Inheritance Taxation and Wealth Effects on the Labor Supply of Heirs

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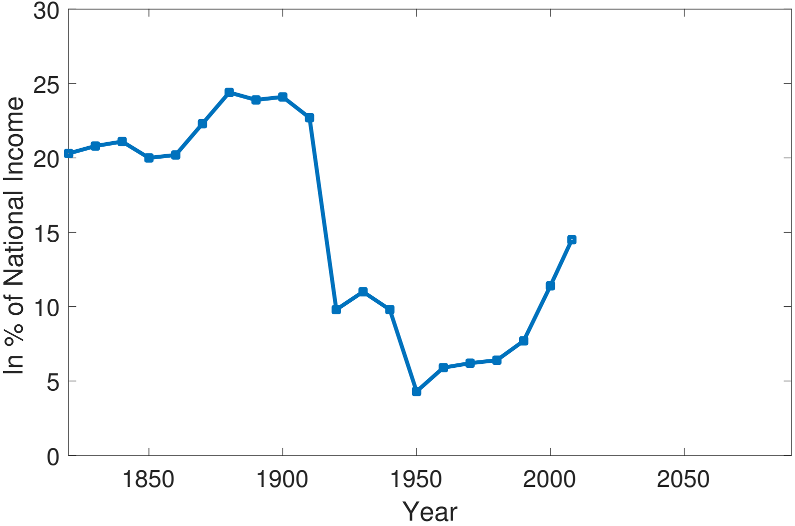
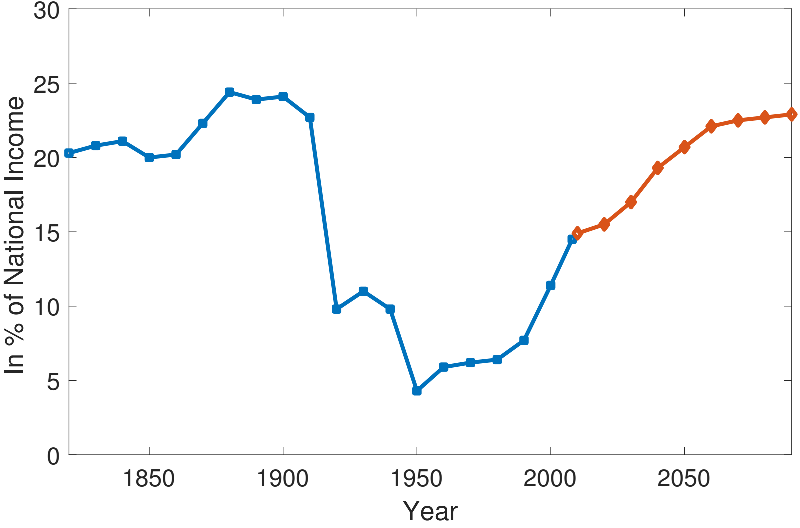
Annual Inheritance Flow



Source: Piketty (2011, QJE): On the Long-run Evolution of Inheritance

Annual Inheritance Flow ($g = 1.0\%$, $r = 5.0\%$)



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Motivation

- Inheritances of growing importance in Western economies
- Inheritance taxation potential source of tax revenue
- Incentive effects of inheritance taxation poorly understood

In This Paper

- Contribute to incidence of inheritance taxation
- One particular channel: labor supply of heirs
- Why important for tax incidence?
  - If government raises bequest taxes

  $\Rightarrow$ Wealth effect on labor earnings of heirs

  $\Rightarrow$ Higher labor income tax revenue

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- Contribute to incidence of inheritance taxation
- One particular channel: labor supply of heirs
- Why important for tax incidence?
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  $\Rightarrow$ Wealth effect on labor earnings of heirs

  $\Rightarrow$ Higher labor income tax revenue
- Result:

  Each additional Euro of bequest tax revenue leads to an increase in labor income taxes of 8.9 Cents in Germany

How Do We Arrive There

- Empirical measurement complicated
  - Anticipation effects
  - Hard to find exogenous variation

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  - One dollar increase in lottery wealth

  $\Rightarrow$ 1.07 cents decline in annual earnings in first 5 years

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- However, evidence of lottery gains on labor income
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  $\Rightarrow$ 1.07 cents decline in annual earnings in first 5 years
- Theory: Back-of-the-envelope calculation fails
  - Bequests (partially) anticipated by heirs
  - If bequests uncertain, even (ex-post) non-heirs affected

Quantitative Life-Cycle Model

- Quantitative life-cycle model to replicate lottery evidence
- Realistic expectations about size and timing of inheritances

Related Literature

Quantitative Life-Cycle Model

- Quantitative life-cycle model to replicate lottery evidence
- Realistic expectations about size and timing of inheritances
- Evaluate labor supply effects of bequest taxation
- For each Euro of bequest tax revenue

  $\Rightarrow$ 8.9 cents increase in labor income taxes

  - 48% owing to anticipation effect

Related Literature

Theoretical Explorations

Theoretical Explorations

- Characterize main mechanisms at work
- Study sequence of models:
  - Connect wealth effect to preference parameters
  - Illustrate our calibration strategy
  - Show importance of anticipation effects

Model 1: Static Framework

- Preferences:

$$U = u(c,l) = \frac{c^{1-\gamma}}{1-\gamma} - \frac{l^{1+\chi}}{1+\chi}$$

- Budget constraint:

$$c \leq (1-\tau)y + \underbrace{(1-\tau_b)b + T}_{=R} \quad \text{with} \quad y = wl$$

- Bequests b exogenous and subject to tax τ_b

Model 1: Static Framework

- Change in earnings y due to change in R

$$\eta = \frac{dy}{dR} = -\frac{1}{\left(1 + \frac{\chi}{\gamma}\right)(1-\tau) + \frac{\chi}{\gamma}\frac{R}{y}} \leq 0$$

- *A 1 Euro change in unearned income leads to a change in labor earnings of η Euros.*

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- For change in bequest tax

$$\frac{dy}{d\tau_b} = \frac{dy}{dR} \times \frac{dR}{d\tau_b} = -\eta \times b$$

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- LESSON: $\frac{\chi}{\gamma}$ important determinant of income effect

Model 2: Intertemporal Labor Supply

- Augment to two-period model
- Preferences

$$U = u(c_1, l_1) + \beta u(c_2, l_2)$$

- Dynamic budget constraint

$$c_1 + \frac{c_2}{1+r} \leq (1-\tau)\Big[\underbrace{y_1 + \frac{y_2}{1+r}}_{=:y}\Big] + \underbrace{(1-\tau_b)b + T_1 + \frac{T_2}{1+r}}_{=:R}$$

- Bequests received in period 1

Model 2: Intertemporal Labor Supply

- Present value reaction in income

$$\eta = \frac{dy}{dR} = \frac{dy_1 + \frac{dy_2}{1+r}}{dR} = -\frac{1}{\left(1+\frac{\chi}{\gamma}\right)(1-\tau) + \frac{\chi}{\gamma}\frac{R}{y}} \leq 0$$

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- Define

$$\eta_1 = \frac{dy_1}{dR} \quad \text{and} \quad \eta_2 = \frac{dy_2}{dR} \quad \text{such that} \quad \eta = \eta_1 + \frac{\eta_2}{1+r}$$

- Impulse response function

$$\eta_2 = \left[\frac{w_2}{w_1}\right]^{1+\frac{1}{\chi}} \left[\beta(1+r)\right]^{-\frac{1}{\chi}} \eta_1$$

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- LESSON: β majorly determines impulse response

Model 3: Anticipation Effects

- Add a period $t = 0$ before receipt of b
- Only fraction π receives bequest
- Expected utility

$$U = u(c_0, l_0) + \beta\Big[\pi\left(u(c_1^I, l_1^I) + \beta u(c_2^I, l_2^I)\right) + (1-\pi)\left(u(c_1^N, l_1^N) + \beta u(c_2^N, l_2^N)\right)\Big]$$

Model 3: Anticipation Effects

- Period 0 budget constraint

$$c_0 \leq (1-\tau)y_0 + \underbrace{T_0 - a_1}_{=:R_0}$$

- Period 0 wealth effect (constant savings)

$$\eta_0 = \left.\frac{dy_0}{dR_0}\right|_{da_1=0} = -\frac{1}{\left(1+\frac{\chi}{\gamma}\right)(1-\tau) + \frac{\chi}{\gamma}\frac{R_0}{y_0}}$$

Model 3: Anticipation Effects

- Period 1 intertemporal budget constraint ($K = I, N$)

$$c_1^K + \frac{c_2^K}{1+r} \leq (1-\tau)\Big[\underbrace{y_1^K + \frac{y_2^K}{1+r}}_{y^K}\Big]$$

$$+ \underbrace{\mathbb{1}_{K=I}(1-\tau_b)b + T_1 + \frac{T_2}{1+r} + (1+r)a_1}_{=:R^K}$$

- Period 1 wealth effect (constant savings)

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Model 3: Anticipation Effects

- Savings response to change in bequest tax: $\alpha = \frac{da_1}{d\tau_b b}$.
- Change in exogenous income

$$\frac{dR_0}{d\tau_b b} = -\alpha \;,\; \frac{dR^N}{d\tau_b b} = (1+r)\alpha \text{ and } \frac{dR^I}{d\tau_b b} = -1 + (1+r)\alpha$$

- Present value of income reaction

$$\frac{dy}{d\tau_b b} = \underbrace{-\frac{\pi\eta^I}{1+r}}_{\text{naive effect}} \; \underbrace{-\alpha\left[\eta_0 - \left(\pi\eta^I + (1-\pi)\eta^N\right)\right]}_{\text{effect of savings adjustment}}$$

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$$= \underbrace{-\alpha\eta_0}_{\text{anticipation effect}} \ \underbrace{+\pi\eta^I\left[\alpha - \frac{1}{1+r}\right]}_{\text{heir effect}} + \underbrace{(1-\pi)\eta^N\alpha}_{\text{non-heir effect}}$$

Lessons Learned

- Without anticipation effects (lotteries)
  - $\frac{\chi}{\gamma}$ mainly governs PV reaction
  - β shapes impulse response
- Anticipation effects
  - Arise when savings change prior to bequest receipt
  - Also causes non-heir change in labor earnings
  - Can distort empirical estimates

$\Rightarrow$ Use quantitative model to evaluate effects

The Quantitative Model

Timing and Endowments

- Time $t \in \{1, \ldots, T\}$ is discrete
- Continuum of mass 1 of heterogeneous households
- Enter economy at age 20, retire at 65
- Draw a time-invariant earnings capacity $e \in \{1, \ldots, E\}$
- Draw a signal $s \in \{0, \ldots, n\}$ about inheritance class

Bequests and Expectations

- Uncertainty with respect to timing and size
- Each individual has exactly one parent
  - still alive when household enters economy
  - dies according to unconditional distribution p_t^e
  - dies with certainty when agent alive $\sum_{t=1}^{T} p_t^e = 1$
  - leaves a bequest $b \in \{b_{it}^e\}_{i=0}^n$

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  - leaves a bequest $b \in \{b_{it}^e\}_{i=0}^{n}$
- Individual expectations about i depend on signal s

$$\Rightarrow \sum_{i=1}^{I} \pi_{si} = 1$$

Dynamic Life Cycle Decision Making

- Value function

$$V_t(e,s,h_t,W_t) = \max_{c_t,l_t,a_{t+1}} \left\{ \frac{c_t^{1-\gamma}}{1-\gamma} - \frac{l_t^{1+\chi}}{1+\chi} \right.$$
$$\left. + \beta \mathbb{E}\left[V_{t+1}\left(e,s,h_{t+1},W_{t+1}\right) \middle| e,s,h_t \right] \right\}$$

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- Dynamic budget constraint

$$c_t + a_{t+1} = w_t^e l_t - \mathcal{T}\left(w_t^e l_t\right) + \mathcal{P}_t^e + W_t$$

with household wealth

$$W_t = \left[1 + (1-\tau_k)r\right] a_t + (1-\tau_b) b_{it}^e$$

Parameterizing Expectations

- Fraction φ_s^e receives signal s
- Cross-sectional distribution of heirs on bequest classes ω_i^e
- Consistency between expectations and actual distribution

$$\forall i, e: \sum_{s=0}^{n} \varphi_s^e \cdot \pi_{is}^e = \omega_i^e$$

Parameterizing Expectations

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$$\forall i, e: \sum_{s=0}^{n} \varphi_s^e \cdot \pi_{is}^e = \omega_i^e$$

- We assume that

$$\pi_{is}^e = (1-\sigma)\omega_i^e + \sigma \cdot \mathbb{1}(i = s) \quad \text{for} \quad \sigma \in [0,1]$$

- σ is a measure of signal quality

Calibration

Calibration Summary

- From German Socio-Economic Panel (SOEP)
  - 8 different earnings classes e ▸ Details
  - Share of heirs by age ▸ Details
  - Mean bequest by age-earnings class ▸ Details
  - Distribution around means + no inheritance ▸ Details
- Signal quality: $\sigma = 0.75$???
- Prices and government policy ▸ Details

Wealth Effects on Labor Supply

- Match lottery evidence from Cesarini et al. (2017)
- Recall from theoretical analysis:
  - $\frac{\chi}{\gamma}$ mainly governs PV reaction
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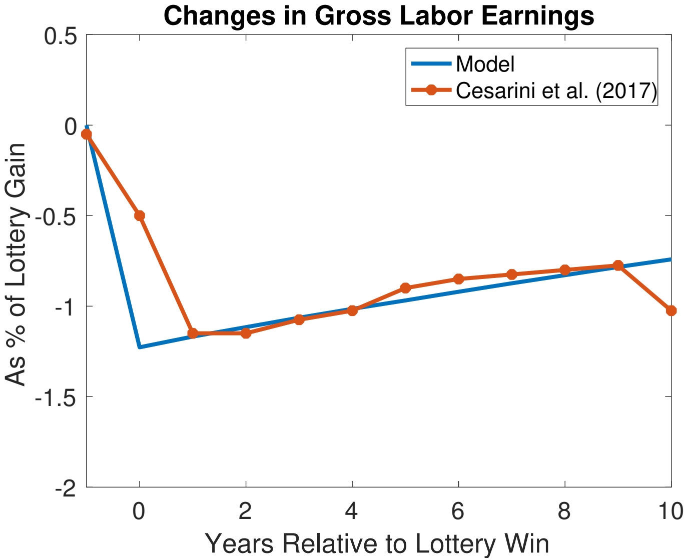
Wealth Effects on Labor Supply

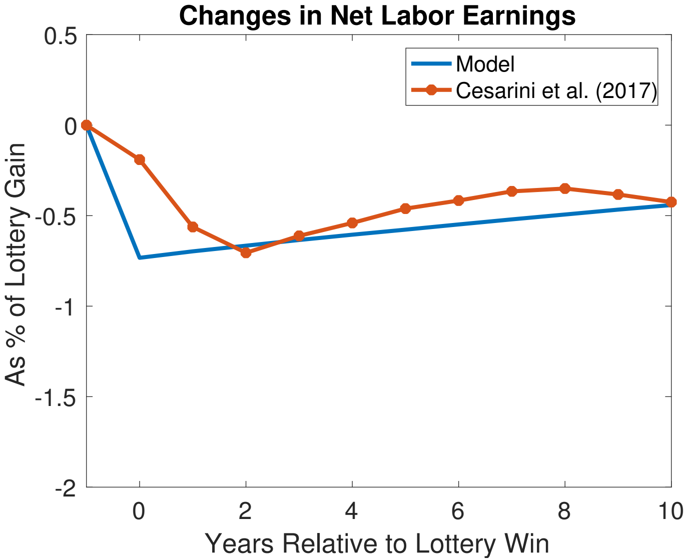
- Match lottery evidence from Cesarini et al. (2017)
- Recall from theoretical analysis:
  - $\frac{\chi}{\gamma}$ mainly governs PV reaction
  - β shapes impulse response
- We proceed as follows:
  - fix risk aversion at $\gamma = 1$
  - $\chi \rightarrow$ 1.07 cents decline in annual earnings in first 5 years
  - $\beta \rightarrow$ steepness of impulse response
- Preferred Parameters: $\chi = 4.06$ and $\beta = 0.981$

Fit For Average IRF (Gross Earnings)



Source: Cesarini/Lindqvist/Notowidigdo/Ostling (2017, AER)

Fit For Average IRF (Net Earnings, Untargeted)



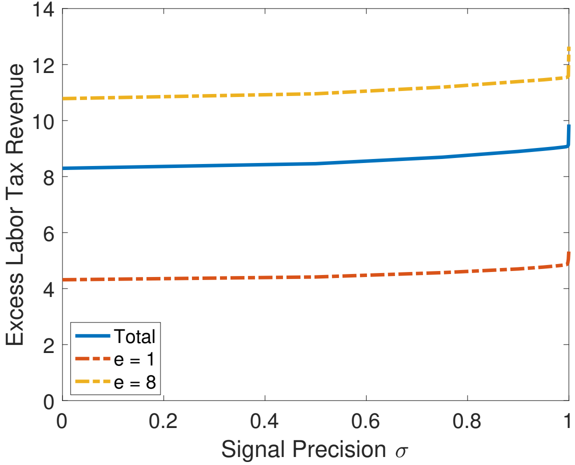
Source: Cesarini/Lindqvist/Notowidigdo/Ostling (2017, AER)

Simulation Results

Increase Uniform Bequest Tax by 1%

		Decomposition		
	Total	*Anticipation*	*Heirs*	*Non-Heirs*
Earnings	21.66	10.52	11.80	-0.66
	(14.59, 24.82)			
Taxes	8.87	4.24	4.90	-0.27
	(5.99, 10.16)			

The Role of Signal Quality



No Anticipation: Myopia

		Decomposition		
	Total	*Anticipation*	*Heirs*	*Non-Heirs*
Earnings	14.32	0.00	14.32	0.00
Taxes	5.97	0.00	5.97	0.00

Further Results

- Heterogeneity across income distribution ▸ Details
- Short-run vs. long-run interpretation ▸ Details
- Sensitivity analysis with respect to γ and χ ▸ Details

Conclusion

- Inheritance taxes increase heirs' labor supply
- Leads to additional income tax revenue from heirs
- Each additional Euro of bequest tax revenue leads to an increase in labor income taxes of 8.9 Cents in Germany

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- Leads to additional income tax revenue from heirs
- Each additional Euro of bequest tax revenue leads to an increase in labor income taxes of 8.9 Cents in Germany
- Methodology:
  - State-of-the-art quantitative life-cycle model
  - \+ quasi-experimental evidence on effects of lottery gains
- Robustness tests regarding expectations

Related Literature

- Wealth effects of lottery gains
  - Imbens/Rubin/Sacerdote (AER, 2001)
  - Cesarini/Lindqvist/Notowidigdo/Ostling (AER, 2017)
- Impact of inheritances on labor supply and earnings
  - Holtz-Eakin/Joulfaian/Rosen (QJE, 1993)
  - Brown/Coile/Weisbenner (REStat, 2010)
  - Doorley and Pestel (WP, 2016)
  - Elinder/Erixson/Ohlsson (BE A&P, 2012)
  - Bø/Halvorsen/Thoresen (JHR, 2018)

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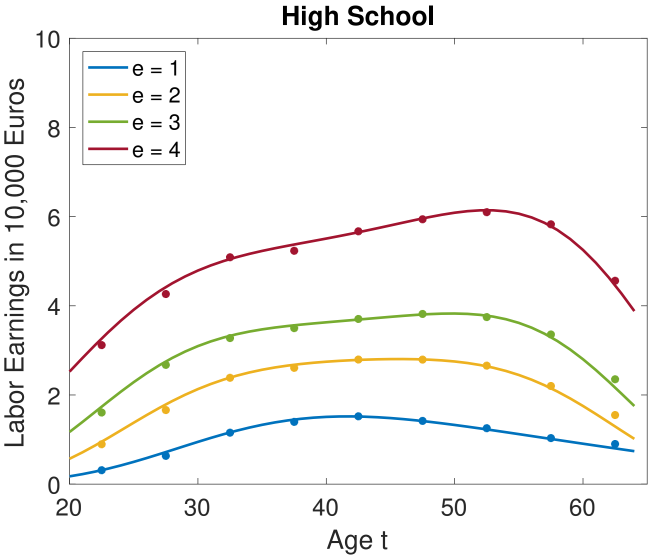
Earnings Classes Non-College



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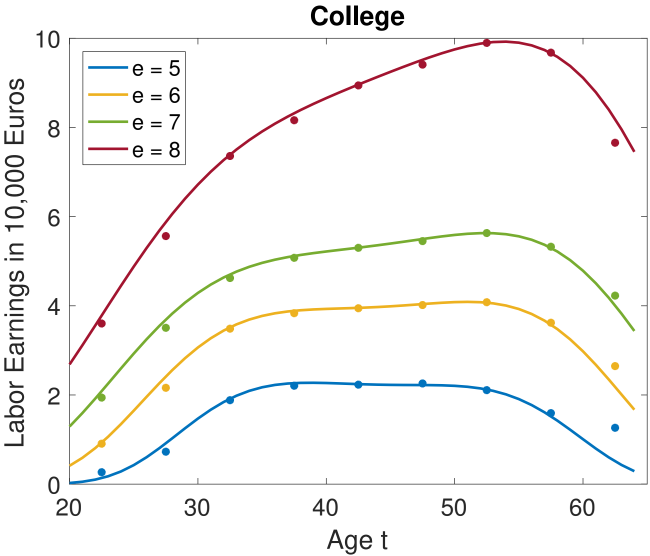
Earnings Classes College



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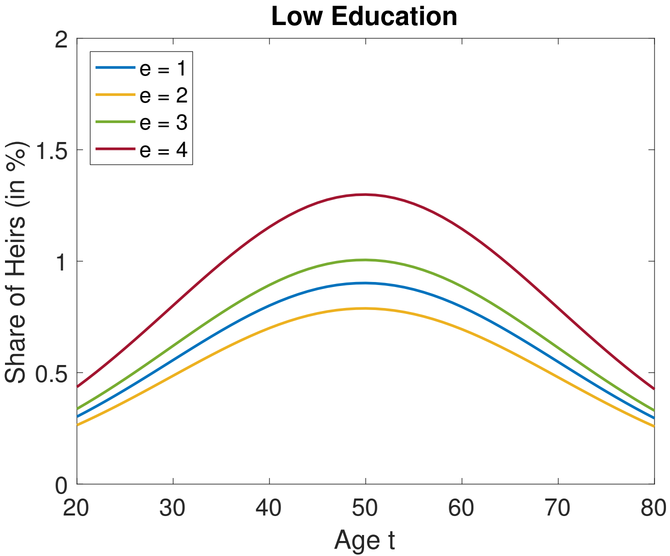
Probability Ancestral Death Non-College



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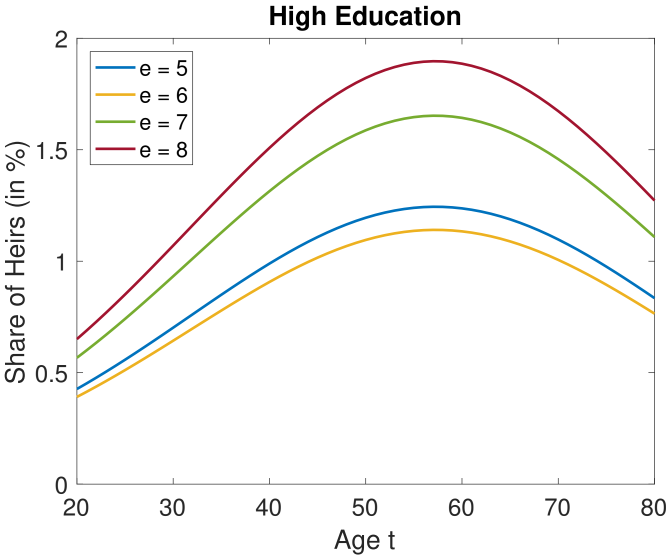

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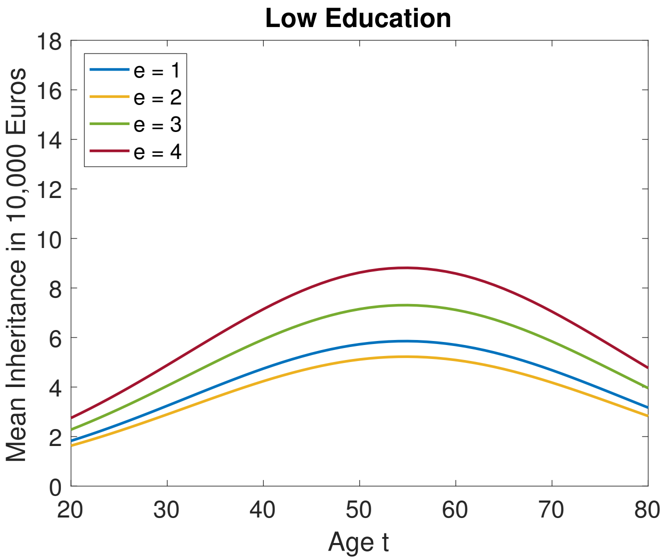
Mean Bequests Non-College



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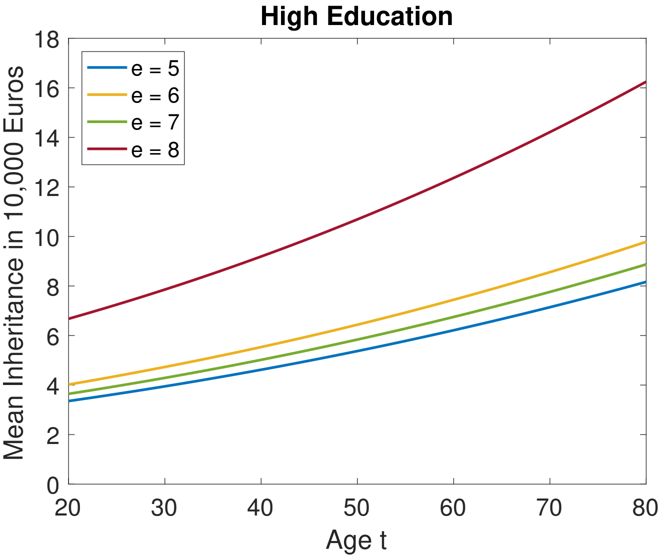

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Bequest Classes (Relative to Mean)

Education	Q1 ($i = 1$)	Q2 ($i = 2$)	Q3 ($i = 3$)	Q4 ($i = 4$)
Low	0.070	0.232	0.611	3.095
High	0.070	0.258	0.704	2.971

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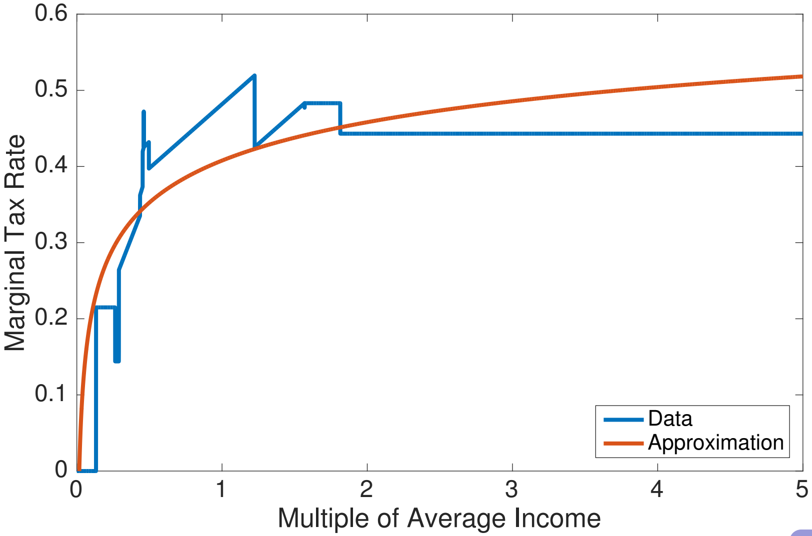
Marginal Tax Schedule



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Preference Parameters, Price and Government Policy

Parameter	Value	Note
T	61	Age of death = 80
t_r	46	Retirement age = 65
r	4%	Interest rate
a_0	0	No initial wealth
$\mathcal{P}$	0.40	Pension = 40% of av. gross income
τ_0	0.321	Average labor earnings tax rate
τ_1	0.128	Progressivity of labor tax
τ_k	0.25	Linear capital income tax
τ_b	0.00	Linear inheritance tax

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Heterogeneity in Effects

	Low Education				*High Education*			
e =	1	2	3	4	5	6	7	8
Earnings	15.01	20.57	21.53	24.07	16.30	20.22	23.40	24.38
Taxes	4.57	7.52	8.47	10.34	5.65	8.01	9.87	11.19

Effects are measured as fraction of change in bequest tax revenue by earnings class.

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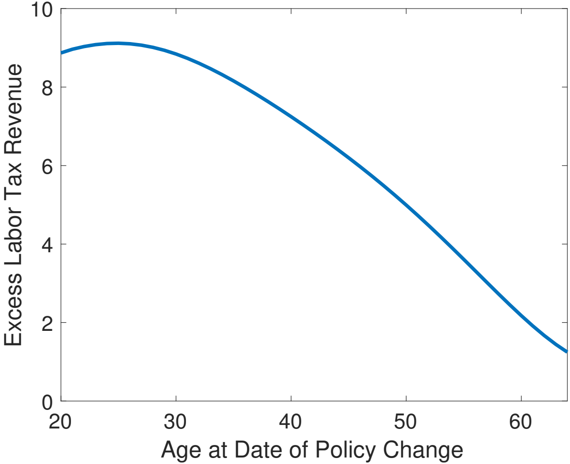
Short-run vs. Long-Run Interpretation



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Sensitivity Analysis

	$\gamma = 0.51$, $\chi = 2.0$ *and* $\beta = 0.9715$			
	Total	*Anticipation*	*Heirs*	*Non-Heirs*
Gross Earnings	22.32	11.41	11.64	-0.73
Labor Taxes	9.13	4.59	4.83	-0.29
	$\gamma = 4.0$, $\chi = 16.8$ *and* $\beta = 1.04$			
	Total	*Anticipation*	*Heirs*	*Non-Heirs*
Gross Earnings	18.86	6.65	12.61	-0.40
Labor Taxes	7.76	2.69	5.24	-0.16

Effects are measured as fraction of change in bequest tax revenue.

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