Optimal Redistribution: Rising Inequality vs. Rising Living Standards

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Motivation

- Large increase in **income inequality** in the US from 1950 to 2010
  - Larger top income shares, thicker Pareto tail

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⇒ How does the standard of living affect the optimal tax-and-transfer ($t\&T$) system?

  - Changing redistribution-efficiency trade-off

What We Do

- **This paper:** Optimal taxation with non-homothetic preferences
  - Heterogeneous income elasticities of demand across sectors (Engel's law)

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- Mirrlees formula: two main effects of growth
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- Quantitatively large effects of rising living standards
  - Growth calls for less redistribution
  - Dampens by at least 25% the optimal increase in redistribution due to rising inequality

Mirrleesian Optimal Nonlinear Income Taxation with Non-Homothetic Preferences

Households

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  - $c = (c_1, \dots, c_J)$ denotes a basket of consumption goods

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- Let u denote the indirect utility function

$$u(e;p) \equiv \max_{\{c_j\}_j} U(c) \quad \text{s.t.} \quad \sum_j p_j c_j = e$$

where e is nominal expenditures and p is the vector of prices

Optimal Taxation Problem

- Household's static maximization problem:

$$V(\theta; \mathcal{T}(\cdot), p) \equiv \max_{e,n} u(e; p) - v(n) \quad \text{s.t.} \quad e = n\theta - \mathcal{T}(n\theta)$$

  - $\mathcal{T}(\cdot)$: fully nonlinear tax-and-transfer schedule
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- Government's maximization problem given Pareto weights $\{w(\theta)\}$:

$$\max_{\mathcal{T}(\cdot)} \int_{\underline{\theta}}^{\overline{\theta}} V(\theta; \mathcal{T}(\cdot), p) w(\theta) f(\theta) d\theta \ \ \text{s.t.} \ \ \int_{\underline{\theta}}^{\overline{\theta}} \mathcal{T}(n(\theta; \mathcal{T}(\cdot), p)\theta) f(\theta) d\theta \geq G$$

  - Balanced budget where G is exogenous spending

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- **Aggregate growth** modeled as a proportional fall in p

$$\hat{p} = p/(1+g)$$

Nonlinear Taxes: General Formula

- Optimal marginal rate equates efficiency costs of taxation to distribution gains $\forall y(\hat{\theta})$

  Heathcote and Tsujiyama (2021)

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  - Let $\eta(\theta)\equiv dy(\theta)/d\mathcal{T}(0)$ denote the income effect of type-θ worker
  - Let $u_e(\theta)$ denote the marginal utility of expenditure of type-θ worker

- Changes in p can alter: $\eta(\theta)$, $u_e(\theta)$, $y(\theta)$

Nonlinear Taxes: Efficiency Cost $E(g)$

- Efficiency costs of taxes and transfers depend on elasticities φ^{-1} and income effects η

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  - **Numerator:** Increasing revenues through higher marginal rate at $y(\hat{\theta})\dots$
    - $+$ Decreases labor supply of worker with $y(\hat{\theta})$: elasticity φ^{-1}
    - $+$ Increases labor supply of workers with $y > y(\hat{\theta})$: income effect η

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    + Increases labor supply of workers with $y > y(\hat{\theta})$: income effect η
  - **Denominator:** Increasing the lump-sum transfer...
    + Decreases labor supply of all workers: income effect η

Nonlinear Taxes: Distribution Gains $D(g)$

- Distribution gains of taxes and transfers depend on dispersion of marginal utilities u_e

$$\underbrace{1-\frac{1-\frac{\mathcal{T}'(y(\hat{\theta}))}{1-\mathcal{T}'(y(\hat{\theta}))}\frac{1}{1+\varphi}\frac{\hat{\theta}f(\hat{\theta})}{1-F(\hat{\theta})}+\int_{\hat{\theta}}^{\bar{\theta}}\mathcal{T}'(y(x))\eta(x)\frac{dF(x)}{1-F(\hat{\theta})}}{1+\int_{\underline{\theta}}^{\bar{\theta}}\mathcal{T}'(y(x))\eta(x)dF(x)}}_{E(g)}=\underbrace{1-\frac{\int_{\hat{\theta}}^{\bar{\theta}}u_e(x)\frac{w(x)}{f(x)}\frac{dF(x)}{1-F(\hat{\theta})}}{\int_{\underline{\theta}}^{\bar{\theta}}u_e(x)\frac{w(x)}{f(x)}dF(x)}}_{D(g)}$$

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  - **Numerator:** Welfare loss from taxing workers with $y > y(\hat{\theta})$
  - **Denominator:** Welfare gains from increasing lump-sum transfer

Homothetic Benchmark Neutrality Result

- Assume homothetic CRRA preferences

$$U(c) = \frac{[\mathcal{C}(c)]^{1-\gamma}}{1-\gamma}, \text{ where } \mathcal{C}(c) = \left(\sum_j \Omega_j^{\frac{1}{\sigma}} c_j^{\frac{\sigma-1}{\sigma}} \right)^{\frac{1-\sigma}{\sigma}}$$

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- What about non-homothetic preferences?

Non-Homothetic Preferences

- Consumption patterns across goods require non-homothetic preferences
  - Service shares are rising over time and with income in the cross-section

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- Nonlinear Engel curves requires varying intertemporal elasticity of substitution

  Stiglitz (1969), Hanoch (1977), Crossley and Low (2011)
  - Typically imply increasing intertemporal elasticity of substitution (DRRA)
    + "Luxuries are easier to postpone," Browning and Crossley (2000)

Non-Homothetic Preferences Non-Homothetic CES

Comin, Lashkari, and Mestieri (2021)

- Utility from aggregated consumption: $\mathcal{C}(c)^{1-\gamma}/(1-\gamma)$
- Consumption aggregator $\mathcal{C}(c)$ implicitly defined by

$$\sum_{j}^{J}\left(\Omega_j(\mathcal{C}(c))^{\varepsilon_j}\right)^{\frac{1}{\sigma}} c_j^{\frac{\sigma-1}{\sigma}} = 1.$$

  - Key parameters: ε_j governs income elasticity of demand for good j
  - Elasticity of substitution between goods σ

    $\Rightarrow$ $\partial c_j/\partial e = \sigma + (1-\sigma)\varepsilon_j/\bar{\varepsilon}$

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    $\Rightarrow$ $\partial c_j/\partial e = \sigma + (1-\sigma)\varepsilon_j/\bar{\varepsilon}$

$\Rightarrow$ Typically implies DRRA

  - Formal proof of necessary and sufficient conditions for two goods
  - Quantitatively true for typical calibration with three goods

DRRA Conditions Stone-Geary IA Preferences (Alder, Boppart, and Müller 2022)

Non-Homothetic Preferences & Growth

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   $\rightarrow$ Redistribution should decrease with growth

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2. **DRRA** $\Rightarrow$ Income effect $\eta(\theta)$ decreases with growth

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   $\rightarrow$ Redistribution should decrease with growth

2. **DRRA** $\Rightarrow$ Income effect $\eta(\theta)$ decreases with growth

   (a) Efficiency cost of taxes increases $\rightarrow$ Redistribution should decrease with growth

Non-Homothetic Preferences & Growth

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Quantification in a Dynamic Model with Private Insurance

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- Dynamic incomplete markets model with private saving

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  - To discipline/validate DRRA with both labor supply and dynamic savings decisions
    - + Cardinalization (Chetty, 2006)
- Parametric tax-and-transfer system

Households: Value Function

- Household's value function with productivity θ and assets a:

$$V(a,\theta) = \max_{e,a',n} \left\{ u(e;p) - B\frac{n^{1+\varphi}}{1+\varphi} + \beta \mathbb{E}_{\theta'} \left[V(a',\theta') \,|\theta \right] \right\}$$

s.t.

$$e + a' \leq \theta n + (1+r)a - \mathcal{T}(\theta n), \quad a' \geq 0$$

  - Productivity θ follows a stochastic process
  - Discount factor β
  - Fixed interest rate r (partial equilibrium)

Calibration Overview

- Calibration to the US economy in 1950 and 2010 with three sectors

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2. Government
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     Ferriere, Grübener, Navarro, and Vardishvili (2023)
     $$\mathcal{T}(y) = \exp\left[\log(\lambda)\left(y^{-2\tau}\right)\right] y - T$$
     - λ captures level of the tax rates, τ captures progressivity
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3. Consumption and labor supply patterns in time series and cross-section
4. Inequality dynamics

Calibration Preferences

- Non-homothetic CES parameters
  - ε_j and σ: estimates of Comin, Lashkari, and Mestieri (2021) with CEX micro data
    - $\sigma = 0.3$; $\varepsilon_A = 0.1, \varepsilon_G = 1.0, \varepsilon_S = 1.8$

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  - Ω_j: match aggregate sector shares in 2010
    Computed based on Herrendorf, Rogerson, and Valentinyi (2013) [NIPA]
    - Agriculture (food) 8%, goods 26%, services 67%
    - Untargeted 1950: agriculture 17% [data 22%], goods 49% [39%], services 34% [39%]

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    - Untargeted 1950: agriculture 17% [data 22%], goods 49% [39%], services 34% [39%]
- Remaining preference parameters
  - Fix Frisch elasticity $1/\varphi$ to standard value of 0.5
  - Consumption curvature $\gamma = 0.75$ to match risk aversion ≈ 1 in 2010

Calibration Inequality

- Wages follow AR(1) in logs, with appended Pareto tail
  - Persistence ρ fixed at 0.9
  - Shock innovation set to match variance of log income from SCF+
    Kuhn, Schularick, and Steins (2020)
  - Time-varying Pareto tail parameter
    Aoki and Nirei (2017)

1950	Income Share by Quintile				
Model	6%	11%	13%	21%	49%
Data (SCF+)	6%	11%	15%	21%	48%

2010	Income Share by Quintile				
Model	4%	9%	11%	19%	56%
Data (SCF+)	4%	9%	13%	21%	53%

SCF+ | CEX (Aguiar and Bils 2015) | Asset Distribution

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1950			Expenditure Share by Quintile		
Model	8%	13%	17%	23%	39%
Data	-	-	-	-	-

2010			Expenditure Share by Quintile		
Model	7%	11%	16%	21%	45%
Data (CEX)	9%	14%	18%	23%	35%

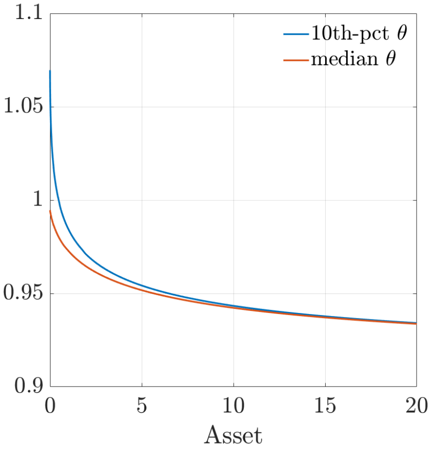
SCF+ | CEX (Aguiar and Bils 2015) | Asset Distribution

Implied RRA in the Model Decreasing RRA

- Calibrated non-homothetic preferences imply DRRA

Implied RRA in the Model **Decreasing RRA**

- Calibrated non-homothetic preferences imply DRRA
  - RRA falls from 1.07 to 0.99, small dispersion
    - + Consistent with evidence: Euler, risk sharing, portfolio



Implied RRA in the Model Decreasing RRA

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  - Falling labor supply over time; cross-sectional patterns
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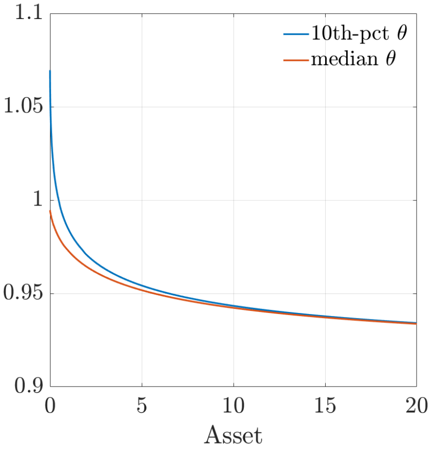

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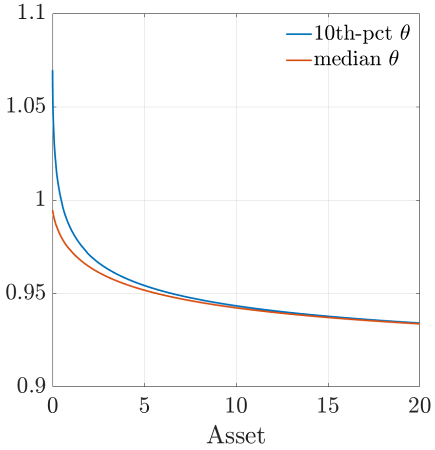
  - Falling labor supply over time; cross-sectional patterns
    Boppart and Krusell (2020), Mantovani (2022)
- Model relation between RRA, wealth effects, and MPCs

$$\eta\left(\varphi\frac{e}{\theta n}+\frac{e\mathcal{T}''(\theta n)}{\mathcal{T}'(\theta n)}\right)=\text{MPC}\times\text{RRA}$$

  - MPC ≈ 0.18, wealth effects ≈ 0.02 in 2010
    Golosov, Graber, Mogstad, and Novgorodsky (2023)



Efficiency vs. Distribution with Growth

- Use Mirrlees formula to quantify how growth changes efficiency vs. distribution concerns
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    - Pareto weights such that calibrated 1950 tax system is optimal

Partial Insurance Expenditure Distribution

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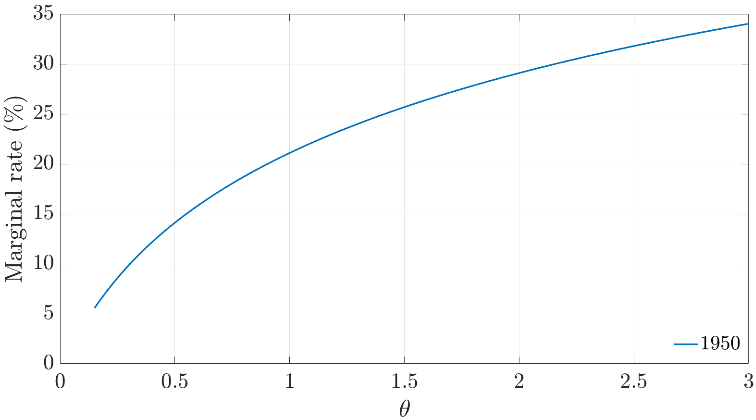
    Bourguignon and Spadaro (2012), Lockwood and Weinzierl (2016), Hendren (2020)
    - Pareto weights such that calibrated 1950 tax system is optimal
  - Optimal taxes with growth of 2010
    - Decomposition into effects of marginal utilities, income effects, and the hours distribution

Partial Insurance Expenditure Distribution

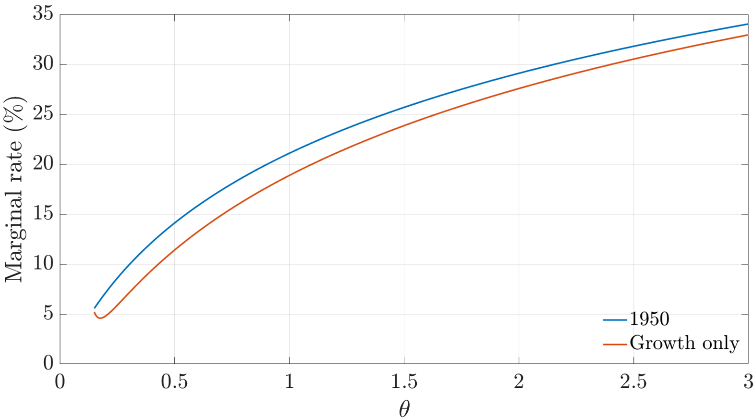
Optimal Marginal Rates with Growth



- Optimal 1950 transfers: $T/Y = 1.2\%$

Formula Utilitarian Planner

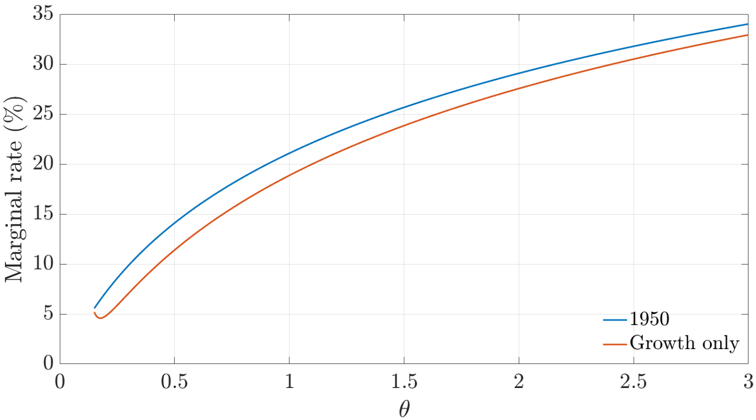
Optimal Marginal Rates with Growth



- Optimal 1950 transfers: $T/Y = 1.2\%$ $\Rightarrow$ With 2010 growth, $T/Y = -0.7\%$

Formula Utilitarian Planner

Optimal Marginal Rates with Growth



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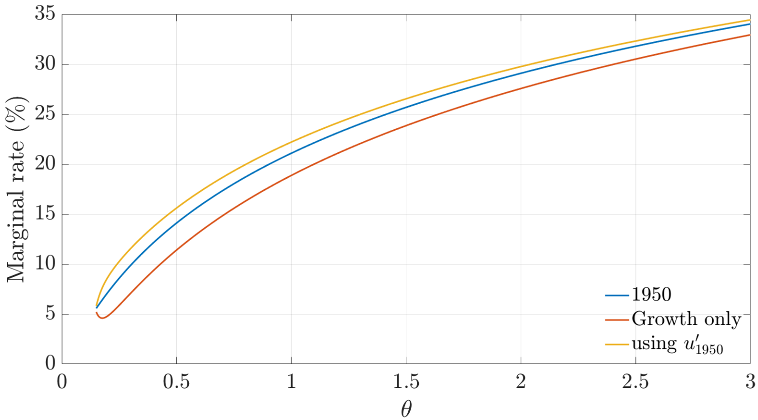
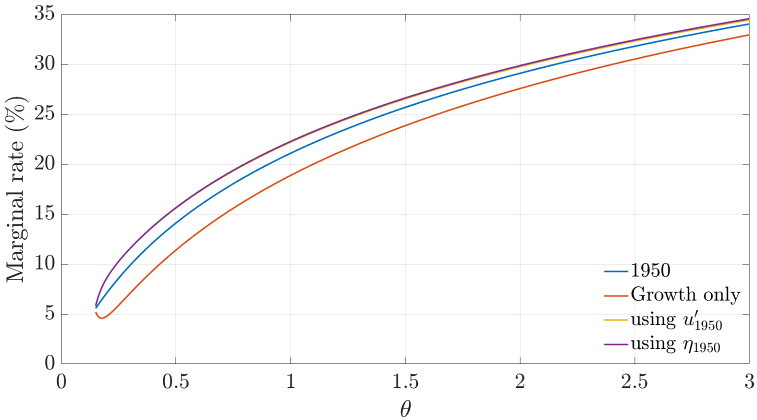
Optimal Marginal Rates with Growth



- With 2010 growth, $T/Y = -0.7\%$ $\Rightarrow$ With 1950 marg. u dispersion, $T/Y = 2.4\%$

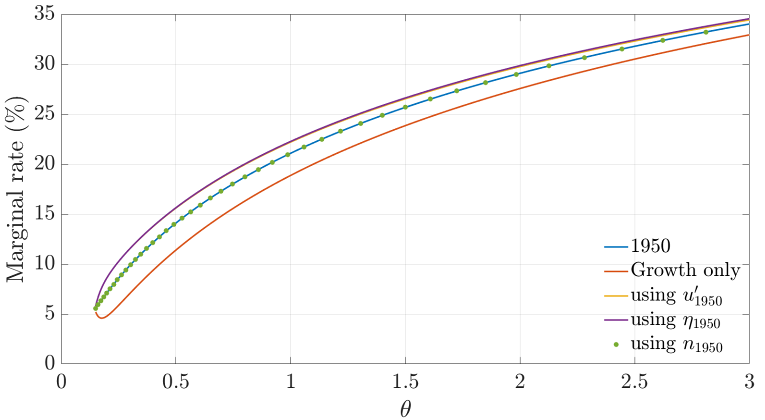
Optimal Marginal Rates with Growth



- With 2010 growth, $T/Y = -0.7\%$ $\Rightarrow$ With 1950 income effects, $T/Y = 2.4\%$

Formula Utilitarian Planner

Optimal Marginal Rates with Growth



- With 2010 growth, $T/Y = -0.7\%$ $\Rightarrow$ With 1950 hours worked, $T/Y = 1.2\%$ (1950 level)

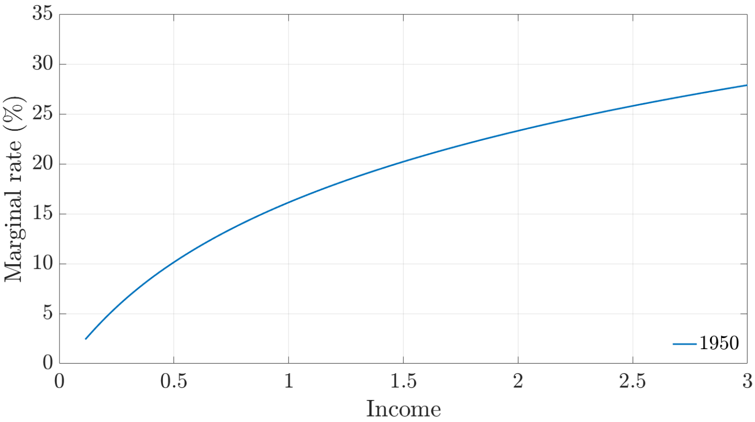
Formula Utilitarian Planner

Rising Living Standards vs. Rising Inequality

- Use dynamic model to quantify effect of rising living standards relative to rising inequality
- Start from 1950
  - Inverse optimum
  - First add inequality only
  - Second compare optimal 2010 with inequality and growth

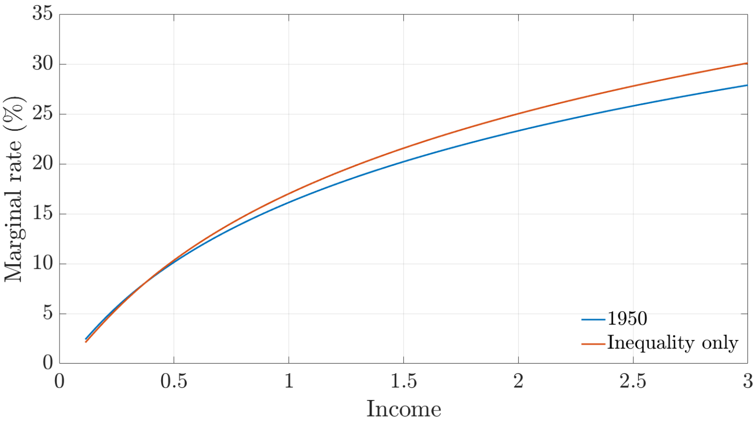
Weights

Optimal Marginal Rates



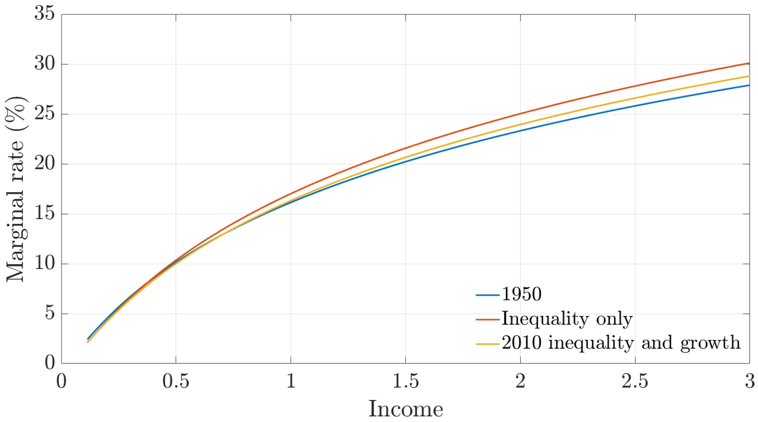
- Calibration in 1950: $T/Y = 0.9\%$

Optimal Marginal Rates



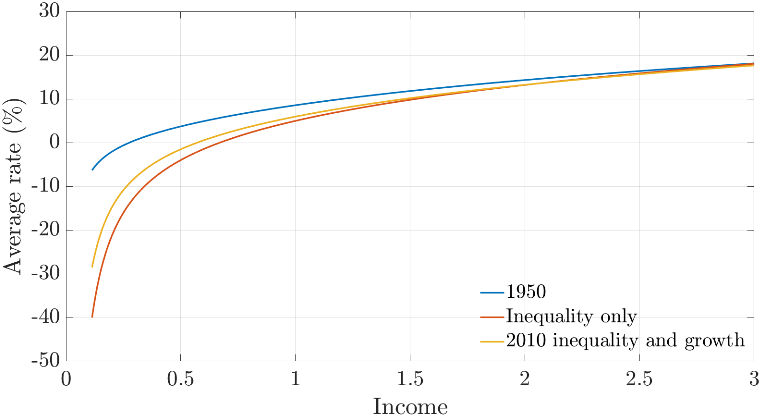
- Calibration in 1950: $T/Y = 0.9\%$ $\Rightarrow T/Y = 4.4\%$ with higher inequality

Optimal Marginal Rates



- Calibration in 1950: $T/Y = 0.9\%$ $\Rightarrow T/Y = 3.3\%$ with higher inequality and growth
  - Growth reduces increase in T/Y by 31%

Optimal Average Rates



- Growth reduces increase in top-10 minus bottom-10 average rates by 28%

Conclusion

Conclusion

- Optimal taxation with rising living standards
  - Affect efficiency and distribution concerns
- Dampen optimal increase in redistribution due to rising inequality

Conclusion

- Optimal taxation with rising living standards
  - Affect efficiency and distribution concerns
- Dampen optimal increase in redistribution due to rising inequality
- New rationale for dynamics of public debt management?

Appendix

Literature

Literature

- **Optimal taxation**
  - Stationary economies and business cycle fluctuations in homothetic one sector economies
    Mirrlees (1971)-Diamond (1998)-Saez (2001), Ramsey (1927)-Werning (2007)-Heathcote, Storesletten, and Violante (2017)
  - Optimal tax system over time in homothetic economies
    Mankiw, Weinzierl, and Yagan (2009), Diamond and Saez (2011), Scheuer and Werning (2017), Heathcote, Storesletten, and Violante (2020), Brinca, Duarte, Holter, and Oliveira (2022)
  - Optimal taxation with non-homothetic preferences
    Kushnir and Zubrickas (2021), Jaravel and Olivi (2022)
- **Consumption patterns, Engel curves, and non-homothetic preferences**
  Geary (1950), Herrendorf, Rogerson, and Valentinyi (2013), Boppart (2014), Herrendorf, Rogerson, and Valentinyi (2014), Aguiar and Bils (2015), Comin, Lashkari, and Mestieri (2021), Alder, Boppart, and Müller (2022)

Back

Evidence: Risk Aversion and IES

- IES increasing in consumption/wealth, based on estimating consumption Euler equation
  Blundell, Browning, and Meghir (1994), Attanasio and Browning (1995), Atkeson and Ogaki (1996)

- DRRA supported by consumption data from Indian villages
  Ogaki and Zhang (2001), Zhang and Ogaki (2004)

- DRRA powerful in matching portfolio choices across the wealth distribution
  Wachter and Yogo (2010), Straub (2019), Cioffi (2021), Meeuwis (2022)

Back

Data Appendix

SCF+

- Long-run data on income and wealth inequality in the US
  Compiled by Kuhn, Schularick, and Steins (2020)
  - Based on historical waves of the Survey of Consumer Finances (SCF)
  - Time period 1949-2016
- Income components
  - Wages and salaries
  - Income from professional practice and self-employment
  - Business and farm income
  - Excluded: rental income, interest, dividends, transfers

Back

SCF+ (cont.)

- Net worth/wealth components (assets - debt)
  - Assets
    - Liquid assets: checking, savings, call/money market accounts, certificates of deposit
    - Housing and other real estate
    - Bonds, stocks and business equity, mutual funds
    - Cash value of life insurance
    - Defined-contribution retirement plans
    - Cars
  - Debt
    - Housing debt: debt on owner-occupied homes, home equity loans and lines of credit
    - Other debt: car loans, education loans, consumer loans

Back

SCF+ (cont.)

- Sample selection
  - Head of household aged 25 to 60
  - Minimum income restriction
    - $5,000 for 2010 (in 2016 dollars)
    - In 1950 such that ratio of minimum income to median is the same ($2,700)

Back

Census and ACS

- Data for hours worked from IPUMS USA
  Ruggles et al. (2022)
  - 1950: Census 1% sample
  - 2010: American Community Survey (ACS)
- Hours worked variables
  - 1950: hours worked last week
  - 2010: usual hours worked per week
- Statistics based on hours worked of household head

Back

Census and ACS (cont.)

- Same basic sample selection criteria as in SCF+
  - Household head aged 25-60
  - Minimum household income of \$2,700 (1950) or \$5,000 (2010), in 2016 dollars
- Some additional criteria to reduce influence of outliers on hours
  - Only households with one family and not more than one couple
  - Hours per week between 20 and 80
  - Hours per year at least 240
  - Weeks worked per year at least 20
  - Minimum real wage per hour of \$1

CEX

- Consumption data from Consumer Expenditure Survey (CEX), from Aguiar and Bils (2015)
- 20 expenditure categories grouped into 3 sectors Comin, Lashkari, and Mestieri (2021)
  - Agriculture: food at home
  - Goods: vehicle purchasing, leasing, insurance; alcoholic beverages; all other transportation; men's and women's clothing; shoes and other apparel; furniture and fixtures; appliances, phones, computers with associated services; children's clothing; personal care; tobacco, other smoking
  - Services: housing; utilities; health expenditures including insurance; food away from home; entertainment equipment and subscription television; entertainment fees, admissions, reading; domestic services and childcare; education; cash contributions (not for alimony/support)
- Household heads aged 25 to 60; minimum household income (in 2016 dollars) $5,000
- For expenditure distribution, adjust by dividing by square root of family size

Back

Government Spending

- Source: White House Office of Management & Budget
- Programs included in transfers
  - General retirement and disability insurance (excluding social security)
  - Federal employee retirement and disability
  - Unemployment compensation
  - Housing assistance
  - Food and nutrition assistance
  - Other income security
- Government spending
  - Supposed to capture all remaining federal spending
  - Purposefully chosen such that G/Y constant
    - Spending has risen in the data
    - Largely deficit financed, which cannot be captured in the model

Back

Model Appendix

Non-Homothetic Preferences Non-Homothetic CES

Comin, Lashkari, and Mestieri (2021)

- Conditions for DRRA with two goods: $\varepsilon_1 < \varepsilon_2 = 1$
  - Necessary condition: $\gamma > \varepsilon_1$
  - Sufficient condition: $\gamma + \varepsilon_1 \geq 2$
- Typical calibration with three goods $\Rightarrow$ quantitatively true

Non-Homothetic Preferences

Geary (1950)

- **One-sector** Stone-Geary preferences

$$u(c) = \frac{(c - \bar{c})^{1-\gamma}}{1-\gamma}$$

- Subsistence consumption level $\bar{c} > 0$

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$\Rightarrow$ Implies increasing elasticity of intertemporal substitution (DRRA)

- Counterfactual: vanishing non-homotheticities

Non-Homothetic Preferences IA Preferences

Alder, Boppart, and Müller (2022)

- Preferences defined over expenditures $e = \sum_j p_j c_j$

$$v(e,p) = \frac{1-\varepsilon}{\varepsilon} \frac{1}{\mathbf{B}(p)^{\varepsilon}} \left(e - \underbrace{\sum_j p_j \bar{c}_j}_{\bar{\mathbf{A}}(p)} \right)^{\varepsilon} - \mathbf{D}(p)$$

  – Price function $\mathbf{B}(p) = \left(\sum_j \Omega_j p_j^{1-\sigma} \right)^{1/(1-\sigma)} (= p^{\star})$

D-Term Back

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  - Price function $\mathbf{D}(p)$ is independent of expenditures e (PIGL)

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  - Price function $\mathbf{D}(p)$ is independent of expenditures e (PIGL)

$\Rightarrow$ Typically implies DRRA

  - u exhibits DRRA $\Leftrightarrow \bar{\mathbf{A}}(p) > 0$
  - Typical calibration with three goods $\Rightarrow \bar{\mathbf{A}}(p) > 0$

Non-Homothetic Preferences IA Preferences

Alder, Boppart, and Müller (2022)

$$D(p) = \frac{(1-\varepsilon)\nu}{\kappa\gamma}\left[\left(\frac{\tilde{D}(p)}{B(p)}\right)^{\gamma} - 1\right]$$

$$\tilde{D}(p) = \left(\sum_{j \in J} \theta_j p_{j,t}^{1-\phi}\right)^{\frac{1}{1-\phi}}$$

Calibration Aggregates

- Prices for all goods p_A, p_G, p_S pinned down by growth and relative price changes
  - Aggregate growth in GDP per capita: 3.3
    NIPA
  - Prices relative to goods
    Computed based on Herrendorf, Rogerson, and Valentinyi (2013) [NIPA]
    + Agriculture (food) $\rightarrow$ 1.00, 1.87
    + Services $\rightarrow$ 1.00, 3.16
- Interest rate fixed at 2%; discount factor to match wealth-to-income ratio of 4 in 2010
  Piketty and Zucman (2014) [NIPA]
  - Untargeted wealth-to-income ratio in 1950 of 3 [data: 3.5]

Back

Calibration Government

- Parametric tax function plus lump-sum transfer

  Ferriere, Grübener, Navarro, and Vardishvili (2023)

$$\bar{\tau}(y) = \exp\left[\log(\lambda)\left(y^{-2\tau}\right)\right]$$

  - λ captures level of the tax rates, τ captures progressivity

Calibration Government

- Parametric tax function plus lump-sum transfer

  Ferriere, Grübener, Navarro, and Vardishvili (2023)

$$\bar{\tau}(y) = \exp\left[\log(\lambda)\left(y^{-2\tau}\right)\right]$$

  – λ captures level of the tax rates, τ captures progressivity

- Government spending

  White House Office of Management & Budget

  – Transfer T, spending on income security: T/Y: 1.1%, 3.6%

  – Exogenous spending G, all remaining spending: $G/Y \approx 14\%$ constant

- Difference in Average Marginal Tax Rate (AMTR) between top 10% and bottom 90%

  Mertens and Montiel Olea (2018)

  – 13%, 9%

Labor Supply in the Time Series and Cross-Section

- Fall in average hours across time: 7% [Census/ACS 3%]

  Ruggles et al. (2022); Ramey and Francis (2009), Boppart and Krusell (2020)

- Correlation between hours and hourly wage in the cross-section
  - Roughly flat hours profile in 1950 [Census/ACS: negative]
  - Positive in 2010 [Census/ACS: positive]

  Ruggles et al. (2022); Mantovani (2022)

Census/ACS Back

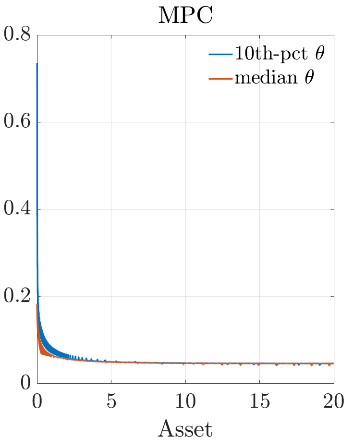
Asset Distribution

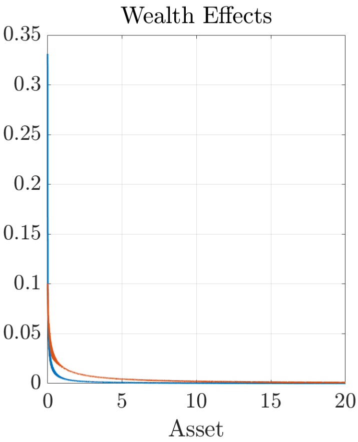
1950	Wealth Share by Quintile				
Model	0%	2%	6%	17%	76%
Data (SCF+)	0%	1%	4%	11%	84%

2010	Wealth Share by Quintile				
Model	0%	1%	5%	13%	81%
Data (SCF+)	-1%	1%	3%	10%	87%

Back

Implied RRA in the Model MPCs and Wealth Effects



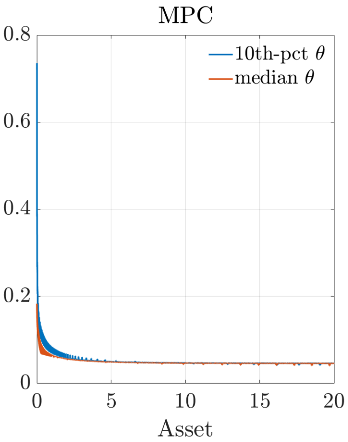


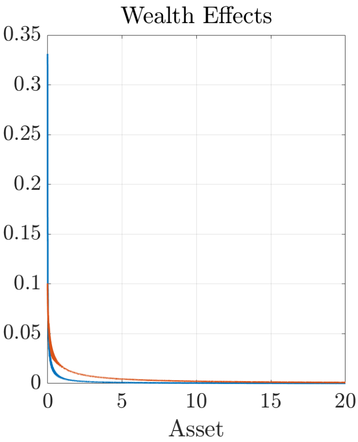
- Model MPC: 18% in 2010

  Johnson, Parker, and Souleles (2006), Fagereng, Holm, and Natvik (2021), Kaplan and Violante (2022)

Back | Wealth Effects

Implied RRA in the Model MPCs and Wealth Effects





- Model MPC: 18% in 2010
  Johnson, Parker, and Souleles (2006), Fagereng, Holm, and Natvik (2021), Kaplan and Violante (2022)

- Wealth effects: 0.02 in 2010
  Golosov, Graber, Mogstad, and Novgorodsky (2023)

Back Wealth Effects

Wealth Effects: Evidence Golosov, Graber, Mogstad, and Novgorodsky (2023)

- How does income respond to unexpected wealth shocks?
  - Golosov et al. merge US tax data with data on lottery winnings
  - Compute earnings change over five years after lottery win
  - Earnings drop by on average $2.3\$$ per $100\$$ of win
- Replicate in model using mean post-tax win
  - Earnings drop by on average $2.1\$$ per $100\$$ of win

Back

Calibration: Inequality

- A partial-insurance approach
  - Calibrate $f(.)$ as exponentially modified Gaussian (EMG) to match dispersion in expenditures

Back

Calibration: Inequality

- A partial-insurance approach
  - Calibrate $f(.)$ as exponentially modified Gaussian (EMG) to match dispersion in expenditures

- In 2010, data on income and expenditure inequality
  - Dispersion: $\mathbb{V}[\log y] = 0.78$; $\mathbb{V}[\log e] \approx 0.35$

    SCF+ (Kuhn, Schularick, and Steins 2020); Attanasio and Pistaferri (2014), Heathcote, Perri, and Violante (2010)
  - Pareto tail: $\lambda_y = 1.65$; $\lambda_e \approx 3.3$

    Aoki and Nirei (2017); Toda and Walsh (2015)

Calibration: Inequality

- A partial-insurance approach
  - Calibrate $f(.)$ as exponentially modified Gaussian (EMG) to match dispersion in expenditures
- In 2010, data on income and expenditure inequality
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    SCF+ (Kuhn, Schularick, and Steins 2020); Attanasio and Pistaferri (2014), Heathcote, Perri, and Violante (2010)
  - Pareto tail: $\lambda_y = 1.65$; $\lambda_e \approx 3.3$
    Aoki and Nirei (2017); Toda and Walsh (2015)
- In 1950, data on income inequality only
  - Dispersion: $\mathbb{V}[\log y] = 0.57$; $\Rightarrow$ infer $\mathbb{V}[\log e] \approx 0.25$
    SCF+ (Kuhn, Schularick, and Steins 2020)
  - Pareto tail: $\lambda_y = 2.2 \Rightarrow$ infer $\lambda_e = 4.4$
    Aoki and Nirei (2017)

Back

Calibration: Expenditure Inequality

1950	Expenditure Share by Quintile				
Dynamic model	8%	13%	17%	23%	39%
Static model	9%	13%	17%	23%	38%

2010	Expenditure Share by Quintile				
Dynamic model	7%	11%	16%	21%	45%
Static model	7%	12%	16%	23%	43%

Efficiency vs. Distribution **Decomposition**

- Decomposition into effects of marginal utilities, income effects, and the hours distribution

$$\underbrace{1-\frac{1-\frac{\mathcal{T}'(y(\hat{\theta}))}{1-\mathcal{T}'(y(\hat{\theta}))}\frac{1}{1+\varphi}\hat{\theta}f(\hat{\theta})+\int_{\hat{\theta}}^{\bar{\theta}}\mathcal{T}'(y(x))\eta(x)dF(x)}{1+\int_{\underline{\theta}}^{\bar{\theta}}\mathcal{T}'(y(x))\eta(x)dF(x)}}_{E(p)}=\underbrace{1-\frac{\int_{\hat{\theta}}^{\bar{\theta}}u_e(x)\frac{w(x)}{f(x)}dF(x)}{\int_{\underline{\theta}}^{\bar{\theta}}u_e(x)\frac{w(x)}{f(x)}dF(x)}}_{D(p)}$$

- Starting from optimal taxes with growth

Back

Efficiency vs. Distribution Decomposition

- Decomposition into effects of marginal utilities, income effects, and the hours distribution

$$\underbrace{1-\frac{1-\frac{\mathcal{T}'(y(\hat\theta))}{1-\mathcal{T}'(y(\hat\theta))}\frac{1}{1+\varphi}\hat\theta f(\hat\theta)+\int_{\hat\theta}^{\bar\theta}\mathcal{T}'(y(x))\eta(x)dF(x)}{1+\int_{\underline{\theta}}^{\bar\theta}\mathcal{T}'(y(x))\eta(x)dF(x)}}_{E(p)}=\underbrace{1-\frac{\int_{\hat\theta}^{\bar\theta}u_e(x)\frac{w(x)}{f(x)}dF(x)}{\int_{\underline{\theta}}^{\bar\theta}u_e(x)\frac{w(x)}{f(x)}dF(x)}}_{D(p)}$$

- Starting from optimal taxes with growth

1. Optimal taxes with $u_e(\cdot)$ computed using p_{1950}

Back

Efficiency vs. Distribution Decomposition

- Decomposition into effects of marginal utilities, income effects, and the hours distribution

$$\underbrace{1-\frac{1-\frac{\mathcal{T}'(y(\hat{\theta}))}{1-\mathcal{T}'(y(\hat{\theta}))}\frac{1}{1+\varphi}\hat{\theta}f(\hat{\theta})+\int_{\hat{\theta}}^{\bar{\theta}}\mathcal{T}'(y(x))\eta(x)dF(x)}{1+\int_{\underline{\theta}}^{\bar{\theta}}\mathcal{T}'(y(x))\eta(x)dF(x)}}_{E(p)}=\underbrace{1-\frac{\int_{\hat{\theta}}^{\bar{\theta}}u_e(x)\frac{w(x)}{f(x)}dF(x)}{\int_{\underline{\theta}}^{\bar{\theta}}u_e(x)\frac{w(x)}{f(x)}dF(x)}}_{D(p)}$$

- Starting from optimal taxes with growth

  1. Optimal taxes with $u_e(\cdot)$ computed using p_{1950}
  2. Adding $\eta(\cdot)$ using p_{1950}

Back

Efficiency vs. Distribution Decomposition

- Decomposition into effects of marginal utilities, income effects, and the hours distribution

$$\underbrace{1-\frac{1-\frac{\mathcal{T}'(y(\hat{\theta}))}{1-\mathcal{T}'(y(\hat{\theta}))}\frac{1}{1+\varphi}\hat{\theta}f(\hat{\theta})+\int_{\hat{\theta}}^{\bar{\theta}}\mathcal{T}'(y(x))\eta(x)dF(x)}{1+\int_{\underline{\theta}}^{\bar{\theta}}\mathcal{T}'(y(x))\eta(x)dF(x)}}_{E(p)}=\underbrace{1-\frac{\int_{\hat{\theta}}^{\bar{\theta}}u_e(x)\frac{w(x)}{f(x)}dF(x)}{\int_{\underline{\theta}}^{\bar{\theta}}u_e(x)\frac{w(x)}{f(x)}dF(x)}}_{D(p)}$$

- Starting from optimal taxes with growth

1. Optimal taxes with $u_e(\cdot)$ computed using p_{1950}
2. Adding $\eta(\cdot)$ using p_{1950}
3. Adding $n(\cdot)$ using p_{1950}

Back

Efficiency vs. Distribution Decomposition

- Decomposition into effects of marginal utilities, income effects, and the hours distribution

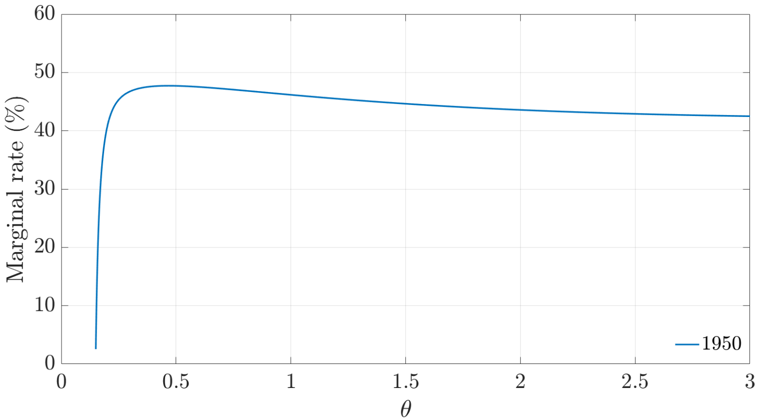
$$\underbrace{1-\frac{1-\frac{\mathcal{T}'(y(\hat{\theta}))}{1-\mathcal{T}'(y(\hat{\theta}))}\frac{1}{1+\varphi}\hat{\theta}f(\hat{\theta})+\int_{\hat{\theta}}^{\bar{\theta}}\mathcal{T}'(y(x))\eta(x)dF(x)}{1+\int_{\underline{\theta}}^{\bar{\theta}}\mathcal{T}'(y(x))\eta(x)dF(x)}}_{E(p)}=\underbrace{1-\frac{\int_{\hat{\theta}}^{\bar{\theta}}u_e(x)\frac{w(x)}{f(x)}dF(x)}{\int_{\underline{\theta}}^{\bar{\theta}}u_e(x)\frac{w(x)}{f(x)}dF(x)}}_{D(p)}$$

- Starting from optimal taxes with growth

1. Optimal taxes with $u_e(\cdot)$ computed using p_{1950}
2. Adding $\eta(\cdot)$ using p_{1950}
3. Adding $n(\cdot)$ using p_{1950}

$\Rightarrow$ Back to 1950

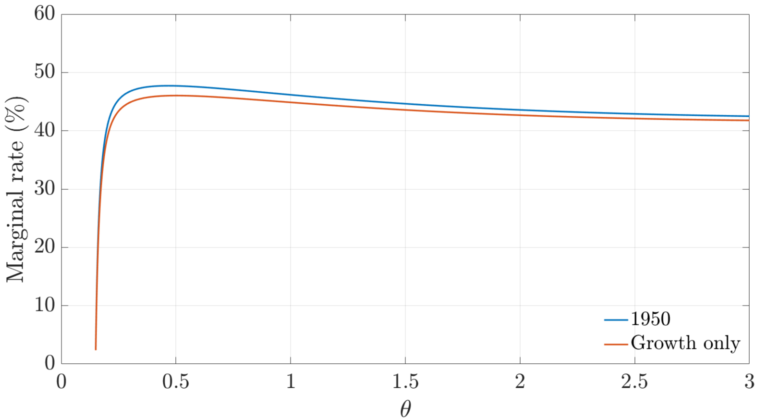
Optimal Marginal Rates with Growth **Utilitarian**



- Optimal 1950 transfers: $T/Y = 25.2\%$

Back

Optimal Marginal Rates with Growth Utilitarian



- Optimal 1950 transfers: T/Y = 25.2% ⇒ With 2010 growth, $T/Y = 24.0\%$

Weights

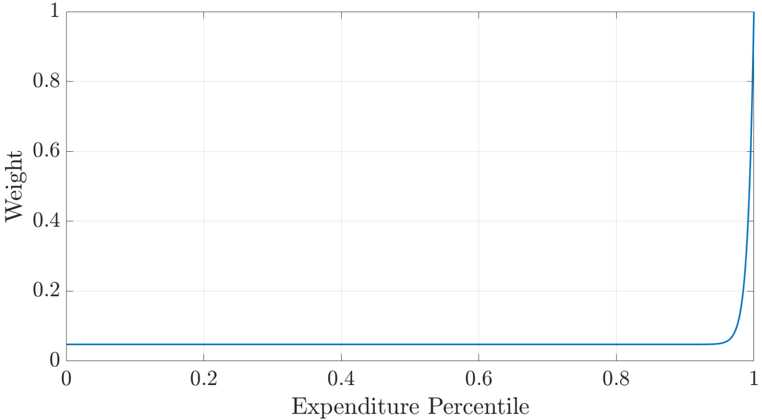
- More degrees of freedom in finding inverse optimum weights
- Restriction to functional form motivated by instruments: lump sum and progressivity
- Weights as function of percentiles of the expenditure distribution

$$\omega\left(p_i\right) = \mu + p_i(e_i)^{\nu}$$

- $\mu = 0.05$, $\nu = 116.4$

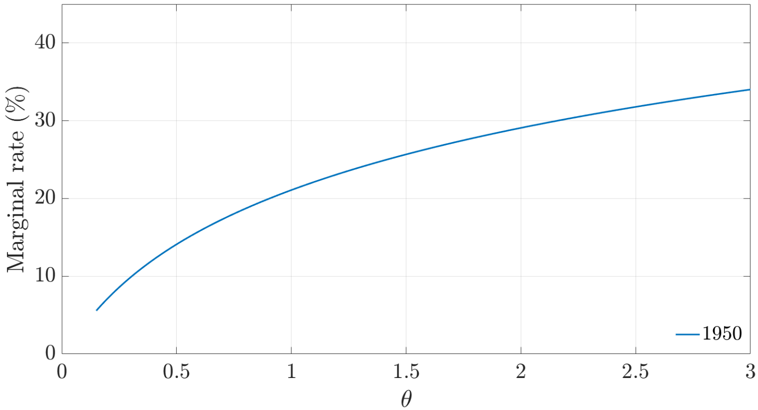
Back

Weights



Back

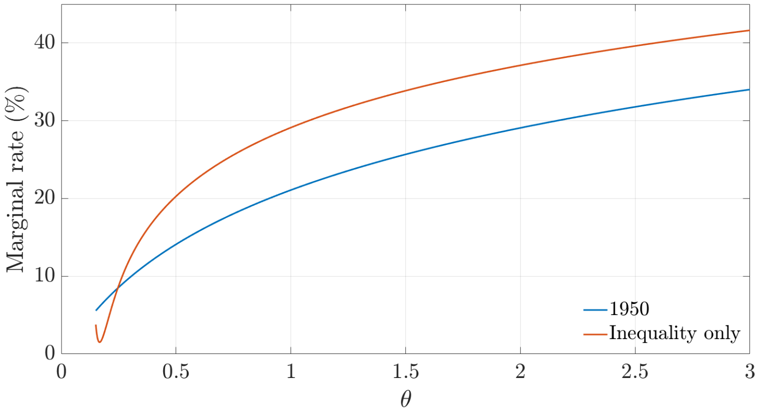
Optimal Marginal Rates Mirrlees



- Calibration in 1950: $T/Y = 1.2\%$

Back

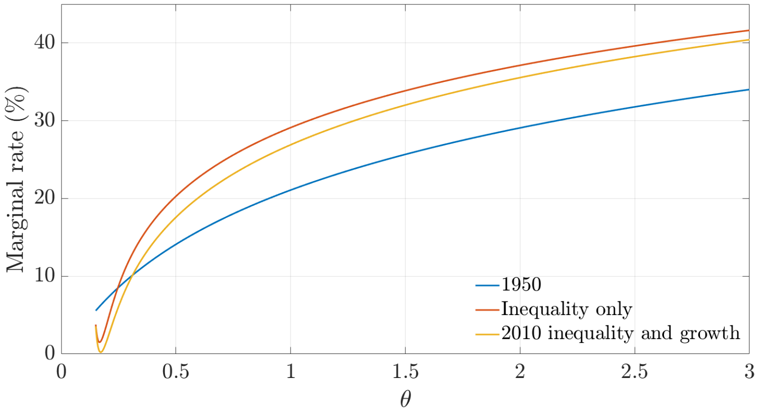
Optimal Marginal Rates Mirrlees



- Calibration in 1950: $T/Y = 1.2\% \;\Rightarrow T/Y = 6.7\%$ with higher inequality

Back

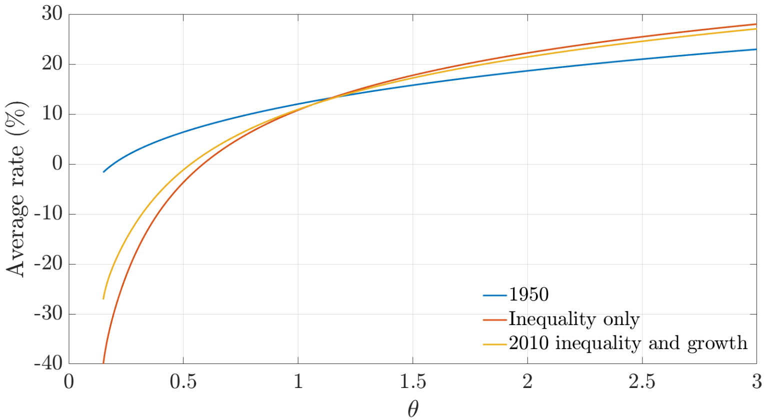
Optimal Marginal Rates Mirrlees



- Calibration in 1950: $T/Y = 1.2\%$ $\Rightarrow T/Y = 4.5\%$ with higher inequality and growth
  - Growth reduces increase in T/Y by 40%

Back

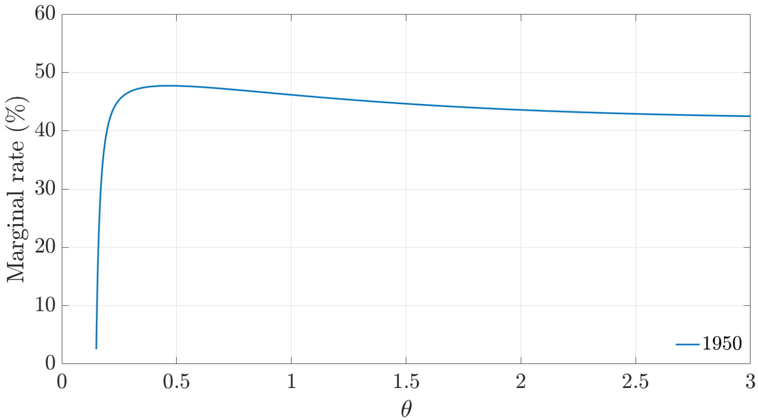
Optimal Average Rates Mirrlees



- Growth reduces increase in top-10 minus bottom-10 average rates by 26%

Back

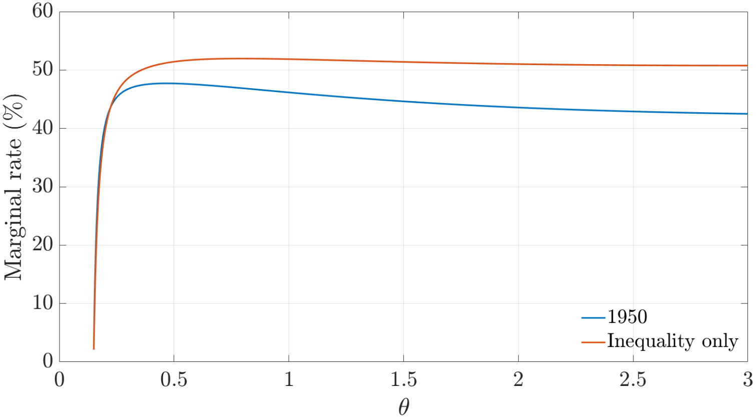
Optimal Marginal Rates Mirrlees Utilitarian



- Optimum in 1950: $T/Y = 25.2\%$

Back

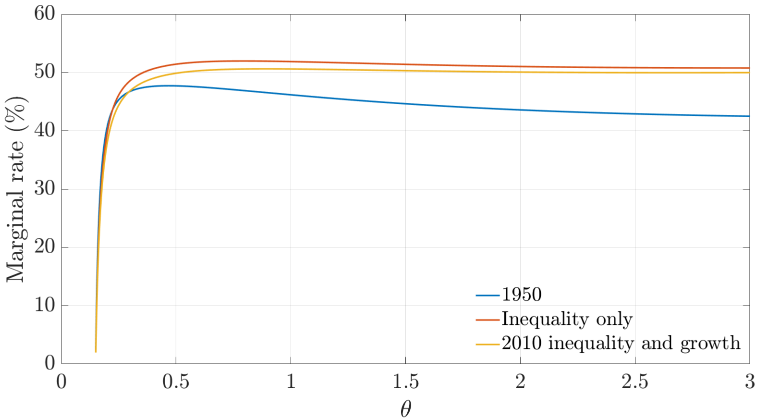
Optimal Marginal Rates Mirrlees Utilitarian



- Optimum in 1950: $T/Y = 25.2\%$ $\Rightarrow T/Y = 29.2\%$ with higher inequality

Back

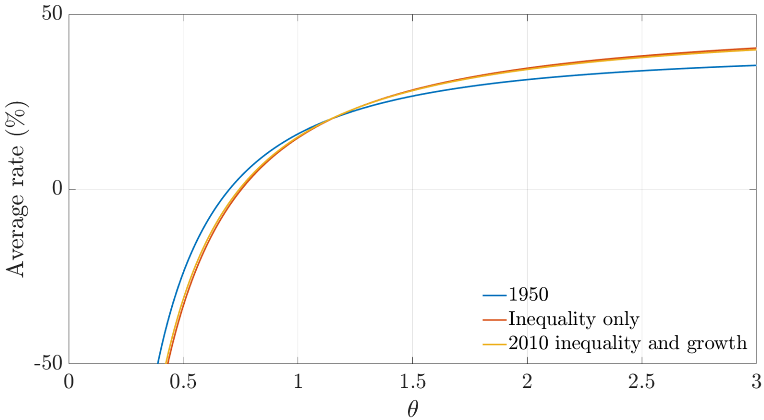
Optimal Marginal Rates Mirrlees Utilitarian



- Optimum in 1950: $T/Y = 25.2\%$ $\Rightarrow T/Y = 27.6\%$ with higher inequality and growth
  - Growth reduces increase in T/Y by 39%

Back

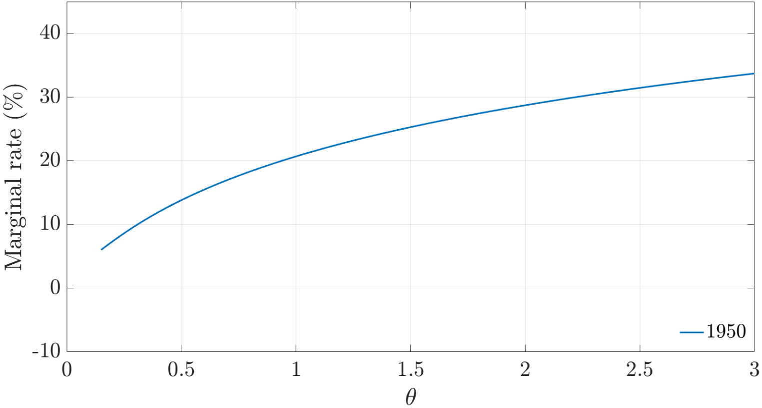
Optimal Average Rates **Mirrlees Utilitarian**



- Growth reduces increase in top-10 minus bottom-10 average rates by 9%

Back

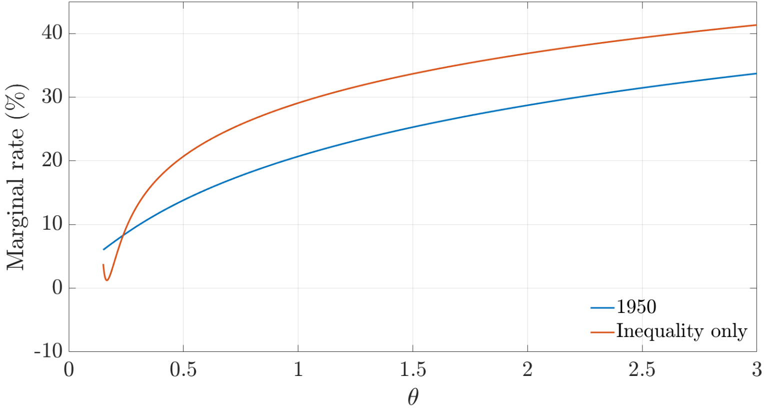
Optimal Marginal Rates Mirrlees IA Preferences



- Calibration in 1950: $T/Y = 1.1\%$

Parameters Back

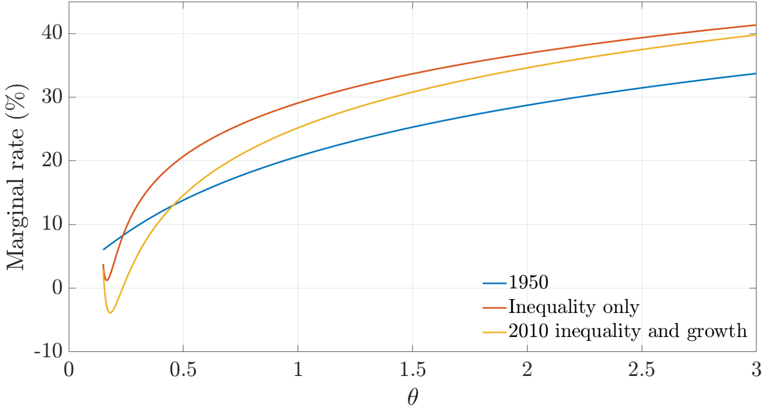
Optimal Marginal Rates Mirrlees IA Preferences



- Calibration in 1950: $T/Y = 1.1\% \;\Rightarrow T/Y = 6.1\%$ with higher inequality

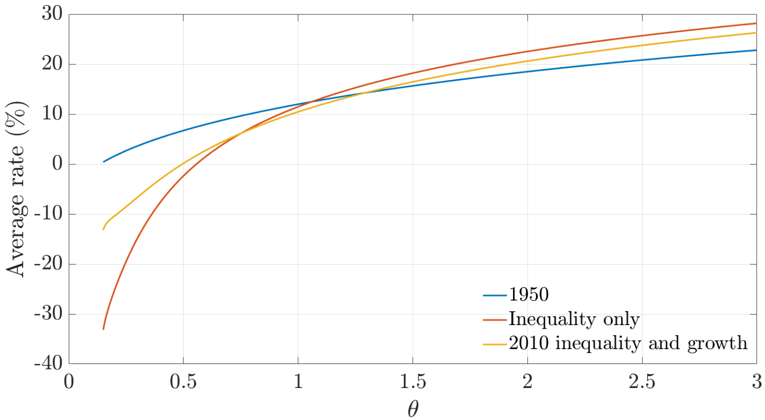
Parameters Back

Optimal Marginal Rates Mirrlees IA Preferences



- Calibration in 1950: $T/Y = 1.1\%$ $\Rightarrow T/Y = 2.4\%$ with higher inequality and growth
  - Growth reduces increase in T/Y by 73%

Optimal Average Rates **Mirrlees IA Preferences**



- Growth reduces increase in top-10 minus bottom-10 average rates by 44%

Back

IA Parameters

- $\varepsilon = \gamma = 0.1$
- A-term
  - $\bar{c}_A = 0.03,\ \bar{c}_G = 0.00,\ \bar{c}_S = 0.005$
- B-term
  - $\sigma = 0.001$
  - $\omega_A = 0.05,\ \omega_G = 0.4,\ \omega_S = 0.55$
- D-term
  - $\nu = 15$
  - $\phi = 2$
  - $\theta_A = 0.1,\ \theta_G = 0.6,\ \theta_S = 0.3$

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