HE2002 Macroeconomics II

Tutorial 1– Questions & Solutions

Nanyang Technological University
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Academic Year 2024/2025, Semester 2

Overview of This Tutorial

This tutorial covers equilibrium in the goods market, fiscal multipliers (including the balanced budget multiplier), and the role of automatic stabilisers in a simple Keynesian model.

- **Question 1:** Equilibrium GDP, disposable income, and consumption in a basic goods market setup.

- **Question 2:** Total demand, the adjustment of production, and the effect of a fiscal expansion (using the same economy as Question 1).

- **Question 3:** Balanced budget multiplier and its dependence on the propensity to consume.

- **Question 4:** Automatic stabilisers with income-dependent taxation and their effect on output fluctuations.

Question 1 (Chapter 3, Q2)

Problem

Suppose that an economy is characterized by the following behavioral equations (in billions of euros):

$$
\begin{aligned}
C &= 480 + 0.5Y_D, \\
I &= 110, \\
T &= 70, \\
G &= 250.
\end{aligned}
$$

Solve for the following variables.

(a) Equilibrium GDP (Y).

(b) Disposable income (Y_D).

(c) Consumption spending (C).

Solution

Method 1: Solve for equilibrium output Y first

Disposable income is
$$Y_D = Y - T = Y - 70.$$

Substitute into the consumption function:

$$C = 480 + 0.5(Y - 70) = 480 + 0.5Y - 35 = 445 + 0.5Y.$$

Total demand (goods market demand) is

$$Z = C + I + G = (445 + 0.5Y) + 110 + 250 = 805 + 0.5Y.$$

In equilibrium, output equals demand, $Y = Z$, so

$$Y = 805 + 0.5Y \quad \Rightarrow \quad 0.5Y = 805 \quad \Rightarrow \quad Y = 1610.$$

Then

$$Y_D = Y - T = 1610 - 70 = 1540, \qquad C = 480 + 0.5Y_D = 480 + 0.5 \cdot 1540 = 1250.$$

Method 2: Solve for disposable income Y_D first

Goods market equilibrium implies

$$Y = C + I + G = (480 + 0.5Y_D) + 110 + 250 = 840 + 0.5Y_D.$$

Also,

$$Y_D = Y - T = Y - 70 \quad \Rightarrow \quad Y = Y_D + 70.$$

Substitute:

$$Y_D + 70 = 840 + 0.5Y_D \quad \Rightarrow \quad 0.5Y_D = 770 \quad \Rightarrow \quad Y_D = 1540.$$

Thus

$$Y = Y_D + 70 = 1610, \qquad C = 480 + 0.5Y_D = 1250.$$

Question 2 (Chapter 3, Q3)

Problem

Consider an economy described by the following behavioural equations (in billions of euros):

$$C = 480 + 0.5Y_D,$$
$$I = 110,$$
$$T = 70,$$
$$G = 250.$$

(a) Solve for equilibrium output. Compute total demand. Explain how it affects production.

(b) Assume that government spending is now $G = 300$ (billion). Solve for equilibrium output, consumption, and disposable income. Why might the government decide to expand fiscal spending? Make a reasonable guess based on your results.

Solution

Disposable income is

$$Y_D = Y - T = Y - 70.$$

Substitute into the consumption function:

$$C = 480 + 0.5(Y - 70) = 480 + 0.5Y - 35 = 445 + 0.5Y.$$

(a) **Equilibrium with $G = 250$.**

Total demand is

$$Z = C + I + G = (44025 + 0.5Y) + 110 + 250 = 805 + 0.5Y.$$

Equilibrium requires $Y = Z$, hence

$$Y = 805 + 0.5Y \quad \Rightarrow \quad 0.5Y = 805 \quad \Rightarrow \quad Y = 1610.$$

At equilibrium, total demand equals output:

$$Z = 805 + 0.5(1610) = 1610.$$

If $Y < Z$, desired spending exceeds production, inventories fall, and firms raise production; if $Y > Z$, inventories rise, and firms cut production. These inventory adjustments push output toward $Y = 1610$.

(b) **Fiscal expansion to $G = 300$.**

Now total demand becomes

$$Z' = C + I + G' = (445 + 0.5Y) + 110 + 300 = 855 + 0.5Y.$$

Equilibrium is

$$Y = 855 + 0.5Y \quad \Rightarrow \quad 0.5Y = 855 \quad \Rightarrow \quad Y = 1710.$$

Then

$$Y_D = Y - 70 = 1710 - 70 = 1640, \qquad C = 480 + 0.5Y_D = 480 + 0.5 \cdot 1640 = 1300.$$

Here $\Delta G = 50$ raises equilibrium output by $\Delta Y = 100$, so the government spending multiplier (in this numerical example) is $\Delta Y/\Delta G = 2$. A plausible reason to expand fiscal spending is to increase aggregate demand and raise equilibrium output, which increases disposable income and consumption.

Question 3 (Chapter 3, Q4: The balanced budget multiplier)

Problem

For both political and macroeconomic reasons, governments are often reluctant to run budget deficits. Here, examine whether policy changes in G and T that maintain a balanced budget are macroeconomically neutral. Put another way, is it possible to affect output through changes in G and T so that the government budget remains balanced?

Start from

$$Y = \frac{1}{1 - c_1}\left[c_0 + \bar{I} + G - c_1 T\right].$$

(a) By how much does Y increase when G increases by one unit?

(b) By how much does Y decrease when T increases by one unit?

(c) Why are your answers to parts (a) and (b) different?

(d) Suppose that the economy starts with a balanced budget: $G = T$. If the increase in G is equal to the increase in T, then the budget remains in balance. Suppose that G and T increase by one unit each. Using your answers to (a) and (b), what is the change in equilibrium GDP? Are balanced budget changes in G and T macroeconomically neutral?

(e) How does the specific value of the propensity to consume affect your answer to part (d)? Why?

Solution

(a)
$$\frac{\partial Y}{\partial G} = \frac{1}{1 - c_1}.$$

(b)
$$\frac{\partial Y}{\partial T} = -\frac{c_1}{1 - c_1}.$$

(c) Taxes affect demand only through consumption (via disposable income), so only the fraction c_1 of a tax change feeds into demand, whereas G enters demand one-for-one.

(d) With $\Delta G = \Delta T = 1$,
$$\Delta Y = \frac{1}{1 - c_1} - \frac{c_1}{1 - c_1} = 1.$$
So balanced budget changes are not neutral: output rises by one unit.

(e) The balanced budget multiplier remains 1 for any $0 < c_1 < 1$; the separate effects of G and T depend on c_1, but in a balanced budget change they net out to 1.

Question 4 (Chapter 3, Q5: Automatic stabilizers)

Problem

In this chapter, the fiscal policy variables G and T are assumed independent of the level of income. In the real world, however, this is not the case: taxes typically depend on the level of income and so tend to be higher when income is higher. This question examines how this automatic response of taxes can help reduce the impact of changes in autonomous spending on output.

Consider the following behavioral equations:

$$C = c_0 + c_1 Y_D,$$
$$T = t_0 + t_1 Y,$$
$$Y_D = Y - T.$$

Government spending G and investment I are both constant. Assume that $0 < t_1 < 1$.

(a) Solve for equilibrium output.

(b) What is the multiplier in this model? Does the economy respond more to changes in autonomous spending when $t_1 = 0$ or when t_1 is positive? Explain.

(c) In this model, taxes increase automatically when income rises and fall automatically when income declines. How does this feature affect the response of output to changes in autonomous spending? Based on your answer, explain why fiscal policy in this case is referred to as an automatic stabilizer.

Solution

Since $T = t_0 + t_1 Y$, disposable income is

$$Y_D = Y - T = Y - (t_0 + t_1 Y) = (1 - t_1)Y - t_0.$$

Consumption becomes

$$C = c_0 + c_1 Y_D = c_0 + c_1 \big[(1 - t_1)Y - t_0\big] = (c_0 - c_1 t_0) + c_1(1 - t_1)Y.$$

(a) Equilibrium:

$$Y = C + I + G = (c_0 - c_1 t_0) + c_1(1 - t_1)Y + I + G.$$

So

$$\big[1 - c_1(1 - t_1)\big]Y = (c_0 - c_1 t_0) + I + G,$$
$$Y = \frac{(c_0 - c_1 t_0) + I + G}{1 - c_1(1 - t_1)}.$$

(b) The multiplier on autonomous spending is

$$\frac{1}{1 - c_1(1 - t_1)}.$$

If $t_1 = 0$, this reduces to $1/(1-c_1)$; if $t_1 > 0$, the denominator is larger, so the multiplier is smaller and the response is weaker.

(c) When income rises, taxes rise automatically, reducing disposable income and consumption; when income falls, taxes fall, cushioning disposable income and consumption. This dampens the impact of shocks on output, hence the term *automatic stabilizer*.