Optimal Fiscal Policy With Redistribution

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Motivation

- Standard **Ramsey problem**: lump-sum taxes arbitrarily ruled-out
  - Labor taxes are smoothed; Capital tax is zero
- Arbitrary second-best?

- **Werning problem**: heterogenous agents, linear taxes on revenues from labor and capital, lump-sum taxes:
  - Positive (distortionary) labor taxes emerge endogenously as a redistributive tool
  - Trade-off: efficiency versus redistribution
- Extension: with nonlinear taxes (Mirleesian model)?

Environment

- **The agents:**
  - + Heterogenous workers: $\forall i \in I$ a mass π_i of type-i agents:
    - Productivity θ_i: $U^i(c_t^i, L_t^i) = U(c_t^i, \frac{L_t^i}{\theta_i})$
  - + Government
  - + Representative firm
- **Aggregate uncertainty**: $s^t = (s_0, s_1, ..., s_t)$ w.p. $\nu_t(s^t)$
- **Resource constraint** $\forall t \ \forall s^t$:

$$c_t(s^t) + K_{t+1}(s^t) + g_t(s^t) \leq F(L_t(s^t), K_t(s^{t-1}), s^t) + (1-\delta)K_t(s^{t-1})$$

with $\sum_i \pi_i c_t^i(s^t) = c_t(s^t)$ and $\sum_i \pi_i L_t^i(s^t) = L_t(s^t)$

- **Complete Markets**

Competitive Equilibrium I

Policy: Given an initial debt, linear labor and capital taxes, lump-sum taxes, not indexed by i:

$$\{\tau_t(s^t), \kappa_t(s^t), T_t(s^t)\}_{t,s^t}$$

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$$\{\tau_t(s^t), \kappa_t(s^t), T_t(s^t)\}_{t,s^t}$$

+ Government:

$$\sum_{i \in I} \pi_i B^i(s_0) + \sum_{t,s^t} p_t(s^t) g_t(s^t) \leq T + \ldots$$

$$\ldots + \sum_{t,s^t} p_t(s^t)(\tau(s^t) w_t(s^t) L_t(s^t) + \kappa_t(s^t)(r_t(s^t) - \delta) K_t(s^{t-1}))$$

where $T = \sum_{t,s^t} p_t(s^t) T_t(s^t)$.

+ Representative firm: Static maximization.

$$w_t = F_L(L_t, K_t, s_t) \;\; \text{and} \;\; r_t = F_K(L_t, K_t, s_t)$$

Competitive Equilibrium II

+ Households:

$$\max_{\{c_t^i(s^t), L_t^i(s^t)\}} \sum_{t=0}^{\infty} \beta^t \sum_{s^t} \nu_t(s^t) U^i(c_t^i(s^t), L_t^i(s^t))$$

such that

$$\sum_{t,s^t} p_t(s^t)\left[c_t^i(s^t) - w_t(s^t)(1-\tau_t(s^t))L_t^i(s^t) + T_t(s^t)\right] \leq \Omega_0^i$$

where $\Omega_0^i \equiv (1 + (1-\kappa_0)(r_0 - \delta))k_0^i + B^i(s_0)$.

Competitive Equilibrium II

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where $\Omega_0^i \equiv (1 + (1-\kappa_0)(r_0 - \delta))k_0^i + B^i(s_0)$.

First-order conditions:

$$p(s^t) = \beta \nu_t(s^t) \frac{U_c^i(s^t)}{U_c^i(s_0)}; \quad w_t(s^t)(1 - \tau_t^l(s^t)) = -\frac{U_L^i(s^t)}{U_c^i(s^t)}$$

Standard implementability constraints for each agent ($\forall i \in I$):

$$\sum_{t,s^t} \beta^t \nu_t(s^t)\left[U_c^i(s^t)c_t^i(s^t) + U_L^i(s^t)L_t^i(s^t)\right] \leq U_c^i(s_0)(\Omega_0^i - T)$$

Allocating Aggregates I

$\forall$ C.E. $\exists$ **market weights** $\phi \equiv \{\phi^i\}$, with $\phi^i \geq 0$ and $\sum \phi^i \pi^i = 1$, so that the individual assignments solve the static subproblem:

$$U^m(c, L; \phi) \equiv \max_{\{c^i, L^i\}} \sum_{i \in I} \phi^i \pi^i U^i(c^i, L^i)$$

$$\text{s.t.} \sum_{i \in I} c^i \pi^i = c \text{ and } \sum_{i \in I} L^i \pi^i = L$$

Notation:

Let $\hat{c}^i_t(c_t(s^t), L_t(s^t); \phi)$, $\hat{L}^i_t(c_t(s^t), L_t(s^t); \phi)$, the solution for i.

Let $\hat{U}^i(c_t(s^t), L_t(s^t); \phi) = U^i(\hat{c}^i_t(c_t(s^t), L_t(s^t); \phi), \hat{L}^i_t(c_t(s^t), L_t(s^t); \phi))$.

Then, $U^m(c, L; \phi) \equiv \sum_{i \in I} \phi^i \pi^i \hat{U}^i(c, L; \phi)$.

Envelope Conditions:

$$U^m_c(c, L; \phi) = \phi^i U^i_c(\hat{c}^i, \hat{L}^i; \phi) \text{ and } U^m_L(c, L; \phi) = \phi^i U^i_L(\hat{c}^i, \hat{L}^i; \phi)$$

Allocating Aggregates II

+ **FOC** if market-representative-agent:

$$w_t(1-\tau_t) = \frac{-U_L^m(c_t, L_t; \phi)}{U_C^m(c_t, L_t; \phi)} = \frac{-\phi^i U_L^i(\hat{c}_t^i, \hat{L}_t^i; \phi)}{\phi^i U_C^i(\hat{c}_t^i, \hat{L}_t^i; \phi)}$$

+ **Implementability constraints** can be rewritten $\forall i \in I$:

$$\sum_{t,s^t} \beta^t \nu_t(s^t) \left[U_c^m(c_t(s^t), L_t(s^t); \phi) \hat{c}_t^i(c_t(s^t), L_t(s^t); \phi) + \ldots \right.$$

$$\left. \ldots + U_L^m(c_t(s^t), L_t(s^t); \phi) \hat{L}_t^i(c_t(s^t), L_t(s^t); \phi) \right] \leq U_c^m(c_0, L_0; \phi)(\Omega_0^i - T)$$

Proposition: *Given $\{\Omega_0^i\}$, an aggregate allocation $\{c_t(s^t), L_t(s^t), K_{t+1}(s^t)\}$ can be supported by a C.E. $\Leftrightarrow$ the resource constraint holds and $\exists$ market weights ϕ and a lum-sum tax T such that the new implementability conditions hold $\forall i \in I$.*

The Planner Problem

Let $\lambda \equiv \lambda_i$, where λ_i is the Pareto weight of agent i.

$$\max_{\{c_t(s^t), L_t(s^t), K_t(s^t); T; \phi\}} \sum_i \lambda_i \pi_i \sum_{t, s^t} \nu_t(s^t) \hat{U}^i(c_t(s^t), L_t(s^t); \phi)$$

such that:

- Resource constraints hold $\forall t \; \forall s^t$
- New Implementability constraints hold $\forall i \in I$

Two Examples: Optimal Wedges

+ **Separable Isoelastic Utility:** $U^i(c,L) = \frac{1}{1-\sigma} c^{1-\sigma} - \frac{\alpha}{\gamma}\left(L/\theta^i\right)^{\gamma}$

  - τ is constant across time and states; $\kappa = 0$

+ **Balanced Growth Preferences:** $U^i(c,L) = \frac{\left(c^{\alpha}(1-L/\theta^i)^{1-\alpha}\right)^{1-\sigma}}{1-\sigma}$

  - Quantitatively: τ is constant across time and states; κ is zero;

+ **A partial-equivalence with Ramsey:**

In these two cases, these two expressions are proportional for some $\hat{\mu}$:

$$\begin{cases} \sum_i \pi_i \left(\lambda_i \hat{U}^i(c,L) + \mu_i [U_c^m(c,L)\hat{c}^i + U_L^m(c,L)\hat{L}^i]\right) \\ \hat{U}^m(c,L) + \hat{\mu}[U_c^m(c,L)c + U_L^m(c,L)L] \end{cases}$$

Distortionary Labor Taxes are Desirable (sometimes)

The marginal cost from distortions should be equated to the marginal benefit from redistribution.

- **RA:** the marginal benefit from redistribution is constant (zero).
- **Aggregate shocks but no shift in the distribution of types:** the marginal benefit from redistribution is basically constant.
- **Shocks to the distribution:**
  - Separable isoelastic utility function;
  - $g_t(s^t) = 0$, $TFP(s_t) = 1$; θ_t^H / θ_t^L is a function of s_t.
  - Then, $\tau(s^t) = \tau(s_t)$ and $\kappa(s^t) = 0$.

Three Differences with a Ramsey Plan

- **Capital taxation and time-inconsistency:**
    - Ramsey: redistribution between private and public sector
    - Werning: redistribution between private agents
- **Debt management:**
    - Ramsey: debt as an insurance tool
    - Werning: a Ricardian Equivalence
- **State-contingent capital taxes:**
    - Werning: Cannot replicate a complete-market outcome

A Mirleesian Economy with Aggregate Uncertainty

Planner Problem:

$$\max \sum_{t,s^t} \beta^t \nu_t(s^t) \sum_{i \in I} \pi^i \lambda^i \left(u(c^i(s^t)) - v(\frac{L^i_t(s^t)}{\theta^i_t(s^t)}) \right) \text{ s.t.}$$

- Resource Constraint holds $\forall t \; \forall s^t$;
- Incentive Constraint holds $\forall i \in I$ and for all reports $j \in I$

$$\sum_{t,s^t} \beta^t \nu_t(s^t) \left([u(c^i(s^t)) - v(\frac{L^i_t(s^t)}{\theta^i_t(s^t)})] - [u(c^j(s^t)) - v(\frac{L^j_t(s^t)}{\theta^j_t(s^t)})] \right) \geq 0$$

A Mirleesian Economy with Aggregate Uncertainty

Planner Problem:

$$\max \sum_{t,s^t} \beta^t \nu_t(s^t) \sum_{i \in I} \pi^i \lambda^i \left(u(c^i(s^t)) - v(\frac{L_t^i(s^t)}{\theta_t^i(s^t)}) \right) \text{ s.t.}$$

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$$\sum_{t,s^t} \beta^t \nu_t(s^t) \left([u(c^i(s^t)) - v(\frac{L_t^i(s^t)}{\theta_t^i(s^t)})] - [u(c^j(s^t)) - v(\frac{L_t^j(s^t)}{\theta_t^j(s^t)})] \right) \geq 0$$

Proposition: *At any constrained-efficient allocation:*
(i) The intertemporal Euler equation holds.
(ii) The implicit marginal tax on labor $\tau_t^i(s^t)$ depends only on the current skill distribution $\{\theta_t^i(s^t)\}$.

Conclusion/Next Steps

- A rationale for distortionary taxes
- A tractable model for Ramsey problems with heterogeneity
- Bridge between Ramsey and Mirlees