Principles of Macroeconomics: GDP and Expenditure

Class 16

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Overview

- ▶ Announcements:
  - Deep breath, carry on
  - LC 11, GH 11 due Friday at 11:59pm
- ▶ Topics:
  - Expenditure and GDP
  - The Multiplier
- ▶ Readings:
  - Chapter 11, chapter 12.1-12.2

Recall from Tuesday:

- Consumption: $C = A + MPC \times Y^D$, where $Y^D = GDP$
- Investment: $I = I_{planned} + I_{unplanned}$
- Planned expenditure: $AE_{planned} = C + I_{planned}$
- GDP: $GDP = C + I = AE_{planned} + I_{unplanned}$

Income-Expenditure Equilibrium
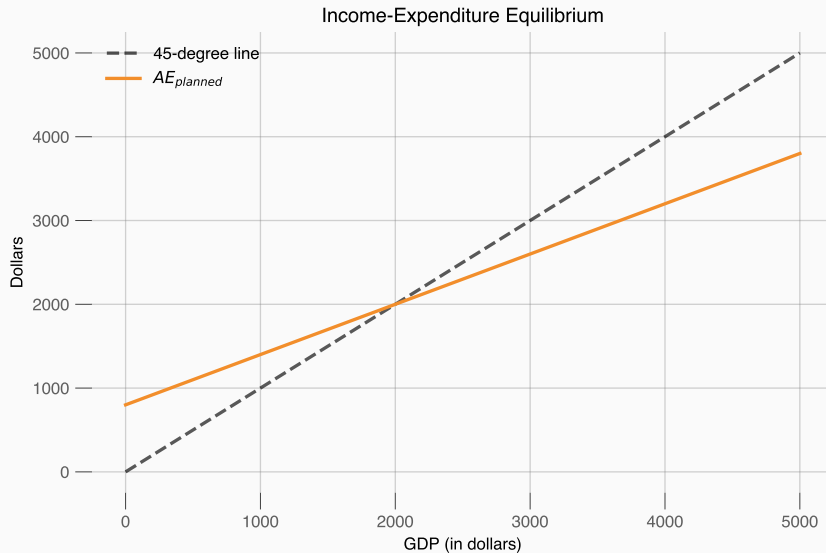
Dynamic Adjustment

Recall, if $GDP > AE_{planned}$, then $I_{unplanned} > 0$

- ▶ Inventory rising $\longrightarrow$ firms cut production
- ▶ Firms cutting production lowers GDP and income
- ▶ Economy slides down the $AE_{planned}$ curve as C falls (why does C fall?)
- ▶ Output settles at equilibrium

Or, if $GDP < AE_{planned}$, then $I_{unplanned} < 0$

- ▶ Inventory falling $\longrightarrow$ firms increase production
- ▶ Increasing production raises GDP and income
- ▶ Economy slides up the $AE_{planned}$ curve as C increases (why does C rise?)
- ▶ Output settles at equilibrium
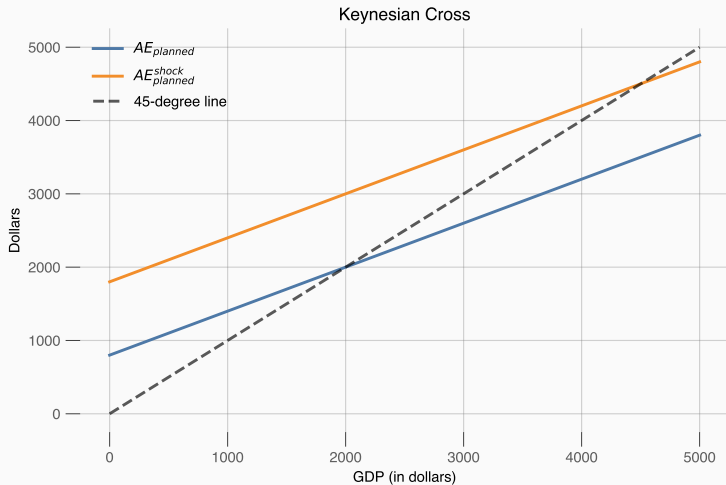
What happens if $AE_{planned}$ increases?

- ▶ Example: consumers are more optimistic about the future and raise their income (A increases)
- ▶ Example: interest rates fall, planned investment increases

Then we shift the $AE_{planned}$ curve up

- ▶ Given initial GDP, then $GDP < AE_{planned}$, so $I_{unplanned} < 0$
- ▶ Then firms expand production $\longrightarrow GDP \uparrow$, $C \uparrow$
- ▶ Slide up the $AE_{planned}$ curve
- ▶ GDP rises next period

Suppose that $A = 300$, $MPC = 0.6$, and $I_{planned} = 500$. Suppose a shock increases A by \$1000.

Keynesian Cross

Legend:
- $AE_{planned}$
- $AE_{planned}^{shock}$
- 45-degree line

x-axis: GDP (in dollars)
y-axis: Dollars

The Multiplier

- Remember, in equilibrium: $GDP = AE_{planned}$. After manipulation, we got:
  $GDP = \frac{A + I_{planned}}{1 - MPC}$

- How much does GDP rise when we increase A?
  - $\frac{dGDP}{d(A + I_{planned})} = \frac{1}{1 - MPC}$, known as the multiplier
  - If $MPC < 1$, then the multiplier is > 1. For example, if the $MPC = 0.5$, then the multiplier is 2.
  - GDP rises more than one-for-one with changes in autonomous aggregate spending

▶ Let's think about the multiplier. Start with this equation:

$$GDP = A + MPC \times GDP + I_{planned}$$

- If A increases by \$1, then GDP rises by \$1. This is the direct effect of the shock
- C depends on GDP though, so C also rises by $\$1 \times MPC$. This is a feedback effect
- But GDP depends on C... etc, etc.

▶ Conclusion: GDP will rise by more than \$1

An Example

Notre Dame hosts a student movie night and orders pizza.

(1) Notre Dame pays the pizza place $1000

(2) Suppose the pizza shop owner saves $400 and spends $600 on a roundtrip flight to LA
   - What is the owner's MPC? 0.6
   - What is the gain to GDP? $1000 \times 0.6 = $600

(3) Now the airline pays their 6 employees a portion of the $600, say $100 each. Each of them go to the gas station and buy $35 worth of gas and save the rest.
   - What are the employees' MPCs? 0.35
   - How much additional GDP? $1000 \times 0.6 \times 0.35 = $210

So total GDP is $1000 + $600 + $210 + ...

▶ For simplicity, let's assume that the MPCs at each layer are the same. Then we would have:

$$GDP = \left[1 + MPC + MPC^2 + MPC^3 + ...\right] (A + I_{planned})$$
$$= (A + I_{planned}) + MPC \times (A + I_{planned}) + MPC^2 \times (A + I_{planned}) + \cdots$$

▶ If $MPC < 1$, then this is a geometric series and we get:

$$GDP = \frac{A + I_{planned}}{1 - MPC}$$

▶ With government spending, GDP becomes:

$$GDP = C + I + G$$

▶ We can work with this equation:

$$GDP = A + MPC \times GDP + I_{planned} + G + I_{unplanned}$$

▶ Imposing equilibrium ($I_{unplanned} = 0$), we get:

$$GDP = \frac{A + I_{planned} + G}{1 - MPC}$$

- If the government increases G by \$1, GDP then increases by $\frac{1}{1-MPC} > 1$
- This math implies that the government should spend additional funds to boost the economy
- But then why is there such a debate over government spending?
  - Particularly in the wake of the Great Recession – it was not obvious to many that fiscal stimulus was helpful
- Two main ideas:
  - Fiscal policy has supply-side effects we have not talked about
  - Fiscal policy interacts with monetary policy – the Fed may increase the interest rate if government spending increases inflation, which will push down $I_{planned}$

Practice Problem

Suppose that $A = 400$, $MPC = 0.75$, $I_{planned} = 500$, and $G = 200$.

(a) Write the algebraic expression for $AE_{planned}$ with and without government

(b) Compute equilibrium GDP with and without government

(c) Suppose that households become more optimistic about their income in the future. Which parameter does this change? If that parameter increases by 25%, compute the increase in GDP

(d) Suppose that GDP is 200 above $AE_{planned}$. What does this imply for $I_{unplanned}$? How will production change?

(e) Monetary policy tightens (the interest rate increases). What happens to $I_{planned}$? If $I_{planned}$ changes by 80, what is the new GDP level?

(f) Sketch the Keynesian cross with $AE_{planned}$ before the government, with government, and post the household optimism shock. Label everything.

(a) No government: $AE_{planned} = A + MPC \times GDP + I_{planned}$. Without government:
$AE_{planned} = A + MPC \times GDP + I_{planned} + G$.

(b) The multiplier is: $\frac{1}{1-0.75} = 4$. Without government: $GDP = 4 \times (400 + 500) = 3600$. With government: $GDP = 4 \times (400 + 500 + 200) = 4400$.

(c) A will increase by 100. Then: $GDP_1 = 4400 + (4 \times 100) = 4800$

(d) $I_{unplanned} > 0$. Production will fall as firms cut how much inventory they need in the future.

(e) $I_{planned}$ will fall by 80. Then: $GDP = 4 \times (400 + 200 + 420) = 4080$

(f) Draw the standard Keynesian Cross diagram. The initial equilibrium will be at $GDP = 3600$. We then shift the curve up (no change in slope) so that the new equilibrium will be $GDP = 4400$. Lastly, we shift the curve up again (no change in slope) to a final equilibrium of $GDP = 4800$.

Summary

- The Keynesian Cross with Shocks
- The Multiplier

- Remember: homework due Friday night
- Read chapter 12.1-12.2