HE2002 Macroeconomics II
Lecture 1 The Goods Market

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1 Lecture Outline

- ▶ The Composition of GDP

- ▶ The Demand for Goods

- ▶ The Determination of Equilibrium Output

- ▶ Investment Equals Saving: An Alternative Way of Thinking about Goods-Market Equilibrium

Lecture 1 to 4

- ▶ Investigate how the **goods** and **money** markets move in the **short run** (**IS**-**LM**).

- ▶ Using the theoretical framework, we study what can be done by a **fiscal authority** and a **central bank** to **stabilize** macroeconomic **fluctuations**.
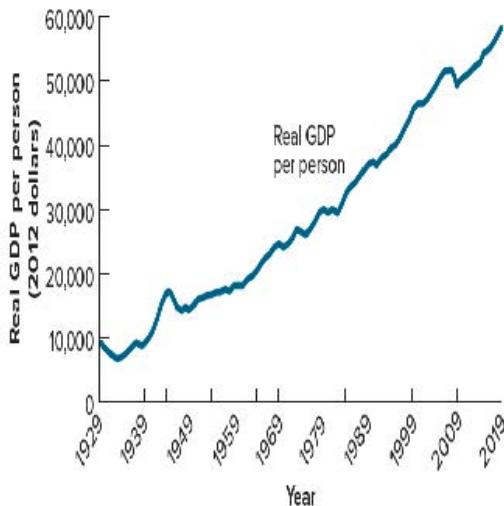
Recap of HE1002

- What are the major macroeconomic issues?

    - Economic Growth and Living Standards

    - Productivity

    - Recessions and Expansions

    - Unemployment

    - Inflation

    - Economic Inter-dependence among Nations

Recap of HE1002

- What do macroeconomics polices do?
    - Promoting Long Run Economic Growth
    - Managing short run economic fluctuation
        - shorten and reduce the severity of recession
        - prevent overheating of economy to avoid increase in inflation

Recap of HE1002

- Cyclical ups and downs - Recessions and expansions

Recap of HE1002

- ▶ How do we measure the size of Singapore's economy?

  - GDP

- ▶ From the theories we have learned in HE1002, Which one determines the output in the short run, supply or demand?

  - Demand

2 The Goods Market

- ▶ When economists think about year-to-year movements in economic activity, they focus on the interactions among **demand**, **production**, and **income**

  - ▶ Changes in the demand for goods lead to changes in production

  - ▶ Changes in production lead to changes in income

  - ▶ Changes in income lead to changes in the demand for goods

We have learned measuring GDP using output method, expenditure method and income method in HE1002.

3 The Composition of GDP

Let's think about the **expenditure method** for measuring GDP learned in HE1002.

- **Consumption** (C): goods and services purchased by consumers

- **Investment** (I) or fixed investment: the sum of nonresidential investment and residential investment

- **Government spending** (G): purchases of goods and services by the federal, state, and local governments; excluding government transfers

4 The Composition of GDP

- **Exports** (X): purchases of goods and services by foreigners

- **Imports** (IM): purchases of foreign goods and services by domestic consumers, firms and the government

- **Net exports** or **trade balance**: $X - IM$

    $NX > 0 \Leftrightarrow \text{Exports}(X) > \text{Imports}(IM) \Leftrightarrow \text{trade surplus}$

    $NX < 0 \Leftrightarrow \text{Imports}(IM) > \text{Exports}(X) \Leftrightarrow \text{trade deficit}$

- Inventory investment: difference between production and sales

    Note: Unlike in HE1002, we ignore inventory in the models discussed in HE2002 and HE3002.

5 The Composition of U.S. GDP, 2018

		Billions of Dollars	Percent of GDP
	GDP (Y)	20,500	100.0
1	Consumption (C)	13,951	68.0
2	Investment (I)	3,595	17.5
	Nonresidential	2,800	13.6
	Residential	795	3.8
3	Government spending (G)	3,522	17.2
4	Net exports	−625	−3.0
	Exports (X)	2,550	12.4
	Imports (IM)	−3,156	−15.4
5	Inventory investment	56	0.2

6 The Demand for Goods

$$Z \equiv C + I + G + X - IM$$

▶ The above **identity** defines the total demand for goods (Z) as consumption, plus investment, plus government, plus export, minus imports.

▶ In a closed economy ($X = IM = 0$):

$$Z \equiv C + I + G$$

Note: We will focus on the closed economy models in HE2002 and the open economy models in HE3002.

7 Consumption Function

▶ Consumption (C) is a function of **disposable income** (Y_D), which is the income that remains once consumers have received government transfers and paid their taxes.

$$C = C(Y_D) \qquad (1.1)$$
$$(+)$$

▶ $C(Y_D)$ is called the **consumption function**.

- A function is a mathematical expression that defines a relationship between two (or more) variables

Note: This is a behavioral equation that captures the behavior of consumers.

8 Linear Consumption Function

- Assume that the consumption function is a **linear relation** with two **parameters**, c_0 and c_1:

$$C = c_0 + c_1 Y_D \qquad (1.2)$$

- c_1 is the **propensity to consume**.

- c_0 is what people would consume if their disposable income equals zero.

- Changes in c_0 reflect changes in consumption for a given level of disposable income.

9 Consumption and Disposable Income

► Consumption increases with disposable income but less than one for one.
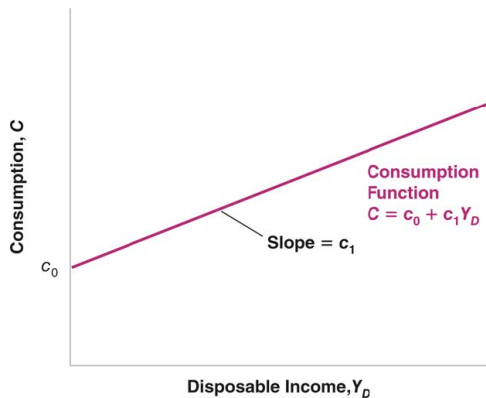
10 Disposable Income

► Disposable income is:

$$Y_D \equiv Y - T$$

where Y is income and T is taxes minus government transfers.

► Replacing Y_D in equation (1.2) gives:

$$C = c_0 + c_1(Y - T) \qquad (1.3)$$

11 Endogenous vs. Exogenous Variables

▶ **Endogenous variables**: variables depend on other variables in the model

▶ **Exogenous variables**: variables not explained within the model but are instead taken as given

$$I = \bar{I} \qquad (1.4)$$

Note: A bar on investment means investment is taken as given. This is an assumption we make in Lecture 1 to focus on studying about the consumption. It will be relaxed after Lecture 2. In fact, investment depends on production Y and interest rate.

12 Fiscal Policy

- T and G describe **fiscal policy** - the choice of taxes and spending by the government.

- G and T are **exogenous** because:
    - We treat G and T as variables chosen by the government and will not try to explain them within the model introduced here.

Sample Question 1 (vevox ID: 160-811-139)

Which of the following is an **endogenous** variable in our model of the goods market in Lecture 1?

- ▶ A) consumption (C)
- ▶ B) disposable income (Y_D)
- ▶ C) saving (S)
- ▶ D) total income (Y)
- ▶ E) all of these

Why Saving is an Endogenous Variable?

S represents the private saving. By definition, it is $Y - T - C$. People use their disposable income for consumption and saving, so $S \equiv Y - T - C$ is an identity. Investment equals saving ($I = S + (T - G)$) is an equilibrium condition that must hold in equilibrium. Y is endogenous and C is endogenous, then you understand $S \equiv Y - T - C$ is an endogenous variable.

In this model, the endogenous variable S depends on the exogenous variables $\bar{I}, G$ and T in the equilibrium. It means once we know the values of $\bar{I}, G$ and T, we will know the equilibrium value of private saving (S). We also solve for Y in equilibrium and it is written as a function of the exogenous variables: $Y = \frac{1}{1-c_1}[c_0 + \bar{I} + G - c_1 T]$.

In fact, investment depends on production Y and the interest rate. Assumption $I = \bar{I}$ will be relaxed after Lecture 2.

13 The Determination of Equilibrium Output

- Assume $X = IM = 0$, so

$$Z \equiv C + I + G$$

- Replacing C and $I = \bar{I}$ from equations (1.3) and (1.4):

$$Z = c_0 + c_1(Y - T) + \bar{I} + G \qquad (1.5)$$

- **Equilibrium in the goods markets** requires

$$Y = Z \qquad (1.6)$$

- This is an **equilibrium condition**. Y is **output** and Z is **demand**.

14 The Equilibrium Condition

▶ Replacing Z in (1.6) by equation (1.5) gives

$$Y = c_0 + c_1(Y - T) + \bar{I} + G \qquad (1.7)$$

▶ In equilibrium, production (Y) is equal to demand (Z), which in turn depends on income (Y), which is itself equal to production.

Note: The statement above holds in a closed economy framework if we ignore the inventory.

15 Characterizing Equilibrium Output in Algebra

- Rewrite equation (1.7):

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

- Reorganize the equation:

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

- Divide both sides by $(1 - c_1)$:

$$Y = \frac{1}{1 - c_1}[c_0 + \bar{I} + G - c_1 T] \qquad (1.8)$$

which characterizes equilibrium output in algebra.

16 Autonomous Spending

- **Autonomous spending**: $[c_0 + \bar{I} + G - c_1 T]$

- It is the part of spending not dependent on output.

- Autonomous spending is positive because if $T = G$ (**balanced budget**) and c_1 is between 0 and 1, then $(G - c_1 T)$ is positive, and so is autonomous spending.

17 The Multiplier

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

► The term $\frac{1}{1-c_1}$ is the **multiplier**, which is larger when c_1 is closer to 1.

► It measures the overall impact on a country's income or output resulting from a change in autonomous spending.

► The multiplier effect captures the cumulative impact of these successive rounds of spending.

Note: The multiplier here is the expenditure multiplier in HE1002. Tax multiplier $\frac{-c_1}{1-c_1}$ is different.

18 The Multiplier - A Numerical Example

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

► If c_1 equals 0.6, the multiplier equals $1/(1 - 0.6) = 2.5$, meaning that an increase of consumption c_0 by \$1 billion will increase output Y by 2.5 x \$1 billion = \$2.5 billion.

# 19 Characterizing Equilibrium Output Graphically

Steps:

- ▶ 1. Plot production as a function of income. Because production equals income, their relation is the 45-degree line. ($Y = Y$)

- ▶ 2. Plot demand as a function of income.

$$Z = (c_0 + \bar{I} + G - c_1 T) + c_1 Y \qquad (1.9)$$
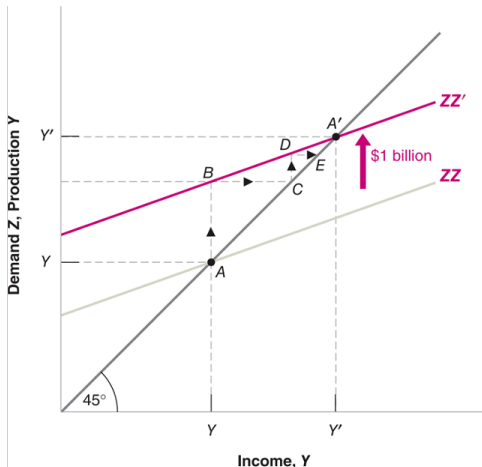
- ▶ 3. In equilibrium, production equals demand.

20 Equilibrium in the Goods Market

▶ Equilibrium output is determined by the condition that production is equal to demand.
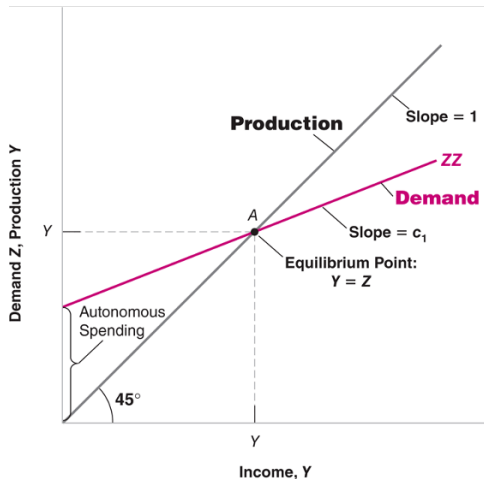
21 An Increase in Autonomous Spending

▶ An increase in autonomous spending has a more than one-for-one effect on equilibrium output.

22 The Cumulative Impact of Successive Rounds of Spending

- AB: first-round increase in production

- BC: first-round increase in income

- CD: second-round increase in demand

- DE: second-round increase in production and income

- The total increase in production after n+1 rounds:

$$1 + c_1 + c_1^2 + ... + c_1^n$$

which is a **geometric series** with a limit of $\frac{1}{1-c_1}$.

23 The Autonomous Expenditure Multiplier

- Specifically, when autonomous spending (A) increases by \$1 billion, Y increases by $1/(1 - c_1) \times$ \$1 billion.

- This can be seen from $\Delta Y = \frac{1}{1-c_1}\Delta A$

  where $\frac{1}{1-c_1}$ is the autonomous expenditure multiplier.

- Graphically, this is shown by an upward shift in Z by \$1 billion.

- The increase in output is larger than the initial shift in demand, by a factor equal to the multiplier. The multiplier depends on the propensity to consume.

24 Effects of An Increase in Tax

- Suppose T increases by \$1 billion, the effect on equilibrium output depends on the value of c_1.

- Specifically, when T **increases** by \$1 billion, Y **decreases** by $c_1/(1 - c_1) \times$ \$1 billion.

- This can be seen from:

$$\Delta Y = -\frac{c_1}{1 - c_1} \Delta T$$

  where $\frac{-c_1}{1 - c_1}$ is the tax multiplier.

- Graphically, this is shown by a downward shift in Z by \$ c_1 billion. $(Z = (c_0 + \bar{I} + G - c_1 T) + c_1 Y)$

Sample Question 2 (vevox ID: 160-811-139)

Suppose the consumption equation is represented by the following:
$C = 250 + 0.75Y_D$. Now assume government spending increases
by 100 for the above economy. Given the above information, we
know that equilibrium output will increase by

- ▶ A) 200.
- ▶ B) 400.
- ▶ C) 800.
- ▶ D) 1000.
- ▶ E) none of these

25 Investment Equals Saving: An Alternative Way of Thinking about Goods Market Equilibrium

- John Maynard Keynes articulated an alternative model that focuses instead on investment and saving in 1936. (Think about the Keynesian Model learned in HE1002)

- **Private saving** (S) is

$$S \equiv Y_D - C, \qquad S \equiv Y - T - C$$

- By definition, **public saving** $= T - G$.

- Public saving $> 0 \Leftrightarrow$ **Budget surplus**

- Public saving $< 0 \Leftrightarrow$ **Budget deficit**

26 IS Relation

- In equilibrium:

$$Y = C + I + G$$

- Subtract T from both sides and move C to the left side:

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

- The left side of the equation is simply S, so

$$S = I + G - T$$

- Or equivalently

$$I = S + (T - G) \qquad (1.10)$$

- This is the **IS relation**, which stands for "**I**nvestment equals **S**aving".

27 Private Saving, Public Saving, and National Saving

- Note that $(Y - T - C)$ is the private saving and $(T - G)$ is the public saving. The sum of private and public savings is national saving.

- We have

$$\text{Private Saving} = I - \text{Public Saving}$$

- And hence

$$I = \text{Private Saving} + \text{Public Saving}$$

$$I = \text{National Saving}$$

28 Two Equivalent Ways of Stating Goods Market Equilibrium

Production = Demand

$$Y = Z$$

Investment = Saving

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

29 Deriving Equilibrium Output with Investment Equals Saving

- We can derive equation (1.8) using equation (1.10)

- Consumption behavior implies that:

$$S = Y - T - C = Y - T - c_0 - c_1(Y - T)$$

- Rearranging terms, so

$$S = -c_0 + (1 - c_1)(Y - T) \qquad (1.11)$$

- $(1 - c_1)$ is called the **propensity to save**, which is between 0 and 1.

30 Deriving Equilibrium Output with Investment Equals Saving

▶ In equilibrium, $I = S + (T - G)$, so that equation (1.10) becomes:

$$I = -c_0 + (1 - c_1)(Y - T) + (T - G)$$

▶ Solve for output:

$$Y = \frac{1}{1 - c_1}[c_0 + \bar{I} + G - c_1 T] \qquad (1.12)$$

which is the same as equation (1.8)

Sample Question 3 (vevox ID: 160-811-139)

Which of the following events will cause a reduction in equilibrium output?

- ► A) an increase in the marginal propensity to save
- ► B) an increase in taxes
- ► C) a reduction in the marginal propensity to consume
- ► D) all of these
- ► E) none of these

Sample Question 4

Suppose the United States economy is represented by the following equations:

$$Z = C + I + G, \ C = 500 + 0.5Y_D, T = 600, \ I = 300$$

$$Y_D = Y - T, \ G = 2000$$

▶ A) Given the above variables, calculate the equilibrium level of output.

▶ B) Now, assume that consumer confidence decreases causing a reduction in autonomous consumption (c_0) from 500 to 400. What is the new equilibrium level of output? How much does income change as a result of this event? What is the multiplier for this economy?

▶ C) Graphically illustrate the effects of this change in autonomous consumption on the demand line (ZZ) and Y. Clearly indicate in your graph the initial and final equilibrium levels of output.

Sample Question 4

31 Exit Ticket (vevox ID: 156-039-274)

- One idea you learned today that was surprising or interesting to you.

- Are there topics you wish had been covered in more detail, or questions you feel are unanswered?

- **Any questions?**

  You can find me at guangzhi.ye@ntu.edu.sg or by scheduling an in-person meeting through https://calendly.com/guangzhiye24.