Redistributive Taxation in a Partial-Insurance Economy

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Redistributive taxation

Two classic roles for government:

1. Provision of public goods
2. Redistribution / insurance

At the same time, the design of public taxation must be sensitive to private incentives

In this light, how progressive should the tax system be?

More specifically

- How does the optimal rate of progressivity for earnings taxation vary with ...

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  4. the desire for public goods

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- How does the optimal rate of progressivity for earnings taxation vary with ...
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  2. the level of inequality / risk in the economy
  3. the amount of privately-provided insurance
  4. the desire for public goods
- Our contribution: Tractable framework that delivers insights on the trade-offs

The Model (H-S-V, 2009)

- Equilibrium heterogeneous-agents model featuring:

  1. differential labor productivity + idiosyncratic productivity risk

  2. flexible labor supply and risk-free bond (*self-insurance*)

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    3. additional risk-sharing (financial markets, family etc.)
    4. nonlinear tax/transfer system

Technology

- Aggregate output linear in effective labor:

$$Y = \int w_i h_i di \equiv \int y_i di$$

- Resource constraint:

$$Y = \int c_i di + G$$

Demographics and preferences

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- Preferences over sequences of consumption, hours, and public good:

$$U(\mathbf{c}_i, \mathbf{h}_i, \mathbf{G}) = \mathbb{E}_0 \sum_{t=0}^{\infty} (\beta\delta)^t u(c_{it}, h_{it}, G_t)$$

  - with period-utility:

$$u\left(c_{it}, h_{it}, G_t\right) = \frac{c_{it}^{1-\gamma} - 1}{1-\gamma} - \widetilde{\varphi}\,\frac{h_{it}^{1+\sigma}}{1+\sigma} + \chi\frac{G_t^{1-\gamma} - 1}{1-\gamma}$$

Wages

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  - ε_{it} component is transitory

    ε_{it} i.i.d. with $\varepsilon_{it} \sim F_\varepsilon$

Financial and insurance markets

- Assets traded competitively (all in zero net supply)
  - Perfect annuity against survival risk
  - Non-contingent bond
  - Complete markets for ε shocks

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  - Perfect annuity against survival risk
  - Non-contingent bond
  - Complete markets for ε shocks
- Market structure
  - $v_\varepsilon = 0 \Rightarrow$ bond economy
  - $v_\alpha = 0 \Rightarrow$ full insurance
  - In between: "partial insurance"

Government

- Two parameter tax/transfer function to redistribute and finance public good G

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- Disposable post-government earnings:

$$\tilde{y}_i = \lambda y_i^{1-\tau}$$

- Government budget constraint (no public debt):

$$G = \int \left[y_i - \lambda y_i^{1-\tau} \right] di$$

Our model of fiscal redistribution

- The parameter τ measures the rate of progressivity:

$$\ln(\tilde{y}_i) = \ln(\lambda) + (1 - \tau)\ln(y_i)$$

1. $\tau = 0 \rightarrow \tilde{y}_i = \lambda y_i$: no redistribution: flat tax rate $(1 - \lambda)$
2. $\tau = 1 \rightarrow \tilde{y}_i = \lambda$: full redistribution

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  2. $\tau = 1 \rightarrow \tilde{y}_i = \lambda$: full redistribution

- If $\tau > 0$:
  1. The system is progressive: $\frac{T'(y)}{T(y)/y} = \frac{1-\lambda(1-\tau)y^{-\tau}}{1-\lambda y^{-\tau}} > 1 \quad \forall y$
  2. The system generates a transfer $(\tilde{y}_i > y_i)$ for low earnings

Empirical relevance of our model for taxes / transfers

- CPS 1980-2005, positive labor income: 1,026,829 obs.
- Estimated slope by OLS: $\tau = 0.26$ ($R^2 = 0.88$)

Agent's Problem

$$V(\alpha, b) = \max_{c,h,b',B(\cdot)} \int_{\mathcal{E}} \left(u(c,h,G) + \delta\beta \int_{\Omega} V(\alpha+\omega, b')\, dF_{\omega} \right) dF_{\varepsilon}$$

subject to

$$\int_{\mathcal{E}} Q(\cdot)\, B(\cdot)\, d\varepsilon = b$$

$$c + q\delta b' = B(\varepsilon) + \lambda \cdot (\exp(\alpha+\varepsilon)\, h)^{1-\tau} \qquad \forall \varepsilon$$

$$c \geq 0, \qquad h \geq 0, \qquad b' \geq \underline{B}$$

$$b_0 = 0$$

A stationary equilibrium is a set of prices $(q, Q(\cdot))$ and a policy (G, τ, λ) s.t. when agents take these as given and maximize utility, markets clear and the government budget is balanced

“No bond trading” equilibrium

- There exists an equilibrium in which the wealth distribution is always degenerate at zero

  $\Rightarrow$ individual allocations only depend on (α, ε)

- Generalization of Constantinides and Duffie (JPE, 1996)
  - CRRA prefs, unit root shocks to log disposable income

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- Our environment micro-founds unit root disposable income:

  1. Flexible labor supply $\Rightarrow$ earnings endogenous
  2. Private risk sharing
  3. Non-linear taxation and transfers
  4. Individual wage process richer than unit root

Equilibrium risk-free rate r^*

- Under log-normality of the shocks, closed form for r^*
- With inelastic labor $(\sigma = \infty)$ and linear taxes $(\tau = 0)$:

$$\frac{\rho - r^*}{\gamma} = (\gamma + 1)\,\frac{v_\omega}{2}$$

where $(\gamma + 1)$ is the coefficient of relative prudence

- With non-linear taxes $(\tau \neq 0)$:

$$\frac{\rho - r^*}{\gamma} = (1 - \tau)\,(\gamma\,(1 - \tau) + 1)\,\frac{v_\omega}{2}$$

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- $\frac{\partial r^*}{\partial \tau} > 0$: more progressivity $\Rightarrow$ less precautionary saving $\Rightarrow$ higher risk-free rate

Equilibrium allocations: hours worked

$$\ln h^*(\alpha,\varepsilon) = \underbrace{\frac{1}{(1-\tau)(\widehat{\sigma}+\gamma)}\left[(1-\gamma)\ln\lambda^* + \ln(1-\tau) - \varphi\right]}_{\text{Representative agent}}$$

$$- \underbrace{M_h(v_\varepsilon)}_{\text{Wealth effect}} + \underbrace{\frac{1-\gamma}{\widehat{\sigma}+\gamma}\alpha}_{\text{Unins. shock}} + \underbrace{\frac{1}{\widehat{\sigma}}\varepsilon}_{\text{Insurable shock}}$$

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- Tax-modified Frisch elasticity (decreasing in τ):

$$\frac{1}{\widehat{\sigma}} \equiv \frac{1-\tau}{\sigma+\tau}$$

- γ measures the relative strength of income vs. substitution effect for uninsurable shocks

Equilibrium allocations: consumption

$$\ln c^*(\alpha) = \underbrace{\frac{1}{\widehat{\sigma}+\gamma}\left[(1+\widehat{\sigma})\ln\lambda^* + \ln(1-\tau) - \varphi\right]}_{\text{Representative agent}}$$

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- The transmission coefficient of a permanent uninsured shock:

$$\pi(\gamma,\sigma,\tau) = \underbrace{(1-\tau)\left[\frac{\sigma+\gamma}{\sigma+\gamma+\tau(1-\gamma)}\right]}_{\text{TAX PROGRESSIVITY}} \quad \underbrace{\frac{\sigma+1}{\sigma+\gamma}}_{\text{LABOR SUPPLY}}$$

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- Quantitatively $(\gamma = \sigma = 2, \tau = 0.26)$:

$$0.60 \quad = \quad 0.74 \times 1.07 = 0.79 \quad \times \quad 0.75$$

Government's problem

- Government puts weight β^t on all agents born at date $t = 0, ..., \infty$ and chooses sequences $\{\tau_t, G_t\}_{t=0}^{\infty}$
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$\Rightarrow$ The dynamic Ramsey problem reduces to a sequence of static problems, where the government chooses the pair (τ, G) to maximize:

$$\mathcal{W}(\tau, G) \equiv \int \int u\left(c^*(\alpha; \tau, G), h^*(\alpha, \varepsilon; \tau, G), G\right) dF_\varepsilon dF_\alpha$$

subject to

- (h^*, c^*) are competitive equilibrium allocations
- government budget constraint is satisfied

Roadmap for welfare analysis

- Assumption: log-normal shocks
- Assumption: log-utility over private and public goods $(\gamma = 1)$

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- Assumption: log-utility over private and public goods $(\gamma = 1)$

1. No utility from public goods $(\chi = 0)$
   - Instrument chosen: τ
2. Valued G $(\chi > 0)$
   - Instruments chosen: (τ, G)

Social welfare function $(\chi = 0)$

- Representative agent $(v_\alpha = 0, v_\varepsilon = 0)$:

$$\mathcal{W}^{RA}(\tau) = -\varphi + \frac{\ln(1-\tau) - (1-\tau)}{1+\sigma}$$

  - Welfare maximizing $\tau = 0$

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- Heterogeneous agents $(v_\alpha > 0, v_\varepsilon > 0)$:

$$\mathcal{W}(\tau) = \underbrace{-\varphi + \frac{\ln(1-\tau) - (1-\tau)}{1+\sigma}}_{\mathcal{W}^{RA}(\tau)} + \underbrace{\frac{1}{\hat{\sigma}} v_\varepsilon}_{\ln(Y/H)} - \underbrace{(1-\tau)^2 \frac{v_\alpha}{2}}_{var(\ln c)} - \sigma \underbrace{\left(\frac{1}{\hat{\sigma}^2}\right) \frac{v_\varepsilon}{2}}_{var(\ln h)}$$

Comparative statics

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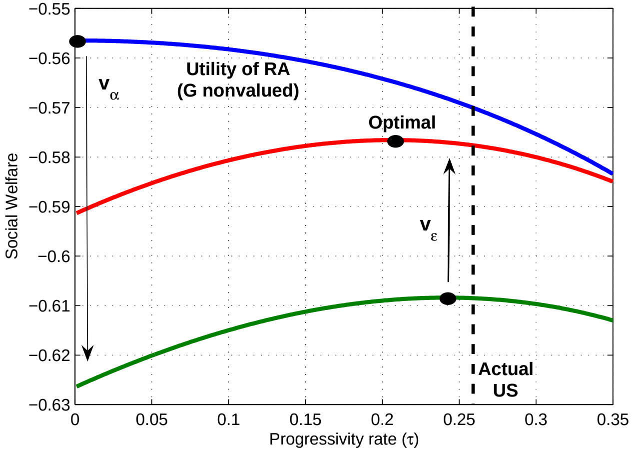
- $\frac{\partial \tau^*}{\partial \sigma} > 0$: less elastic labor supply $\Rightarrow$ less severe distortions
- $\frac{\partial \tau^*}{\partial v_\varepsilon} < 0$: more insurable risk $\Rightarrow$ more distortion of labor effort

Welfare Functions, $\chi = 0$



Valued government consumption: $\chi > 0$

- Representative agent $(v_\alpha = v_\varepsilon = 0)$
- Define $g \equiv G/Y$
- Welfare-maximizing fiscal policy given by:

$$\begin{aligned} g^* &= \frac{\chi}{1+\chi} && \textit{Samuelson's condition} \\ \tau^* &= -\chi && \textit{Regressive taxation} \end{aligned}$$

- Allocations (C^*, H^*, G^*) induced by (g^*, τ^*) are first best

Intuition

- Optimal regressivity $(\tau^* = -\chi)$ achieves both:
  - desired average tax rate (to finance G)
  - zero marginal tax rate at H^* (as with a lump-sum tax)
- Note that H^* is larger than it would be absent taxes: taxation is used to increase hours worked to socially efficient level

Heterogeneity and public goods

- Optimal public good provision g^* is unchanged: $g^* = \frac{\chi}{1+\chi}$

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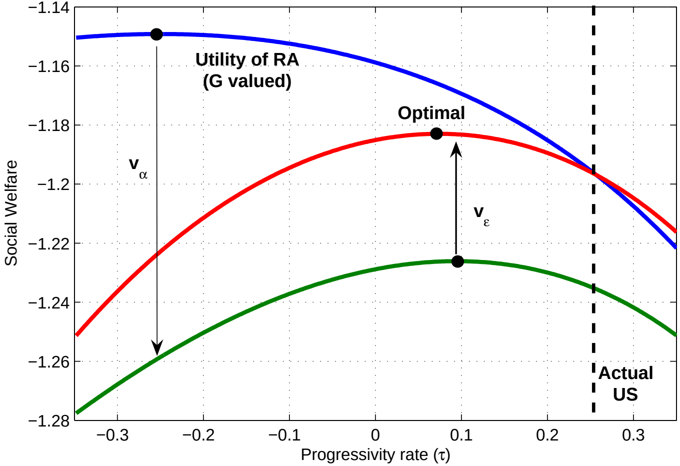
- Trade-off in determining optimal rate of progressivity:
  - Stronger taste for G (higher χ) $\Rightarrow$ more regressive taxation
  - More uninsurable risk (higher v_α) $\Rightarrow$ more progressive taxation
  - More rigid labor supply (higher σ) $\Rightarrow$ more progressive taxation
  - More insurable risk (higher v_ε) $\Rightarrow$ flatter taxation

Welfare Functions, $\chi = 0.25$



Progressive or regressive taxation?

- Parameter space can be divided into two regions:

$$\begin{array}{lcl} \chi > v_\alpha(1+\sigma) & \Rightarrow & \tau^* < 0 \\ \chi = v_\alpha(1+\sigma) & \Rightarrow & \tau^* = 0 \\ \chi < v_\alpha(1+\sigma) & \Rightarrow & \tau^* > 0 \end{array}$$

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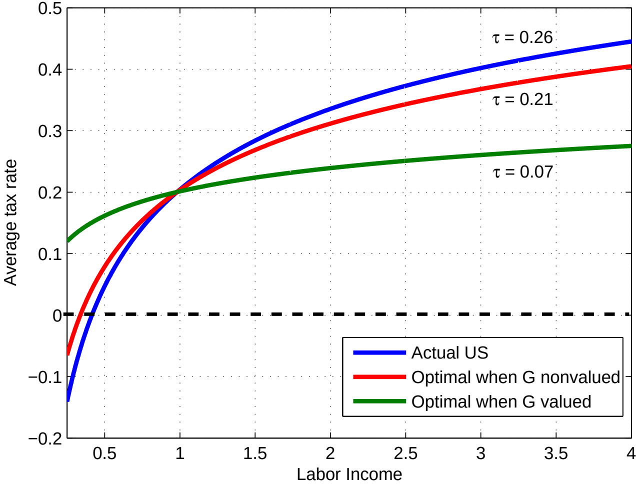
- With $v_\alpha = v_\varepsilon = 0.14,$ and $\chi = 0.25$ $(g^* = 0.2)$

$$\begin{array}{lcll} \sigma = 0.8 & \Rightarrow & \tau^* = 0.00 & \textit{(flat)} \\ \sigma = 2.0 & \Rightarrow & \tau^* = 0.07 & \textit{(optimal)} \\ \sigma = 6.3 & \Rightarrow & \tau^* = 0.26 & \textit{(actual US)} \end{array}$$

Average tax rate: actual US vs optimal



Political Economy

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- Policy is determined in a repeated voting game
- Each period the agent with median α picks (τ, G)
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  $\Rightarrow$ each median voter solves a static maximization problem
- For $\gamma = 1$ and $\alpha \sim N\left(-\frac{v_\alpha}{2}, v_\alpha\right)$ the outcome of the voting game is equal to the Ramsey policy
- ... but different motives for redistribution:
  - Ramsey planner values equality given utilitarian SWF
  - Median voter benefits since $\alpha_{median} = -\frac{v_\alpha}{2} < \alpha_{mean} = 0$

Consumption Taxation

$$c = \lambda \tilde{c}^{1-\tau}$$

- Recall that consumption depends on α but does not depend on the realization of ε
- Thus consumption taxes can redistribute wrt. uninsurable shocks without distorting the efficient response of hours to insurable shocks
- Trade-off between public good provision and redistribution remains

Concluding remarks

- Tractable incomplete-markets model to study the two key roles of fiscal policy: redistribution and public good provision
- Positive and normative analysis

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- Positive and normative analysis

- What's next?

  - Solve model for general CRRA preferences $(\gamma \neq 1)$

  - Quantify how much of G is pure public good (e.g., defense) and how much is a transfer (e.g., public education)

Solving for competitive equilibrium

1. Conjecture no bond-trade: α uninsured and ε fully insured
2. Economy as continuum of groups indexed by α: within group, the Welfare Theorems apply
   - Use group-planner problem to derive allocations, taking tax function (λ^*) as given
3. Use agents FOC to back out "shadow" bond price for each group, i.e., $\mathbb{E}_t[MRS_{t,t+1}]$
4. Verify no-bond-trading equilibrium: check that shadow bond price is independent of island-specific characteristics
5. Given eq. allocations, solve for λ^* via aggregate government budget constraint