MACROECONOMICS

PSE Summer School, 2023

On the Optimal Design of Fiscal Policy

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Summer School PSE

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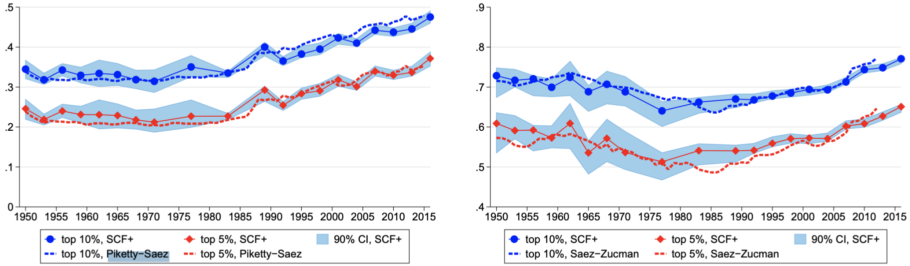
Income and wealth inequality have increased since 1950

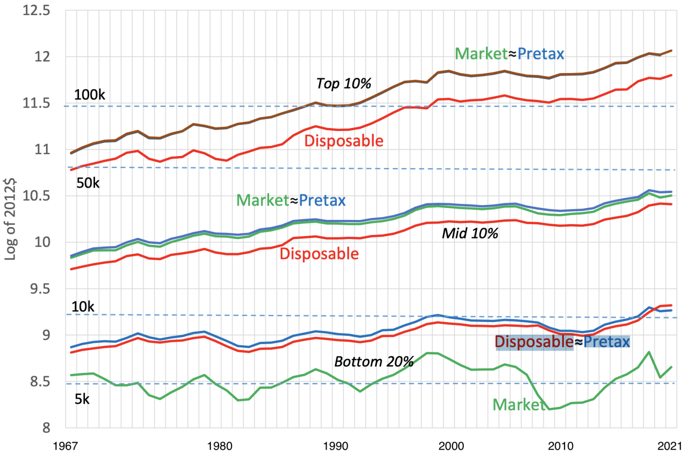
Figure 5: Top 5% and top 10% income and wealth shares



(a) Income (b) Wealth

- Top-income and -wealth shares have increased (SCF+, United States)
  Kuhn, Schularick and Stein (2020)

Income and wealth inequality have increased since 1950



- Household income has been flat for 5 decades at the bottom (CPS, United States)

  Heathcote, Violante, Perri and Zhang (2022)

Rethinking fiscal policy

- High levels of inequality
  Piketty Saez (2003), Heathcote Perri Violante (2010), Kuhn, Schularick and Stein (2020), Saez and Zucman (2020, 2022), Heathcote, Violante, Perri and Zhang (2022), ...

- New questions in the policy debate, on the role of the welfare state
  - Should we implement a Universal Basic Income?
  - Should we tax wealth?

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- This class: rethinking fiscal policy
  - Optimal taxes at the household level
  - Old classical theoretical literature, new quantitative macro literature

Lecture 1

Capital and Wealth Taxes

On capital taxes

Should we tax capital?

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- A classic question in macro...

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  - ... which came back in recent policy debate

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  - ... which came back in recent policy debate

- Methodology
  - Ramsey plans
  - Quantitative heterogeneous-agent models

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Should we tax capital?

- A classic question in macro...
  - ... which came back in recent policy debate
- Methodology
  - Ramsey plans
  - Quantitative heterogeneous-agent models
- Deterministic, long-run, steady-state

Should we tax capital?

1. Optimal fiscal policy in representative-agent models

    - Define **Ramsey plans** to compute optimal taxes

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   - Define **Ramsey plans** to compute optimal taxes
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2. Optimal fiscal policy in a standard Aiyagari models
   - Insurance, redistribution, and life-cycle dynamics

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   - Capital taxes should be 34%
3. Optimal fiscal policy with heterogeneous capital returns
   - New facts on capital returns

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   - Define **Ramsey plans** to compute optimal taxes
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   - Insurance, redistribution, and life-cycle dynamics
   - Capital taxes should be 34%
3. Optimal fiscal policy with heterogeneous capital returns
   - New facts on capital returns
   - Capital taxes should be negative, wealth taxes should be positive

Literature **Main references (many more at the end)**

- On optimal fiscal policy in RA models and the latest controversies
  - **Chamley (1986)**, Judd (1985), Straub and Werning (2020)
  - Chari, Christiano, and Kehoe (1994), Farhi (2010), ...

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  - **Conesa, Kitao, and Krueger (2009)**
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- On models with entrepreneurs and heterogeneous capital returns
  - **Guvenen et al. (2023)**
  - Kitao (2008), Bhandari and McGrattan (2020), Boar and Knowles (2020), Gaillard and Wangner (2022), ...

1. Optimal Taxes in a Deterministic Growth Model

General motivation

- Optimal taxes in a **competitive equilibrium**

General motivation

- Optimal taxes in a **competitive equilibrium**
  - Households' behaviors and prices

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- Taxes: functional forms

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- Commitment in time-zero

General motivation

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  - Households' behaviors and prices
- Taxes: functional forms
- Commitment in time-zero
- Outline: environment; equilibrium; Ramsey plan

Environment Preferences and resources

- Preferences of the representative household:

$$\sum_{t=0}^{\infty} \beta^t u(c_t, l_t), \tag{1}$$

where c_t: consumption, l_t: leisure.

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- The two resource constraints are given by

$$l_t + n_t = 1$$

where n_t: labor, and

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$$l_t + n_t = 1$$

where n_t: labor, and

$$g_t + c_t + k_{t+1} = A_t F(k_t, n_t) + (1-\delta)k_t, \tag{2}$$

where g_t: government expenditure, A_t: TFP, k_t: capital with k_0 is given.

- Planner problem

Environment First-Best

- Planner problem

- Two efficiency conditions

$$u_{c,t} A_t F_{n,t} = u_{l,t} \tag{3}$$

$$u_{c,t} = \beta u_{c,t+1} \left[A_{t+1} F_{k,t+1} + 1 - \delta \right] \tag{4}$$

Competitive Equilibrium with Taxes Three agents

- Representative household
- Representative firm
- Government

Competitive Equilibrium with Taxes Government

- Government
  - Spending g_t
  - Public debt b_t, labor tax τ_t^n, capital tax τ_t^k, lump-sum taxes T_t
  - b_0 given

Competitive Equilibrium with Taxes **Government**

- Government
  - Spending g_t
  - Public debt b_t, labor tax τ_t^n, capital tax τ_t^k, lump-sum taxes T_t
  - b_0 given

- Budget constraint:

$$g_t + b_t = \tau_t^k r_t k_t + \tau_t^n w_t n_t + b_{t+1}/R_t + T_t \tag{5}$$

where r_t: renting price of capital, w_t: price of labor, R_t: gross rate of return on one-period bonds from t to $t+1$.

Competitive Equilibrium with Taxes **Households**

- Household
  - Save in b_t and k_t
  - b_0 and k_0 given

Competitive Equilibrium with Taxes **Households**

- Household
  - Save in b_t and k_t
  - b_0 and k_0 given

- Maximizes utility given budget constraint:

$$c_t + k_{t+1} + b_{t+1}/R_t = (1-\tau_t^n)w_t n_t + (1-\tau_t^k)r_t k_t - T_t + (1-\delta)k_t + b_t \tag{6}$$

Competitive Equilibrium with Taxes **Households**

- Household's maximization problem

Competitive Equilibrium with Taxes **Households**

- Household's maximization problem

- Three first-order conditions

$$u_{l,t} = u_{c,t} w_t (1 - \tau_t^n) \tag{7}$$

$$u_{c,t} = \beta u_{c,t+1} [(1 - \tau_{t+1}^k) r_{t+1} + 1 - \delta] \tag{8}$$

$$R_t = (1 - \tau_{t+1}^k) r_{t+1} + 1 - \delta \tag{9}$$

Competitive Equilibrium with Taxes Firms

The representative firm is standard and maximizes its profit every period:

$$r_t = A_t F_{k,t} \tag{10}$$

$$w_t = A_t F_{n,t} \tag{11}$$

Competitive Equilibrium with Taxes Definition

Let $x \equiv \{x_t\}_{t=0}^{\infty}$.

Definition

A **feasible allocation** is a sequence (k, c, n, g) such that the resource constraint (2) holds $\forall t \geq 0$.

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Definition

A **price system** is a non-negative bounded sequence (w, r, R).

Definition

A **government policy system** is a sequence $(g, \tau_k, \tau_n, T, b)$.

Competitive Equilibrium with Taxes Definition

Definition

A **competitive equilibrium** is a feasible allocation, a price system, and a government policy, such that:

a. Given the price system and the government policy, the allocation solves the firm's problem and the household's problem

b. Given the allocation and the price system, the government policy satisfies the sequence of government budget constraints (5).

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- An infinity of CE! Why?

Competitive Equilibrium with Taxes Distortions

Claim

The first-best allocation requires capital and labor taxes to be zero.

Competitive Equilibrium with Taxes Distortions

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The first-best allocation requires capital and labor taxes to be zero.

- Labor and capital taxes are said to be distortionary.
- What about τ_0^k? What about lump-sum taxes?

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The first-best can be implemented by lump-sum taxes and balanced budget.

Competitive Equilibrium with Taxes **Distortions**

Claim

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Claim

The first-best can be implemented by lump-sum taxes and balanced budget.

Claim

Ricardian equivalence: the first-best allocation can be implemented by any path $\{b_t\}$ for debt, and $T_t = g_t + b_t - b_{t+1}/R_t$.

Ramsey Plan Definition

Government

- Choose sequences of tax rates at time-0
- Anticipate households' responses to tax plans
- Benevolent

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A Ramey problem is to choose a competitive equilibrium which maximizes (ex ante) consumer welfare.

Ramsey Plan Definition

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- Anticipate households' responses to tax plans
- Benevolent

Definition

A Ramey problem is to choose a competitive equilibrium which maximizes (ex ante) consumer welfare.

- Rule-out lump-sum taxes and assume τ_0^k is given. Why?

Ramsey Plan Definition

- A Ramsey plan is a complicated problem
  - Choose allocations, price system, and government policy
  - To maximize utility (1)
  - S.T. all equations holds: resource (2), gov BC (5), HH BC (6) & FOC (7), (8), (9), Firm FOC (10), (11)

Ramsey Plan **Definition**

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  - Choose allocations, price system, and government policy
  - To maximize utility (1)
  - S.T. all equations holds: resource (2), gov BC (5), HH BC (6) & FOC (7), (8), (9), Firm FOC (10), (11)

$\Rightarrow$ Goal: to simplify the Ramsey plan

Ramsey Plan Simplify the problem

- First, we can ignore the household budget constraint

Ramsey Plan **Simplify the problem**

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  - Euler theorem: $F(k,n) = F_k k + F_n n$

Ramsey Plan Simplify the problem

- First, we can ignore the household budget constraint
  - Euler theorem: $F(k, n) = F_k k + F_n n$
  - Resource constraint (2) + govt budget constraint

$$g_t + c_t + k_{t+1} = A_t F(k_t, n_t) + (1 - \delta) k_t \tag{2}$$

$$g_t + b_t = \tau_t^k r_t k_t + \tau_t^n w_t n_t + b_{t+1} / R_t \tag{5}$$

Ramsey Plan Simplify the problem

- Dual approach: use **after-tax prices**
  - $\tilde{r}_t \equiv (1-\tau_{kt})F_{k,t}$ and $\tilde{w}_t \equiv (1-\tau_{nt})F_{n,t}$
  - Solve for $\tilde{r}_t$ and $\tilde{w}_t$ instead of r_t and w_t

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  - Get rid of two controls: τ_t^k and τ_t^n, and two FOC (firm)

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  - Solve for $\tilde{r}_t$ and $\tilde{w}_t$ instead of r_t and w_t
  - Get rid of two controls: τ_t^k and τ_t^n, and two FOC (firm)
- Rewrite government's budget constraint

Ramsey Plan Lagrangian

$$L = \sum_{t=0}^{\infty} \beta^t \left\{ u(c_t, 1-n_t) + \right.$$

Ramsey Plan Lagrangian

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Ramsey Plan Lagrangian

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+ \lambda_t \left[A_t F(k_t, n_t) + (1 - \delta) k_t - k_{t+1} - c_t - g_t \right] + \\
+ \mu_{1t} \left[u_l(c_t, 1 - n_t) - u_c(c_t, 1 - n_t) \tilde{w}_t \right] + \\
+ \mu_{2t} \left[u_c(c_t, 1 - n_t) - \beta u_c(c_{t+1}, 1 - n_{t+1}) \left(\tilde{r}_{t+1} + 1 - \delta \right) \right] \\
+ \mu_{3t} \left[R_t - \tilde{r}_{t+1} + 1 - \delta \right]
\end{array} \right.
$$

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- No more taxes!
- What do I chose?
  - Allocations $\{c_t, k_{t+1}, n_t\}$ and after-tax prices $\{\tilde{w}_t, \tilde{r}_t, R_t\}$

Ramsey Plan Lagrangian

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- No more taxes!
- What do I chose?
    - Allocations $\{c_t, k_{t+1}, n_t\}$ and after-tax prices $\{\tilde{w}_t, \tilde{r}_t, R_t\}$
- Then I can compute taxes:

$$\tilde{r}_t = (1-\tau_t^k) r_t = (1-\tau_t^k) F_k(n_t, k_t)$$
$$\tilde{w}_t = (1-\tau_t^n) w_t = (1-\tau_t^n) F_n(n_t, k_t)$$

Ramsey Plan Lagrangian

$$L = \sum_{t=0}^{\infty} \beta^t \left\{ \begin{array}{c} u(c_t, 1-n_t) + \\ +\Phi_t \left[A_t F(k_t, n_t) - \tilde{r}_t k_t - \tilde{w}_t n_t - g_t + b_{t+1}/R_t - b_t \right] + \\ +\lambda_t \left[A_t F(k_t, n_t) + (1-\delta) k_t - k_{t+1} - c_t - g_t \right] + \\ +\mu_{1t} \left[u_l(c_t, 1-n_t) - u_c(c_t, 1-n_t) \tilde{w}_t \right] + \\ +\mu_{2t} \left[u_c(c_t, 1-n_t) - \beta u_c(c_{t+1}, 1-n_{t+1}) \left(\tilde{r}_{t+1} + 1 - \delta \right) \right] \\ +\mu_{3t} \left[R_t - \tilde{r}_{t+1} + 1 - \delta \right] \end{array} \right\}$$

Ramsey Plan Capital taxes in the long-run

- FOC w.r.t. k_{t+1}

$$\lambda_t = \beta \left[\Phi_{t+1} \left(A_{t+1} F_k(k_{t+1}, n_{t+1}) - \tilde{r}_{t+1} \right) + \lambda_{t+1} (A_{t+1} F_k(k_{t+1}, n_{t+1}) + 1 - \delta) \right]$$

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- Long-run non-stochastic steady-state: $g_t = g$, $A_t = A$, assuming the steady-state converges

$$\lambda = \beta \left[\Phi \left(r - \tilde{r} \right) + \lambda (r + 1 - \delta) \right]$$

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$$\lambda = \beta \left[\Phi \left(r - \tilde{r} \right) + \lambda (r + 1 - \delta) \right]$$

- Households' Euler equation (8) in steady-state
$$1 = \beta \left((1 - \delta) + \tilde{r} \right)$$

Ramsey Plan Capital taxes in the long-run

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- Long-run non-stochastic steady-state: $g_t = g$, $A_t = A$, assuming the steady-state converges

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- Households' Euler equation (8) in steady-state

$$1 = \beta\left((1-\delta) + \tilde{r}\right)$$

- Combining these equations

$$(\lambda + \Phi)(r - \tilde{r}) = 0$$

Ramsey Plan Capital taxes in the long-run

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$$\lambda_t = \beta \left[\Phi_{t+1}\left(A_{t+1}F_k(k_{t+1}, n_{t+1}) - \tilde{r}_{t+1}\right) + \lambda_{t+1}(A_{t+1}F_k(k_{t+1}, n_{t+1}) + 1 - \delta)\right]$$

- Long-run non-stochastic steady-state: $g_t = g$, $A_t = A$, assuming the steady-state converges
$$\lambda = \beta \left[\Phi\left(r - \tilde{r}\right) + \lambda(r + 1 - \delta)\right]$$

- Households' Euler equation (8) in steady-state
$$1 = \beta\left((1-\delta) + \tilde{r}\right)$$

- Combining these equations
$$(\lambda + \Phi)(r - \tilde{r}) = 0$$

- Under some conditions, $\lambda + \Phi > 0 => r = \tilde{r} => \tau_k = 0$

Ramsey Plan Capital taxes should be zero...

- Capital should not be taxed in the long run!

Ramsey Plan Capital taxes should be zero...

- Capital should not be taxed in the long run!
  - How to finance g in the long-run? With labor taxes! (or assets?)

Ramsey Plan Capital taxes should be zero...

- Capital should not be taxed in the long run!
  - How to finance g in the long-run? With labor taxes! (or assets?)
  - An **efficiency** argument

Ramsey Plan **Capital taxes should be zero... or one!**

- Capital should not be taxed in the long run!
  - How to finance g in the long-run? With labor taxes! (or assets?)
  - An **efficiency** argument
- But in the short run... $\tau_0^k = \bar{\tau}$!
  - Terrible time-consistency problem

Ramsey Plan Should capital taxes really be zero??

- Straub and Werning (2020)

Ramsey Plan Should capital taxes really be zero??

- Straub and Werning (2020)
- Key argument: $\tau_k < \bar{\tau}$ in the long-un and an interior steady-state exists

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$\Rightarrow$ Not as general as we thought it was...

Optimal Fiscal Policy in RBC Model Taking stock

- Capital taxes should be zero. . .
- . . . in the long-run, and under some conditions

2. Optimal Fiscal Policy in Standard Aiyagari Models

Fiscal policy in standard Aiyagari models Capital taxes

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- Environment; equilibrium; optimal policy

Environment Demography

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- Value consumption and labor:

$$\mathbb{E} \sum_{j=1}^{J} \beta^{j-1} u(c_j, n_j)$$

Environment Demography

- Idiosyncratic productivity of agent with type i and age j: $\varepsilon_j \alpha_i \eta$

- Heterogeneity in several dimensions

  - Age j: ε_j captures the age-profile productivity, with $\varepsilon_j = 0 \; \forall \; j > J_r$
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- Household state: (a, η, i, j)

Environment Technology

- Technology

$$G_t + C_t + K_{t+1} - (1-\delta)K_t = K_t^{\alpha} N_t^{1-\alpha} \tag{12}$$

- Aggregate stationary steady-state
  - Aggregates are constant... but not idiosyncratic variables!

Environment Government

- Social Security
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- Exogenous spending G_t financed by
  - A linear tax τ_k on capital income $r_t(A_t + Tr_t)$
  - A linear tax τ_c on consumption c
  - A progressive tax $T(.)$ on taxable labor income $y_L - \tau_{ss} min\{y_L, \overline{y}\}$ where $y_L = w\varepsilon_j \alpha_i \eta$

Competitive Equilibrium Definition

A stationary recursive competitive equilibrium (RCE) is:

- a policy $\{G, \tau_c, \tau_k, T, \tau_{ss}, \overline{y}, SS\}$
- a policy for the firm $\{N, K\}$
- value and policy functions for the household $\{\nu(a,\eta,i,j), c(a,\eta,i,j), a'(a,\eta,i,j), n(a,\eta,i,j)\}$ and bequests (Tr)
- prices $\{w, r\}$ and a distribution $\Phi(a,\eta,i,j)$

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s.t.:

1. Given prices and policies, the household behaves optimally:

$$\nu(a,\eta,i,j) = \max_{c,a',n} u(c,n) + \beta\psi_j \int_{\eta'|\eta} \nu(a',\eta',i,j+1)\pi(\eta'|\eta) \text{ s.t.}$$

$$(1+\tau_c)c + a' = y_L - \tau_{ss} min\{y_L, \overline{y}\} - T(y_L^T) + [1 + r(1-\tau_k)](a + Tr) \text{ if } j < J_r, \text{ where } y_L = w\varepsilon_j\alpha_i\eta n$$

$$(1+\tau_c)c + a' = ss + [1 + r(1-\tau_k)](a + \text{Tr}) \text{ if } j \geq J_r$$

$$a' \geq \underline{a}$$

Competitive Equilibrium Definition

2. Firms behave optimally:

$$r = \alpha \left(\frac{N}{K} \right)^{1-\alpha} - \delta, \text{ and } w = (1-\alpha) \left(\frac{K}{N} \right)^{\alpha}$$

Competitive Equilibrium **Definition**

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3. Social Security system is balanced:

$$\tau_{ss} \int \min\{w\alpha_i \varepsilon_j \eta n(a,\eta,i,j), \overline{y}\}\Phi(a,\eta,i,j) = SS \int \Phi(a,\eta,i,j \geq J_r)$$

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5. The government's budget constraint holds:

$$G = \int \tau_k r(a+Tr)\Phi(a,\eta,i,j) + \int T(y_L^T(\eta,i,j))\Phi(a,\eta,i,j)\cdots$$
$$+\int \tau_c c(a,\eta,i,j)\Phi(a,\eta,i,j)$$

Competitive Equilibrium Definition

6. Markets clear:

$$K = \int a\Phi(a, \eta, i, j)$$

$$N = \int \varepsilon_j \alpha_i \eta n(a, \eta, i, j)\Phi(a, \eta, i, j)$$

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7. The measure is stationary: $\forall \mathcal{J}$ s.t. 1 non in $\mathcal{J}$,

$$\Phi(A \times E \times \mathcal{I} \times \mathcal{J}) = \int Q((a, \eta, i, j); A \times E \times \mathcal{I} \times \mathcal{J})\Phi(a, \varepsilon, i, j)$$

where

$$Q(a, \eta, i, j; A \times E \times \mathcal{I} \times \mathcal{J}) = \cdots$$
$$\psi_j \int 1_{(a'(a,\eta,i,j)\in A)\times(i\in\mathcal{I})\times(j+1)\in\mathcal{J})} \sum_{\eta'} P(\eta' \in E|\eta)\Phi(a, \eta, i, j)$$

Calibration

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  - Agents born at age 20, retire at age 65, die w.p.1 at age 100
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- Technology: $\alpha = 0.36$, δ s.t. $\frac{I}{Y} = 25\%$
- Heterogeneity
  - Age-profile productivities $\{\epsilon_j\}$ follow Hansen (93)
  - Two types $\{\alpha_i\}$
  - Productivity $\{\eta\}$ follows Storesletten, Telmer, Yaron (04)

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- Government
  - G s.t. $G/Y = 0.17$
  - $\tau_c = 5\%$
  - Total income (including capital) taxed a la Gouveia and Strauss (94)

$$T(y) = \kappa_0 \left(y - \left(y^{-\kappa_1} + \kappa_2 \right)^{-\frac{1}{\kappa_1}} \right)$$

where κ_0 captures the average tax rate (26%), κ_1 level of progressivity (0.76), κ_2 solves the budget constraint

Calibration A comment on tax functions

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  - Short-run capital gains are taxed differently in the U.S.
  - Real estate is taxed linearly
  - Corporate profits are taxed linearly
  - Measurement issues...

Results Optimal plan

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  - Tax capital to lower labor taxes

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- Evaluate life-cycle components
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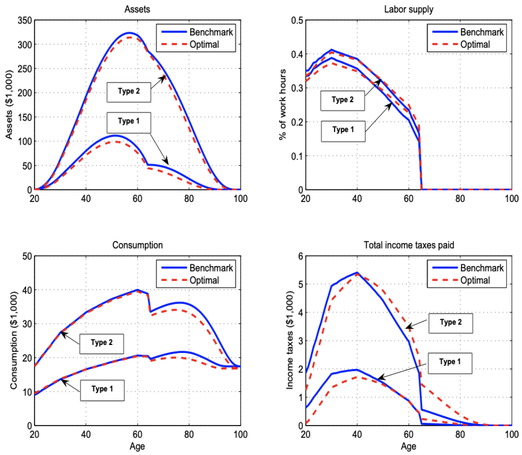

Figure 1: Life Cycle Profiles of Assets, Labor Supply, Consumption and Taxes

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  - Less elastic labor supply decreases τ_k
  - Robustness w.r.t.: IES, D/GDP, social welfare function, U, ...
  - No transitions (!!!)

3. Heterogeneous Capital Returns

Taxing capital? An ongoing debate

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- Policy: Taxing capital to redistribute?

Understanding capital? Mechanisms of accumulation

- **Basic Aiyagari model** fails to generate realistic wealth distributions
  - Standard log-AR(1) process (Floden and Lindé 2001) & preferences

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    - + Entrepreneurship, and more generally, **heterogeneous capital returns**

Heterogeneous returns Theory

- Heterogeneous capital returns: most promising theoretical avenue
  - Can generate fat tails in wealth distribution
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- Norwegian administrative data
  - Individual tax records 2004-2015
  - \+ Labor and capital income
  - \+ **Asset holdings and liabilities**

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    - **Asset holdings and liabilities**
  - Private business balance sheet
  - Housing transactions registry
  - Data on deposits and loans

- Compute individual returns to wealth

Heterogeneous capital returns Data

- Very heterogeneous returns on wealth
  - Large heterogeneity: standard deviation 22.1%
  - Large scale dependence: from net worth-10th to 90th, returns $+18$pp
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$\Rightarrow$ Implications for taxation?

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$$(1 + r(1 - \tau_k))a_i = (1 - \tau_a)(1 + r)a_i$$

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- What if returns are heterogeneous?

$$(1 + r_i(1 - \tau_k))a_i \text{ vs. } (1 - \tau_a)(1 + r_i)a_i$$

· Guvenen et al. (2023)

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- Assume two agents, a and b
  - Same wealth $k = \$1000$; but different returns: $r^a = 0 < r^b = 0.2$

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  - Good for efficiency, bad for redistribution?

“Use it or lose it!” Three channels

In a dynamic general-equilibrium model

1. “Use-it-or-lose-it” channel
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1. “Use-it-or-lose-it” channel
    - Capital reallocates toward more productive entrepreneurs
2. “Behavior response” channel
    - More productive entrepreneurs will save more
3. “Price” channel
    - Wages and interest rates will adjust

Environment Demographics

- Overlapping generations (OLG) model
  - Age h, live up to H years
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  - Portfolio choice
    - + Choose how much to invest in own technology ("entrepreneurship")

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  - Stochastic transition downwards

Environment Production

- Final good: $Y = Q^{\alpha} L^{1-\alpha}$
  - Aggregate labor L, with $\alpha = 0.4$
  - Intermediates: $Q = \left(\int x_{ih}^{\mu}\right)^{\frac{1}{\mu}}$, with $\mu = 0.9$
  - Competitive sector
- Intermediate goods: $x_{ih} = z_{ih} k_{ih}$
  - Price $p_{ih} = \alpha x_{ih}^{\mu-1} Q^{\alpha-\mu} L^{1-\alpha}$

Environment Household problem and equilibrium

1. Choose capital to max profits

$$\pi(a, z) = \max_{k \le \nu(z)a} p(zk)zk - (r + \delta)k$$

- Financial friction which generates misallocation
- Invests more if z is higher and if a is higher

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$$V_h(a,\bar{z},\mathcal{I},e,\kappa) = \max_{c,n,a'} u(c,n) + \beta s_{h+1}\mathbb{E}\left[V_{h+1}(a',\bar{z},\mathcal{I}',e',\kappa)\right]$$

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$$a' \geq \underline{a}$$

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- Equilibrium: $\int a = \int k$

Calibration

- Dynamics of entrepreneurship to match fast wealth growth of super wealthy (Forbes 400)
- Standard earnings risk
- Taxes: $\tau_k = 25\%$, $\tau_\ell = 22.4\%$, $\tau_c = 7.5\%$

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$\Rightarrow$ Generates high wealth inequality!

	top-50	top-10	top-1	top-0.5	top-0.1
Data	0.99	0.75	0.36	0.27	0.14
Model	0.97	0.66	0.36	0.31	0.23

- Data: SCF+Forbes 2010

Main experiment A wealth tax

Tax reform

- Set $\tau_k = 0$, balance budget with a wealth tax
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    - Larger K: $+20\% \rightarrow$ agents save more
    - Larger Q: $+25\% \rightarrow$ less misallocation
    - Larger Y and C: $+10\%$
    - Higher wages, smaller net interest rates on the risk-free rate
    - Large welfare gains: $+7.4\%$!

Main experiment A wealth tax

- Why does capital increase? Three channels

Main experiment **A wealth tax**

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  - "Use-it-or-loose-it" [fixing prices & decision rules to benchmark] $K \uparrow$

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- Who wins from the reform?

Main experiment A wealth tax

- Who wins from the reform? Welfare gains by age and entrepreneurial ability

TABLE IX – Welfare Gain/Loss by Age Group and Entrepreneurial Ability

	Entrepreneurial Ability Groups ($\bar{z}_i$ Percentiles)					
Age	0–40	40–80	80–90	90–99	99–99.9	99.9+
groups:	*RN Reform*					
20	7.0	7.3	7.9	8.9	10.6	11.7
21–34	6.5	6.3	6.3	6.6	7.0	6.8
35–49	5.1	4.4	3.9	3.3	1.7	0.1
50–64	2.3	1.8	1.4	0.8	–0.6	–1.8
65+	–0.2	–0.3	–0.4	–0.6	–1.2	–1.8

- The high-wealth/low-z (= the old) **lose**
- The young **benefit**. . .
  + From $\tau_k = 0$ (high z)
  + From higher w (low a)

Optimal taxation

Optimize steady-state fiscal system

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  - Gaillard and Wangner (2023) , Ferey, Lockwood, Taubinsky (2023), , Guvenen et al. (2023b), etc.!

Taxing capital? Gaillard and Wangner (2023)

- On taxation and heterogeneous returns
  - Productivity or rents?
  - Scale or type dependency?

$\Rightarrow$ Capital income or wealth taxation?

Lecture 2

Labor Taxes and Transfers

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    - Linear labor taxes to finance **spending** $G \dots$

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      ...but not to absorb shocks: "smooth distortions!"

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   - Linear labor taxes to finance transfers T!

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   - Going further: **Progressive** taxes?

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- Hard to analyze?
  - A highly multi-dimensional object
  - Computational?

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    - Progressive taxes (brackets) on labor and capital income taxes

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  - Transfers: SNAP, TANF, ... means-tested
- Non-monetary transfers: spending on education, etc.

Optimal progressivity Two approaches

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    - Difficult to bring into rich quantitative models?

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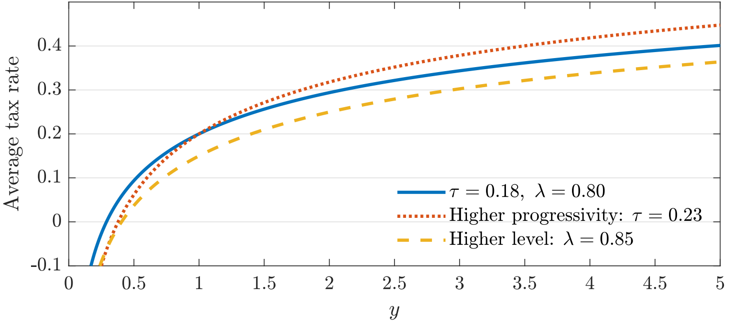
  - Quantitatively realistic model
  - But simple tax functions?
- "New" approach: a rich Ramsey approach
  - Heathcote, Storesletten, and Violante (2014), Heathcote, Storesletten, and Violante (2017)
  - Ferriere, Grübener, Navarro, and Vardishvili (2023)

1. Optimal Progressivity With Loglinear Income Taxes

Loglinear tax function

- 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
  - If $\tau = 1$: full redistribution $y - \mathcal{T}(y) = \lambda \quad \forall y$



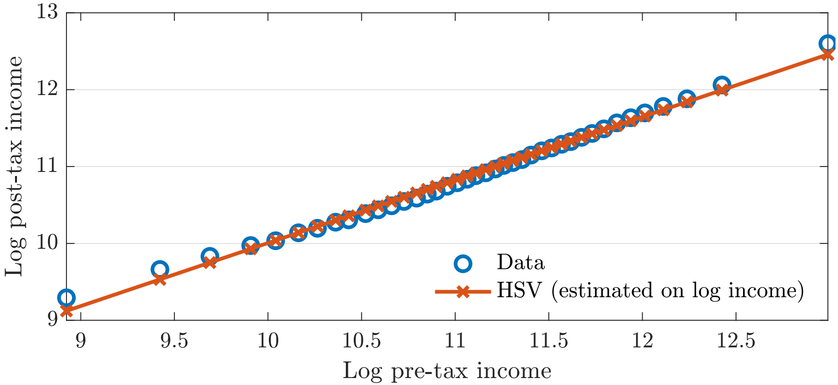
Data Taxes and transfers FGNV (2023)

- CPS 2013, working-age population
  - Total pre-tax income
  - Minus personal federal and state income taxes; payroll taxes
  - Minus payroll taxes (including employer share)
  - Plus tax credits
  - Plus SNAP and Housing Assistance (CBO imputation); Welfare

    IPUMS CPS

    Imputation of transfers following CBO Habib (2018)

Log-linear tax function



- Linear estimate on log income: $\log(y^{at}) = \log(\lambda) + (1-\tau)\log(y)$
- Estimated progressivity $\tau = 0.18$

Log-linear tax function

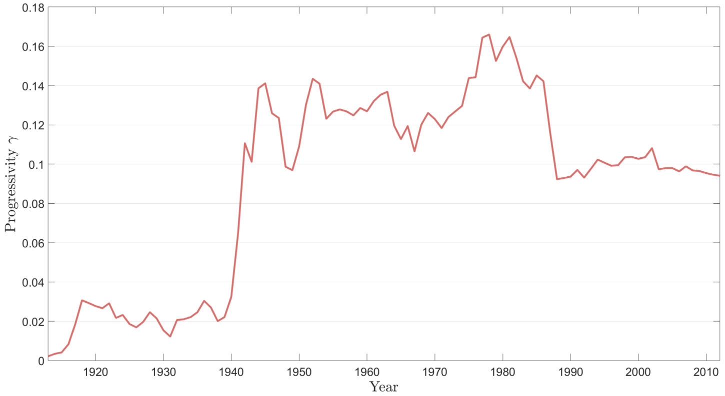


Figure 12: U.S. Federal Income Tax Progressivity

- A crude estimate over time Ferriere and Navarro (2023)

A tractable environment HSV (2017), FGNV (2023)

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

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  - Budget: $G = \int y_{it} di - \lambda \int y_{it}^{1-\tau} di$

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- No capital, representative **firm** with linear production function
- Utilitarian **government**
  - Budget: $G = \int y_{it} di - \lambda \int y_{it}^{1-\tau} di$
- A continuum of **workers**
  - Heterogenous wages: log-normal distribution with variance v_ω
  - Separable utility function: $\log c_{it} - B\frac{n_{it}^{1+\varphi}}{1+\varphi}$
  - Hand-to-mouth workers: $c_{it} = \lambda(z_{it} n_{it})^{1-\tau}$

Welfare Heterogeneous agents

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

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

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

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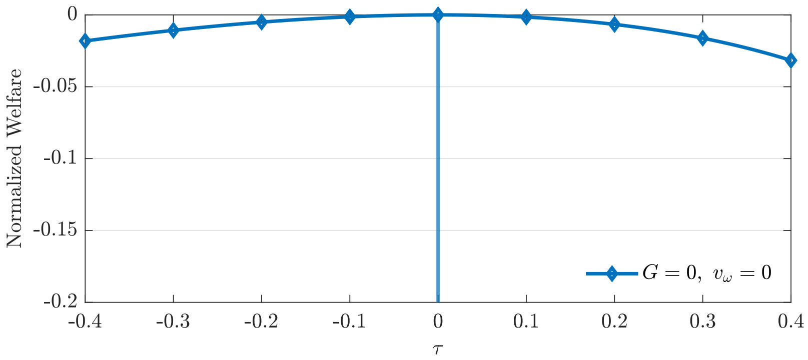
  - Size term $\downarrow$ with τ; Labor disutility term $\uparrow$ with τ

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

- Calibration: $\tau = 0.18$, $\varphi = 2.5$, $G/Y = 0.223$, v_ω to match $\mathbb{V}[\log c] = 0.18$

Welfare **Optimal τ**



- Optimal income-tax progressivity:
  - No spending, no heterogeneity: $\tau = 0$

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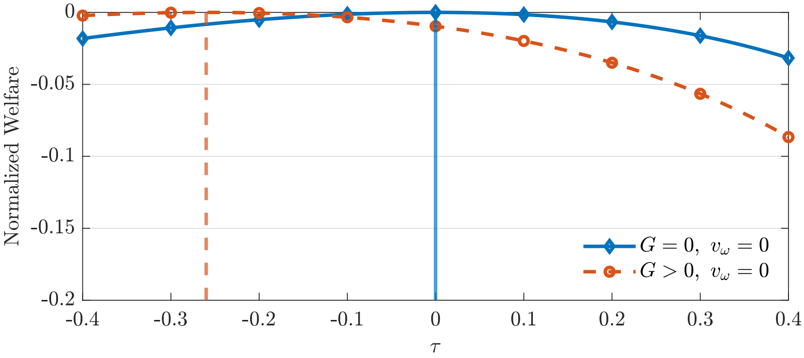

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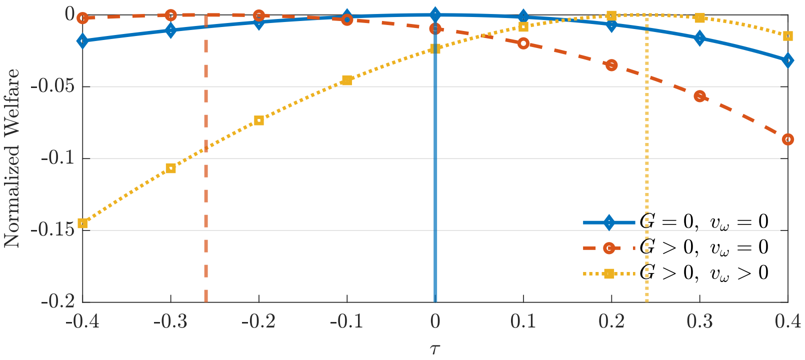

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Adding savings HSV (2014)

- A richer model with hand-to-mouth households *in equilibrium*
  - Richer structure of stochastic process

    $$\log w_t = \alpha_t + \varepsilon_t$$

    where

    $$\alpha_t = \alpha_{t-1} + w_t, \ \varepsilon_t = \theta_t$$

    with w_t and θ_t normally i.i.d. (+ stochastic death)

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$\Rightarrow$ "Partial-insurance" framework

- $v_\omega + v_\theta$ to capture variance of log income
- v_ω to capture variance of log consumption

Optimal income-tax progressivity HSV (2017)

- A richer model with many more features

  1. Endogenous spending

  2. Distribution over preference parameters

$$u_i(c_{it}, h_{it}, G) = \log c_{it} - B_i \frac{n_{it}^{1+\varphi}}{1+\varphi} + \chi \log G$$

  where $\log B_i \sim \mathcal{N}(\frac{v_B}{2}, v_B)$

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3. Investment in education

$$U_i = -v_i(s_i) + \mathbb{E}_0 \sum_{t=0}^{\infty} (\beta\delta)^t u_i(c_{it}, n_{it}, G)$$

   where $v_i(s_i) = \frac{1}{\kappa_i^{1/\psi}} \frac{s_i^{1+1/\psi}}{1+1/\psi}$, where $\kappa_i \sim exp(1)$

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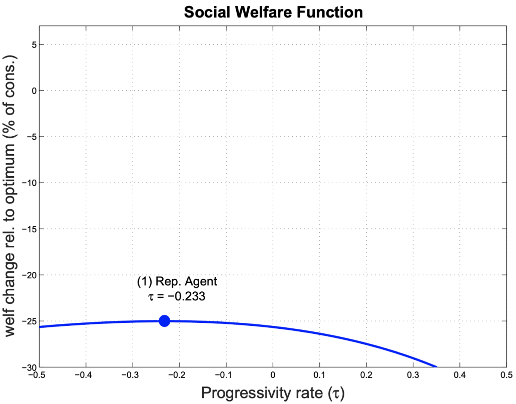
4. [Insurable shocks] ε

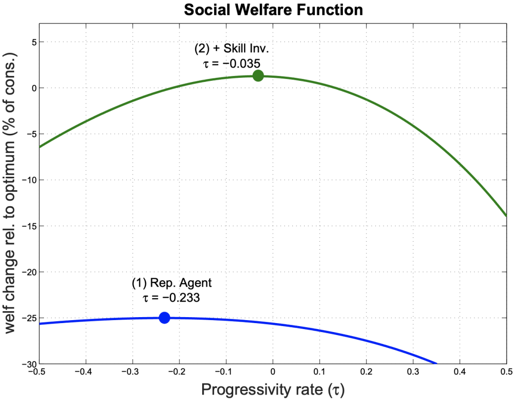
Welfare HSV (2017)

- Representative-agent, $\chi > 0$



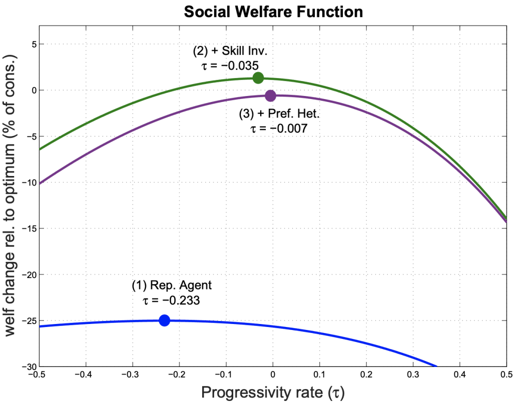
Welfare HSV (2017)

- With heterogeneity in skills



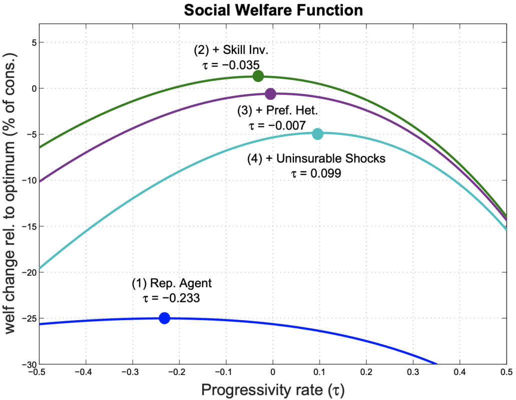
Welfare HSV (2017)

- With heterogeneity in labor disutility



Welfare HSV (2017)

- With uninsurable shocks



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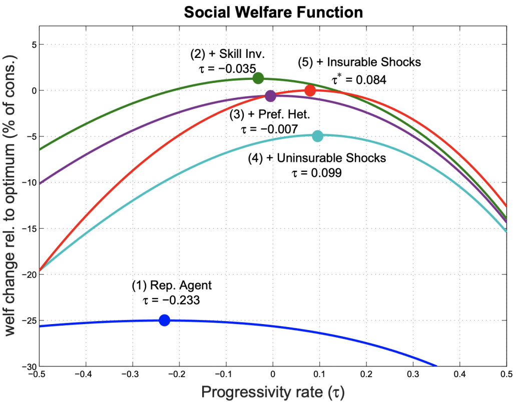

Taking stock HSV (2017)

- Taxes should be progressive
  - Optimal progressivity should be lower than in the U.S. . . .

Taking stock HSV (2017)

- Taxes should be progressive
  - Optimal progressivity should be lower than in the U.S. . . .

- A great framework to think about optimal progressivity!

- Going further: adding an intercept?
  - Mirrlees typical findings: a quick overview
  - Revisiting the data

Adding Transfers

- Tax and transfer functions
  - Progressive income taxes: $\mathcal{T}(y) = y - \lambda y^{1-\tau}$
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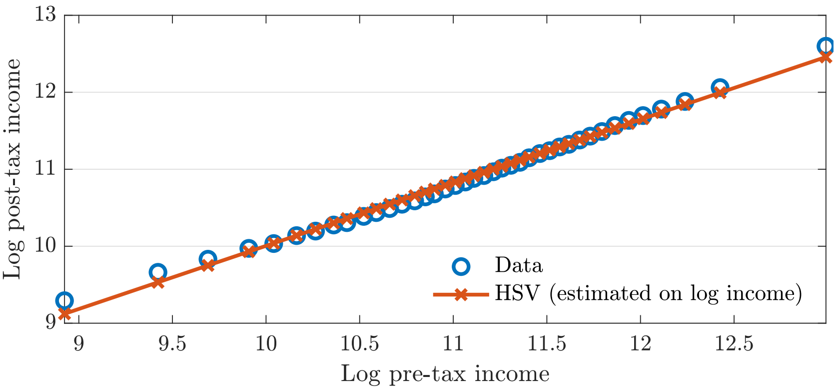
  - Hand-to-mouth workers: $c_{it} = \lambda (z_{it} n_{it})^{1-\tau} + T$

Loglinear tax function No transfer (HSV)



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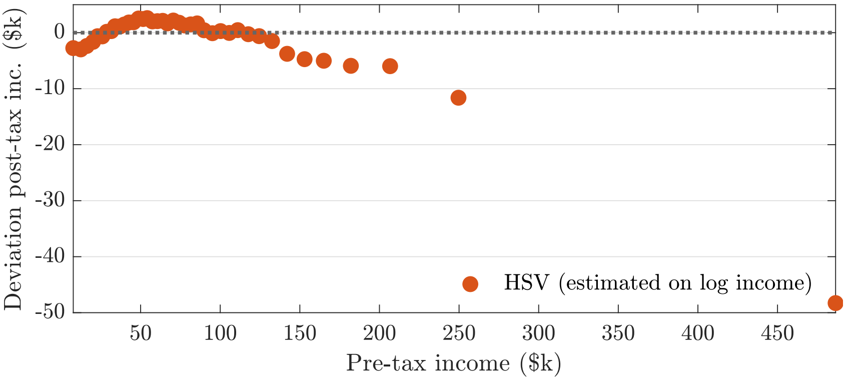

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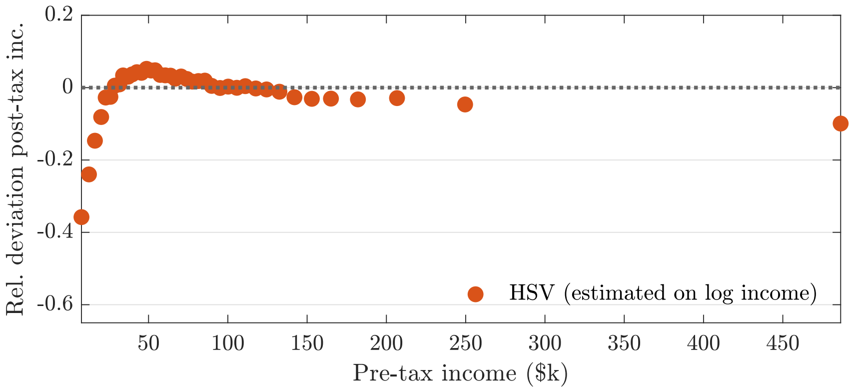

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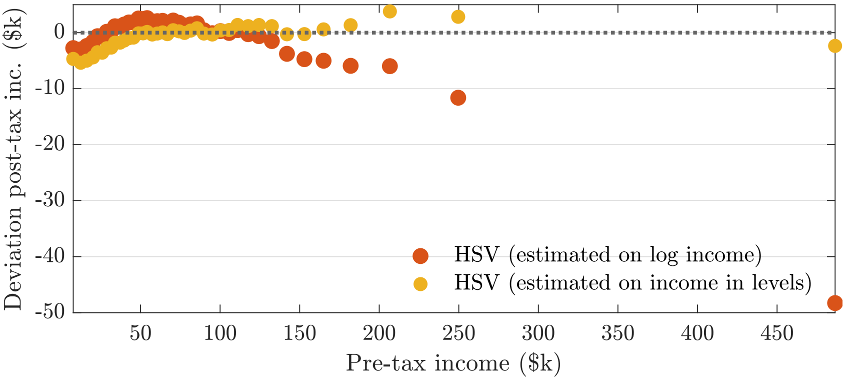
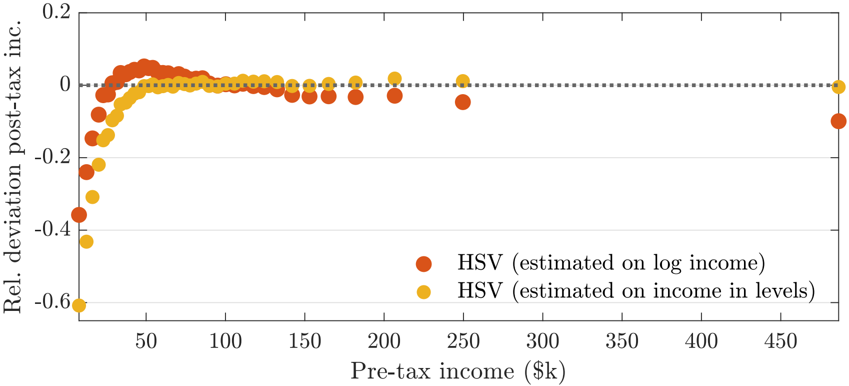


- Non-linear estimate on income in levels: $y^{at} = \lambda y^{1-\tau}$
- Estimated progressivity: $\tau = 0.09$

Loglinear tax function No transfer



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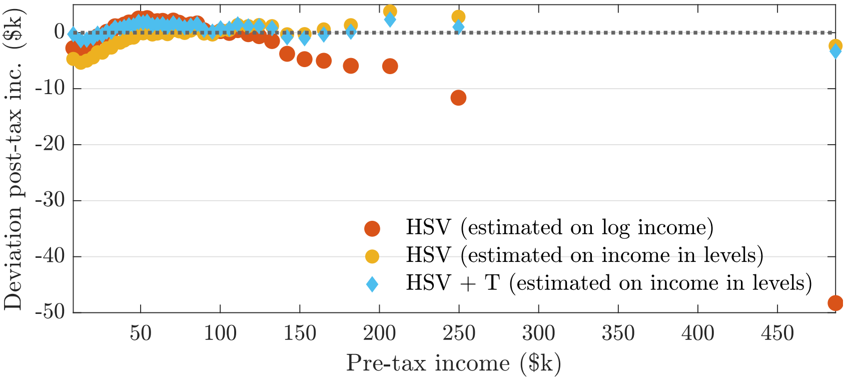
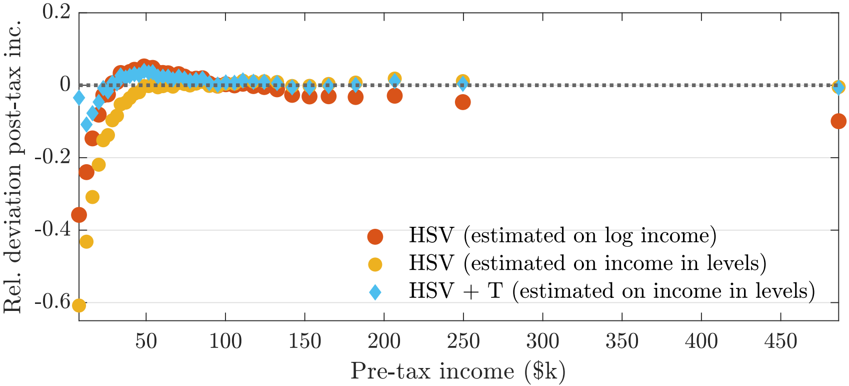
Empirical fit **Loglinear tax function with a transfer**



- Non-linear estimate on income in levels: $y^{at} = \lambda y^{1-\tau} + T$
- Estimated progressivity $\tau = 0.06$, transfer $T \approx \$5,400$

Empirical fit Loglinear tax function with a transfer



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Transfers Heterogeneous agents

- Implicit function theorem: approximation of the FOC around $T = 0$:

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

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- Approximated formula with heterogeneity $v_\omega > 0$

$$W(\tau, T) = W(\tau, 0) + T\Bigg[\Omega_e(\tau, v_\omega) + \Omega_r(\tau, v_\omega)\Bigg],$$

where the two terms capture

  - Efficiency concerns
  - Redistribution concerns ($\Omega_r(\tau, v_\omega) = 0$ when $v_\omega = 0$)

Transfers Welfare: Efficiency

- **Efficiency** with a representative agent ($v_\omega = 0$):

$$\Omega_e(\tau, 0) \equiv \underbrace{U_c(C_0(\tau)) \left.\frac{\partial Y^{ra}(\tau, T)}{\partial T}\right|_{T=0}}_{\text{Size } <\mathbf{0}} \underbrace{+U_n(n_0(\tau)) \left.\frac{\partial n^{ra}(\tau, T)}{\partial T}\right|_{T=0}}_{\text{Labor disutility } >\mathbf{0}}$$

  - Claim: Ω_e **decreases with** τ
    - + Offset the effects of progressivity on labor supply incentives

- With heterogeneity, efficiency Ω_e numerically decreases with τ

$\Rightarrow$ **Efficiency** gains of T are **decreasing** in τ

Transfers Welfare: Redistribution

- Redistribution $\Omega_r(\tau, v_\omega)$

$$\Omega_r(\tau, v_\omega) \equiv \mathbb{E}\left[U_c(c_0(\tau))\right] - U_c(C_0(\tau)) = (1-\tau)^2 \frac{1}{n_0(\tau) - G} v_\omega$$

  - Positive as long as $v_\omega > 0$ and **decreases** with τ

$\Rightarrow$ **Redistribution** gains of T are **decreasing** in τ

$\Rightarrow$ Overall **negative** optimal relationship between T and τ

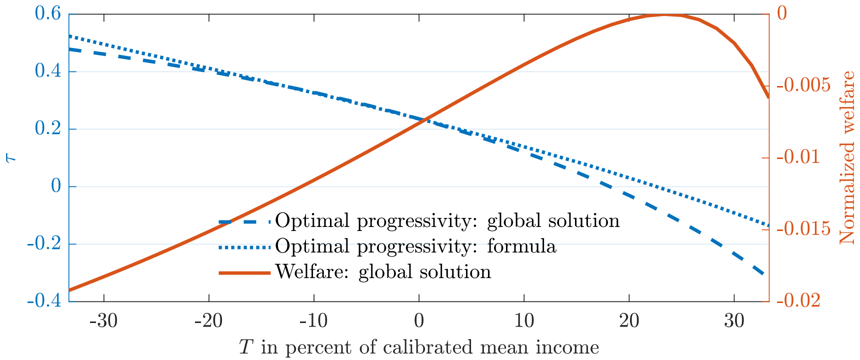
- Use formula to evaluate local welfare gains of transfers:

$$W(\tau, T) = W(\tau, 0) + T\left[\Omega^e(\tau, v_\omega) + \Omega^r(\tau, v_\omega)\right]$$

  - At calibrated v_ω and τ: -0.54 + 0.78 > 0

Transfers Heterogeneous agents

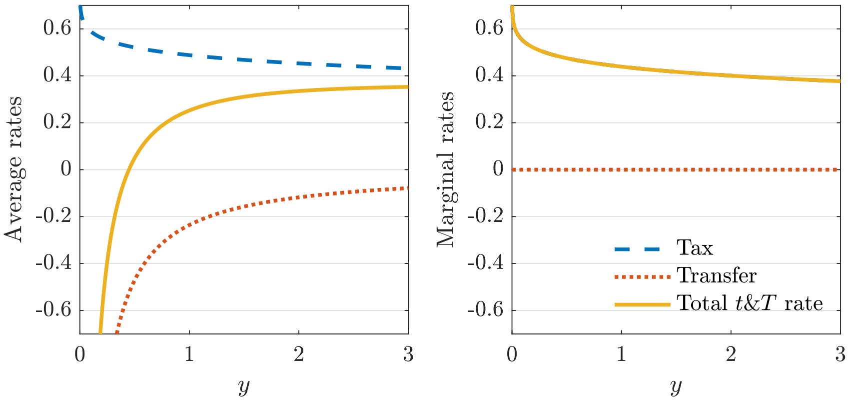
- A **negative** relationship between τ and T



- Formula: a good approximation
- Optimal transfers are large, with regressive income taxes

Optimal plan with transfers Global static solution

- Generous transfers: $T/Y = 23\%$, regressive income taxes: $\tau = -0.09$



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Optimal plan with transfers **Global static solution**

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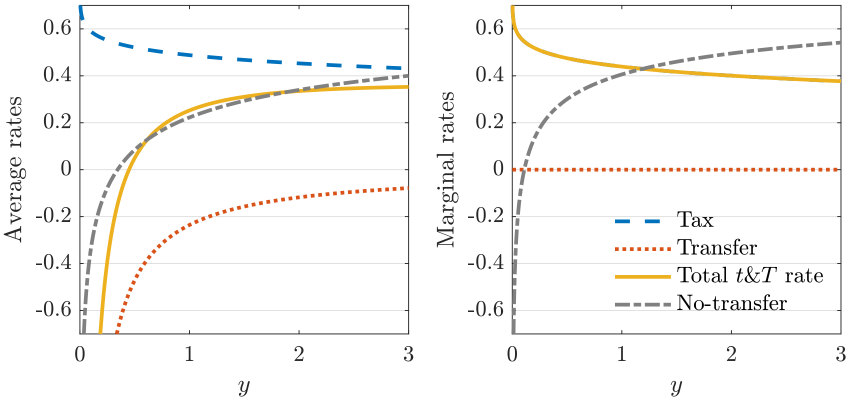

- Average taxes are increasing, marginal taxes are decreasing
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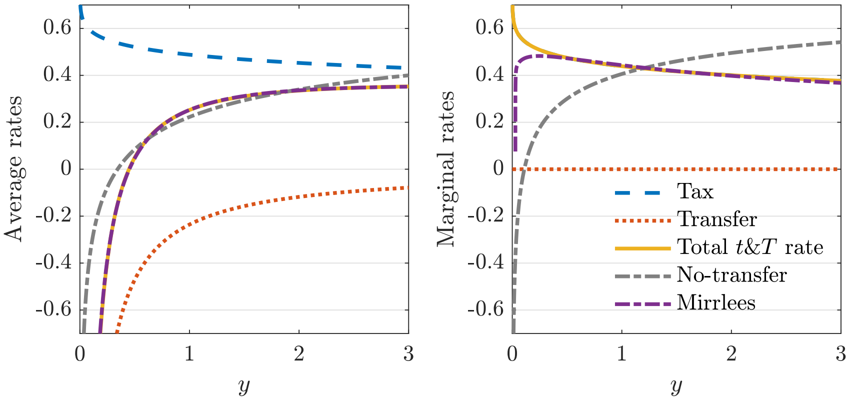
Optimal plan with transfers **Comparison to second-best**

- Welfare in CE terms: HSV: +0.14%, HSV+T: +0.90%



- Close to welfare gains of the Mirrlees/second-best allocation: +0.93%

Taking stock

- Loglinear taxes plus a transfer
  - Is still simple and tractable
  - Fits the data better
- Welfare gains from allowing for transfers
  - Break the link between average and marginal $t\&T$ rates
  - Systematically close to the second-best!

2. Revisiting the Welfare State

A Quantitative Approach

The Welfare State in the US **A complex safety net**

- Complex design
  - Means-tested (on labor and capital income), phasing-in, phasing-out in time, etc.
  - Partly refundable, partly not...
  - Federal and state level
  - Very heterogeneous take-up rates (and difficult to align in the data)
- It's big: 2.5% of GDP
- It depends a lot on the number of children, on the structure of the household, etc.

The Welfare State in the US **Is it optimal?**

- Effects of **both**:
  - Transfers themselves, and associated taxes to finance them...

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- Effects of **both**:
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- On multiple margins
  - Labor supply: intensive margin, extensive margin, search
  - Human capital accumulation: college decision, over the working life
  - Savings, self-insurance, physical capital accumulation

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    - Investment in early childhood?
    - The gender gap?
    - Household status? Number of children?
    - ...

Reforms: Typical proposals

- Universal Basic Income
  - Guaranteed unconditional (lump-sum) transfer
  - At the individual or hh level? Children?

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  - Friedman's proposal
  - Nothing else but a lump-sum tax with a flat rate
- Can we disentangle the optimal transfers from the optimal tax?

Roadmap

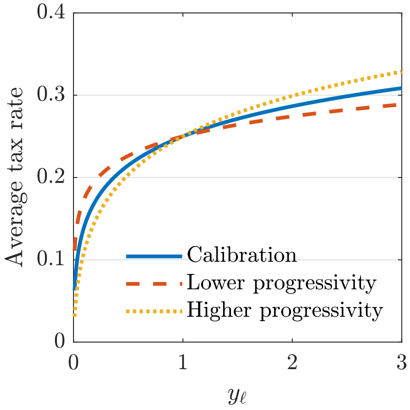
- Separating taxes and transfers in the data: new functional forms
- Optimizing on transfers
  - Ferriere et al. (2023)
  - Guner et al. (2023)
  - Jaimovich Saporta-Eksten, Setty and Yedid-Levi (2022)
  - Daruich and Fernandez (2023)
  - Holter, Krueger and Stepanchuk (2023)
  - ...

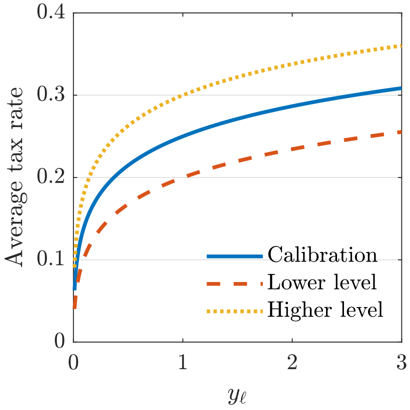
Taxes and transfers in the data

- Ferriere et al (2023)
- New functional forms for taxes and transfers
- Fit to the data
- Optimized fiscal instruments

Fiscal system Income taxes

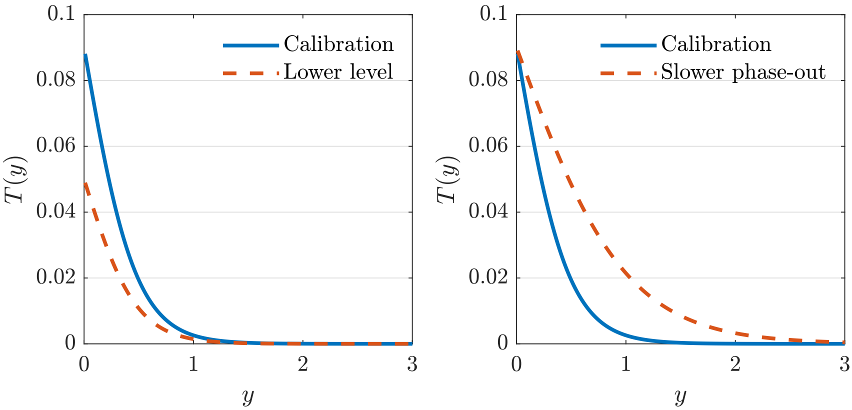
- Flat capital tax τ_k
- Progressive labor tax: $\exp\left(\log(\lambda)\left(\frac{y_\ell}{\bar{y}}\right)^{-2\theta}\right) y_\ell$, with level λ and progressivity θ



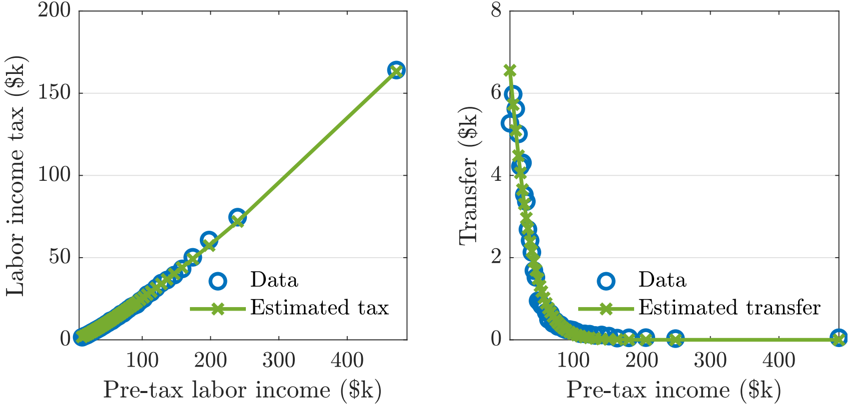


Fiscal system Transfers

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

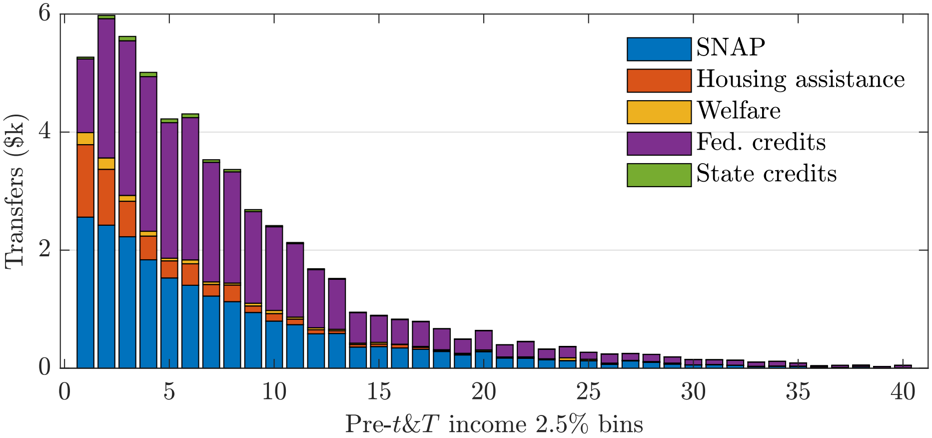


Calibration **Fiscal system: Micro estimates**

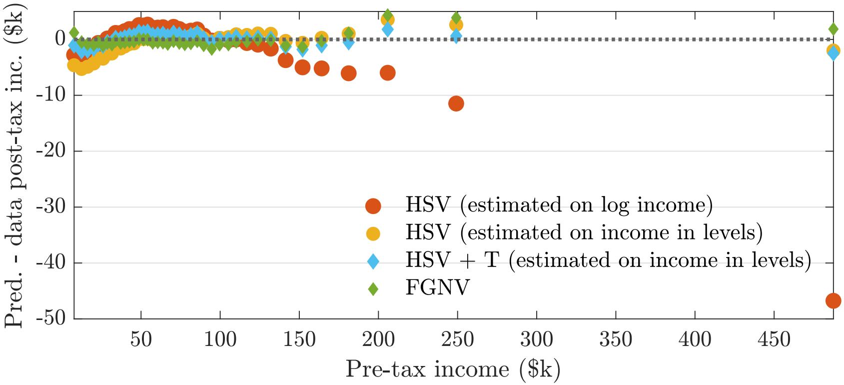


- Estimated on taxes and transfers: $\theta = 0.08$, $m = 0.09$, $\xi = 4.22$

Transfers Components across the distribution

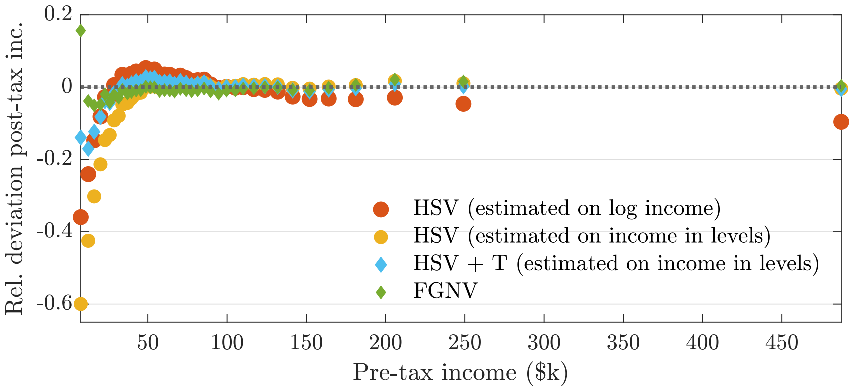


Fiscal system **After-tax-and-transfer income fit**



- Predicted after-tax-and-transfer income

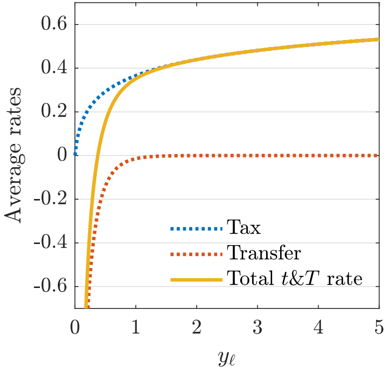
Fiscal system After-tax-and-transfer income fit

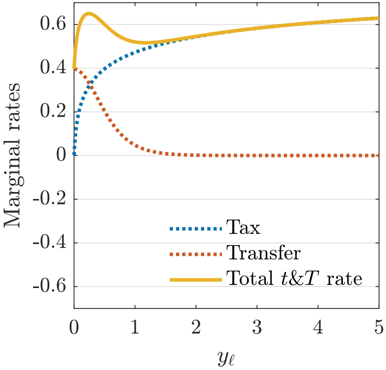


- Predicted after-tax-and-transfer income
    - Relative to pre-tax income

Optimal tax-and-transfer plan

- The **optimal plan** features
  - Large transfers $m = 0.23$, i.e. $\$20k$, with phase-out $\xi = 3.41$
  - Moderate tax progressivity $\theta = 0.14$





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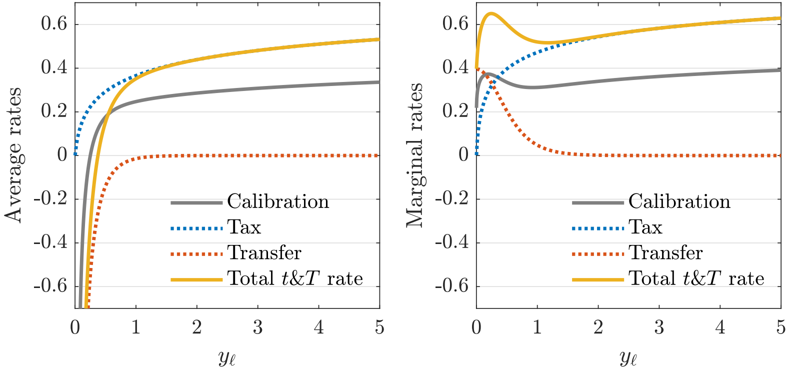

Optimal plan Average and marginal rates

Data	Q1	Q2	Q3	Q4	Q5
Tax rate	16%	19%	22%	24%	29%
Transfer rate	23%	4%	1%	0%	0%

Optimal (long-run)	Q1	Q2	Q3	Q4	Q5
Tax rate	19%	23%	26%	26%	36%
Transfer rate	85%	24%	8%	2%	0%

Optimal plan Average and marginal rates

Data	Q1	Q2	Q3	Q4	Q5
Tax rate	16%	19%	22%	24%	30%
Transfer rate	23%	4%	0%	0%	0%
Average $t\&T$ rate	-7%	16%	21%	24%	29%

Optimal (long-run)	Q1	Q2	Q3	Q4	Q5
Tax rate	19%	23%	26%	26%	36%
Transfer rate	85%	24%	8%	2%	%
Average $t\&T$ rate	-66%	-1%	19%	24%	36%

- Average $t\&T$ rates are strongly increasing...

Optimal plan Average and marginal rates

Data	Q1	Q2	Q3	Q4	Q5
Tax rate	16%	19%	22%	24%	29%
Transfer rate	23%	4%	1%	0%	0%
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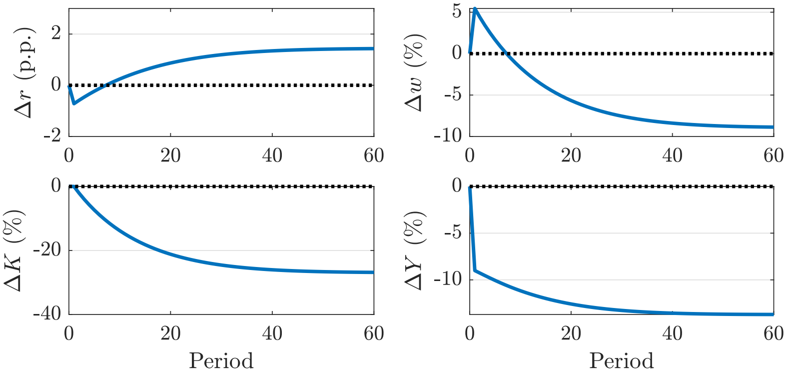
Optimal (long-run)	Q1	Q2	Q3	Q4	Q5
Tax rate	19%	23%	26%	26%	36%
Transfer rate	85%	24%	8%	2%	0%
Average $t\&T$ rate	-66%	-1%	19%	24%	36%
Marginal $t\&T$ rate	63%	61%	55%	48%	50%

- Average $t\&T$ rates are strongly increasing...but not marginal $t\&T$ rates

Optimal tax-and-transfer plan **Transitions and welfare**



- The economy (output, capital, wages) shrinks

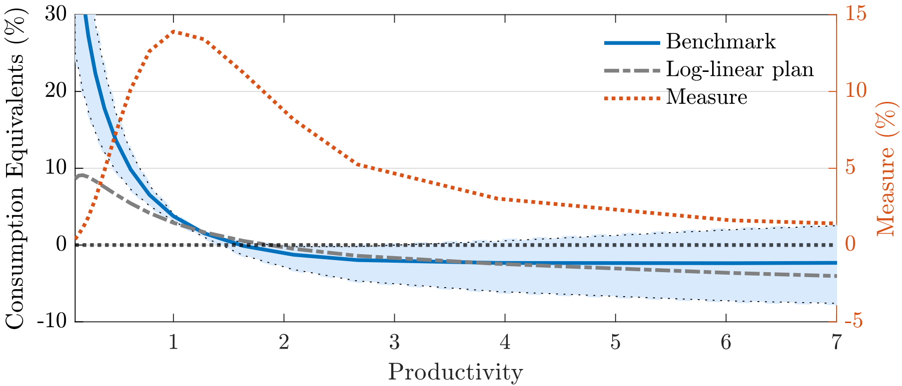
Optimal tax-and-transfer plan **Transitions and welfare**

Mean hours	Hours worked quintile				
Calibration	0.20	0.28	0.32	0.35	0.38
Optimal	0.18	0.25	0.28	0.31	0.34

Log hours deviation	Wage quintile				
Calibration	-0.03	0.00	-0.04	0.05	0.01
Optimal	-0.18	-0.07	-0.01	0.12	0.13

- The economy (output, capital, wages) shrinks, but better allocation of hours worked

Optimal tax-and-transfer plan **Transitions and welfare**



- The economy (output, capital, wages) shrinks, but better allocation of hours worked
- Large welfare gains (6%); 76% of households benefit

Non-monotonic marginal rates UBI and log-linear plans

- Optimal plan with **lump-sum** transfers ($\xi = 0$)
  - Large transfer: $\$19k$ financed with flatter taxes $\theta = 0.04$

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Non-monotonic marginal rates UBI and log-linear plans

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  - Large transfer: $\$19k$ financed with flatter taxes $\theta = 0.04$
- **Welfare gains** are 5.36% vs. 6.00% with phase-out
- Optimal **affine**: transfer of $\$20k$, tax 60%, CE 5.26%

Optimal UBI Average and marginal rates

With phase-out	Q1	Q2	Q3	Q4	Q5
Tax rate	19%	23%	26%	26%	36%
Transfer rate	85%	24%	8%	2%	0%
Average $t\&T$ rate	-66%	-1%	19%	24%	36%
Marginal $t\&T$ rate	63%	61%	55%	48%	50%

Lump-sum	Q1	Q2	Q3	Q4	Q5
Tax rate	48%	46%	47%	41%	48%
Transfer rate	97%	49%	33%	22%	9%
Average $t\&T$ rate	-48%	-3%	15%	19%	40%
Marginal $t\&T$ rate	56%	58%	59%	59%	61%

- Different tax rates and transfer rates, not so different overall rates

Taking stock

- Transfers should be more generous, but taxes should not be much more progressive
- Monotonic marginal rates deliver large welfare gains
  - UBI delivers large gains

A focus on the household structure

- Guner, Kaygusuz and Ventura (2023)
  - A very rich modeling of the current US system
  - Simple exploration of the optimal welfare state

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- Guner, Kaygusuz and Ventura (2023)
  - A very rich modeling of the current US system
  - Simple exploration of the optimal welfare state
- Depart from the typical household structure
  - Heterogeneity in gender x hh structure x education
  - + Income risk
  - + Number of kids and cost of labor force participation
  - + Tax-and-transfer system

A focus on the household structure Guner et al. (2023)

- Detailed modeling of the existing tax-and-transfer system
  - Progressive taxes by hh structure: τ^M, τ^F
  - Tax credits as in the data
  - Childcare subsidies as a function of hh structure and children age
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  - Childcare subsidies as a function of hh structure and children age
  - Other transfers
- Control: consumption, savings, extensive and intensive labor decision
- Capture accurately income risk by hh structure, gender, education
  - Increasing of the wage-gender gap over the life-cycle
  - Smaller increase in variance of log earnings for female
  - U-shape female labor force participation

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Very simple exploration of the welfare state in PE and steady-state

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Very simple exploration of the welfare state in PE and steady-state

- Replacing the welfare state with... nothing
  - Output goes up, but LFP goes down for unskilled married females
  - Aggregate welfare losses, especially for single females
  - Majority support

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Very simple exploration of the welfare state in PE and steady-state

- Replacing the welfare state with... nothing
  - Output goes up, but LFP goes down for unskilled married females
  - Aggregate welfare losses, especially for single females
  - Majority support
- Implementing a UBI: optimal $\$2,600$
  - Keeping the progressivity fixed, adjusting λ
  - Output shrinks
  - Aggregate welfare losses, especially from unskilled single females
  - Welfare gains from married households, and majority support

A focus on the household structure Guner et al. (2023)

- Implementing a Negative Income Tax
    - Income tax progressivity at $\tau = 0$, adjust λ
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  - Still, unskilled single females loose
- How to think of transfers without taxes?
- Transitions? Just out in the new version!

A focus on labor market frictions

- Jaimovich Saporta-Eksten, Setty and Yedid-Levi (2022)
- Joint analysis of UBI and associated taxation on
  - Labor supply distortion: extensive margin
  - Capital accumulation
- Aiyagari model with search-and-matching frictions
  - Productivity and unemployment risk
- Steady-state GE model

A focus on labor market frictions Jaimovich et al. (2022)

- Optimal UBI, keeping progressivity at calibrated value?
  - Bad for welfare, because bad for output
  - Distortions, income effects, insurance effects

A focus on labor market frictions Jaimovich et al. (2022)

- Optimal UBI, keeping progressivity at calibrated value?
  - Bad for welfare, because bad for output
  - Distortions, income effects, insurance effects
- Optimal UBI as a function of progressivity?
  - Negative relationship between UBI and progressivity
  - Higher progressivity helps to mitigate the effect of UBI on LFP

Quantitative Macro Public Finance

- Very active field to bridge the gap between Mirrlees and Ramsey
    - Quantify redistribution needs and efficiency concerns
    - Flexible modeling yet serious calibration
    - Policy!

Appendix

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