ECON 3123: Macroeconomic Theory I

Tutorial Note 2: Consumption and Goods Market

Teaching Assistant: Harlly Zhou

Decomposition of GDP

GDP is the sum of consumption, investment, government spending, net export, and inverntory investment, which we always ignored due to its relatively tiny size.

$$Y = C + I + G + NX, \quad \text{where } NX = EX - IM.$$

(1) Consumption (C) is the purchase of goods and services by consumers. It is the largest component of GDP.

(2) Investment (I) is the sum of nonresidential investment (*e.g.,* a new machine bought by firm) and residential investment (*e.g.,* purchase of a new house).

(3) Government sepnding (G) is the purchase of goods and services by different layers of government. Note that government transfer is not government spending.

(4) Exports (EX) are purchase of domestic goods by foreigners. Imports (IM) are purvchases of foreign goods by domestic consumers, firms and government. Net exports (NX) is the difference between exports and imports. It can be negative.

(5) Invertory investment is the difference betwee nproduction and purchases. It can be negative.

Exercise 1. *(1) Which of the following is not a category of consumption spending in the national income accounts?*

A. Consumer durables

B. Nondurable goods

C. Services

D. Housing purchases

(2) *In the expenditure approach to GDP, which of the following would be excluded from measurements of GDP?*

   A. *Government payments for goods produced by foreign firms*

   B. *Government payments for goods produced by firms owned by state or local governments*

   C. *Government payments for welfare*

   D. *All government payments are included in GDP.Housing purchases*

Consumption and Keynesian Cross

Consumption Function The main factor that determines consumption is **disposable income**, denoted by Y_D. It is the income that remains once consumers receive transfers from the government and pay their taxes:

$$Y_D = Y - T.$$

We assume that the consumption satisfies the following linear relation:

$$C = c_0 + c_1 Y_D = c_0 + c_1(Y - T).$$

This is a behvioral equation.

(a) The parameter c_0, autonomous consumption, captures the consumption when $Y_D = 0$: subsistence level of consumption, and effects of other factors.

(b) The parameter c_1, marginal propensity to consume (MPC), captures the effect an additional dollar of disposable income has on consumption.

Keynesian Cross Assume that investment value is exogenously given as

$$I = \bar{I},$$

and that $NX = 0$. The demand for goods is

$$\begin{aligned} Z &\equiv C + I + G + NX \\ &= C + \bar{I} + G \\ &= [c_0 + c_1(Y - T)] + \bar{I} + G \\ &= (c_0 + \bar{I} + G - c_1 T) + c_1 Y. \end{aligned} \tag{1}$$

Given **income** Y, people want to purchase Z amount of goods and services.

The supply for goods is the total production Y.

The equilibrium condition is

$$\text{Demand} \ = \ \text{Supply} \quad \Longleftrightarrow \quad Z = Y. \tag{2}$$

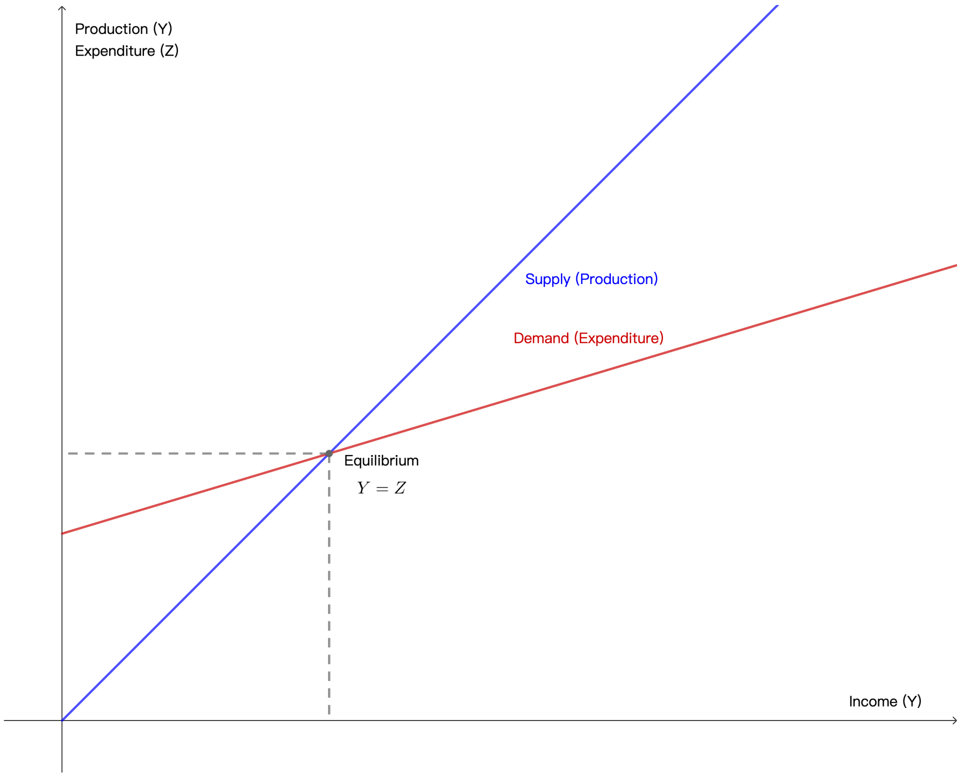

Figure 1: Goods Market Equilibrium, Keynesian Cross

Figure 1 graphically shows the equilibrium.

- On the supply side, given income Y, we always have income equal to production. So it is the blue 45 degree line.

- On the demand side, we assume that $c_0 + \bar{I} + G - c_1 T > 0$ and $c_1 > 0$. Since we typically have $c_1 < 1$ (why?), this ensures the existence of equilibrium.

Autonomous Spending and Multiplier Now consider increasing the autonomous consumption. This moves the demand line upward so that the equilibrium income and expenditure both increase. This is shown in Figure 2.

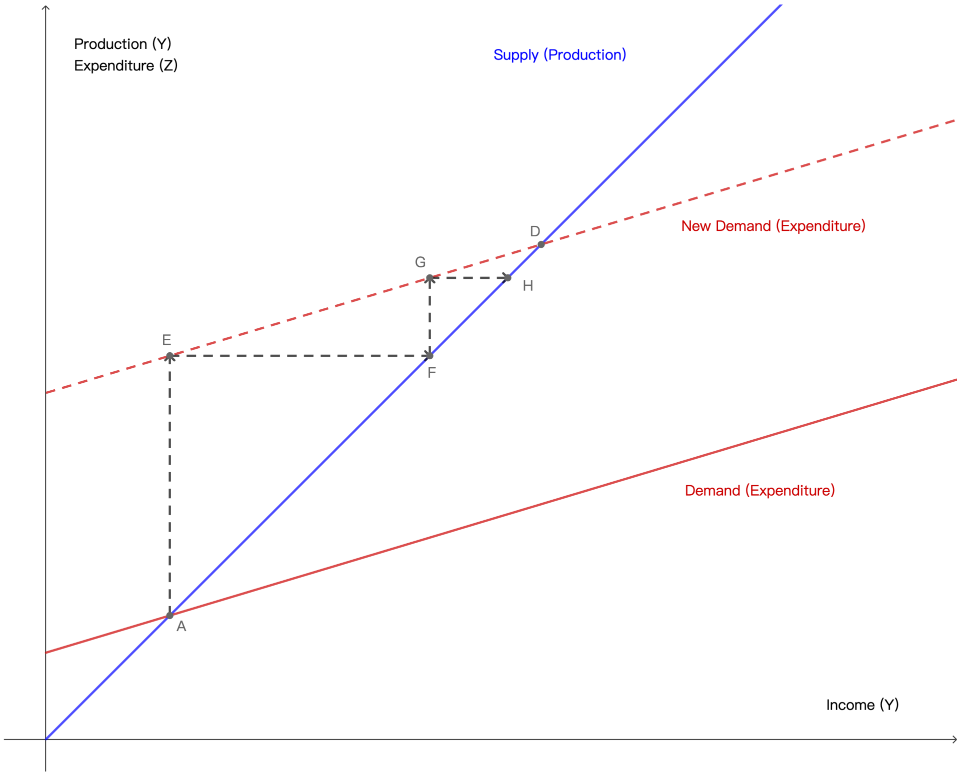

Figure 2: Increasing c_0 moves demand upward

We would like to know how equilibrium output change from point A to point D when c_0 increases to c_0'. This idea is captured by the concept of **multiplier**. The multiplier implies how much output will increase given a unit increase in autonomous spending.

Graphically, we can decompose the increase from A to D into multiple rounds. In the n-th round of increase, the output increases by c_1^{n-1} unit. Summing up all the rounds, we get a geometric series:

$$1 + c_1 + c_1^2 + \cdots + c_1^n + \cdots = \sum_{i=1}^{+\infty} c_1^{i-1} = \frac{1}{1 - c_1}.$$

Algebraically, substituting (1) into (2), we get

$$Y = (c_0 + \bar{I} + G - c_1 T) + c_1 Y.$$

This isequivalent to

$$Y = \frac{1}{1 - c_1}(c_0 + \bar{I} + G - c_1 T).$$

Holding other variables constant, if we inrease c_0 by 1 unit, then Y increases by $\frac{1}{1-c_1}$ units.

MPC and Multiplier Figure 3 illustrates the change of equilibrium with two different demand lines that differ only in c_1, the marginal propensity to consumption. We notice that given a same amount of increase in the autonomous spending, the increase of equilibrium output is larger for demand line 2 whose MPC is larger.

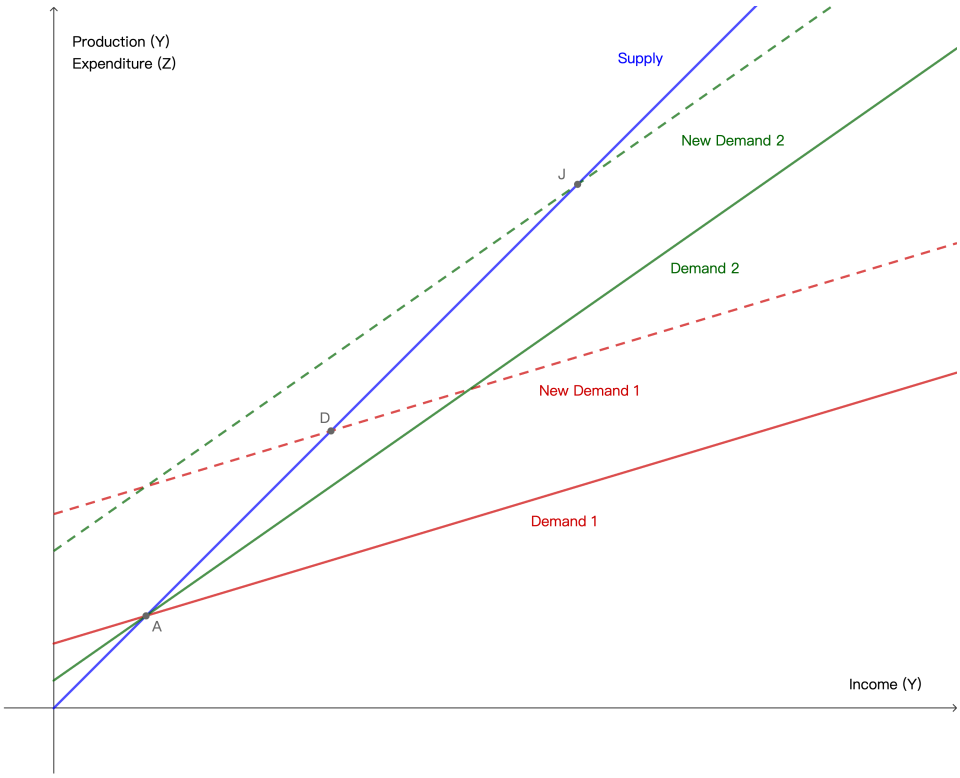

Figure 3: Increasing c_1 yields larger multiplier

Algebraically, when c_1 increases, $\frac{1}{1-c_1}$ also increases.

Exercise 2. *Chapter 3, Question 2 in Blanchard, Olivier (2021), Macroeconomics, 8th ed., Pearson.*

Example 1. *Chapter 3, Question 5 (a)(b) and Question 6 (b) in Blanchard, Olivier (2021), Macroeconomics, 8th ed., Pearson.*

[Words omitted.] Consider the following behavioral equations:

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

where G and I are constants. Assume that $t_1 \in (0, 1)$.

a. *Solve for the equilibrium output.*

b. *What is the multiplier? Does the economy respond more to changes in autonomous spending when $t_1 = 0$ or $t_1 > 0$? Explain.*

c. *Solve for taxes in equilibrium.*

Exercise 3. *Chapter 3, Question 5 (c) and Question 6 (c)(d) in Blanchard, Olivier (2021), Macroeconomics, 8th ed., Pearson.*

Savings

Private Saving and Public Saving **Private saving** equals disposable income minus consumption:

$$S = Y_D - C = Y - T - C. \tag{3}$$

Public saving equals taxes (net of transfers) minus government spending:

$$T - G$$

Goods Market Equilibrium and IS relation By (1) and (2), the equilibrium condition can be rewritten as

$$Y = C + I + G. \tag{4}$$

Rewriting the condition, we get

$$Y - T - C = I + G - T.$$

Note that that left-hand side (LHS) of the equation is private savings S. Rearranging the temrs, we get the IS relation:

$$I = S + (T - G),$$

Investment equals **S**avings. More specifically, IS relation implies that at goods market equilibrium, the amount that firms want to invest must equal the amount that people and the government want to save.

As we have just shown, we can alternatively think about goods-market equilibrium as the condition that investment equals savings.

The Paradox of Saving Substituting the consumption function into (3), we obtain

$$S = -c_0 + (1 - c_1)(Y - T).$$

$1 - c_1$ is called the **marginal propensity to save** (MPS).

What happens if we decrease saving by increasing c_0? You will deal with this in Problem Set.

Exercise 4. *When a person gets an increase in current income, what is likely to happen to consumption and saving?*

A. Consumption increases and saving increases.

B. Consumption increases and saving decreases.

C. Consumption decreases and saving increases.

D. Consumption decreases and saving decreases.

Example 2. *Consider an economy characterized by the following behavioral equations:*

$$C = c_0 + c_1 Y_D$$
$$Y_D = Y - T$$
$$T = t_1 Y + t_2 C$$

where $t_1, t_2 \in (0, 1)$. G and I are given. This is case when we tax both income and consumption. The economy is now at its equilibrium.

(1) Solve for the equilibrium output.

(2) What is the multiplier? Does this form of tax stabilizes output changes when there is a change in c_0, comparing with exogenous tax? Discuss cases where it does and it does not based on the equilibrium in part (1).

(3) Suppose that c_0 increases by 1 unit. In the new equibrlium, will consumption also increase by 1 unit? Discuss cases where it will and it will not based on the equilibrium in part (1).

(4) Write equilibrium saving as a function of Y.

(5) What is the MPS? Show that when c_0 increases by 1 unit, if $t_1 + t_2 = 1$, the new equilibrium saving will decrease by 1 unit.

Government and Fiscal Policy: Financial Stimulus

Recall that at equilibrium, we have

$$Y = Z = C + I + G \tag{5}$$
$$= \frac{1}{1 - c_1}(c_0 + \bar{I} + G - c_1 T), \tag{6}$$

where consumption satisfies the following behavioral equation:

$$C = c_0 + c_1(Y - T). \tag{7}$$

In the previous two examples, we have seen some ways to stabilize business cycles. Government can actually use financial stimulus to stabilize business cycle. Consider the following three alternatives:

(1) Increase government spending by 1 unit while holding other accounts constant.

If G increases by 1 unit, then Y increases by 1 unit via (5), so C increases by c_1 unit via (7). This takes effect again in the equilibrium condition, which lets Y increase by c_1 more unit via (5), thus C increase by $c_1 \times c_1 = c_1^2$ unit via (7). Continued with the process, we get the **spending multiplier**:

$$\frac{\Delta Y}{\Delta G} = \frac{\sum_{i=0}^{+\infty} c_1^i}{1} = \frac{1}{1 - c_1}.$$

(2) Decrease tax by 1 unit while holding other accounts constant.

If T decreases by 1 unit, then C increases by c_1 unit via (7), so that Y increases by c_1 unit via (5). This takes effect on C which lets C increase by $c_1 \times c_1 = c_1^2$ unit via (7) thus increasing Y by c_1^2 more unit via (5). Continuing with this process, we get the **tax multiplier**:

$$\frac{\Delta Y}{\Delta T} = \frac{\sum_{i=1}^{+\infty} c_1^i}{-1} = -\frac{c_1}{1 - c_1}.$$

(3) Increase both government spending and tax by 1 unit while holding other accounts constant.

This will give you the **balanced budget multiplier**. Try to derive this by yourself as a review of the class note.

Exercise 5. *In this exercise, we consider tax (T) and transfers (R) as two variables in the economy. Consider an economy characterized by the following behavioral equations:*

$$C = c_0 + c_1 Y_D$$

$$Y_D = Y - T + R$$

$$R = r_1 - r_2 Y.$$

G, T and I are constants. r_1, r_2 are between 0 and 1.

(1) Explain the intuition for the negative coefficient of Y in the transfer equation.

(2) Consider a balanced budget where G and T increases by 1 unit at the same time. What is the balanced budget multiplier?

(3) Can this economy be characterized by the following system of behavioral equations? Explain the correspondence between them.

$$\begin{aligned} C &= c_0 + c_1 Y_D \\ Y_D &= Y - T \\ T &= t_0 + t_1 Y. \end{aligned}$$