The Political Economy of Nonlinear Capital Taxation

Emmanuel Farhi Iván Werning

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Introduction

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- **normative** theories ➡ mixed
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  - others: $\tau^k \neq 0$ (Non-Separability / Inverse Euler)

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  - no-commitment

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  - ▷ commitment but heterogenous agents
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  - unrestricted tax instruments: redistribution vs. incentives

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  - ex-post temptation: extreme redistribution (capital levy)

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  - reputation

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$\tau^{K\prime} > 0$ ➡ $\downarrow$ future inequality

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- results → ex-ante considerations, not ex-post

Related Literature

- Ramsey...
  - time-inconsistency: Kydland-Prescott (1977); Fischer (1980); Klein-Rios-Rull (2003)
  - Reputation: Kotlikoff-Persson-Svensson (1988); Chari-Kehoe (1990); Benhabib-Rustichini (1996)

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- Mirrleesian economies...
  - Political economy: Sleet-Yeltekin (2007); Acemoglu-Golosov-Tsyvinski (2007)
  - intergenerational optimum: Farhi-Werning (2007, 2008)

Outline

1. Two Period Model
2. Infinite Horizon Model

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Two Period Model

Environment

- continuum of agents θ

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$$v_0 = u(c_0) - \theta h(n_0) + \beta u(c_1)$$

- resource constraint

$$\int c_0(\theta)\, dF(\theta) + k_1 \leq \int n_0(\theta)\, dF(\theta)$$
$$\int c_1(\theta)\, dF(\theta) \leq R k_1 \qquad \text{[RC]}$$

- continuum of agents θ
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$$\int c_0(\theta)\, dF(\theta) + \frac{1}{R} \int c_1(\theta)\, dF(\theta) \leq \int n_0(\theta)\, dF(\theta)$$

[RC]

Incentives

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- incentive compatibility: $(c_0(\theta), n_0(\theta), c_1(\theta))$:

$$u(c_0(\theta)) - \theta h(n_0(\theta)) + \beta u(c_1(\theta)) \geq u(c_0(\theta')) - \theta h(n_0(\theta')) + \beta u(c_1(\theta')) \qquad \text{[IC]}$$

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- budget constraints:

$$c_0 + a_0 \leq n_0 - T^n(n_0)$$
$$c_1 \leq Ra_0 - T^a(a_0) \quad \text{[BC]}$$

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Proposition. [Implementation]

[IC] ⟷ [BC]

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- propose policies → $v_0^i(\theta)$ for $i = A, B$

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- result → maximize

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- crucial: values equality in consumption

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- idea: separability

Policy Game

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- reform. . .
  - cost: ρ lost output

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  - $t = 0$: choose tax system to max $\int v_0(\theta)\,dF(\theta)$
  - $t = 1$: choose reform or not to max $\int v_1(\theta)\,dF(\theta)$
- reform...
  - cost: ρ lost output
  - benefit: equalize consumption $c_1(\theta) = Rk_1 - \rho$
- compare...

$$\int u(c_1(\theta))\,dF(\theta) \quad \text{vs.} \quad u(Rk_1 - \rho)$$

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- $t = 0$ candidates...

$$(T_A^n, T_A^a) \quad \text{vs.} \quad (T_B^n, T_B^a)$$

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- winner i^*...

$$(T_{i^*}^n, T_{i^*}^a)$$

Policy Game

- $t = 0$ candidates...

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- $t = 1$ candidates
  - no reform → $T^a_{i^*}$ implemented
  - reform → full redistribution

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- $t = 1$ candidates
  - no reform ➡ $T_{i^*}^a$ implemented
  - reform ➡ full redistribution (expropriation tax: $\hat{T}^a(Ra) = Ra - RK_1 - \rho$)

No Commitment

- solving backwards...

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- $t = 1$: no reform if and only if

$$\int u(c_1(\theta))\, dF(\theta) \geq u(Rk_1 - \rho)$$

strategy maps: T_0^a and $a(\theta)$ ➡ reform or not

- $t = 0$: candidates always avoid reform...
  ... otherwise output ρ lost!

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➡ constrained optimum problem

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$$\max \int v_0(\theta)\, dF(\theta)$$

subject to IC, RC and

$$\int u(c_1(\theta))\, dF(\theta) \geq u(Rk_1 - \rho) \qquad [\nu]$$

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- first-order conditions → $\tau^k(\theta) \neq 0$

Main Result

Two formulas for capital taxes

- progressivity

$$\tau^k(\theta) = \frac{\beta R u'(Rk_1 - \rho) - u'(c_0(\theta))}{\mu_0 \nu^{-1} \beta + \beta R u'(Rk_1 - \rho)}$$

- level

$$\tau^k(\theta) = \frac{u'(Rk_1 - \rho) - u'(c_1(\theta))}{\mu_0 \nu^{-1} R^{-1} + u'(Rk_1 - \rho) - u'(c_1(\theta))}$$

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Proposition.
(i) τ^k progressive
(ii) positive at top
(iii) negative at bottom

Intuition

- no-commitment constraint

$$\int u(c_1(\theta))\,dF(\theta) \geq u(Rk_1 - \rho)$$

→ distortions

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- ex-ante: progressivity reduces inequality

→ helps avoid ex-post reform

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- two effects
  - ▷ LHS → progressive subsidy
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- implementation: $T^a(a)$ convex, increasing at the top, decreasing at the bottom

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- mechanism...
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Infinite Horizon

Setup

- infinite horizon → dynamic game
- no cost of reform ($\rho = 0$)
- consumption and work each period

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- no cost of reform ($\rho = 0$)
- consumption and work each period

- two differences...

1. reputational equilibria → "endogenize ρ"
2. commitment case → immiseration

Setup

- preferences

$$v_t = \mathbb{E}_{t-1}[u(c_t) - \theta_t h(n_t) + \beta v_{t+1}],$$
$$= \sum_{s=0}^{\infty} \beta^s \, \mathbb{E}_{t-1}\left[u(c_{t+s}) - \theta_{t+s} h(n_{t+s})\right]$$

- $\{\theta_t\}$ i.i.d., private information

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- Revelation principle on equilibrium path (Albanesi-Sleet, 2007; Acemoglu-Golosov-Tsyvinski, 2007)

Incentives

- Utility from strategy σ...

$$U\left(\{c_t, n_t\}, \sigma\right) \equiv \sum_{t,\theta^t} \beta^t [u\left(c_t\left(\sigma^t(\theta^t)\right)\right) - \theta_t h(n_t(\sigma^t(\theta^t)))] \Pr(\theta^t)$$

- incentive compatibility

$$U\left(\{c_t, n_t\}, \sigma^*\right) \geq U\left(\{c_t, n_t\}, \sigma\right) \qquad \text{[IC]}$$

for all σ

Technology

- $v =$ initial utility entitlement
- $\psi =$ distribution of v
- resource constraint...

$$C_t + K_{t+1} \leq F\big(K_t, N_t\big) \qquad t = 0, 1, \ldots \qquad \text{[RC]}$$

$$N_t \equiv \int \sum_{\theta^t} n_t^v(\theta^t) \, \Pr(\theta^t) \, d\psi(v)$$

$$C_t \equiv \int \sum_{\theta^t} c_t^v(\theta^t) \, \Pr(\theta^t) \, d\psi(v)$$

Feasible allocation. $\big(\{c_t^v, n_t^v\}, K_t\big)$:

IC, RC and $v = U(\{c_t^v, n_t^v\}, \sigma^*)$

- H^t = public history entering period t
  - past reports $\sigma^{t-1,v}(\theta^{t-1})$
  - past allocations $\left(\{c_s^v, n_s^v\}_{s \le t-1}, \{K_s\}_{s \le t} \right)$

Policy Game

- $H^t =$ public history entering period t
  - past reports $\sigma^{t-1,v}(\theta^{t-1})$
  - past allocations $\left(\{c_s^v, n_s^v\}_{s \leq t-1}, \{K_s\}_{s \leq t}\right)$

- Timing within period...

  1. agents: report $\sigma_t^v(\theta^t)$ and work $n_t^v\left(\sigma_t^v(\theta^t)\right)$
  2. candidates: platforms $\left(\{c_t^v\}, K_{t+1}\right)$ s.t. RC
  3. voting: winning platform implemented
  4. move to next period ⟶ H_{t+1}

Credibility

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- credible allocations: feasibile and...

$$\int U\left(\{c_{t+s}^v, n_{t+s}^v\}_{s\geq 0}, \sigma^*\right) d\psi(v) \geq \hat{W}\left(K_t, \{n_t^v(\theta^t)\}\right)$$

Credibility

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$$\hat{W}(K, \{n_\theta\}) \equiv$$
$$\max_{K'} \left\{ u(F(K,N) - K') - \sum_\theta \int \theta h(n_\theta) \Pr(\theta) + \beta W(K') \right\}$$

- $W(K)$ = worst equilibrium payoff

Planning Problem

- best equilibrium ⟷ Dual planning problem:

$$\min K_0 \quad \text{s.t. } \left(\{c_t^v, n_t^v\}; \{K_t\}\right) \text{ credible}$$

FOCs

$$\frac{\mu_{t+1}}{\mu_t}\beta F_K(K_{t+1}, N_{t+1}) - \frac{\nu_{t+1}}{\mu_t}\beta \hat{W}_K(K_{t+1}, \{n^v_{t+1}\}) = 1$$

$$\frac{1}{u'(c^v(\theta^t))} - \frac{\nu_{t+1}}{\mu_{t+1}-\mu_t} = \frac{\mu_{t+1}}{\mu_t}\left(\mathbb{E}_t\left[\frac{1}{u'(c^v(\theta^{t+1}))}\right] - \frac{\nu_{t+1}}{\mu_{t+1}-\mu_t}\right)$$

Main Result

- average capital tax:

$$1 - \bar{\tau}_t(v_t) \equiv \sum_{\theta} \big(1 - \tau(v_t, \theta)\big) p(\theta)$$

- average capital tax is progressive:

$$\bar{\tau}_{t+1}(v_{t+1}) = \frac{\beta \hat{W}_K(K_{t+1}, \{n^v_{t+1}\}) - u'\big(c^v(\theta^t)\big)}{\beta R_{t+1}} \frac{\nu_{t+1}}{\mu_{t+1}}$$

or

$$\bar{\tau}_{t+1}(v_{t+1}) = \frac{\beta \hat{W}_K(K_{t+1}, \{n^v_{t+1}\}) - \beta R_{t+1} \big(\mathbb{E}_t \big[u'^{-1}\big(c^v(\theta^{t+1})\big)}{\beta R_{t+1} \frac{\mu_{t+1}}{\nu_{t+1}} - \beta R_{t+1} \big(\mathbb{E}_t \big[u'^{-1}\big(c^v(\theta^{t+1})\big)\big]\big)^{-1}}$$

Worst

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$$W(K) = \min_{n \in [0,\bar{n}]} \max_{K'} \{u(F(K,n) - K') - h(n) + \beta W(K')\}$$

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$$W(K) = \min_{n \in [0,\bar{n}]} \max_{K'} \{u(F(K,n) - K') - h(n) + \beta W(K')\}$$

- two implications...

1. $W(K)$ is nondecreasing and concave
2. $\hat{W}(K, \{n_\theta\})$ is increasing, concave, and differentiable.

- back to sign...

Worst

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Two Period Model
Infinite Horizon
❖ Setup
❖ Policy Game
❖ Planning Problem
❖ FOCs
❖ Main Result
❖ Worst
❖ Non i.i.d. shocks
Conclusions

- what is the worst?

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$$\bar{\tau}_{t+1}\left(v_{t+1}\right) = \frac{\beta \hat{W}_K(K_{t+1}, \{n^v_{t+1}\}) - \beta R_{t+1}\left(\mathbb{E}_t\left[u'^{-1}\left(c^v(\theta^{t+1})\right.\right.\right.}{\beta R_{t+1}\frac{\mu_{t+1}}{\nu_{t+1}} - \beta R_{t+1}\left(\mathbb{E}_t\left[u'^{-1}\left(c^v(\theta^{t+1})\right)\right]\right)^{-1}}$$

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$$W(K) = \min_{n \in [0,\bar{n}]} \max_{K'} \{u(F(K,n) - K') - h(n) + \beta W(K')\}$$

- two implications...

1. $W(K)$ is nondecreasing and concave
2. $\hat{W}(K, \{n_\theta\})$ is increasing, concave, and differentiable.

- back to sign...

$$\bar{\tau}_{t+1}\left(v_{t+1}\right) = \beta R_{t+1} \frac{u'(\hat{C}_{t+1}) - \left(\mathbb{E}_t\left[u'^{-1}\left(c^v(\theta^{t+1})\right)\right]\right)^{-1}}{\beta R_{t+1}\frac{\mu_{t+1}}{\nu_{t+1}} - \beta R_{t+1}\left(\mathbb{E}_t\left[u'^{-1}\left(c^v(\theta^{t+1})\right)\right]\right)^{-}}$$

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- potential rachet effects...
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1. general mechanisms → m^t
2. assume
   - there exists $w > 0$ s.t. $min_{N \geq 0} F_N(K, N) > w$
   - $K \in [0, \bar{K}]$ and $n \in [0, \bar{n}]$ where $\bar{K}, \bar{N} < \infty$
   - $u'(F(\bar{K}, \bar{n})) > (\bar{\theta} h(\bar{n}) - h(0))/w$

→ revelation principle on equilibrium path

Conclusions

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- extensions: other policies? human capital?