Advanced Macroeconomics

Fiscal Policy and Economic Growth

- In this chapter we will introduce the government into exogenous growth models
- We discuss the intertemporal budget constraint of the government
- We analyze the effect of taxes and government expenditures in representative household models

11. Fiscal Policy and Economic Growth

General Equilibrium in the One-Period Model without Government

- Capital stock and labor supply exogenous

$$k = 1, \qquad n = 1, \qquad \widehat{k} = 1$$

- Equilibrium production: $\overline{y} = A$
- Equilibrium rental price of capital (Cobb-Douglas production function)

$$\overline{r} = \alpha A = \alpha \overline{y}$$

- Equilibrium wage

$$\overline{w} = (1 - \alpha)A = (1 - \alpha)\overline{y}$$

- Equilibrium consumption

$$\overline{c} = 1 + \overline{r} + \overline{w} = 1 + \alpha A + (1 - \alpha)A = 1 + A$$

Government Expenditure and Taxes in a One-Period Economy

- Government budget constraint

$$c_g = \tau$$

- Household's utility maximization problem

$$\max_c u(c + c_g) \quad \text{subject to} \quad c = 1 + rk + wn - \tau = 1 + r + w - \tau$$

- Equilibrium private consumption

$$\overline{c} = 1 + \overline{y} - \tau = 1 + A - c_g$$

- Equilibrium aggregate output

$$\overline{y} = \overline{c} - c_g - 1 = A$$

- Government consumption substitutes private consumption without any other real effects
- The same applies in case of proportional income taxes $\tau = t_y(rk + wn) = t_y(r + w)$

One-period Model with Endogenous Labor Supply

- Four endogenous variables: w, n, y, c
- Four equations
  - Combined household FOC (labor supply): $w = c^{\sigma} n^{\varphi}$
  - Combined firm FOC (labor demand): $w = a(a - \alpha)n^{-\alpha}$
  - Goods market equilibrium: $y = c$
  - Production function: $y = an^{1-\alpha}$
- Nominal wage (W) and price level (P) are not determined

One-period Model with Endogenous Labor Supply and Labor Income Tax

- Five endogenous variables: w, n, y, c, c_g
- Five equations
  - Combined household FOC (labor supply): $(1 - t_y)w = c^{\sigma} n^{\varphi}$
  - Combined firm FOC (labor demand): $w = a(1 - \alpha)n^{-\alpha}$
  - Goods market equilibrium: $y = c + c_g$
  - Production function: $y = an^{1-\alpha}$
  - Government budget constraint: $c_g = t_y wn$

Positive Labor Tax Reduces Equilibrium Output

(`labortaxsensitivity.m`)

Government Expenditure, Taxes and Debt in a Two-Period Economy

- Exogenous labor supply ($n_1 = n_2 = 1$)
- Endogenous savings decision
- Debt financing (bonds) of government expenditure possible in the first period

$$d_1 = c_{g1} - \tau_1 \qquad -d_1 = c_{g2} + r_2 d_1 - \tau_2$$

- Primary government expenditure: government expenditure other than interest payments
- Intertemporal government budget constraint

$$c_{g1} + \frac{c_{g2}}{1 + r_2} = \tau_1 + \frac{\tau_2}{1 + r_2}$$

Intertemporal Budget Constraint of the Representative Household

- Intertemporal budget constraint of the representative household

$$c_1 + \frac{c_2}{1 + r_2} = 1 + (r_1 + w_1 - \tau_1) + \frac{w_2 - \tau_2}{1 + r_2}$$

- Combined with the intertemporal government budget constraint

$$c_1 + \frac{c_2}{1 + r_2} = 1 + (r_1 + w_1 - c_{g1}) + \frac{w_2 - c_{g2}}{1 + r_2}$$

- Only the present value of primary government expenditure affects the budget constraint of the representative householdb but not the method of financing primary government expenditure (i.e., tax versus debt finance)

Ricardian Equivalence between Tax and Debt Finance

- Intertemporal utility function of the representative household

$$U = \frac{(c_1 + c_{g1})^{1-\sigma}}{1-\sigma} \frac{1}{1+\rho} \frac{(c_2 + c_{g2})^{1-\sigma}}{1-\sigma}$$

- Ricardian Equivalence: The method of financing the path of government expenditure does not affect the optimal savings and investment decisions
- First-order conditions

$$\begin{aligned} (c_1 + c_{g1})^{\sigma} &= \lambda \\ \frac{(c_2 + c_{g2})^{\sigma}}{1+\rho} &= \frac{\lambda}{1+\rho} \end{aligned}$$

- Euler equation for consumption

$$\frac{1}{1+\rho} \left(\frac{c_2 + c_{g2}}{c_1 + c_{g1}} \right)^{-\sigma} = \frac{1}{1+r_2}$$

Optimal Capital Stock

- Resource constraint ($k_1 = 1$)

$$\begin{aligned} y_1 &= A_1 = c_1 + c_{g1} + (k_2 - 1) \\ y_2 &= A_2 k_2^{\alpha} = c_2 + c_{g2} - k_2 \end{aligned}$$

- Profit maximizing condition for capital demand by firms

$$r_2 = \alpha A_2 k_2^{\alpha - 1}$$

- Optimal capital stock

$$\frac{1}{1+\rho}\left(\frac{1 + A_1 - \overline{k}_2}{\overline{k}_2 + A_2 \overline{k}_2^{\alpha}}\right)^{\sigma} = \frac{1}{1 + \alpha A_2 \overline{k}_2^{\alpha - 1}}$$

- The capital optimality condition is equal to the one in the two-period model without government

Income Taxation and Aggregate Savings and Investment

- With lump sum taxes: Ricardian Equivalence
- Optimal capital stock with income tax t_y

$$\frac{1}{1+\rho}\left(\frac{1+A_1-\overline{k}_2}{\overline{k}_2+A_2\overline{k}_2^{\alpha}}\right)^{\sigma}=\frac{1}{1+(1-t_y)\alpha A_2\overline{k}_2^{\alpha-1}}$$

- The net of tax real interest rate will be lower at the level of savings and investment without an income tax
- Households thus reduce savings and investment
- The capital stock will be lower in period 2, and therefore also output and consumption

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Dynamic Effects of Distortionary Taxation

- Tax on interest income

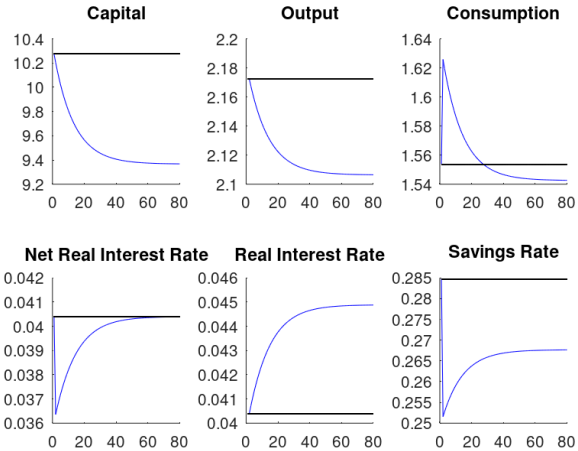
$$\frac{c_{t+1}}{c_t} = \left(\frac{1 + r_{t+1}}{(1+\rho)(1+a)^{\theta}}\right)^{1/\theta} = \left(\frac{1 + (1 - t_k) r_{t+1}}{1+\rho}\right)^{1/\theta} \frac{1}{1+a}$$

- Tax on business profits before interest and depreciation

$$r_t = (1 - t_f)(\alpha * Z_t * k_t^{(\alpha-1)} - \delta)$$

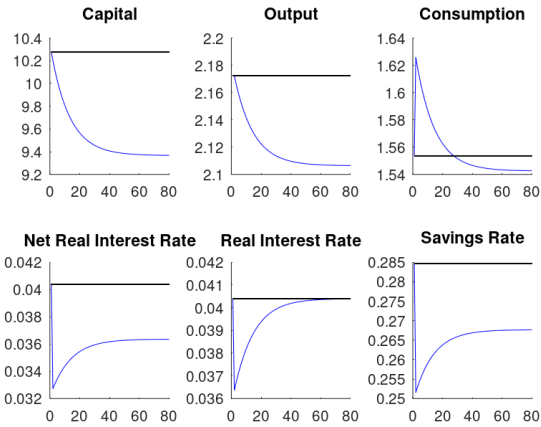
Dynamic Effects of a 10% Tax on Interest Income

(`ramseytax.mod`)



Dynamic Effects of a 10% Tax on Business Profits Before Interest and Depreciation

(`ramseytax.mod`)



11. Fiscal Policy and Economic Growth

Summary I

- In the representative household model without distortionary taxes, fiscal policy has no effects on either the convergence process or the balanced growth path. The only fiscal variable that matters for the path of private consumption is the present value of primary government expenditure, which reduces the present value of private consumption by exactly the same amount.
- The method of financing primary government expenditure, such as government debt and (non-distortionary) taxes does not affect private consumption, or the adjustment and balanced growth path of all other real variables.
- This result is known as Ricardian equivalence between lump sum taxes and government debt. Holdings of government bonds by the representative household are not considered as wealth, and do not affect household consumption, since the representative household realizes that government bonds will be financed by future taxes of equal present value.

Summary II

- In the representative household Ramsey model, labor supply is exogenous. Consequently, tax rates on income from employment do not affect employment and savings, with the result that they do not affect either the adjustment path or the balanced growth path.
- On the other hand, tax rates on capital income or business earnings before interest and depreciation are distortionary, and have negative effects on private savings and investment, the accumulation of capital, real output, real wages and real net interest rates. A dynamic simulation of the Ramsey model, for plausible parameter values, suggests that these effects of capital income taxation may be quantitatively significant.

Literature

 Alogoskoufis, George (2019): Dynamic Macroeconomics, MIT Press, Chapters 2 and 6