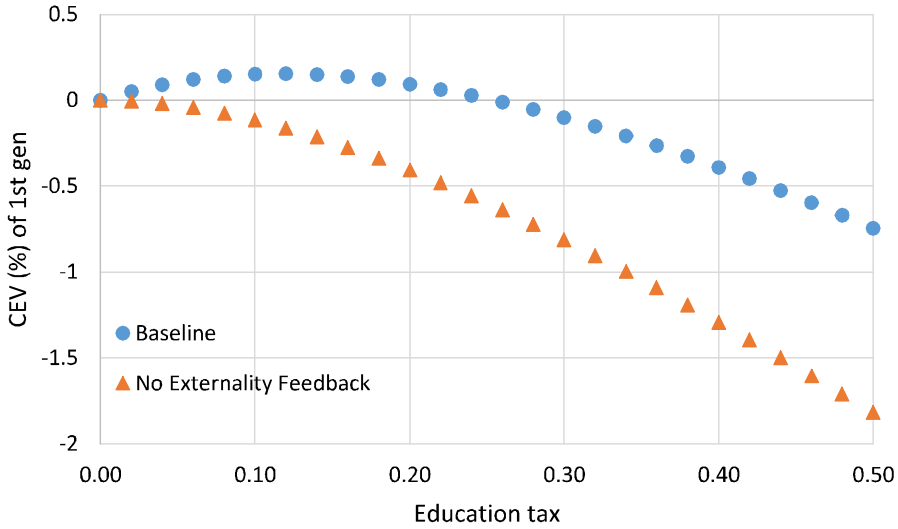
	τ_x^*	ψ^*	CEV (Gen. 1)
Baseline	0.120	0.017	0.236%
No Feedback	0.000	0.000	0.000%

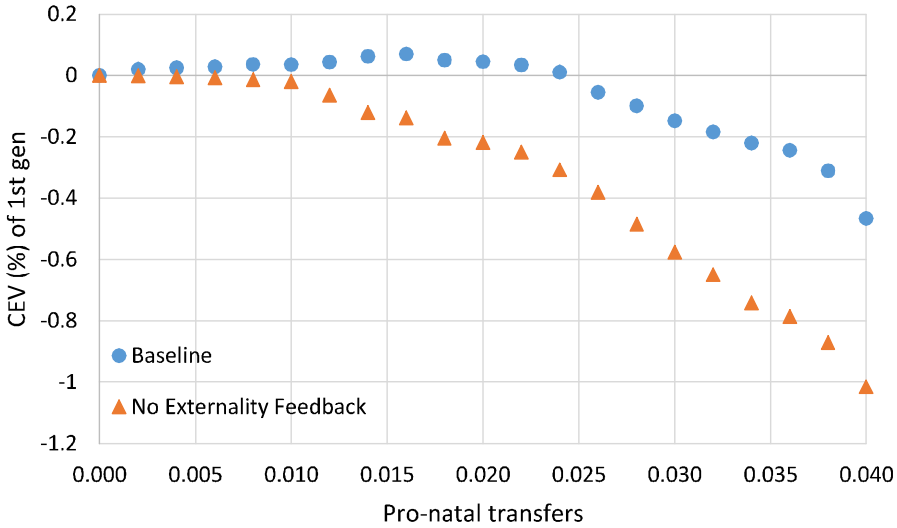
Optimal policy

Permanent change



Partial policy effects on Gen 1 welfare





Optimal policy

Temporary change

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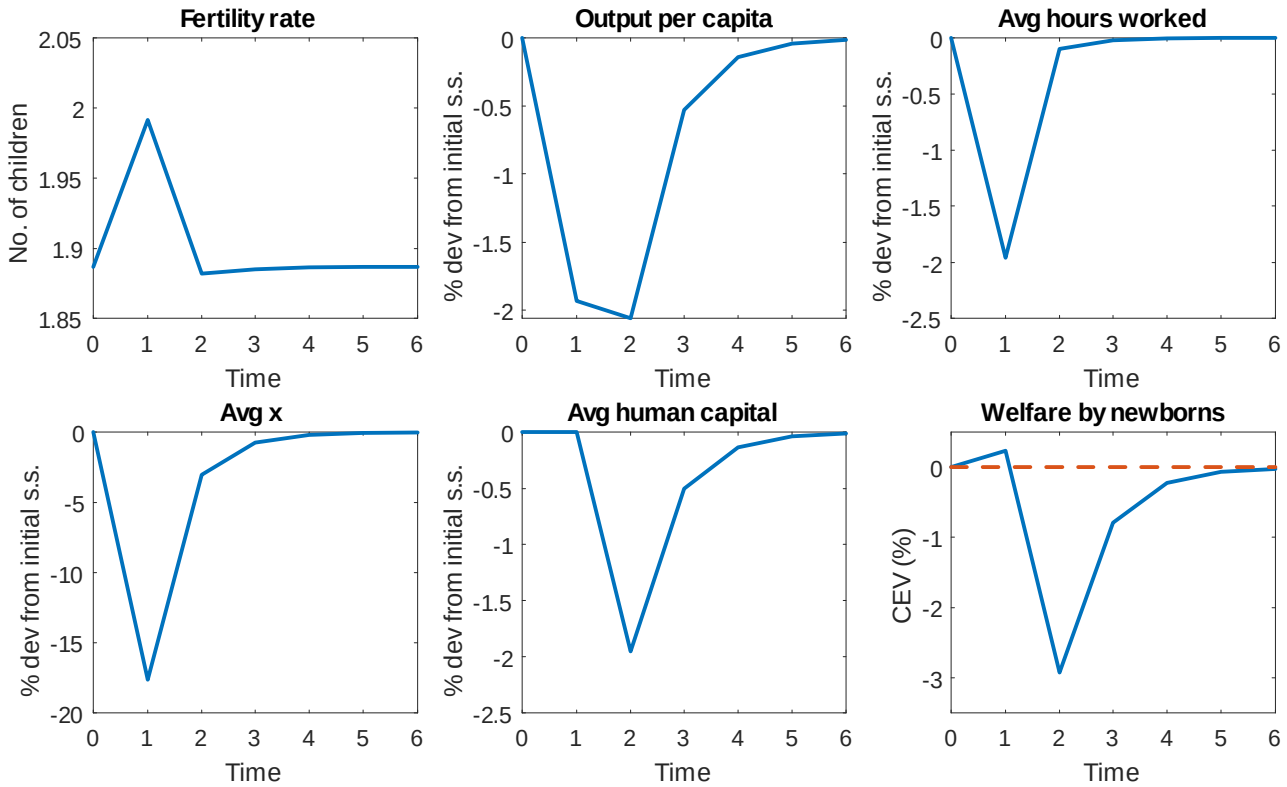


Heterogeneous effects of optimal policy on Gen 1

		Income quintile				
Average		1st	2nd	3rd	4th	5th
Fertility, n	Baseline	1.74	1.89	1.94	1.91	1.95
	Optimal policy	1.96	2.02	1.99	2.00	1.99
	% change	+13.0	+7.0	+2.4	+4.5	+1.7
Childlessness rate	Baseline	0.053	0.030	0.023	0.023	0.020
	Optimal policy	0.035	0.023	0.023	0.019	0.018
	p.p. change	-1.8	-0.7	-0.1	-0.3	-0.2
Investment per child, x	Baseline	0.046	0.056	0.067	0.081	0.111
	Optimal policy	0.037	0.047	0.056	0.068	0.094
	% change	-19.4	-17.0	-16.0	-16.5	-15.7

- Disproportionately raise fertility, reduce x at low-income quintiles.
  - resembling the economy without externality ($\chi = 0$).

Concluding remarks

- Explore a new mechanism linking "education fever" with low birth rates.
  - Parents care about relative quality of children (status externality)

    $\Rightarrow$ high education spending, which makes children very costly

    $\Rightarrow$ low fertility and higher childlessness
- Quantitative model captures cross-sectional patterns of fertility and private education investment well.
  - Without status externality, fertility 16% higher.
- Optimal policy maximizing welfare of the first generation
  - mix of both private education tax and pronatal transfers.
  - welfare gain of 0.24% CEV by addressing distortions
  - at the expense of future generations: they are worse off due to lower HK.

Back up slides

Negishi weights

- How to construct Negishi weights:
  1. Using simulated cross-sectional data in steady state, estimate $\{\hat{\beta}_i\}_{i=0}^{4}$

$$\log c = \beta_0 + \beta_1 \log h + \beta_2 \log \kappa_p + \beta_3 \log b + \beta_4 \log \kappa + \varepsilon$$

  2. Along transitions, for an individual with a state vector (h, κ_p, b, κ), we use the estimated $\{\hat{\beta}_i\}_{i=0}^{4}$ to predict $\hat{c}$, which gives $\varphi = \hat{c}/b$.
  3. Re-scale φ in each period such that they sum up to one.

Return

A-Efficiency

Definition

A feasible allocation $z = \{(f_i, x_i)\}_i$ is $\mathcal{A}$-efficient if there is no other feasible allocation $\hat{z}$ such that

$$\begin{array}{lcll} 1.\ u_i(\hat{f}, \hat{x}) & \geq & u_i(f, x) & \forall i \text{ alive in both allocations, } z \text{ and } z_i \\ 2.\ u_i(\hat{f}, \hat{x}) & > & u_i(f, x) & \text{for some } i \text{ alive in either } z \text{ and } z_i \end{array}$$

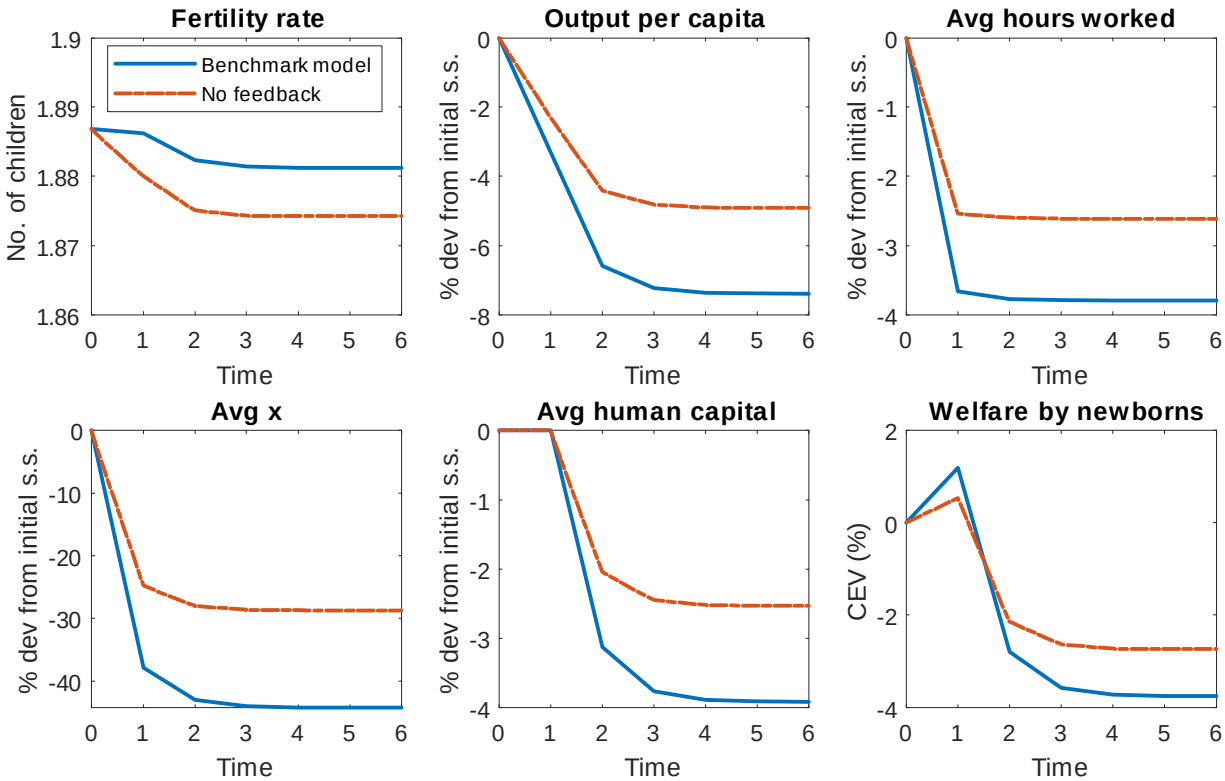
Based on Golosov, Jones and Tertilt (*Econometrica* 2007)

Return

Optimal policy with equal weights

Permanent change

	τ_x^*	ψ^*	CEV (Gen. 1)
Baseline	0.364	0.000	1.196%
No Feedback	0.232	0.000	0.538%



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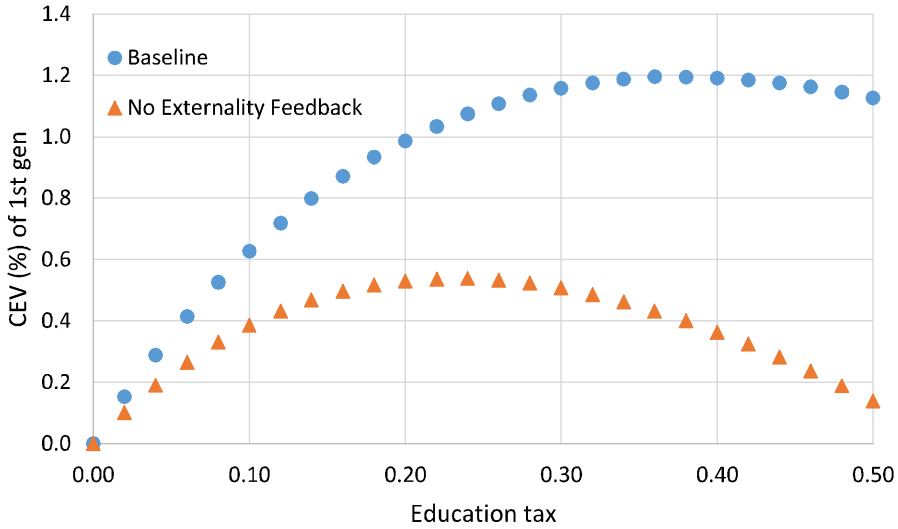

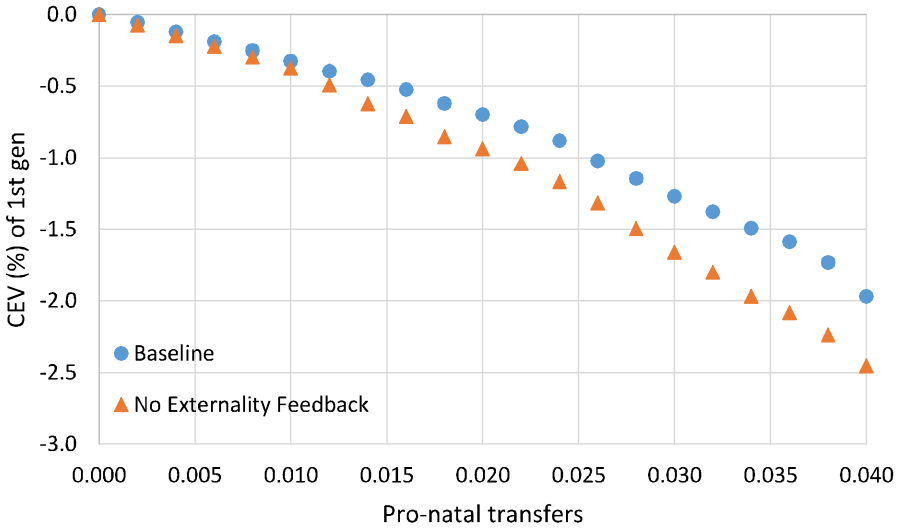

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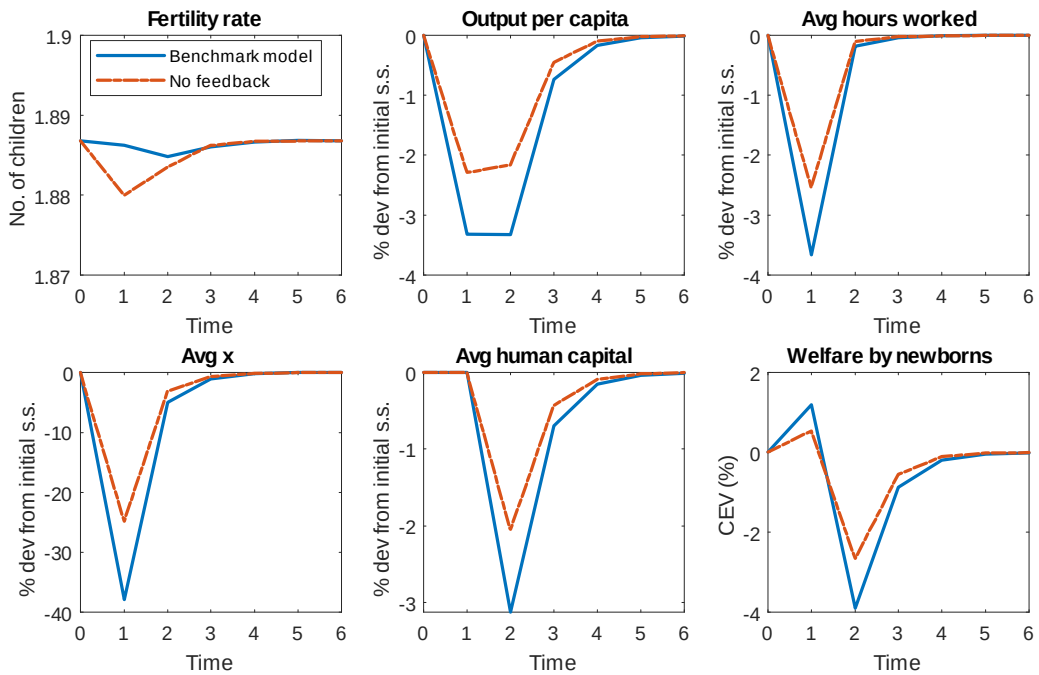

Heterogeneous effects of optimal policy on Gen 1

Equal weights

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Fertility, n	Baseline	1.74	1.89	1.94	1.91	1.95
	Optimal policy	1.78	1.89	1.93	1.91	1.92
	% change	+2.6	+0.1	-0.7	-0.3	-1.6
Childlessness	Baseline	0.053	0.030	0.023	0.023	0.020
rate	Optimal policy	0.051	0.030	0.025	0.027	0.021
	p.p. change	-0.2	+0.0	+0.2	+0.4	+0.1
Investment	Baseline	0.046	0.056	0.067	0.081	0.111
per child, x	Optimal policy	0.031	0.039	0.046	0.055	0.076
	% change	-31.2	-31.1	-31.3	-31.6	-31.7