Larger transfers financed with more progressive taxes? On the optimal design of taxes and transfers

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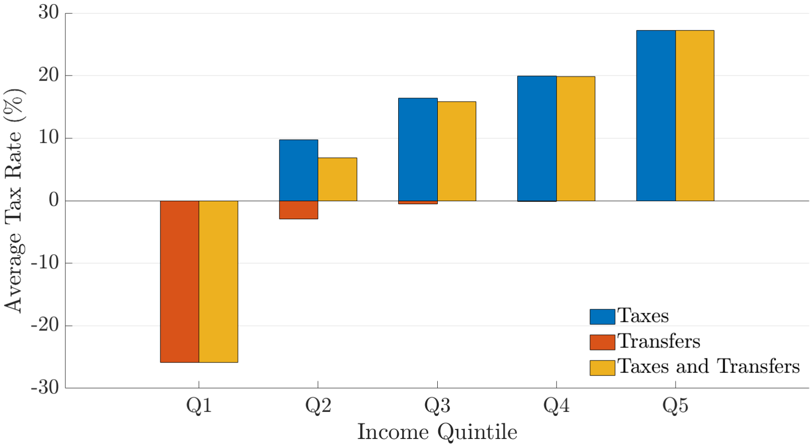
Redistribution in the U.S.

- Taxes and transfers are two key components in the U.S. fiscal system



- Working-age households ranked by income quintiles (CBO, 2013) ▸ Data

Main question

- How should a government design a **tax-and-transfer system** to reduce inequality while preserving efficiency?

- A **Ramsey** approach
  - Progressive taxes & targeted transfers
  - Rich quantitative macro model with a flexible set of fiscal instruments

- Two **questions**
  - Analytical: How should tax progressivity change with more generous transfers?
  - Quantitative: How generous should transfers be? How progressive should taxes be?

Theoretical analysis

- Simple model with progressive income tax scheme & a transfer
  - HSV: Heathcote, Storesletten, and Violante (2017)
  - Loglinear income tax with progressivity τ and a lump-sum T
- Local approximations around $T = 0$ to get a closed-form for welfare
  - Optimal negative relationship between T and τ
  - Due to both redistribution and efficiency concerns

$\Rightarrow$ **Optimal** fiscal plan features large **average** but low **marginal** progressivity

Quantitative analysis

- Standard heterogeneous-agent model augmented with:
  - Rich earnings dynamics: Pareto tail and GMAR process
  - (Heterogeneous discount factors)
- **New** and flexible **fiscal functions**
  - Non-negative progressive income tax: level & curvature
  - Targeted transfers: level & speed of phasing-out
- **Optimal policy**
  - Generous transfers, up to $29k, with a slow phasing-out
  - Moderately progressive income tax schedule

=> Large welfare gains!

Literature

- Evolution of inequality and taxation in the US
  Piketty and Saez (2003), Piketty and Saez (2007), Piketty, Saez, and Zucman (2017), Splinter (2020)

- Parametric tax functions: Empirical estimates
  Gouveia and Strauss (1994), Guner, Kaygusuz, and Ventura (2014), Feenberg, Ferriere, and Navarro (2020)

- Analytical frameworks to evaluate optimal tax progressivity
  Heathcote, Storesletten, and Violante (2014, 2017)

- Quantitative frameworks to evaluate optimal tax progressivity
  Bakış, Kaymak, and Poschke (2015), Guner, Lopez-Daneri, and Ventura (2016), Krueger and Ludwig (2016), Peterman (2016), Kindermann and Krueger (2021), Boar and Midrigan (2021)

- Intersection of Ramsey (1927) and Mirrlees (1971) traditions
  Findeisen and Sachs (2017), Heathcote and Tsujiyama (2021)

An Analytical Model

A tractable environment Bewley-Hugett economy

- No capital, representative **firm** with linear production function

- A utilitarian **government**
  - Raises loglinear taxes: $\mathcal{T}(y) = y - \lambda y^{1-\tau}$ ▸ Graph
  - Budget: $G + T = \int y_{it} di - \lambda \int y_{it}^{1-\tau} di$

- A continuum of infinitely-lived **workers**
  - Separable utility function: $\log c_{it} - B \frac{n_{it}^{1+\varphi}}{1+\varphi}$, with $\varphi \geq 1$
  - Wages AR(1): $\log z_{it} = \rho_z \log z_{i,t-1} + \omega_{i,t}$, with $\omega_{i,t} \sim \mathcal{N}\left(-\frac{v_\omega}{2(1+\rho_z)}, v_\omega\right)$
  - Hand-to-mouth workers: $c_{it} = \lambda (z_{it} n_{it})^{1-\tau} + T$
    - + Extension: uninsurable permanent + insurable iid shocks

No transfers Welfare as a function of progressivity τ

- Policy function for labor is $n_{it} = [(1-\tau)/B]^{\frac{1}{1+\varphi}} \equiv n_0(\tau)$

- Compute Y, λ and c_{it} and obtain welfare in closed-form

$$\mathcal{W}(\tau) = \underbrace{\underbrace{\log\left(n_0(\tau) - G\right)}_{\text{Size}} \underbrace{-\frac{1-\tau}{1+\varphi}}_{\text{Labor disutility}}}_{\text{Efficiency}} \overbrace{-(1-\tau)^2 \frac{v_\omega}{2(1-\rho_z^2)}}^{\text{Redistribution}}$$

- Two **efficiency** terms

  - Size term $\downarrow$ with τ; Labor disutility term $\uparrow$ with τ

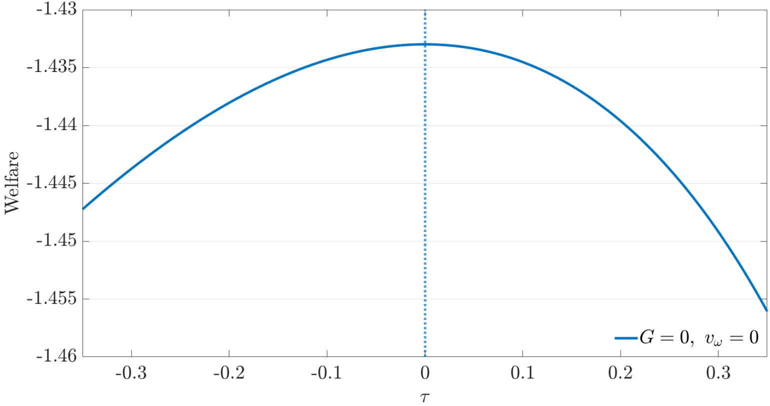
$\Rightarrow$ When $v_\omega = 0$, implements first-best allocation $n^\star(G)$ s.t. $Bn^\varphi(n-G) = 1$

  - Optimal $\tau_0^\star(G) = -G/(n^\star(G) - G)$

- **Redistribution** term $\uparrow$ with τ

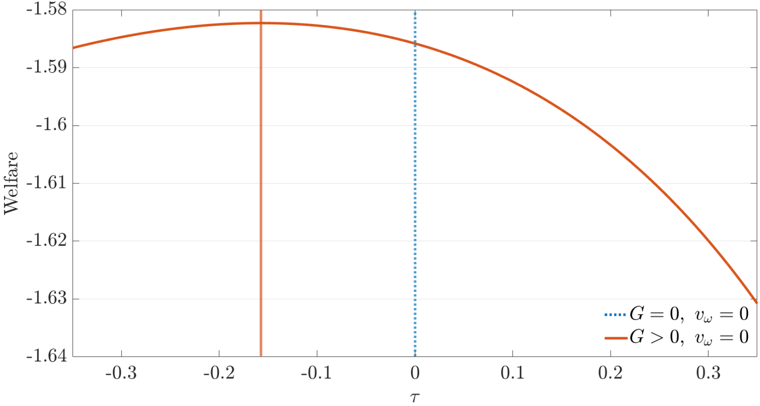
Welfare without transfers **Optimal τ**

- No spending, no heterogeneity: $\tau = 0$ ▸ Calibration



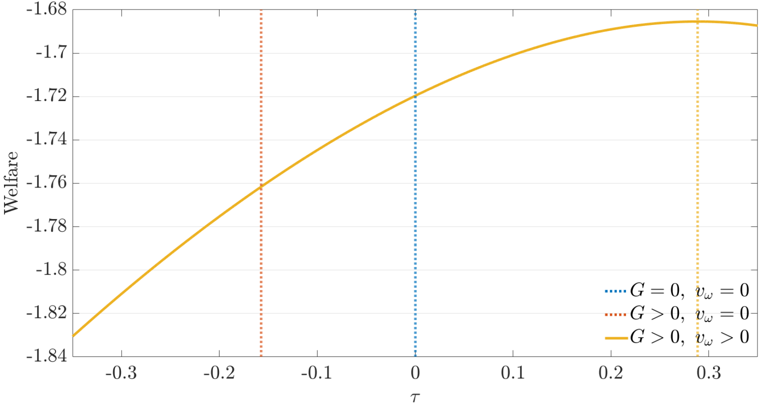
Welfare without transfers **Optimal τ**

- Positive spending, no heterogeneity: $\tau < 0$



Welfare without transfers **Optimal τ**

- Spending, uninsurable shocks: $\tau > 0$



Transfers Approximation around $T = 0$

- Implicit function theorem: approximation of the FOC

$$\hat{n}_{it} \approx n_0(\tau) - \frac{T}{1+\varphi} \frac{n_0(\tau)}{n_0(\tau) - G} z_{it}^{-(1-\tau)}$$

- Let $\eta \equiv \exp\left((1-\tau) \frac{v_\omega}{1-\rho_z^2} \right)$, with $\eta = 1$ when $v_\omega = 0$

- Compute Y, λ and c_{it} and obtain welfare

$$W(\tau, T) = W(\tau, 0) + \frac{T}{1+\varphi} \frac{\eta^{-\tau}}{n_0(\tau) - G} \left(- \frac{n_0(\tau)}{n_0(\tau) - G} + (1-\tau)\eta + (\varphi + \tau)\left(\eta - \eta^{\tau}\right) \right)$$

Transfers Welfare: Representative agent

- Representative agent $v_\omega = 0$, $\eta = 1$

- Optimal fiscal plan attains the first-best allocation $n^\star(G)$

$$n^\star(G) \text{ s.t. } Bn^\varphi(n - G) = 1$$

- For **any** T, optimal τ to implement the first-best given by

$$\tau(G, T) = -\frac{G + T}{n^\star(G) - (G + T)}$$

First Best

  - If $T = 0$, then $\tau = \tau_0^\star(G)$

    $\Rightarrow$ Transfers $T > 0$ when $\tau < \tau_0^\star(G)$

    Tax $T < 0$ when $\tau > \tau_0^\star(G)$ (retrieve $T = -G$ when $\tau = 0$)

$\Rightarrow$ **Negative** relationship between τ and T due to **efficiency** concerns

  - Efficiency gains of T are **decreasing** in τ

Transfers Welfare: Heterogeneous agents

- Approximated formula with heterogeneity $v_\omega > 0$, $\eta > 1$

$$W(\tau,T) = W(\tau,0) + \frac{T}{1+\varphi}\frac{\eta^{-\tau}}{n_0(\tau)-G}\Bigg(\overbrace{\frac{-G}{n_0(\tau)-G} - \tau}^{\text{Efficiency}} \dots$$

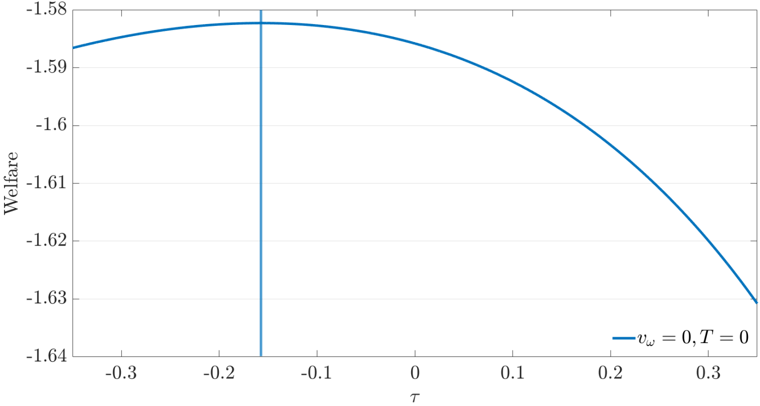
$$\dots \underbrace{+ (1-\tau)(\eta-1) + (\varphi+\tau)(\eta-\eta^{\tau})}_{\text{Redistribution}}\Bigg)$$

- **Efficiency** gains of T are decreasing in τ
  - Consistent with the representative agent
- The **redistribution** gains of T are decreasing in τ
  - Equals 0 when $\tau = 1$

$\Rightarrow$ **Negative** optimal relationship between T and τ Graph

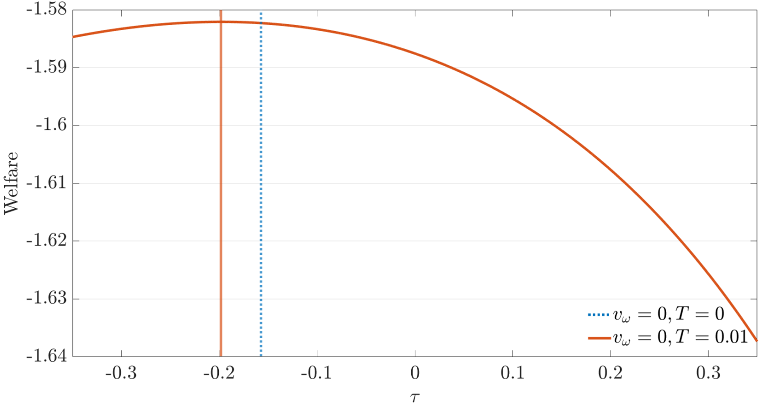
Transfers Heterogeneous agents

- Spending, no heterogeneity



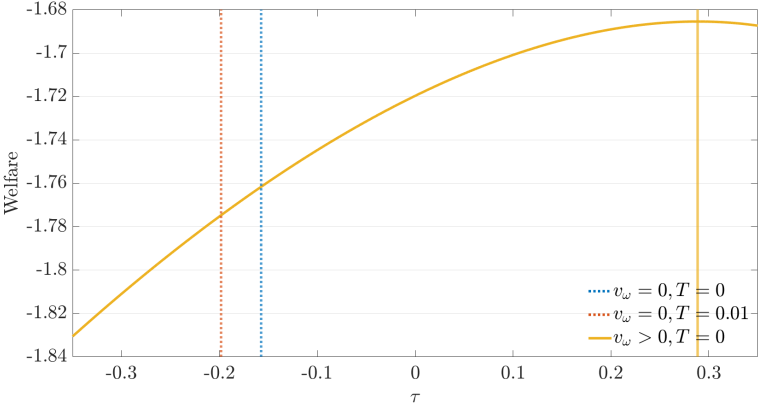
Transfers Heterogeneous agents

- Spending, no heterogeneity, $T > 0 \Rightarrow$ lower τ



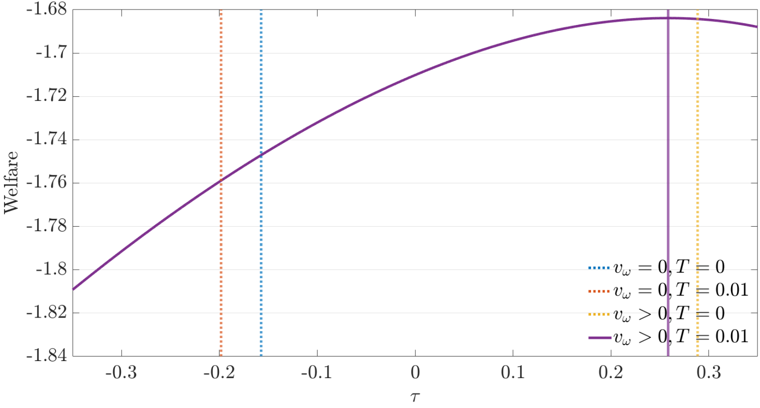
Transfers Heterogeneous agents

- Spending, idiosyncratic shocks



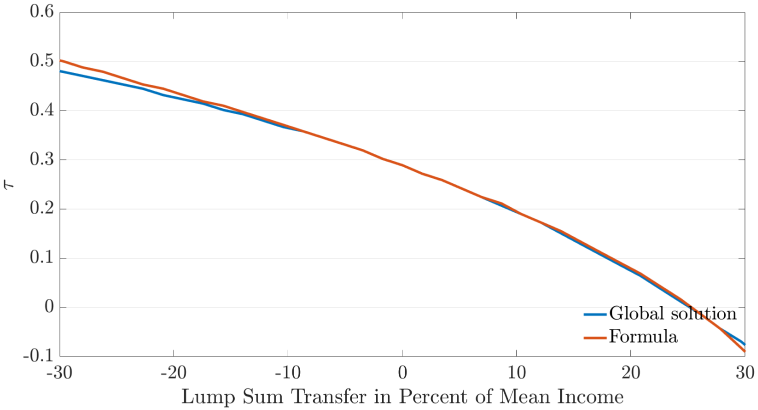
Transfers Heterogeneous agents

- Spending, idiosyncratic shocks, $T > 0 \Rightarrow$ lower τ



Transfers Heterogeneous agents

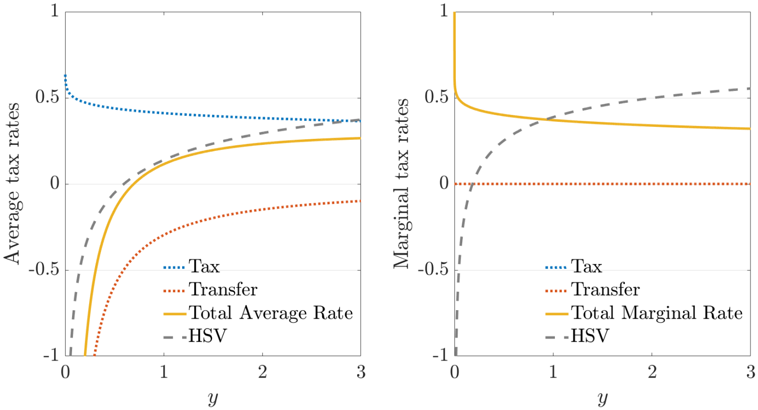
- A **negative** relationship between τ and T



- Formula: a good approximation!

Optimal plan with transfers **Global solution**

- Generous transfers: $T = 0.3$, regressive income taxes: $\tau = -0.08$



- Average taxes are increasing, marginal taxes are decreasing

Taking stock

- Optimal negative relationship between progressivity and transfers
  - Due to both efficiency and redistribution
- The optimal plan looks very different when allowing for transfers

A Quantitative Model

Overview

- Rich quantitative model
  - **Benchmark** economy: standard Aiyagari with
    - + Realistic income risk: Gaussian mixture autoregressive (GMAR)
    - + Income concentration: Pareto tail
  - Extension: heterogeneous discount factors
- Calibration to the U.S.
- Optimize on the fiscal system parameters
  - Global algorithm: TikTak
  - Taking into account **transitions**

Households, firm, government

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

$$V(a,z) = \max_{c,a',n} \left\{ \frac{c^{1-\sigma}}{1-\sigma} - B\frac{n^{1+\varphi}}{1+\varphi} + \beta \mathbb{E}_{z'} \left[V\left(a', z'\right) | z \right] \right\}$$

s.t.

$$c + a' \leq wzn + (1+r)a - \mathcal{T}(wzn, ra), \quad a' \geq 0$$

  - Productivity z follows a stochastic process

- Firm's static profit maximization:

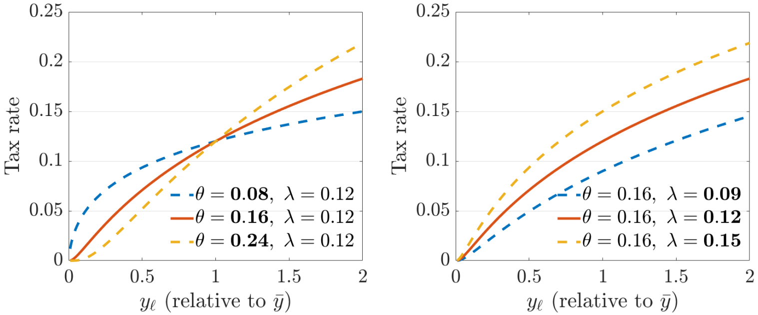
$$\Pi = \max_{K,L} \left\{ L^{\alpha} K^{1-\alpha} - wL - (r+\delta) K \right\}$$

- Government's budget constraint:

$$G + (1+r)D = D + \int \mathcal{T}(wxn, ra)\, d\mu(a,x)$$

Fiscal system Taxes

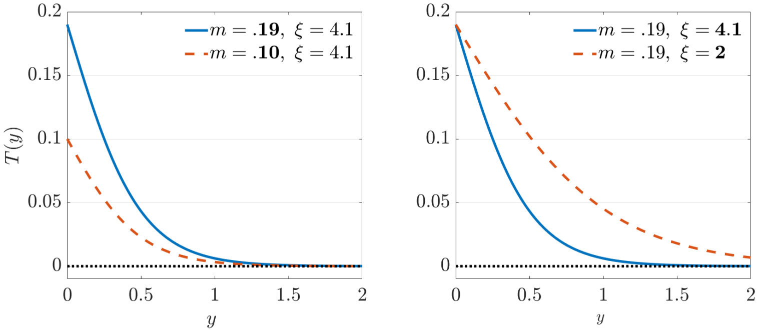
- Flat capital tax: $\tau_k y_k$
- Progressive labor tax: $\exp\left(\log(\lambda)\left(\frac{y_\ell}{\bar{y}}\right)^{-\frac{\theta}{2}}\right) y_\ell$
    - λ is the tax rate at $y_\ell = \bar{y}$, θ captures the progressivity



- Interpretation: θ and τ on a roughly similar scale ▸ Graph

Fiscal system Transfers

- New targeted-transfers function: $m \frac{2\exp\left\{-\xi\left(\frac{y}{\bar{y}}\right)\right\}}{1+\exp\left\{-\xi\left(\frac{y}{\bar{y}}\right)\right\}}$
  - m is the level at $y = 0$, ξ is the speed of phasing-out



Calibration Income process

- Log-productivity follows a Gaussian Mixture Autoregressive Process

$$\log z_t = \rho \log z_{t-1} + \eta_t,$$

$$\eta_t \sim \begin{cases} \mathcal{N}\left(\mu_1, \sigma_1^2\right) & \text{with probability } p_1, \\ \mathcal{N}\left(\mu_2, \sigma_2^2\right) & \text{with probability } 1 - p_1 \end{cases}$$

  Guvenen, Karahan, Ozkan, and Song (2021)

- 5 parameters: $(\rho, p_1, \mu_1, \sigma_1, \sigma_2)$
  - Restriction: $\mu_2 = -\frac{p_1}{1-p_1}\mu_1 \Leftarrow \mathbb{E}\left(\eta_t\right) = 0$

- Pareto tail as in Hubmer, Krusell, and Smith (2020)
  - $\kappa = 1.6$ Aoki and Nirei (2017)

Calibration

- Income process to match household income risk
  - Annual earnings growth distribution from PSID (1978-1992)
  + Std deviation: 0.35, Skewness: -0.45, Kurtosis: 12, P9010: 0.64
  - $p_1 = 0.85$, $\mu_1 = 0.016$ ($\mu_2 = -0.091$), $\sigma_1 = 0.15$, $\sigma_2 = 0.63$
  - Persistence ρ=0.935 to match the top-10 labor income share
- Fiscal parameters to match taxes and transfers per quintile
  - Taxes: $\theta = 0.16$, $\lambda = 0.12$, $\tau_k = 0.35$
  - Transfers: $m = 0.19$, $\xi = 4.1$
- Preferences: $\sigma = 2$, $\varphi^{-1} = 0.4$; Production: $\alpha = 0.64$, $\delta = 0.08$
- Calibrate ($\beta = 0.962, B = 85, D = 0.59$) to match $r = 2\%$, $\bar{h} = 0.3$, $D/Y = 60\%$ ($\Rightarrow G/Y \approx 14\%$)

Calibration Distributions

Income and Wealth Distributions

Data	Q1	Q2	Q3	Q4	Q5	Top 10
Labor income	2%	9%	15%	23%	52%	38%
Net worth	-1%	1%	3%	9%	88%	71%
Baseline	Q1	Q2	Q3	Q4	Q5	Top 10
Labor income	4%	9%	14%	20%	52%	38%
Net worth	0%	2%	8%	18%	72%	52%

Notes: Labor income shares by labor-income quintiles and wealth shares by wealth quintile, households aged 25-60. Data: PSID 2012 for labor income; SCF 2013 for wealth and top-10 labor income.

- Labor elasticity at the top-1%: 0.20

Calibration Fiscal system

Average Tax and Transfer Rates

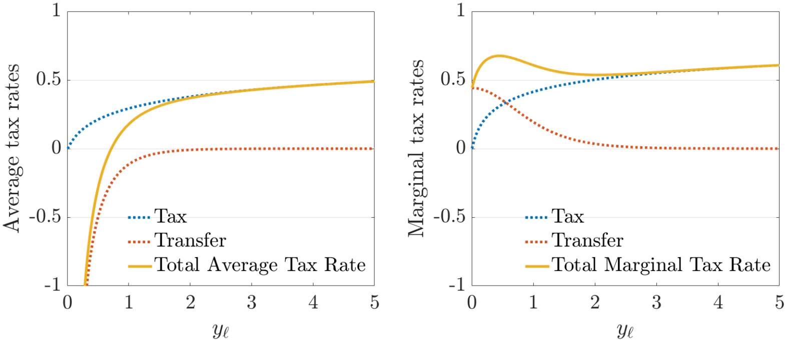
Data	Q1	Q2	Q3	Q4	Q5
Tax rate	0%	10%	16%	20%	27%
Transfer rate	26%	3%	1%	0%	0%
Model	Q1	Q2	Q3	Q4	Q5
Tax rate	8%	11%	14%	17%	28%
Transfer rate	24%	4%	1%	0%	0%

Notes: Average tax rates paid and transfer rates received per income quintile. Data: CBO 2013, working-age households. Model: tax parameters: $\theta = 0.16$, $\lambda = 0.12$; transfer parameters: $m = 0.19$, $\xi = 4.1$.

Graph

Optimal tax-and-transfer plan

- The **optimal plan** features
  - Large transfers $m = 0.46$, with a slow phase-out $\xi = 1.94$
  - Moderate tax progressivity, close to the calibrated value $\theta = 0.17$



Optimal plan Average and marginal rates

Data	Q1	Q2	Q3	Q4	Q5
Tax rate	0%	10%	16%	20%	27%
Transfer rate	26%	3%	1%	0%	0%
Total avg rate	-26%	-7%	15%	20%	27%

Optimal	Q1	Q2	Q3	Q4	Q5
Tax rate	15%	21%	27%	31%	44%
Transfer rate	170%	58%	21%	6%	0%
Total avg rate	-155%	-37%	6%	25%	44%
Marginal rate	62%	66%	62%	53%	51%

- Optimal $T/Y = 10\%$
- Much larger redistribution overall ... but decreasing marginal tax rates

Optimal plan **Transfers vs. progressivity, CE**

- Negative relationship between m and θ
  - At $\approx$ calibrated progressivity θ, transfers should be larger
  - At calibrated transfers, progressivity should be larger at $\theta = 0.30$

▸ Graph

- Welfare gains in consumption equivalent terms: $+$9.64%!
  - 79% of households would benefit
  - Larger welfare gains for the poor
  - Larger losses for the high-z/low-a households

▸ Graph

How important is the phase-out of transfers?

- Optimal plan with lump-sum transfers ($\xi = 0$)
  - Large transfers $m = 0.43$ with almost flat taxes $\theta = 0.03$

With phase-out	Q1	Q2	Q3	Q4	Q5
Tax rate	15%	21%	27%	31%	44%
Transfer rate	170%	58%	21%	6%	0%

Lump-sum	Q1	Q2	Q3	Q4	Q5
Tax rate	56%	56%	57%	55%	58%
Transfer rate	181%	85%	53%	35%	13%

How important is the phase-out of transfers?

With phase-out	Q1	Q2	Q3	Q4	Q5
Total avg rate	-155%	-37%	6%	25%	44%
Marginal rate	62%	66%	62%	53%	51%

Lump-sum	Q1	Q2	Q3	Q4	Q5
Total avg rate	-125%	-29%	4%	20%	45%
Total marg rate	60%	61%	62%	63%	64%

- $T/Y = 29\%$, redistribution almost as large but flatter marginal rates
- **Welfare gains** are 9.43%! vs. 9.62% with phase-out

  $\Rightarrow$ Friedman was right!...but average tax rates $\approx 55 - 60\%$

More

- How important are the Pareto tail and the GMAR? ▸ Departures from normality
- How important is wealth inequality? ▸ Heterogeneous β
- Optimal loglinear plan ▸ HSV
- Optimal steady-state ▸ Steady State

Conclusion

- This paper: optimal design of the tax-and-transfer system

- Main findings
  - Negative optimal relationship between transfers and tax progressivity
    - + For efficiency and redistribution concerns
  - Transfers should be more generous, taxes should be higher. . .
    - + . . . but taxes should not be more progressive

=> Average rates should be **more progressive** than marginal rates

- Large welfare gains

Appendix

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CBO Data: Components of Taxes and Transfers

- Broad measure of market income for non-elderly households
  - Labor and capital income
  - Includes all corporate and payroll taxes
- Taxes
  - Individual income tax (including tax credits) and payroll taxes
  - Corporate income tax and excise taxes
- Transfers
  - SNAP and other means-tested transfers (TANF, etc.)
  - Excluding SSI and Medicaid

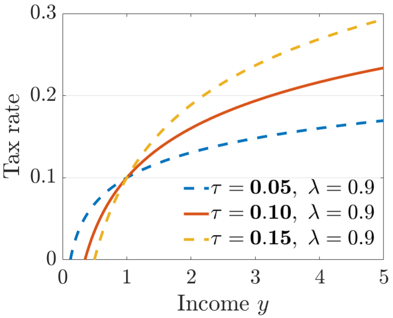
Back

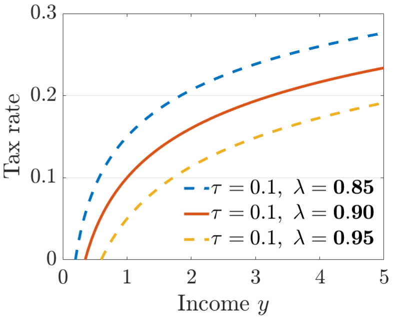
Loglinear tax function **Description**

◂ Back

- A loglinear tax scheme: $\mathcal{T}(y) = y - \lambda y^{1-\tau}$

- Tax progressivity is captured by τ
  - If $\tau = 0$: flat average (and marginal) tax rate $\mathcal{T}(y) = (1-\lambda)y$
  - If $\tau > 0$: progressive tax $\partial[\mathcal{T}(y)y]/\partial y > 0$
  - If $\tau = 1$: full redistribution $y - \mathcal{T}(y) = \lambda \ \ \forall y$





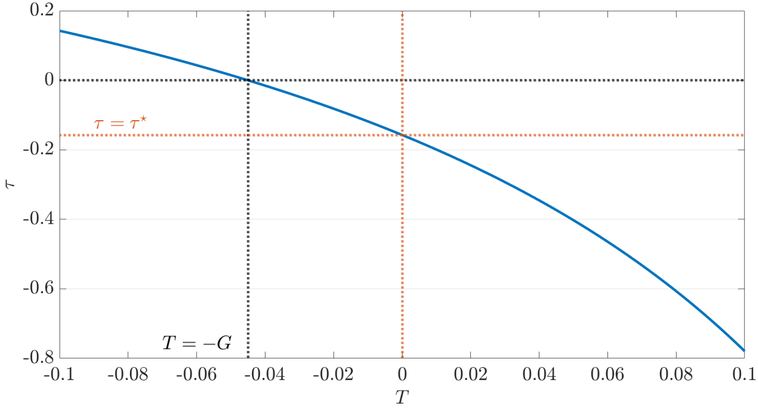
A tractable environment Calibration

◂ Back

- Preference parameters: $\varphi^{-1} = 0.4$, B to match $n_0 = 0.3$
- Fiscal parameters: $\tau = 0.18$, $G/Y = 0.15$
- Idiosyncratic risk: $\rho_z = 0.935$, υ_ω to match $\mathbb{V}[\log c]$

Transfers First-best

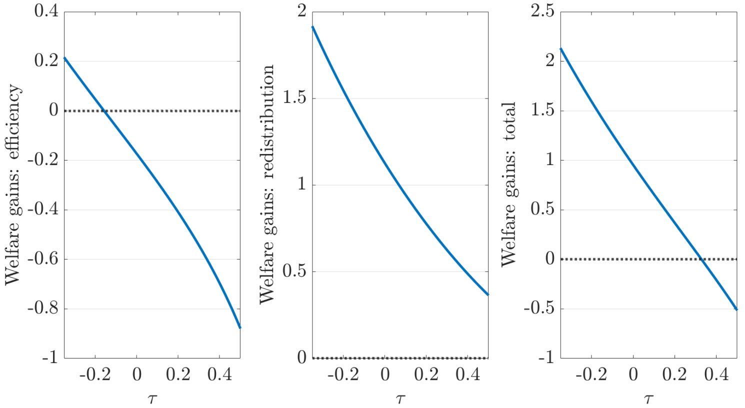
- Negative optimal relationship between T and τ



Back

Transfers Heterogeneous agents

- Negative optimal relationship between T and τ



Back

Equilibrium Definition

A stationary recursive competitive equilibrium is given by

- Households' value functions $\{V\}$ and policies $\{c, a', n\}$. Firm's policies $\{L, K\}$.
- Government's policies $\{G, D, \lambda, \theta, m, \xi\}$
- A measure μ

such that given prices $\{r, w\}$

- Households and the firm solve their respective problems.
- The government's budget constraint holds.
- Markets clear
  - Capital market clears: $K + D = \int_{\mathcal{B}} a'(a, z) d\mu(a, z)$
  - Labor market clears: $L = \int_{\mathcal{B}} zn(a, z) d\mu(a, z)$
  - Goods market clears: $Y = \int_{\mathcal{B}} c(a, z) d\mu(a, z) + \delta K + G$
- Measure μ is stationary

$$\mu(a', z') = \int \mathbb{I}\{a'(a, z) = a'\} \pi_z(z'|z) d\mu(a, z)$$

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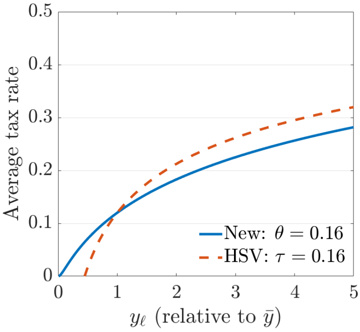
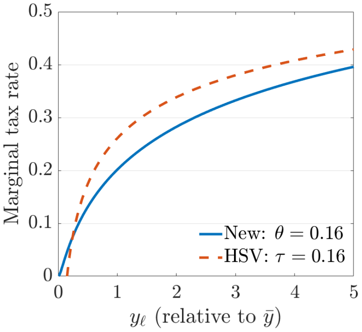
Fiscal system Taxes

- New progressive labor tax resembles HSV except at the bottom





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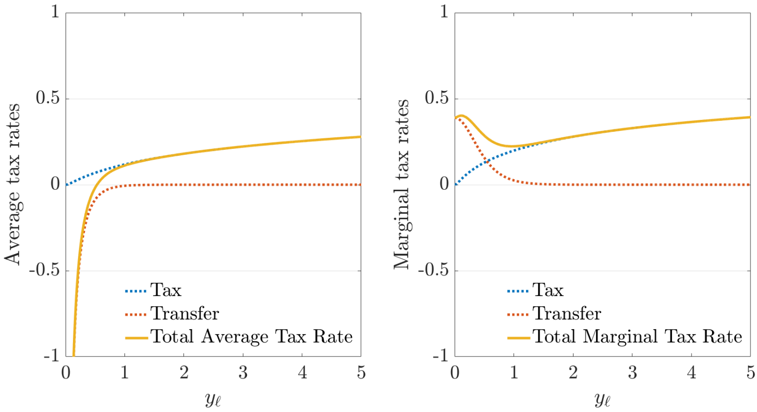
Calibration Fiscal system



- Marginal rates by quintile: 33%, 24%, 21%, 23%, 31%

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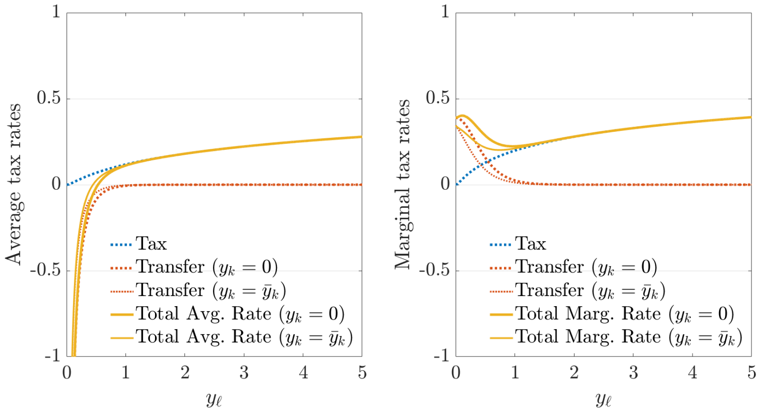
Calibration Fiscal system



- Marginal rates by quintile: 33%, 24%, 21%, 23%, 31%

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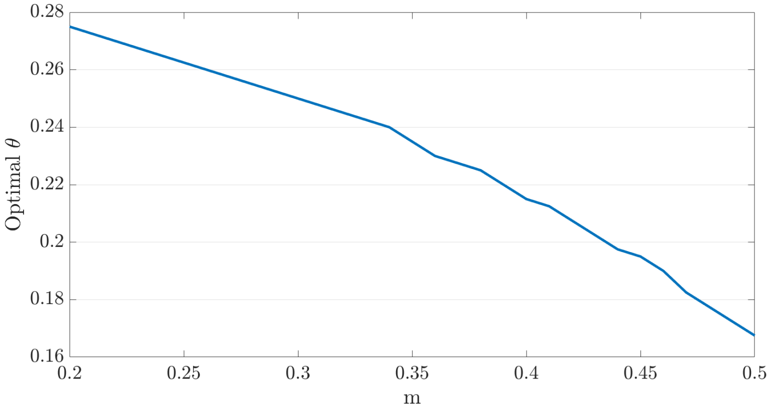
Optimal tax-and-transfer system

- Negative relationship between m and θ



- Keeping ξ constant at $\xi = 2$

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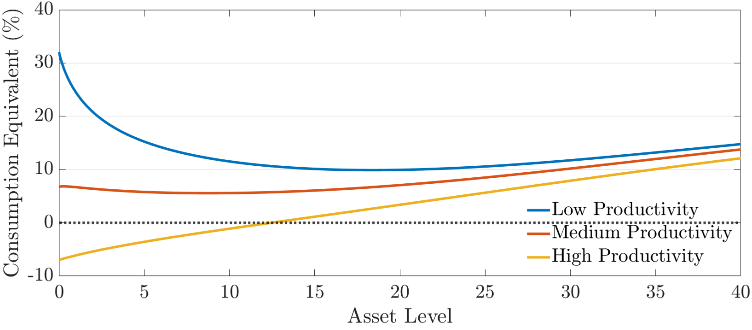
Optimal tax-and-transfer system CE

- Welfare gains: $+9.62\%$, 79% households would benefit



  - Low-x/a households gain from larger transfers
  - High-a households gain from higher r
  - High-x households lose from higher tax rates and lower w

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How important are departures from normality?

- Without a Pareto tail, lower overall progressivity
  - Lower transfers $m = 0.43$
  - Lower progressivity $\theta = 0.09$, lower phase-out $\xi = 1.65$
- No higher order moments: AR(1) (without Pareto tail)
  - σ to match SD of earnings growth (skewness: -0.05, kurtosis 3.08)

=> The system is more generous!

  + Larger transfers than GMAR $m = 0.45$
  + Similar progressivity $\theta = 0.08$ & phase-out $\xi = 1.40$

Total avg rate	Q1	Q2	Q3	Q4	Q5
Benchmark	-155%	-37%	6%	25%	44%
No Pareto tail	-131%	-26%	10%	28%	39%
AR(1)	-151%	-35%	5%	27%	41%

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Heterogeneous Beta

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- Recalibration with heterogeneous stochastic discount factors

  Krusell and Smith (1998)

Net worth dist.	Q1	Q2	Q3	Q4	Q5	Top 10
Data	-1%	1%	3%	9%	88%	71%
Benchmark	0%	2%	8%	18%	72%	52%
Het. β	0%	1%	3%	11%	85%	69%

- Optimal plan with targeted transfers
  - Larger transfers $m = 0.47$
  - Less phase-out $\xi = 0.5$, less progressive taxes $\theta = 0.08$

Total avg rate	Q1	Q2	Q3	Q4	Q5
Benchmark	-155%	-37%	6%	25%	44%
Het. β	-153%	-35%	1%	22%	47%

Optimal loglinear plan

- Steady state: $\tau = 0.40$, with transitions: $\tau = 0.49$
- Consumption equivalent: $+5.08\%$

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Steady-state Benchmark calibration

- Optimal plan without transition:
  - $\theta = 0.03$, $m = 0.36$, $\xi = 0$

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