Discussion of Straub & Werning's Positive Long Run Capital Taxation: Chamley-Judd Revisited

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What This Paper Could Be Interpreted to Say

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- Judd is wrong!

How I Read the Paper

- In a standard macro model,
  - With well-functioning markets
  - With only taxes on labor and capital income
  - With an upper bound on capital taxes
- Optimal taxation implies either
  - Capital taxes are zero after a transition phase at the upper bound, or
  - Capital taxes are at their upper bound forever.
- Which occurs depends on the size of the initial debt.

How I Read the Paper

- Very nice technical contribution
- Would like to see some quantitative exercises
- Not really a justification for current tax systems

Static Public Finance Environment

- I households
- Commodities $x = (c_1, ..., c_N, n_1, ..., n_M, K)$
  - c_i: consumption goods
  - n_j: types of labor
  - K: primary inputs (land or initial capital)
- Technology:

$$f(c_1 + g_1, ..., c_N + g_N, n_1, ..., n_M, K) = 0 \quad [RF]$$

- Preferences: $u^i(x^i)$

Competitive Equilibrium

- Policy: $\pi = (\tau_{c_i}, \tau_{n_j}, \tau_K)$

- Household problem (HH):

$$\max u^i(x^i)$$

s.t.

$$\sum_{i=1}^{N} p_i(1+\tau_{c_i})c_i \leq \sum_{j=1}^{M} w_j(1-\tau_{n_j})n_j + r(1-\tau_K)K$$

- CE is allocation, prices, policies that solves HH and is resource feasible.

Complete and Incomplete Tax Systems

- CE allocation must satisfy IC

$$\sum_{i=1}^{N} c_i u_{c_i} + \sum_{j=1}^{M} n_i u_{n_j} = (1 - \tau_K) F_k K \tag{1}$$

- If no restrictions on taxes, any CE allocation satisfying IC and RF can be implemented as CE.
- Will call such tax systems complete
- Will call tax systems without this property incomplete

The Ramsey Problem

- Choose x, τ_K to solve

$$\max \sum \lambda^i u^i(x^i)$$

$$\sum_{i=1}^{N} c_i u_{c_i} + \sum_{j=1}^{M} n_i u_{n_j} = (1 - \tau_K) F_k K$$

$$f(c_1 + g_1, ..., c_N + g_N, n_1, ..., n_M, K) = 0$$

- Clearly optimal to set $\tau_K = 1$.

The Intermediate Goods Result

- With a complete tax system, Ramsey problem is equivalent to

$$\max \sum \lambda^i u^i(x^i)$$

s.t.

$$IC$$

$$p \cdot y \leq p \cdot y^*$$

- That is, given a price vector p, production efficiency is optimal.

Uniform Commodity Taxation

- If preferences are homothetic over a subset of consumption goods and separable from all labor,
  - Optimal to tax subset at uniform rate
- Corollary of intermediate goods result.

Applying to Macro Models

- Assume taxes on consumption η_t, labor τ_{n_t}, and capital income τ_{k_t}.
- Initial tax rates are given.
- Preferences: $\sum \beta^t [u(c_t) - v(n_t)]$, where $u(c_t) = \frac{c_t^{1-\sigma}}{1-\sigma}$
- IC now becomes

$$\sum \beta^t [c_t u'(c_t) - n_t v'(n_t)] = \frac{u'(c_0)}{1+\eta_0} [(1-\tau_{k_0})(F_{k_0} - \delta) + b_0]$$

- $w(c_t, n_t) = u(c_t) - v(n_t) + \lambda [c_t u'(c_t) - n_t v'(n_t)]$ for $t \geq 1$.

Applying to Macro Models

- Ramsey problem implies

$$w_{c_t} = \beta w_{c_t+1}[F_{k_{t+1}} - \delta + 1]$$

- Since w_{c_t} proportional to u_{c_t}
- No distortion from period 1 on
- May require high taxes on capital income or high consumption taxes in period 1.

Where Did Chamley Go Wrong

- Assume no consumption taxes
- Assume $\tau_{k_t} \leq 1$ for all t.
- Then get additional constraint

$$u_{c_t} \geq \beta u_{c_{t+1}}, \quad \forall t$$

Chamley's Problem

$$V(b_0) = \max \int_0^\infty e^{-\rho t}[u(c_t) - v(n_t)]$$

s.t.

$$\dot{c}_t \geq -\frac{\rho}{\sigma} c_t$$

$$c_t + g_t + \dot{k}_t = f(k_t, n_t) - \delta k_t$$

$$\int_0^\infty e^{-\rho t}[c_t u'(c_t) - n_t v'(n_t)] \geq u'(c_0)(k_0 + b_0)$$

Key First Order Conditions

- $\dot{\eta}_t - \rho\eta_t = \eta_t \frac{\rho}{\sigma} + \lambda_t - (1 + \mu(1 - \delta))u'(c_t)$
- $\dot{\lambda}_t = (\rho - (F_k - \delta))\lambda_t$.
- Claim: Suppose $\eta_t = 0,\ t \in [T, T + \epsilon)$, then $\eta_t = 0,\ \forall t \geq T$.
  - $\lambda_t = (1 + \mu(1 - \delta))u'(c_t),\ t \in [T, T + \epsilon)$.
  - So $\dot{\eta}_t = 0$ at $t = T + \epsilon$.
- So $\eta_t = 0,\ \forall t \geq T$.

Straub & Werning's First Insight

- Suppose $\sigma > 1$.
- Then if $T < \infty$, $1 + \mu(1 - \sigma) > 0$, so μ bounded from above by $\frac{1}{\sigma - 1}$.
- So $V'(b_0) = -\mu u'(c_0)$ is bounded below.

Straub & Werning's Second Insight

- Let $V_\infty(b_0)$ be utility associated with solution assuming constraint binds forever, so
$$c_t = c_0 e^{-\frac{\rho}{\sigma}t}.$$
-
$$V_\infty(b_0) = \max_{c_0} u(c_0)\frac{\sigma}{\rho} - \tilde{V}(c_0)$$
s.t.
$$c_0\frac{\sigma}{\rho} - c_0^\sigma(1+\tau_c)\tilde{V}(c_0) \geq k_0 + b_0$$
- Can show $V_\infty'(b_0) \to -\infty$
- So for large b_0, $V'(b_0) \to -\infty$
- Contradiction!

Judd and All That

- Capitalists and workers
- Suppose workers have no capital, but can save or borrow.
- Two IC constraints

$$\sum \beta^t [c_t^w u_w'(c_t^w) - n_t^w v_w'(n_t^w)] = 0$$

$$\sum \beta^t [c_t^c u_c'(c_t^c) - n_t^c v_c'(n_t^c)] = u'(c_0^c)(k_t + b_t)$$

- Problem essentially identical to Chamley

Judd and All That

- Suppose workers cannot save or borrow.
- Now get countable infinity of IC

$$c_t^w u_w'(c_t^w) - n_t^w v_w'(n_t^w) = 0, \ \forall t$$

- Now we have to worry about whether multipliers converge.

Bottomline

- Theory tells us: if markets work well and consumption, labor, and capital taxes are available,
  - Do not distort production efficiency;
  - That is, do not distort intertemporal margins.

- Developed economies have access to all three.

- So good policy advice is: do not distort intertemporal margins.