Rising Earnings Inequality and Optimal Income Tax And Social Security Policies

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Motivation

- Recent literature studied implications of rising inequality on the optimal income tax-and-transfer system

  Corbae, D'Erasmo, Kuruscu (2009), Lockwood and Weinzierl (2016), Wu (2021), Chang, Chang, Kim (2018), Heathcote, Storesletten, Violante (2020)

- Redistributive role of Social Security has been largely ignored

- Both programs redistribute incomes across and within generations

How did the US government preferences over income redistribution change since the 1980s?

What I do

- OLG model with Ramsey government choosing income tax schedule and public pension system
- Pareto weights depend on agent's age and education

- Decompose total change in actual policies since the 1980s into:
  1. Effect of economic forces (inequality, aging, technology, etc.)
  2. Residual change is attributed to the shift in Pareto weights (government preferences)

Findings

- US government has become less willing to redistribute incomes from educated to uneducated people and ...
- ... more willing to redistribute incomes from workers to retirees
- These findings are conditional on population aging and rising college attendance
- Preferences over income redistribution within/between generations are interconnected and must be studied jointly

Model

Demographics & Production

- Extend general equilibrium model à la Huggett (1996) by:
  - Endogenous human capital accumulation and retirement
  - Optimal joint income taxation and Social Security

- Agents enter as workers with education level $z \in \{H, L\}$
- Survival rates $\psi_{z,j}$ are age- and education-specific
- Agents save into risk-free asset at after-tax return $(1 - \tau_a) r_t$

- Firms produce final good according to $Y_t = K_t^{\varpi} {N_t}^{1-\varpi}$
- Total effective labor supply: $N_t = \left(N_{t,L}^{\rho} + N_{t,H}^{\rho} \right)^{\frac{1}{\rho}}$

Worker's Labor Productivity

- Worker with education level z enters labor market with initial skill $h_{1,z}$ and learning ability θ_z

- Law of motion for skills:

$$h_{j+1,z} = (1 - \delta^h) \cdot h_{j,z} + \theta_z \cdot (h_{j,z} \cdot s)^{\gamma^h}$$

  s – hours spent on learning, δ^h – skill depreciation

- Worker's pre-tax earnings: $e = w_{t,z} \times h_{j,z} \times v_z \times y_{j,z} \times l$

  v_z – fixed effect, $y_{j,z}$ – idiosyncratic shock, l – work hours

Government: Social Security

- Workers pay tax $\tau_{SS,t}$ on taxable earnings $\tilde{e}_{SS} = \min(e, cap_{SS})$

- Normal pension $\bar{b}$ is determined by replacement rate schedule

- Empirical replacement rate schedule is approximated using:

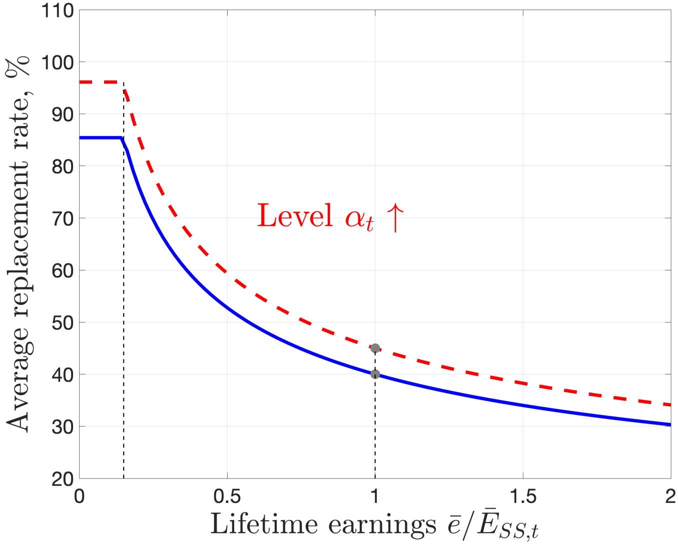
$$R_t(\bar{e}; \alpha_t) = \begin{cases} \alpha_t \times \left(\bar{e}/\bar{E}_{SS,t}\right)^{\bar{\alpha}} & \text{if } \bar{e} \geq \bar{e}_{\min} \\ \alpha_t \times \left(\bar{e}_{\min}/\bar{E}_{SS,t}\right)^{\bar{\alpha}} & \text{otherwise} \end{cases}$$

α_t – level of the replacement rate schedule (policy instrument)

$\bar{E}_{SS,t}$ – mean taxable earnings

- Given α_t, Social Security tax $\tau_{SS,t}$ adjusts each period to balance pay-as-you-go budget

Government: Social Security



Government: Income Taxation

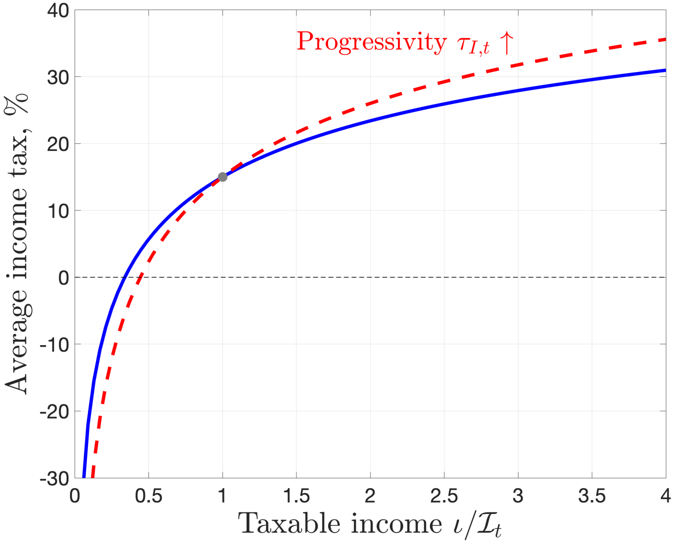
- Taxable income $\iota = e - 0.5\tau_{SS,t}\tilde{e}_{SS} - 0.5\tau_M \tilde{e}_M$
- Income is taxed according to:

$$\Lambda_t(\iota) = \iota/\mathcal{I}_t - (1 - \bar{\tau}_{I,t}) \times (\iota/\mathcal{I}_t)^{1-\tau_{I,t}}$$

$\mathcal{I}_t$ – mean taxable income

- $\tau_{I,t}$ controls income tax progressivity (policy variable)
- Capital income $r_t k$ is taxed separately at fixed rate τ_k
- Given $\tau_{I,t}$, the income tax level $\bar{\tau}_{I,t}$ balances consolidated government budget

Government: Income Taxation



Quantitative Experiment

Set-up

- Economy is in steady state at $t = \{1980, 2010\}$
- Social welfare function:

$$SWF_t = \sum_j \int \underbrace{\omega(\cdot;\boldsymbol{\kappa}_t)}_{\text{Pareto weights}} \underbrace{V_t(\boldsymbol{x};\boldsymbol{\Psi}_t,\boldsymbol{\Upsilon}_t,\boldsymbol{\Upsilon}_t^0)}_{\text{Value function}} \underbrace{dF_{t,j}}_{\text{Distribut.}}$$

$\boldsymbol{\Upsilon}_t = (\tau_{I,t}, \alpha_t)$ – chosen policy, $\boldsymbol{\Upsilon}_t^0$ – initial policy, $\boldsymbol{\Psi}_t$ – model parameters
$\boldsymbol{x}$=(age,education,average earnings,assets,skills,shocks,retirement status)

- Pareto weights: $\omega(j, z;\boldsymbol{\kappa}_t) = \exp(-\kappa_{1,t} \cdot j + \kappa_{2,t} \cdot \mathbb{1}_{z=H})$

$\kappa_{1,t}$ – age bias, $\kappa_{2,t}$ – educational bias

- At time t, government chooses constant future policy $\boldsymbol{\Upsilon}_t^\star$ given by:

$$\boldsymbol{\Upsilon}_t^\star(\boldsymbol{\Psi}_t,\boldsymbol{\kappa}_t;\boldsymbol{\Upsilon}_t^0) = \arg\max_{\boldsymbol{\Upsilon}_t} SWF_t$$

Set-up

	1980	2010	$\triangle$
Progressivity $\tau^\star_{I,t}$	0.187	0.137	–0.05
Replacement rate $\alpha^\star_t$, %	35.9	39.4	+3.5 pp

Table: Income tax and Social Security policies in the data ($\boldsymbol{\Upsilon}_t^{\text{data}}$)

- Over time, income tax progressivity $\downarrow$ and replacement rates $\uparrow$
- The change in $\boldsymbol{\Upsilon}_{2010}^{\text{data}} - \boldsymbol{\Upsilon}_{1980}^{\text{data}}$ is driven by:
  1. Effect of economic forces (aging, inequality, etc.)
  2. Shift in government preferences
- Next I show how to isolate 2) from 1)

Quantitative Experiment: Roadmap

1. Identify Pareto weight parameter $\boldsymbol{\kappa}_{1980}$ that solves:

$$\boldsymbol{\Upsilon}^{\text{data}}_{1980} = \boldsymbol{\Upsilon}^{\star}_{1980}(\boldsymbol{\Psi}_{1980}, \boldsymbol{\kappa}_{1980}; \boldsymbol{\Upsilon}^{\text{data}}_{1980})$$

2. Compute optimal policy under new parameters and old weights:

$$\boldsymbol{\Upsilon}^{\star}_{int} = \boldsymbol{\Upsilon}^{\star}_{int}(\boldsymbol{\Psi}_{2010}, \boldsymbol{\kappa}_{1980}; \boldsymbol{\Upsilon}^{\text{data}}_{1980})$$

$\boldsymbol{\Upsilon}^{\star}_{int} - \boldsymbol{\Upsilon}^{\text{data}}_{1980}$ quantifies the impact of economic forces

3. Identify Pareto weight parameter $\boldsymbol{\kappa}_{2010}$ that solves:

$$\boldsymbol{\Upsilon}^{\text{data}}_{2010} = \boldsymbol{\Upsilon}^{\star}_{int}(\boldsymbol{\Psi}_{2010}, \boldsymbol{\kappa}_{2010}; \boldsymbol{\Upsilon}^{\star}_{int})$$

Shift in government preferences is given by $\boldsymbol{\kappa}_{2010} - \boldsymbol{\kappa}_{1980}$

Findings

Quantitative Experiment

1. Identify Pareto weight parameter $\boldsymbol{\kappa}_{1980}$ that solves:

$$\boldsymbol{\Upsilon}^{\text{data}}_{1980} = \boldsymbol{\Upsilon}^{\star}_{1980}(\boldsymbol{\Psi}_{1980}, \boldsymbol{\kappa}_{1980}; \boldsymbol{\Upsilon}^{\text{data}}_{1980})$$

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$$\boldsymbol{\Upsilon}^{\text{data}}_{2010} = \boldsymbol{\Upsilon}^{\star}_{int}(\boldsymbol{\Psi}_{2010}, \boldsymbol{\kappa}_{2010}; \boldsymbol{\Upsilon}^{\star}_{int})$$

Utilitarian vs. Actual Policies

	Equal Pareto weights		Data
	Newborns	All alive	(1980)
Optimal policy:			
Progressivity $\tau_I^\star$			0.187
Replacement rate $\alpha^\star$, %			35.9
Equilibrium variables:			
Income tax level $\bar{\tau}_I$, %			9.30
Soc.Sec. tax τ_{SS}, %			8.90

Utilitarian vs. Actual Policies

	Equal Pareto weights		Data
	Newborns	All alive	(1980)
Optimal policy:			
Progressivity $\tau_I^\star$	0.141		0.187
Replacement rate $\alpha^\star$, %	0.0		35.9
Equilibrium variables:			
Income tax level $\bar{\tau}_I$, %	11.42		9.30
Soc.Sec. tax τ_{SS}, %	0.0		8.90

- Government prefers to shut down Social Security
- This holds for any distribution of education-specific Pareto weights

This approach fails to explain why
income tax and Social Security programs coexist in the data

Utilitarian vs. Actual Policies

	Equal Pareto weights		Data
	Newborns	All alive	(1980)
Optimal policy:			
Progressivity $\tau_I^\star$, %	0.141	0.048	0.187
Replacement rate $\alpha^\star$, %	0.0	70.0	35.9
Equilibrium variables:			
Income tax level $\bar{\tau}_I$, %	11.42	11.76	9.30
Soc.Sec. tax τ_{SS}, %	0.0	19.53	8.90

- Government chooses positive but too large Social Security

To match both policies, augment this model with education- and age-specific Pareto weights

Estimated Pareto Weights in the 1980s

	Baseline (1980s)
Age bias, $\kappa_{1,t}$	0.069
Weight on age 25 / age 64	15.80
Educational bias, $\kappa_{2,t}$	–0.731
Weight on col./ non-col.	0.48

To match $\Upsilon^{\text{data}}_{1980}$, Pareto weight distribution must be skewed towards younger and less educated workers

Quantitative Experiment: Roadmap

1. Identify Pareto weight parameter $\boldsymbol{\kappa}_{1980}$ that solves:

$$\Upsilon^{\text{data}}_{1980} = \Upsilon^{\star}_{1980}(\Psi_{1980}, \boldsymbol{\kappa}_{1980}; \Upsilon^{\text{data}}_{1980})$$

2. Compute optimal policy under new parameters and old weights:

$$\Upsilon^{\star}_{int} = \Upsilon^{\star}_{int}(\Psi_{2010}, \boldsymbol{\kappa}_{1980}; \Upsilon^{\text{data}}_{1980})$$

3. Identify Pareto weight parameter $\boldsymbol{\kappa}_{2010}$ that solves:

$$\Upsilon^{\text{data}}_{2010} = \Upsilon^{\star}_{int}(\Psi_{2010}, \boldsymbol{\kappa}_{2010}; \Upsilon^{\star}_{int})$$

Optimal Policy in the 2010s: Decomposition

Experiment	Parameters updated	Optimal policies $\tau^{\star}_{I,t}$	Optimal policies $\alpha^{\star}_{t}$	Equilib. variables $\bar{\tau}_{I,\infty}$	Equilib. variables $\tau_{SS,\infty}$
1. Aging	$(\psi_{z,j}, n)$	-0.010	$+9.83$	$+0.46$	$+5.34$
2. Production	(ϖ, δ)	-0.005	-6.55	-2.60	-1.70
3. Social Security	$(J^R, \bar{\alpha}, \bar{e}_{\min}, \delta^p, cap_{SS})$	-0.060	-0.26	$+1.02$	-1.31
4. Medicare	$(m_j, \eta, \tau_M, cap_M)$	-0.050	-1.62	$+1.79$	-0.31
5. Other policies	(τ_c, τ_a, gy, dy)	-0.048	-9.24	$+0.82$	-2.41
6. Inequality:					
– Supply of col. grad.	Π_z	-0.046	-4.10	$+1.10$	-0.71
– Human capital	$(\theta_z, h_{1,z}, \delta^h)$	$+0.063$	$+9.67$	-5.72	$+2.81$
– Fixed effects	$\sigma^2_{v,z}$	$+0.064$	$+4.41$	-4.26	$+1.03$
– Skill complement.	(ρ, Z)	$+0.014$	$+9.20$	-2.96	$+3.45$
– Idiosyncratic risk	$(\rho_z, \sigma^2_{\epsilon,z})$	-0.030	-2.24	$+0.69$	-0.59
7. Total impact	All listed above	$+0.042$	$+1.15$	-4.82	$+1.04$

- Due to economic and demographic forces, optimal income tax progressivity ↑ (recall: in the data it ↓ during 1980–2010)
- Optimal replacement rate level ↑ (in the data it ↑ too but less)

Quantitative Experiment: Roadmap

1. Identify Pareto weight parameter $\boldsymbol{\kappa}_{1980}$ that solves:

$$\boldsymbol{\Upsilon}_{1980}^{\text{data}} = \boldsymbol{\Upsilon}_{1980}^{\star}(\boldsymbol{\Psi}_{1980}, \boldsymbol{\kappa}_{1980}; \boldsymbol{\Upsilon}_{1980}^{\text{data}})$$

2. Compute optimal policy under new parameters and old weights:

$$\boldsymbol{\Upsilon}_{int}^{\star} = \boldsymbol{\Upsilon}_{int}^{\star}(\boldsymbol{\Psi}_{2010}, \boldsymbol{\kappa}_{1980}; \boldsymbol{\Upsilon}_{1980}^{\text{data}})$$

3. Identify Pareto weight parameter $\boldsymbol{\kappa}_{2010}$ that solves:

$$\boldsymbol{\Upsilon}_{2010}^{\text{data}} = \boldsymbol{\Upsilon}_{int}^{\star}(\boldsymbol{\Psi}_{2010}, \boldsymbol{\kappa}_{2010}; \boldsymbol{\Upsilon}_{int}^{\star})$$

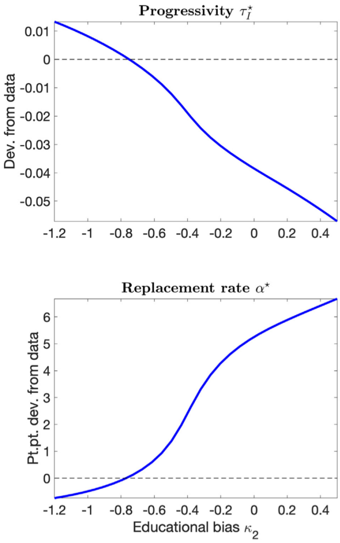
Estimated Trend in Pareto Weights

	Baseline (1980s)	Baseline (2010s)
Age bias, $\kappa_{1,t}$	0.069	0.060
Weight on age 25 / age 64	15.80	11.02
Educational bias, $\kappa_{2,t}$	–0.731	1.260
Weight on col./ non-col.	0.48	3.53

- To rationalize current policy, Pareto weights must have shifted towards older and more educated households during 1980–2010
- Findings are conditional on aging and rising college attendance!
- In the paper, I provide supporting empirical evidence by studying the relative change in voter turnout in Congressional elections

Next I show that government preferences over income redistribution within/between generations interact...

Rising Weight On College Graduates ($\kappa_2 \uparrow$)



Two channels:

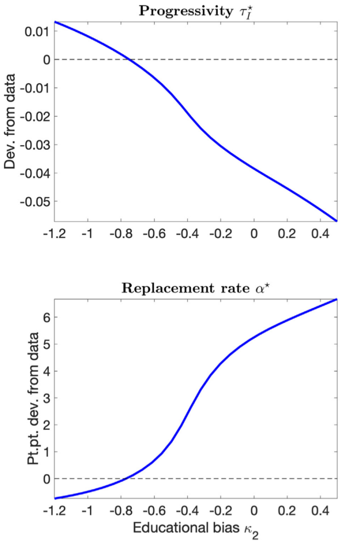
1. $\kappa_2 \uparrow \Rightarrow \tau_I^\star \downarrow$ (standard)

   intra-generational redistribution $\downarrow$

   Heathcote, Storesletten & Violante ('17)

   Heathcote & Tsujiyama ('21), Wu ('21)

Rising Weight On College Graduates ($\kappa_2 \uparrow$)



Two channels:

1. $\kappa_2 \uparrow \Rightarrow \tau_I^\star \downarrow$ (standard)
   intra-generational redistribution $\downarrow$
   Heathcote, Storesletten & Violante ('17)
   Heathcote & Tsujiyama ('21), Wu ('21)

2. $\kappa_2 \uparrow \Rightarrow \alpha^\star \uparrow \Rightarrow \tau_{SS,t} \uparrow$ (new)
   education-specific mortality
   inter-generational redistribution $\uparrow$

Education-Specific Mortality

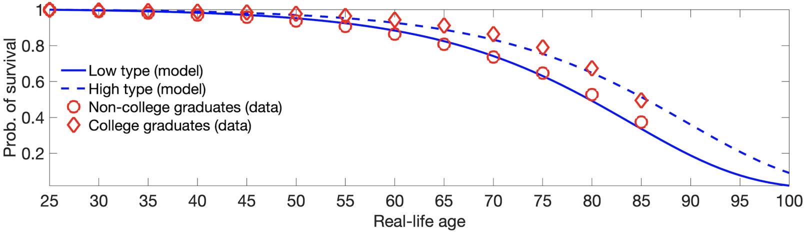
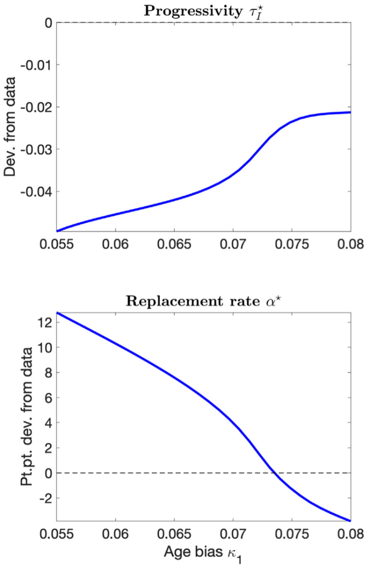


Figure: Survival probability rates for a 25-year-old individual in the model and data (2010)

- The empirical moments are taken from Bound et al. (2014)
- Life expectancy gap between college graduates and high school graduates at age 25 is 6 years (2010)

Rising Weight On Elderly ($\kappa_1 \downarrow$)



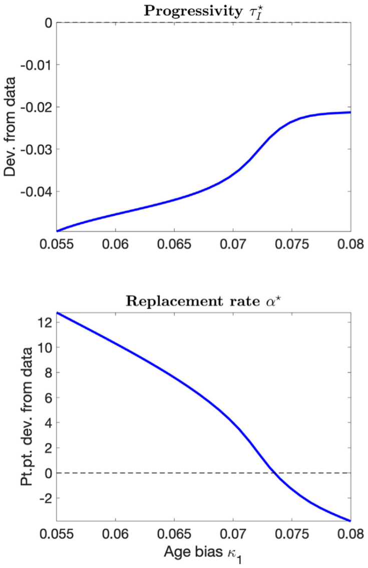
Two channels:

1. $\kappa_1 \downarrow \Rightarrow \alpha^\star \uparrow \Rightarrow \tau_{SS} \uparrow$ (standard)

   inter-generational redistribution $\uparrow$

   Brendler ('20)

Rising Weight On Elderly ($\kappa_1 \downarrow$)



Two channels:

1. $\kappa_1 \downarrow \Rightarrow \alpha^\star \uparrow \Rightarrow \tau_{SS} \uparrow$ (standard)

   inter-generational redistribution $\uparrow$

   Brendler ('20)

2. $\kappa_1 \downarrow \Rightarrow \tau_I^\star \downarrow$ (new)

   intra-generational redistribution $\downarrow$

Government Preferences Interact

- To account for the drop in $\tau_{I,t}^{\text{data}}$, Pareto weights must shift toward college graduates
- Heathcote et al. ('17) attribute the entire drop to $\kappa_{2,t}$
- This paper: As Pareto weights also shift toward older agents, the government optimally chooses to reduce $\tau_{I,2010}^{\star}$
- This exerts an offsetting effect on $\kappa_{2,t}$

Conclusions

- How did the US government preferences over income redistribution change since the 1980s?
- Rich OLG model with Ramsey government who chooses income tax and Social Security policies
- During 1980–2010, US government has become less willing to redistribute incomes from educated to uneducated people and ...
- ... more willing to redistribute incomes from workers to retirees
- Government preferences over income redistribution within/between generations interact and must be studied jointly