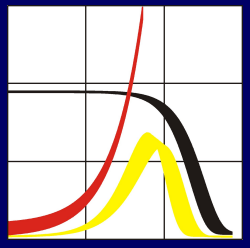


Max Planck Institute for Demographic Research

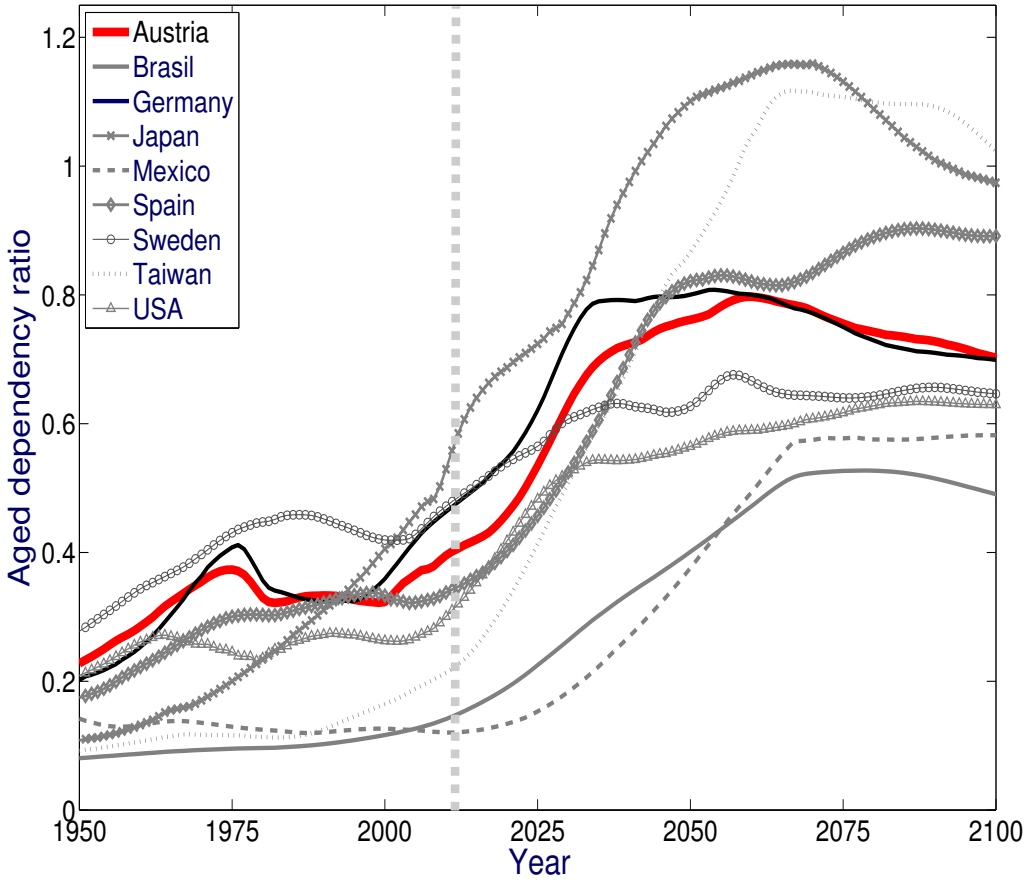
Bequest Estimate and Wealth Impact in Japan: Based on a CGE model with realistic demography
(Work-in-progress)

Miguel Sánchez-Romero[†] Naohiro Ogawa[‡] Rikiya Matsukura[‡]

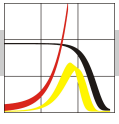
[†] Max Planck Institute for Demographic Research (MPIDR)

[‡] NUPRI, Nihon University

Japan is at the forefront of population aging $\Rightarrow \downarrow$ labor and production



Source: Authors' estimations based on local statistics, HFD, HMD, and UN Population Division. Notes: aged group (ages 62+), working group (ages 18-61).



Necessity of using additional resources for generating economic growth (mainly through **physical capital** and human capital)

However, there aren't estimations of bequest in Japan (micro-macro level)

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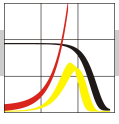

Two main questions:

Can we estimate bequest?

- Macro and historical: Piketty (2011) for France 1820-2050
- Lifecycle models: Kotlikoff and Summers (1981), Kotlikoff (1988), and Modigliani (1986, 1988) applied to US
- Wealth inequality: general equilibrium models (see literature review by Cagetti and Nardi (2008))

Can we use bequest to improve economic growth?

- Shall savings be annuitized?
- Who should receive bequest?
- "The tragedy of annuitization" by Heijdra et al. (2010) $\Rightarrow$ wealth should not be annuitized and it should be transferred to children

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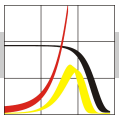
Research goals

1. Provide reliable estimates of bequest flows in Japan (using a CGE model with realistic demography)
2. Give insight on the observed inheritance profiles
3. Give policy recommendations



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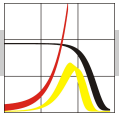
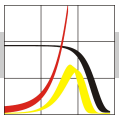


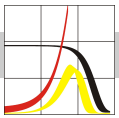
The model set-up

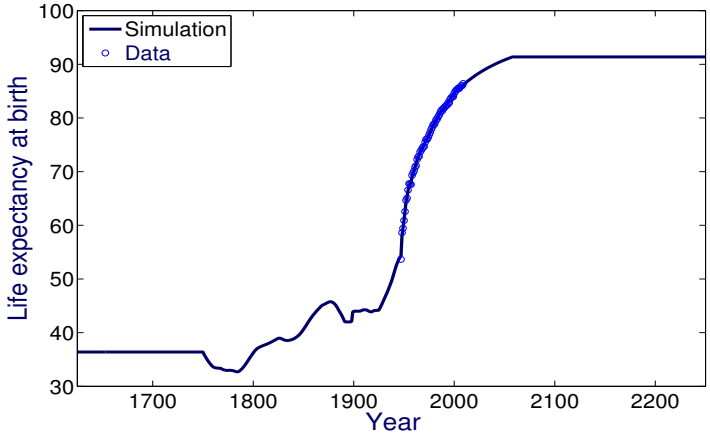
- Population
- Economic model



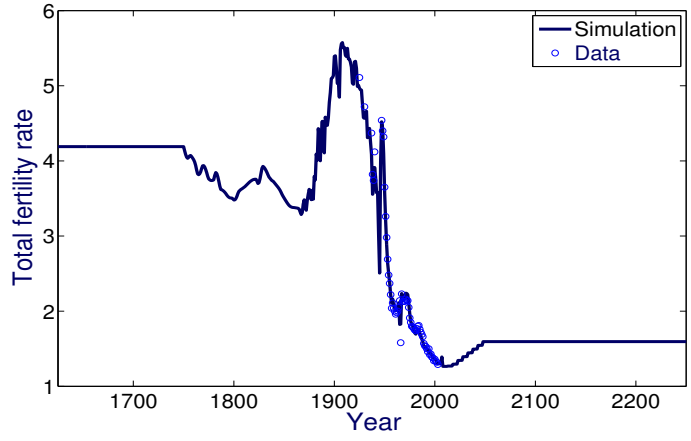
- Population

- Single sex model (“population reconstruction”)
  - Inverse projection, (Lee, 1985)
  - Generalized inverse population projection (Oeppen, 1993)
- Realistic fertility and mortality (exogenous)
- No migration
- Information derived from the population reconstruction:
  - ⋆ Adults, children, expected parents, expected number of sibling, expected number of offspring

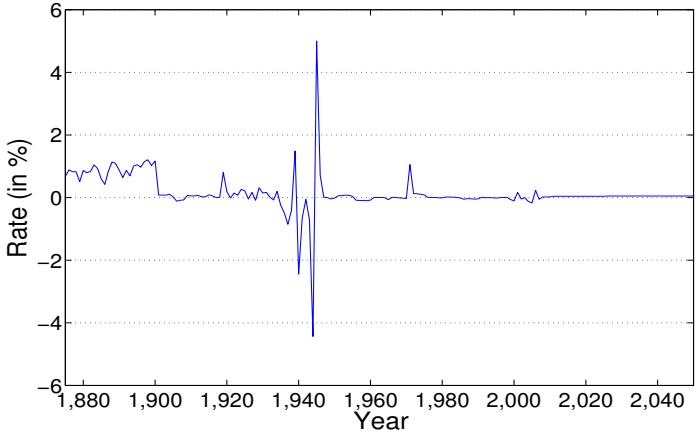




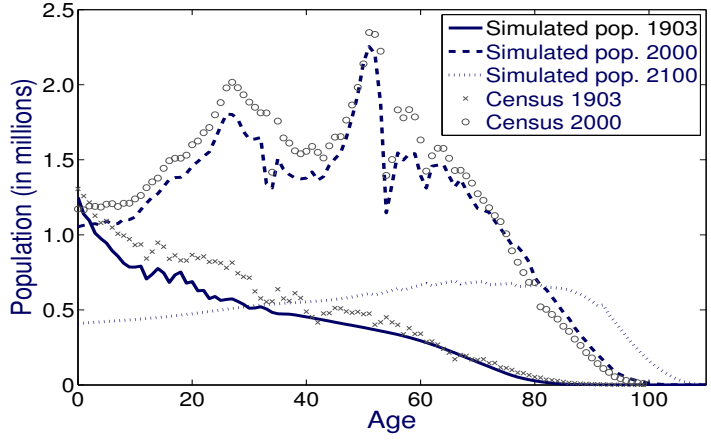
Life expectancy



Total fertility rate

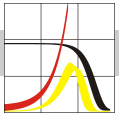


Net migration rate



Population distribution

Source: Authors' calculations. UN Population Division, Ministry of Health and Labor of Japan, and Statistics Bureau of Japan.



Model: CGE OLG model with realistic demography

Assumptions: Closed economy, perfect annuity market, no borrowing constraints, and competitive markets

- **Firm**: Demands labor (H) and capital (K)
- **Government**: Provides goods and services (G) and levies taxes on $\{\tau_{ct}, \tau_l, \tau_k, \tau_p, \tau_b\}$. Our government runs an unbalanced social security pension system
- **Individuals**: Maximum life span 120 years, (endog.) work effort, retirement, saving/consumption (child-rearing cost), and bequest. Preferences similar to Braun et al. (2009) and İmrohoroğlu and Kitao (2012)

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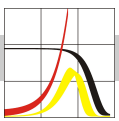


⋆ Economic unit (double-head “pseudo-household”)

- Two adults (2 heads)
- Dependent children
- Economic decisions:
  1. Consumption/saving
  2. Intensive and extensive labor supply (work effort, retirement age)
  3. Bequest
- Assumptions:
  1. No economies of scale
  2. All resources are equally distributed within the heads
  3. All individuals are paired with an individual of the same age when they become adults
  4. Exit from marriage can only occur because of death

Calibration

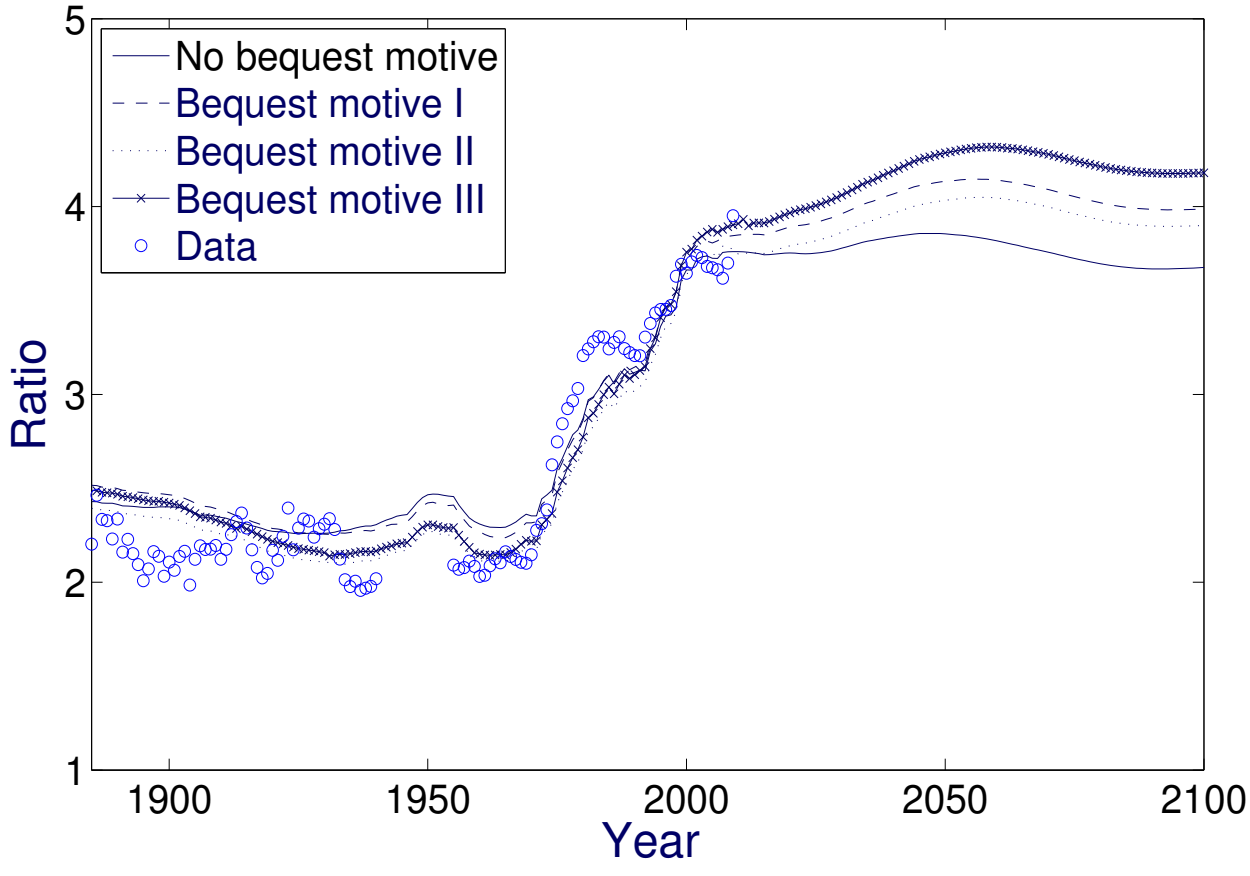
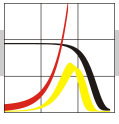
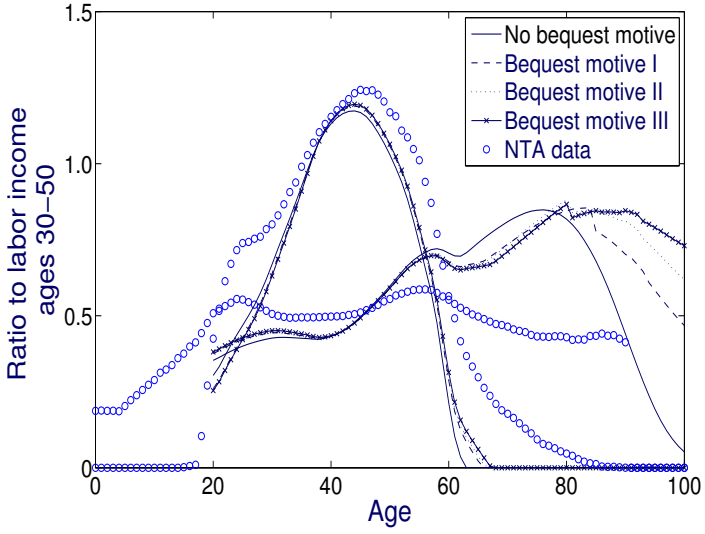
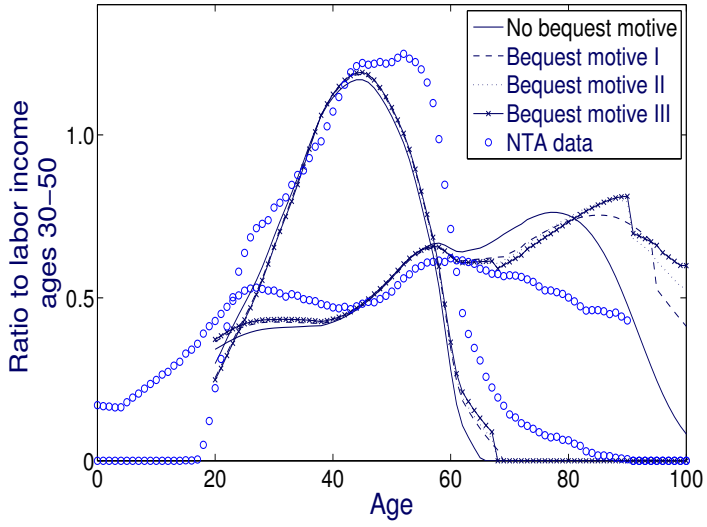


Figure: Capital-output ratio, period 1885-2100, Japan

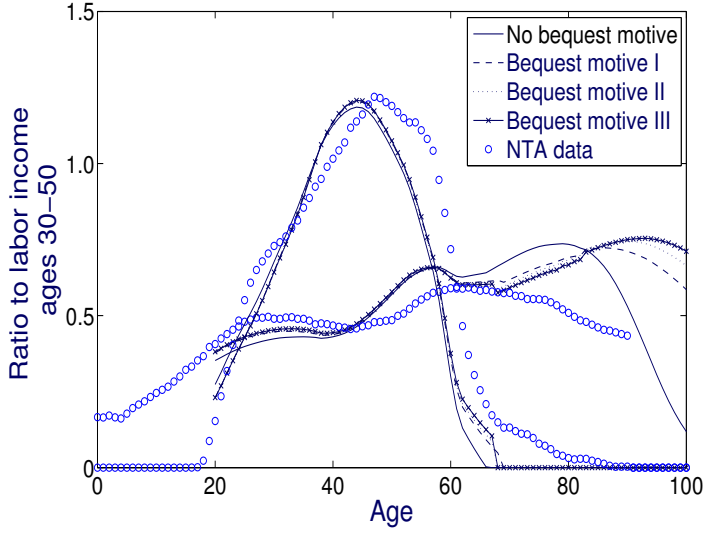




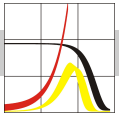
Consumption and labor income, 1984



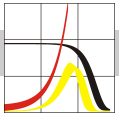
Consumption and labor income, 1994



Consumption and labor income, 2004



Comparison of our model to JSTAR data



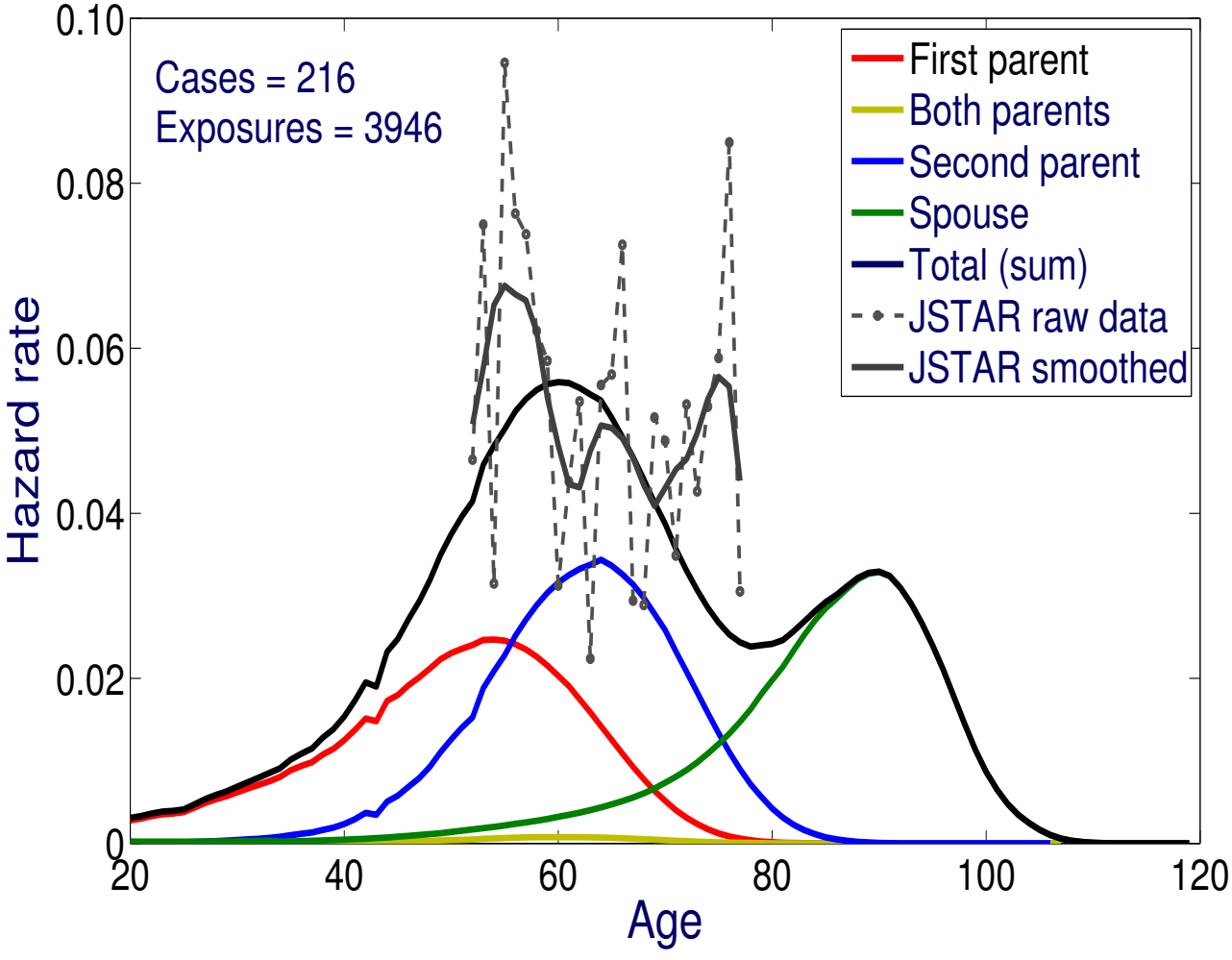
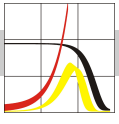


Figure: Inheritance hazard rate, year 2009



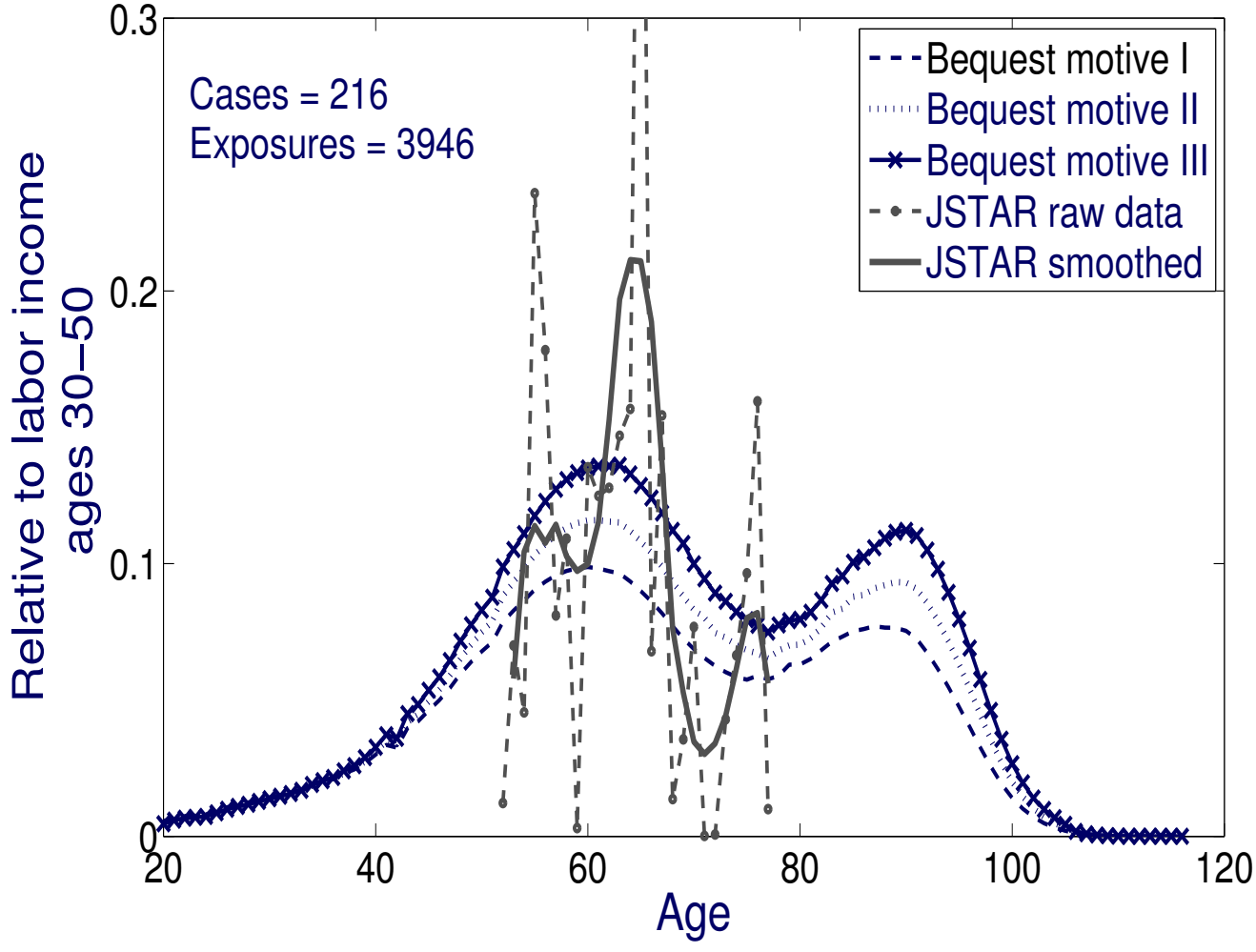


Figure: Average bequest received, year 2009

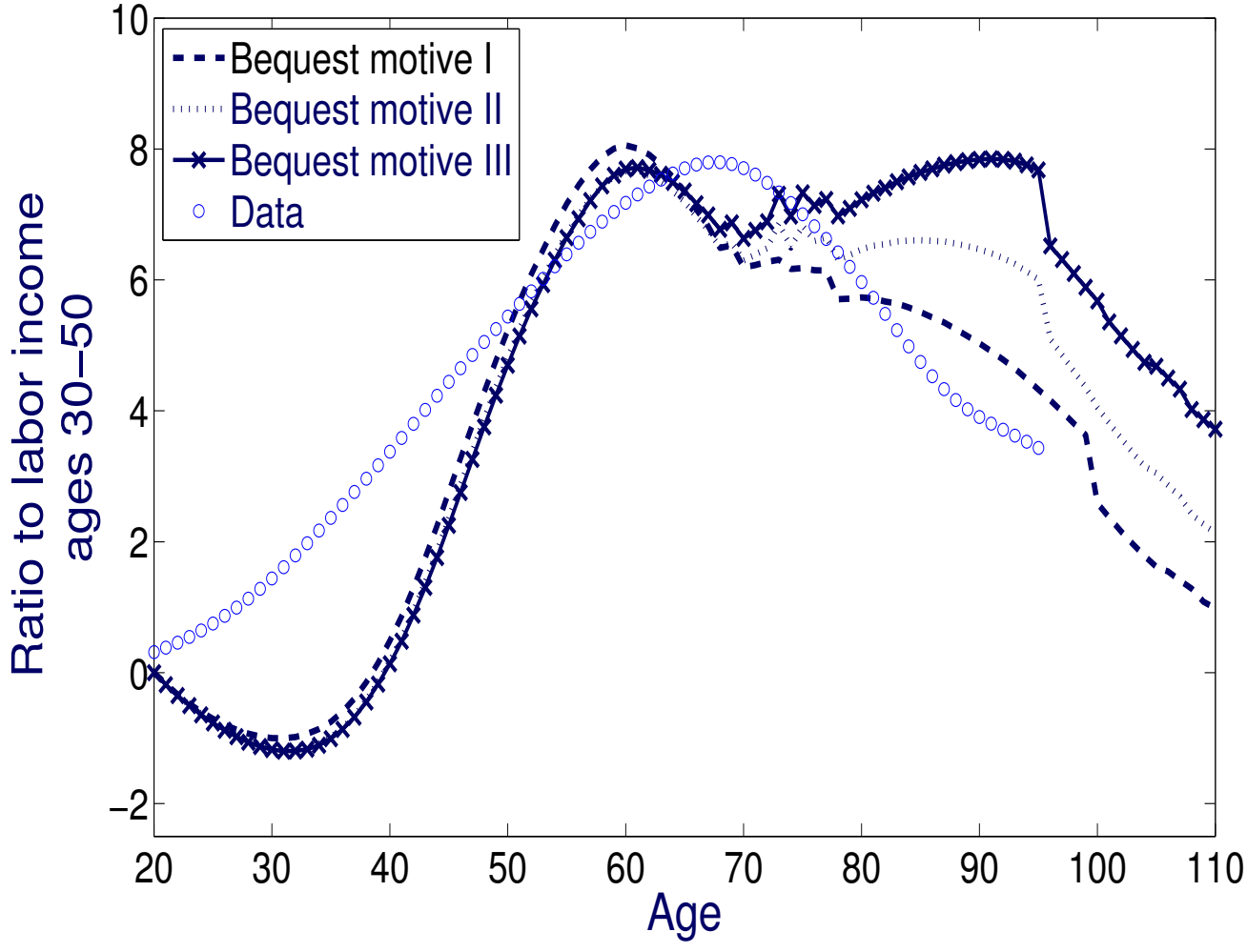
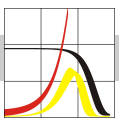
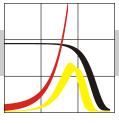


Figure: Assets profile, year 2009



The estimation of bequest in Japan from year 1885 to 2100



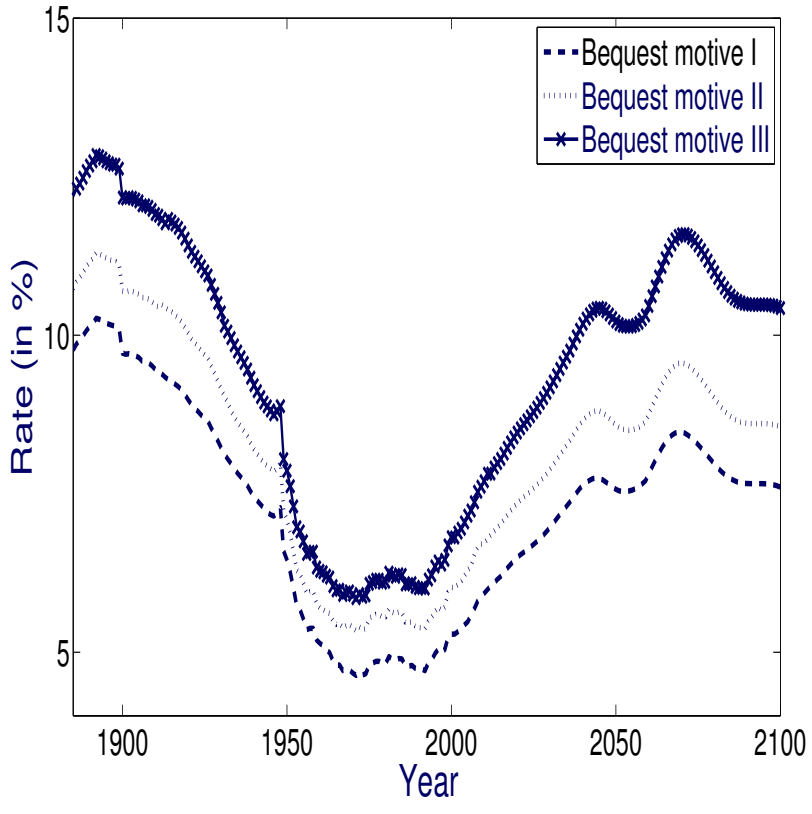
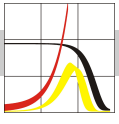
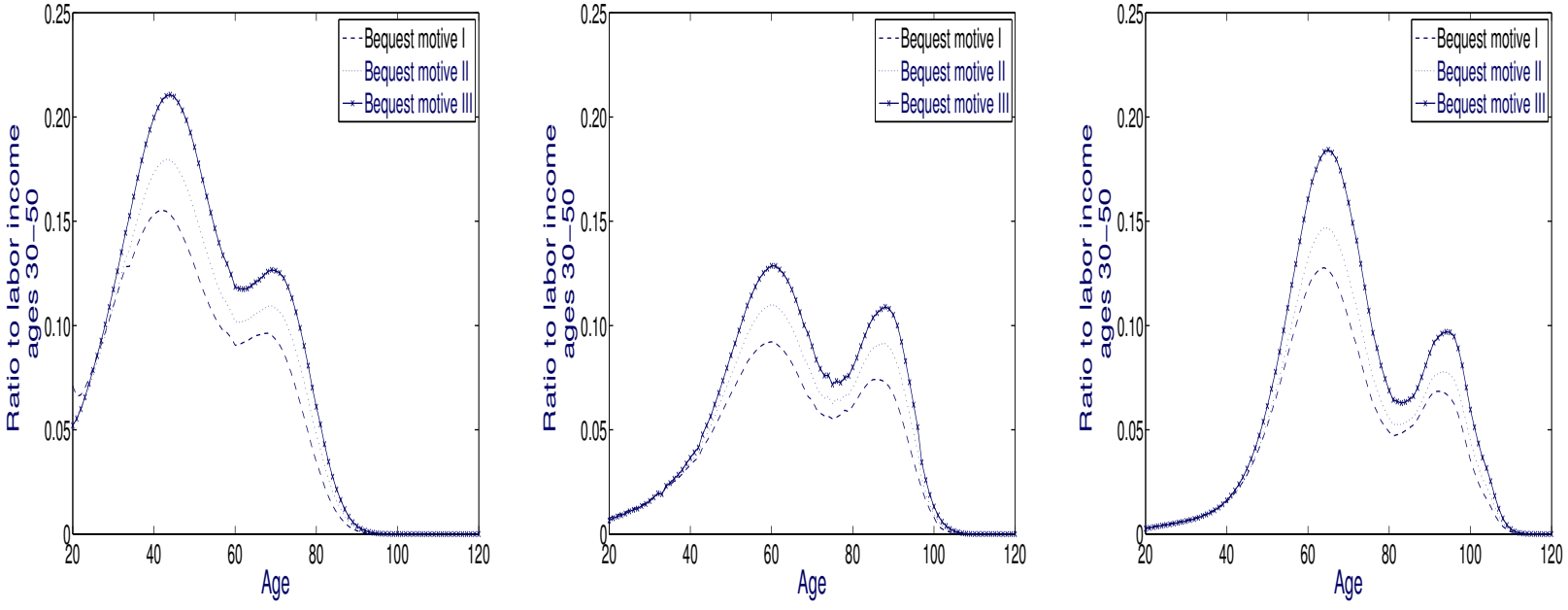


Figure: Bequest to output ratio (period 1885-2100), Japan

U-shaped pattern

- Piketty (2011, QJE): $r > n + \rho$ logic
- Alternative and complementary reasons from demography:
  - **Decline**
  - Rapid population growth $\downarrow K/N$
  - "Tempo effect" postponement of inheritance
  - $\downarrow$ precautionary saving ($\downarrow$ variability of the age at death)
  - **Increase**
  - Declining population $\uparrow K/N$
  - $\uparrow$ saving for retirement motive ($\uparrow e_R$)

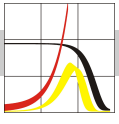




Year 1900 Year 2000 Year 2100

Figure: Simulated evolution of the bequest profile by bequest motive (selected years), Japan

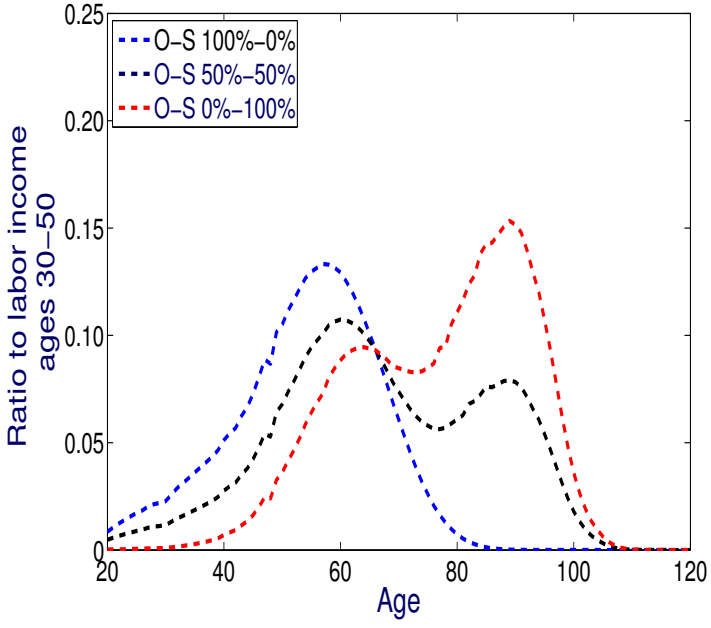
Counterfactual experiment I/II



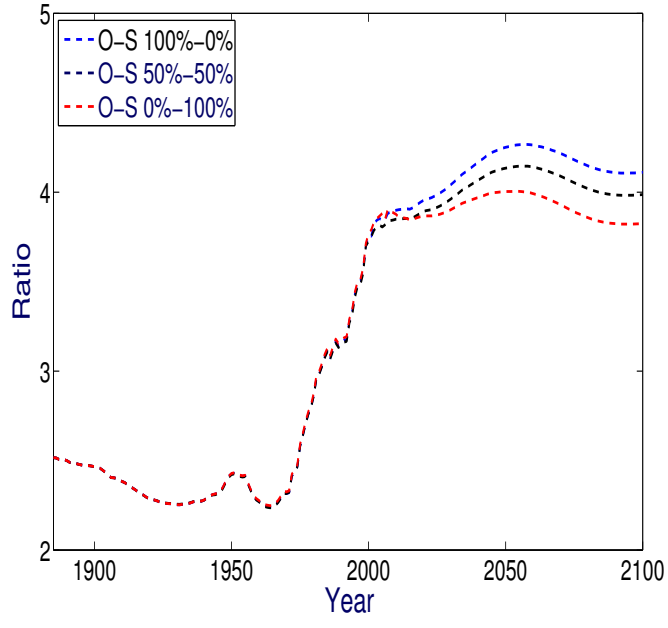
Inheritance law change in year 2015

- Three alternatives

1. Offspring-Spouse (O-S) $\Rightarrow$ 100% - 0%
2. Offspring-Spouse (O-S) $\Rightarrow$ 50% - 50%
3. Offspring-Spouse (O-S) $\Rightarrow$ 0% - 100%



Bequest profile, year 2015

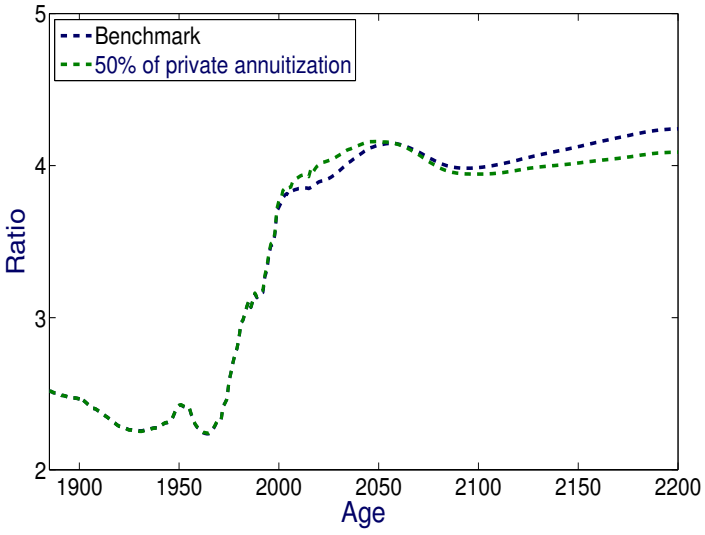


Capital-output ratio, period 1885-2100

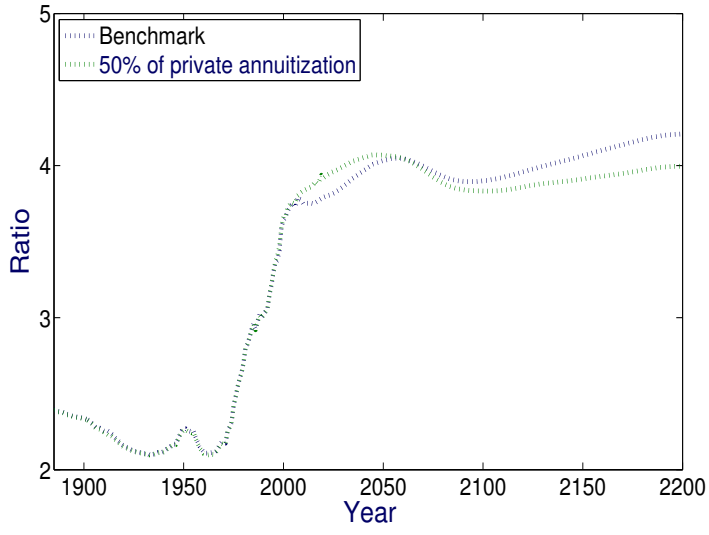
Counterfactual experiment II/II

"tragedy of annuitization: although full annuitization of assets is privately optimal it may not be socially beneficial due to adverse general equilibrium repercussions" [Heijdra et al. (2010), p. 3]

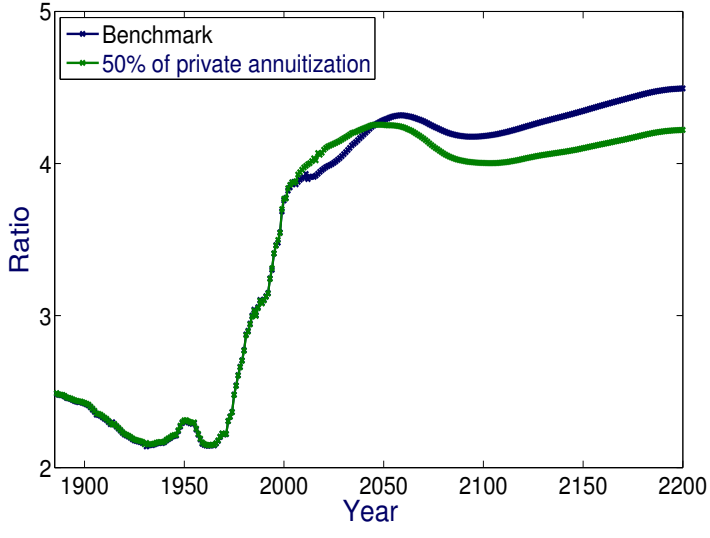
Thought experiment: mandatory annuitization of 50% of private assets from year 2015 onwards



Bequest motive I



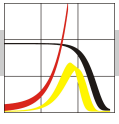
Bequest motive II



Bequest motive III

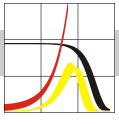
Conclusions

- Bequest profiles can be estimated using CGE models with realistic demography
- Inheritance in Japan also presents a U-shaped pattern similar to that in France ($\approx$ 10% before 1950, 5% 1970-2000, 7%-12% from 2050-)
- We provide an alternative and complementary explanation based on demography for the U-shaped pattern given by Piketty (2011)
- We find similar results shown by Heijdra et al. (2010), known as "The tragedy of annuitization" $\rightarrow$ no annuitization and $\uparrow$ share of transfers to children

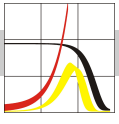


Thank you

The authors would like to thank Ronald Lee, Andrew Mason, and Hidehiko Ichimura for valuable comments.



Estimation of bequest



Bequest: Part I/II

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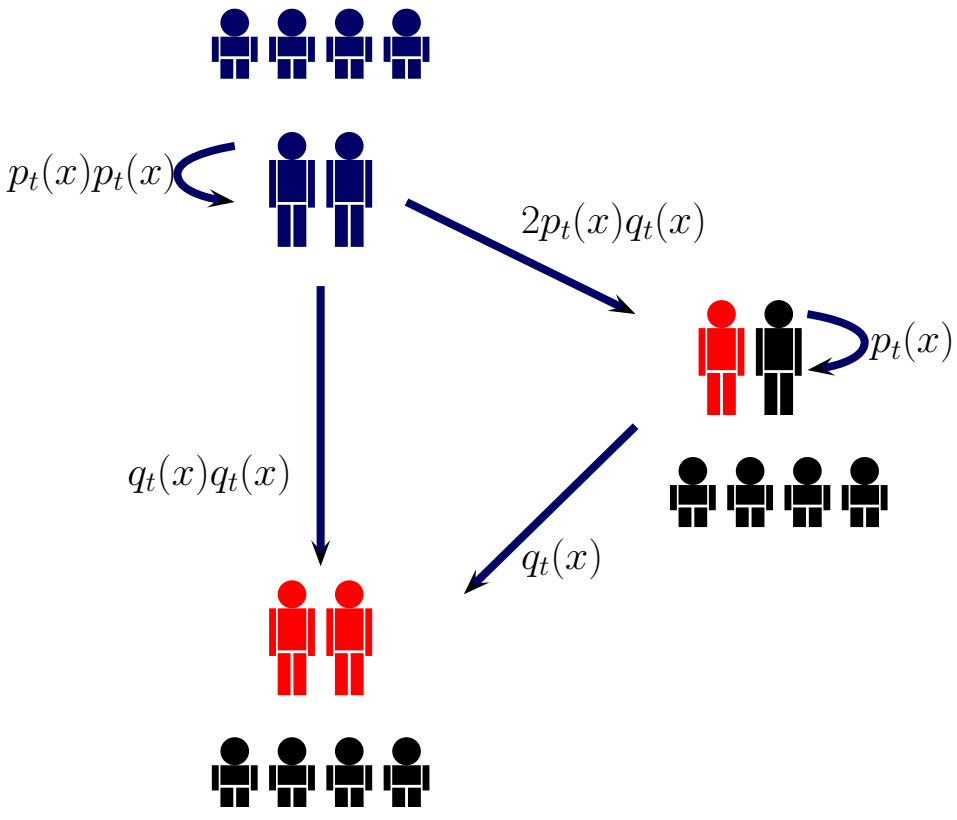


Figure: Expected bequest given, by partnership status and age

Bequest given at age *x* depends on

- Age
- Partnership status {married, widow/er}
- Number of eligible offspring
- Assets holding
- Inheritance law

Bequest: Part II/II

...

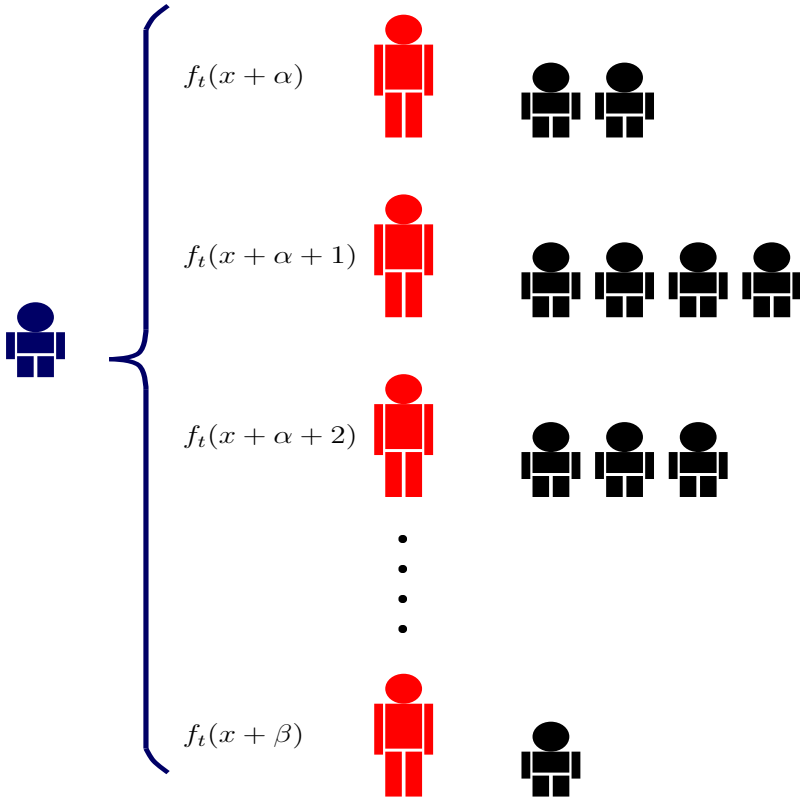
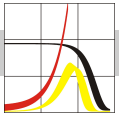


Figure: Expected bequest received from parent(s), by age

Bequest received at age *x* depends on

- Age of the expected parent
- Status of the parent {married, widow/er}
- Assets held by parent(s)
- Own marriage status
- Assets held by spouse
- Inheritance law



"Head's" problem

$$V(a_x;z) = \max_{c_x,\ell_x} \left\{ u(c_x, 1-\ell_x; \eta^c_x, \eta^\ell_x) + \beta \left(p_{x+1} V(a_{x+1};z) + (1-p_{x+1}) U^B(\tilde{a}_{x+1}) \right) \right\} \quad (1)$$

s.t.

$$a_{x+1} = \begin{cases} \left(R_x \left(1+\gamma \frac{q_x}{p_x} \right) - \tau_p \right) a_x + (R_x - \tau_b) B_x + (1-\tau_l)(1-\varsigma\tau_{s,x})\omega\varepsilon_x\ell_x - (1+\tau_{c,x})c_x & \text{if working,} \\ \left(R_x \left(1+\gamma \frac{q_x}{p_x} \right) - \tau_p \right) a_x + (R_x - \tau_b) B_x + (1-\tau_l) b_x(z) - (1+\tau_{c,x})c_x & \text{if retired,} \end{cases}$$

where $\tilde{a}$ is the effective bequest left (or $(1-\gamma)(1-\tau_b)a$), R is the compound (real) interest rate net of capital income tax, or $1+r(1-\tau_k)$, and $\gamma \in [0,1]$ is the percentage of private savings that are annuitized.

First-order conditions

- Optimal consumption (Euler equation)

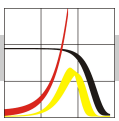
$$\frac{u_c(x)}{u_c(x+1)} = \beta p_{x+1} \left(R_{x+1} \left(1+\gamma \frac{q_{x+1}}{p_{x+1}} \right) - \tau_p \right) \frac{1+\tau_{c,x}}{1+\tau_{c,x+1}} + \beta(1+\tau_{c,x}) \frac{\tilde{a}_{x+1}}{a_{x+1}} \frac{U^B_a(x+1)}{u_c(x+1)}$$

- Optimal work effort

$$u_{1-\ell}(x)/u_c(x) = \omega\varepsilon_x(1-t_x), \text{ where } t_x = (1-\tau_l)(1-\varsigma\tau_{s,x})/(1+\tau_{c,x})$$

- Optimal retirement age

$$z^* = arg\max_{z\in\mathscr{Z}} V(a_{x_0};z)$$



"Head's" problem

$$V(a_x;z) = \max_{c_x,\ell_x} \left\{ u(c_x, 1-\ell_x; \eta_x^c, \eta_x^\ell) + \beta \left(p_{x+1} V(a_{x+1};z) + (1-p_{x+1}) U^B(\tilde{a}_{x+1}) \right) \right\} \quad (1)$$

s.t.

$$a_{x+1} = \begin{cases} \left(R_x \left(1+\gamma \frac{q_x}{p_x} \right) - \tau_p \right) a_x + (R_x - \tau_b) B_x + (1-\tau_l)(1-\varsigma\tau_{s,x})\omega\varepsilon_x\ell_x - (1+\tau_{c,x})c_x & \text{if working,} \\ \left(R_x \left(1+\gamma \frac{q_x}{p_x} \right) - \tau_p \right) a_x + (R_x - \tau_b) B_x + (1-\tau_l) b_x(z) - (1+\tau_{c,x})c_x & \text{if retired,} \end{cases}$$

where $\tilde{a}$ is the effective bequest left (or $(1-\gamma)(1-\tau_b)a$), R is the compound (real) interest rate net of capital income tax, or $1+r(1-\tau_k)$, and $\gamma \in [0,1]$ is the percentage of private savings that are annuitized.

First-order conditions

- Optimal consumption (Euler equation)

$$\frac{u_c(x)}{u_c(x+1)} = \beta p_{x+1} \left(R_{x+1} \left(1+\gamma \frac{q_{x+1}}{p_{x+1}} \right) - \tau_p \right) \frac{1+\tau_{c,x}}{1+\tau_{c,x+1}} + \beta(1+\tau_{c,x}) \frac{\tilde{a}_{x+1}}{a_{x+1}} \frac{U_a^B(x+1)}{u_c(x+1)}$$

- Optimal work effort

$$u_{1-\ell}(x)/u_c(x) = \omega\varepsilon_x(1-t_x), \text{ where } t_x = (1-\tau_l)(1-\varsigma\tau_{s,x})/(1+\tau_{c,x})$$

- Optimal retirement age

$$z^* = arg\max_{z\in\mathscr{Z}} V(a_{x_0};z)$$

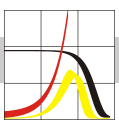


Table: Model economy parameters

	Symbol	Value	Source
Household heads			
Risk aversion parameter	σ	{2.5;3.0;3.50}	
Weight on consumption	ϕ	0.35	
Weight on bequest utility	ψ_1	{0;20;40;60}	
Curvature of bequest utility	ψ_2	$0.40A_\Omega$	
Subjective discount factor	β	1.00	
Age at leaving parent's home	x_0	20	
Employee social contribution share	ς	0.50	
Technology			
Capital share	α	0.363	Hayashi and Prescott (2002), Chen et al. (2007), Braun et al. (2009)
Depreciation rate	δ	5.00%	National accounts
Future labor-aug. techn. progress	dA_t/A_t	1.00%	
Labor efficiency profile	ε_x		Braun et al. (2009)
Government			
Public consumption to output	G/Y	0.12	National accounts
Capital income tax rate	τ_k	0.150	OECD
Labor income tax rate	τ_l	0.075	OECD
Property tax rate	τ_p	0.005	OECD
Bequest tax rate	τ_b	0.100	OECD