

Example: Optimal Taxation

Econ720

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Model

Demographics:

- ▶ A single representative consumer who lives forever.

Endowments:

- ▶ k_0 units of the c/k good at $t = 0$.

Preferences:

$$\sum_{t=0}^{\infty} \beta^t \{u(c_t) + v(g_t)\}$$

Model

Technology:

$$F(K_t, L_t) + (1 - \delta)K_t = c_t + \varphi g_t + G_t + K_{t+1} \quad (1)$$

- ▶ $\varphi > 0$. F has constant returns to scale.

Government:

- ▶ Consumption taxes at rates τ_{ct} and τ_{gt} , respectively.
- ▶ Tax revenues are used to purchase G_t .

Markets:

- ▶ labor: w_t , capital rental: q_t , c/k purchases: 1, g : p_t .

Household

Budget constraint:

Bellman equation:

First-order conditions:

Household Solution

Sequences (c_t, g_t, k_t) that solve

$$\frac{v'(g)}{u'(c)} = p \frac{1 + \tau_g}{1 + \tau_c} \quad (2)$$

$$u'(c) = \beta R' u'(c') \frac{1 + \tau_c}{1 + \tau'_c}$$

and

- ▶ budget constraint
- ▶ k_0 given
- ▶ $\lim_{t \rightarrow \infty} \beta^t u'(c_t) k_t = 0$.

Observations

- ▶ Taxes do not always hit what you would think.
- ▶ Static FOC: $\frac{v'(g)}{u'(c)} = p \frac{1+\tau_g}{1+\tau_c}$
 - ▶ if $\tau_g = \tau_c$: no distortion
- ▶ Euler: $u'(c) = \beta R' u'(c') \frac{1+\tau_c}{1+\tau'_c}$
 - ▶ if $\tau_c = \tau'_c$: no distortion
- ▶ What happens when $\tau_g = \tau_c = \tau'_c$?

Equilibrium

A competitive equilibrium is an allocation
and a price system
that satisfy:

Steady State

- ▶ The Euler equation fixes the interest rate at $R_{ss} = 1/\beta$.
- ▶ The capital stock is then determined by $R_{ss} = 1 - \delta + f'(k_{ss})$.
- ▶ The static first-order condition together with goods market clearing,

$$y \equiv f(k_{ss}) - \delta k_{ss} - G = c_{ss} + \varphi g_{ss} \quad (3)$$

then determine c_{ss} and g_{ss} .

Optimal Taxation

What are the optimal tax rates in steady state?

The government solves:

Government Problem

$$\max_{g, \tau_g} u(y - \varphi g) + v(g) + \lambda \left\{ v'(g) \left[1 + \frac{G - \tau_g \varphi g}{y - \varphi g} \right] - \varphi (1 + \tau_g) u'(y - \varphi g) \right\}$$

The c 's have been substituted out using $c = y - \varphi g$.

The constraint in the braces is the static FOC.

The government budget constraint has been used to replace τ_c by $[G - \tau_g \varphi g]/c$.

First-order conditions

$$g: u'(c) \varphi = v'(g) + \lambda \times \text{stuff}$$

$$\tau_g: \lambda \left\{ v'(g) \frac{\varphi g}{y - \varphi g} + \varphi u'(y - \varphi g) \right\} = 0$$

The term in the $\{\}$ must be strictly positive.

But then λ must be 0!

How is this possible?

Why Does This Happen?

Solution

Proceed mechanically.

Taking the first-order condition for g and imposing $\lambda = 0$ yields

$$\phi u'(c) = v'(g)$$

The tax rates that implement this can be backed out from the static condition: $\tau_g = \tau_c$.

Why are the tax rates the same?

A fundamental principle of optimal taxation indicates to tax goods with lower demand elasticities more heavily.

But this does not apply here.

The two consumption taxes together are equivalent to a lump-sum tax and therefore first-best.