

Supervision 2

Intertemporal Macroeconomics: Government, Investment and Business Cycles

Short question (250 words max)

1. What is Ricardian Equivalence and under what conditions does it hold?

Problems

2. Consider the following two-period neoclassical model of investment. The representative firm faces perfect competition and produces output Y_t according to

$$Y_t = F(K_t, L_t)$$

where $F(\cdot)$ satisfies positive but diminishing marginal product with respect to capital K_t and labor L_t , with $L_t = \bar{L}$. The subscript $t = 1, 2$ indicates the time period. Capital accumulation is described by

$$K_{t+1} = (1 - \delta) K_t + I_t$$

where I_t is the level of investment, δ the depreciation rate ($0 < \delta < 1$), K_1 is predetermined, and $K_3 = 0$. The firm maximizes the present value of its profits

$$\Pi = Y_1 - p_{K,1}I_1 - w_1L_1 + \frac{1}{1+r}(Y_2 - p_{K,2}I_2 - w_2L_2)$$

where r is the real interest rate, $p_{K,t}$ the relative price of capital goods and w_t the real wage. Explain the effect on investment I_1 of:

- (a) An increase in the real interest rate due to disinflationary monetary policy.
 - (b) A partial destruction of the capital stock in period 1 due to an earthquake.
 - (c) An increase in the size of the labor force \bar{L} stemming from the immigration of foreign workers.
 - (d) The (credible) announcement in period 1 of the introduction of an investment tax credit starting in period 2.
3. Consider the market-clearing, neoclassical model in which the supply of labor depends positively on the real interest rate, and consumption and investment demand depend negatively on the real interest rate. Explain the effects on labor supply, consumption demand, investment demand, output and the real interest rate of the following sudden changes:
 - (a) A temporary productivity increase this period.
 - (b) A permanent productivity increase this period.
 - (c) A permanent productivity increase next period.

4. Consider a price-taking representative agent who faces the following optimisation problem

$$\begin{aligned} \max_{\{c_1, c_2, b_2, \ell_1, \ell_2\}} & \{\ln c_1 + \ln \ell_1 + \beta (\ln c_2 + \ln \ell_2)\}, \\ \text{subject to} & \quad c_1 + b_2 = w_1(1 - \ell_1) - T_1, \\ & \quad c_2 = w_2(1 - \ell_2) + b_2(1 + r_2) - T_2, \end{aligned}$$

where c_t denotes consumption, ℓ_t leisure, b_t savings, T_t lump-sum taxes, w_t the real wage, r_t the real interest rate, and β the intertemporal discount factor ($0 < \beta < 1$). The subscript $t = 1, 2$ denotes the time period. [Tripos 2016]

- (a) Derive the agent's intertemporal budget constraint. Give an economic interpretation of the result.
- (b) Find the optimality conditions for c_1 , c_2 , b_2 , ℓ_1 and ℓ_2 . Derive the intertemporal Euler equation for consumption, and the intratemporal (i.e. *within period*) Euler equation characterizing the optimal trade-off between consumption and leisure. Give an intuitive explanation of these Euler equations.

Assume that the economy is closed and that there is no investment. So the GDP identity is given by $y_t = c_t + g_t$, where g_t denotes government purchases, which are exogenous, and y_t denotes aggregate output, which is equal to $y_t = w_t(1 - \ell_t)$. Suppose that $w_t = A_t$, where A_t represents productivity in period $t = 1, 2$. In addition, assume that the government runs a balanced budget such that $T_t = g_t$.

- (c) Solve for the equilibrium level of output y_t in terms of A_t and g_t for $t = 1, 2$. Derive the fiscal multiplier $\partial y_1 / \partial g_1$ for a permanent increase in g_1 . Provide an intuitive explanation of the results.
- (d) Now suppose that $A_1 = A_2 = 1$ and $g_2 = \rho g_1$, where $0 \leq \rho \leq 1$. What are the fiscal multipliers $\partial y_t / \partial g_t$ for $t = 1, 2$? Compare the result to part (c). Derive the equilibrium real interest rate r_2 and explain how it is affected by a rise in g_1 when $\rho = 0$ and when $\rho = 1$. Explain the intuition underlying these results.

Main readings

- Barro (1997), *Macroeconomics*, chapters 5, 6, 9, 12-14.
- Doppelhofer (2009), "Intertemporal Macroeconomics", forthcoming in McCombie and Allington (eds), *Cambridge Essays in Applied Economics*, https://www.vle.cam.ac.uk/pluginfile.php/13437652/mod_resource/content/1/Intertemporal_Macroeconomics.pdf
- Williamson (2013), *Macroeconomics*, chapters 9, 11 and 13 (pp. 501-511).

Supplementary references

- Abel, Bernanke and McNabb (1998), *Macroeconomics*, European Edition, chapter 11
- Blanchard and Johnson (2012), *Macroeconomics*, chapter 16 and 23
- Burda and Wyplosz (2009), *Macroeconomics: A European Text*, chapter 7 and 8
- Mankiw and Taylor (2014), *Macroeconomics - Second European Edition*, chapter 16 and 19; and chapter 20 of first edition

- Prescott (1986), "Theory Ahead of Business-Cycle Measurement", *Carnegie-Rochester Conference Series on Public Policy* 25, 11-44
- Sachs and Larrain (1993), *Macroeconomics in the Global Economy*, chapter 5
- Summers (1986), "Some sceptical observations on real business cycle theory", *Federal Reserve Bank of Minneapolis Quarterly Review* 10, 23-27
- Symposium on Real Business Cycles, *Journal of Economic Perspectives*, Summer 1989