Redistributive Taxation in a Partial-Insurance Economy

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ESWC, SHANGHAI, August, 2010

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Redistributive taxation

Two classic roles for government:

1. Redistribution / social insurance
2. Provision of public goods

At the same time, the design of public taxation must be sensitive to private incentives (Mirlees, 1971)

In light of these objectives, how progressive should the tax system be?

Approach

- Equilibrium heterogeneous-agents model featuring:
    1. production through labor supplied elastically, but no capital
    2. differential “innate ability" + idiosyncratic productivity risk
    3. partial risk-sharing
    4. government expenditures valued by households
- Government chooses optimally progressivity of tax/transfer system and level of expenditures

Contribution

- Tractable framework
- Transparent how optimal rate of progressivity varies with ...
  1. the elasticity of labor supply
  2. the level of inequality / risk in the economy
  3. the amount of privately-provided insurance
  4. the desire for public goods

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

- Perpetual youth demographics with constant survival probability δ

- Preferences over sequences of consumption, hours, and publicly-provided 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:

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

Wages

- Log individual wage is the sum of two components:

$$\ln w_{it} = \alpha_{it} + \varepsilon_{it}$$

  - α_{it} component follows unit root process

    $\alpha_{it} = \alpha_{i,t-1} + \omega_t$ with $\omega_{it} \sim F_\omega$ and $\alpha_{i0} \sim F_{\alpha_0}$

  - 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
- Market structure
  - $v_\alpha = v_\varepsilon = 0 \Rightarrow$ representative agent economy
  - $v_\alpha > 0, v_\varepsilon = 0 \Rightarrow$ bond economy
  - $v_\alpha = 0, v_\varepsilon > 0 \Rightarrow$ complete markets
  - $v_\alpha > 0, v_\varepsilon > 0 \Rightarrow$ “partial insurance”

Government

- Two parameter tax/transfer function to redistribute and finance publicly-provided goods G

- Disposable post-government earnings:

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

- Government budget constraint (no public debt):

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

- Estimate τ by regressing log disposable income against log pre-tax income on CPS data: $\tau = 0.26$

“No bond trade” equilibrium

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

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

- Micro-foundations for Constantinides and Duffie (1996)
  - CRRA prefs, unit root shocks to log disposable income

- We start from richer process for individual wages:

  1. Labor supply: exogenous wages $\rightarrow$ endogenous earnings
  2. Private risk sharing: earnings $\rightarrow$ gross income
  3. Non-linear taxation: gross income $\rightarrow$ disposable income
  4. No bond trade: disposable income = consumption

Equilibrium allocations

$$\ln h^*(\varepsilon;\tau,G) = \underbrace{\frac{1}{(1-\tau)(\widehat{\sigma}+1)}\left[\ln(1-\tau)-\varphi\right]}_{\text{Rep. agent}} - \underbrace{M_h(v_\varepsilon) + \frac{1}{\widehat{\sigma}}\varepsilon}_{\text{Ins. shocks}}$$

- Tax-modified Frisch : $\frac{1}{\widehat{\sigma}} \equiv \frac{1-\tau}{\sigma+\tau}$

$$\ln c^*(\alpha;\tau,G) = \underbrace{\frac{1}{\widehat{\sigma}+1}\left[(1+\widehat{\sigma})\ln\lambda^*(\tau,G)+\ln(1-\tau)-\varphi\right]}_{\text{Rep. agent}} + \underbrace{M_c(v_\varepsilon)}_{\text{Ins. shocks}} + \underbrace{(1-\tau)\alpha}_{\text{Unins. shocks}}$$

Government's problem

- Government chooses (τ, G) to maximize social welfare
- Government puts weight β^t on the welfare of all agents born at dates $t = -\infty, ..., \infty$
- Social Welfare Function becomes:

$$\mathcal{W}(\tau, G) \equiv \frac{1}{1-\beta} \int \int u\left(c^*(\alpha; \tau, G), h^*(\varepsilon; \tau, G), G\right) dF_\varepsilon dF_\alpha$$

Roadmap for welfare analysis

- Assume log-normal shocks

1. No utility from public goods: $\chi = 0 \Rightarrow$ Chose τ $(G = 0)$
   1.1 Rep. agent
   1.2 Heterog. agents
2. Valued G: $\chi > 0 \Rightarrow$ Chose (τ, G)
   2.1 Rep. agent
   2.2 Heterog. agents

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 $\tau = 0$

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

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

  - $\frac{\partial \mathcal{W}(\tau)}{\partial \tau}|_{\tau=0} > 0$ iff $v_\alpha > 0 \Rightarrow$ strictly positive solution for τ^*

Valued G, rep agent: $\chi > 0$, $v_\alpha = v_\varepsilon = 0$

- Welfare-maximizing policy given by:

$$g^* = \frac{\chi}{1+\chi} \quad \textit{Samuelson's condition}$$

$$\tau^* = -\chi \quad \textit{Regressive taxation}$$

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

Valued G, heterog. agents: $\chi > 0$, $v_\alpha > 0$, $v_\varepsilon > 0$

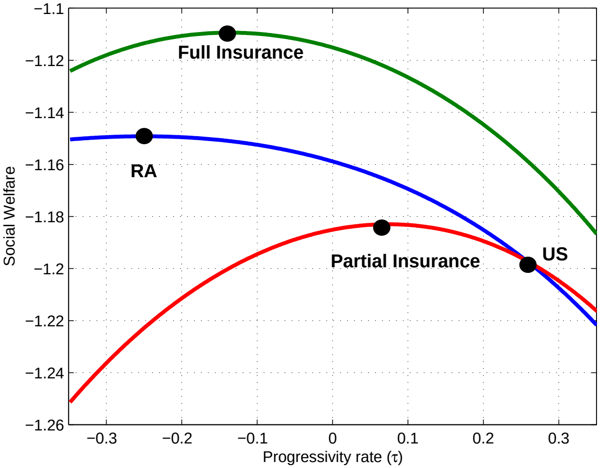
- Optimal public good provision g^* is unchanged: $g^* = \frac{\chi}{1+\chi}$
- Trade-off in determining optimal rate of progressivity:
  - Stronger taste for G (higher χ) $\Rightarrow$ more regressive taxation
  - More uninsurable risk (higher v_α) $\Rightarrow$ more progressivity
- Parameter space can be divided into two regions:

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

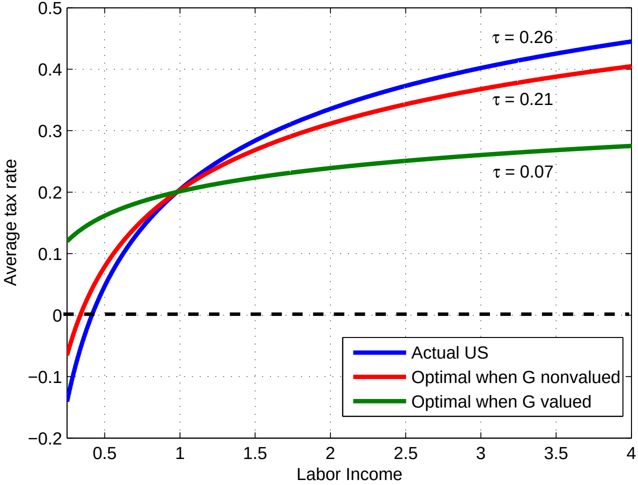
- With $v_\alpha = v_\varepsilon = 0.14$, and $\chi = 0.25$ $(g^* = 0.2)$

$$\begin{aligned} \sigma = 2.0 \quad &\Rightarrow \quad \tau^* = 0.07 \ \textit{(optimal)} \\ \sigma = 6.3 \quad &\Rightarrow \quad \tau^* = 0.26 \ \textit{(actual US)} \end{aligned}$$

Welfare Functions, $\chi = 0.25$

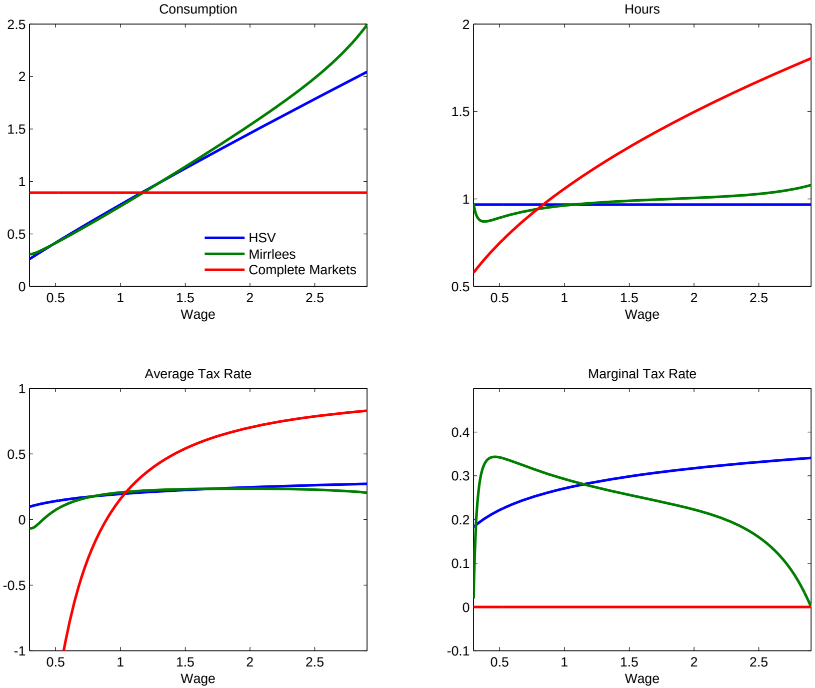


Average tax rate: actual US vs optimal



Relationship to Mirlees approach ($v_\varepsilon = 0$)

- Our Ramsey-style approach
  - specific functional form for earnings tax schedule
- Mirlees approach
  - $ln(w) = \alpha$ unobservable, constrained-efficient allocations implementable via unrestricted earnings tax schedule
- Complete markets
  - $ln(w) = \alpha$ observable, efficient allocations implementable via unrestricted wage tax schedule
- Result 1: In all three economies: $g^* = \frac{G}{Y} = \frac{\chi}{1-\chi}$


Consumption
Hours
Average Tax Rate
Marginal Tax Rate
Wage
HSV
Mirrlees
Complete Markets
0
0.5
1
1.5
2
2.5
-1
-0.5
-0.1
0.1
0.2
0.3
0.4

Progressive consumption taxation

- President's Advisory Panel on Tax Reform (2005) lists a progressive consumed income tax among its proposals
- Implementation: progressive income tax with full deduction for savings
- Argument: avoids distortions to capital accumulation, while retaining scope for redistribution
- Additional argument: consumption taxes redistribute wrt. uninsurable shocks without distorting the efficient response of hours to insurable shocks

Concluding remarks

- We have also studied consumption taxation, and politico-economic equilibrium with policies chosen by a median voter
- What's next?
  - Solve model for general CRRA preferences $(\gamma \neq 1)$
  - Introduce wealth heterogeneity and time-varying taxation