

The IS Curve

This lecture describes the relationship between aggregate output and the real interest rate when the goods market is in equilibrium.

Aggregate Demand: The Basics

A. Aggregate demand is the total amount of output demanded in the economy for a given inflation rate. This measure captures the amount of planned expenditures (as opposed to actual expenditures) in the economy.

B. Aggregate demand is the sum of four types of spending. The resulting equation is called the income identity

$$Y = C + I + G + NX. \quad (1)$$

1. Consumption expenditures (C) is the total demand for consumer goods and services (except housing).
2. Planned investment spending (I) is total planned investment spending on physical capital and inventories by businesses plus planned investment on new housing by consumers.
3. Government purchases (G) is the total spending on government consumption and government investment by all levels of government.
4. Net exports (NX) is the net foreign spending on domestic goods and services defined as exports minus imports.

The Components of Aggregate Demand: The Details

A. Consumption Expenditures

1. Consumption is positively related to disposable income (Y^D), where disposable income is aggregate income (Y) minus taxes (T)

$$Y^D = Y - T. \quad (2)$$

2. The consumption function defines the positive relationship between consumption and disposable income

$$C = \bar{C} + MPC \times (Y - T). \quad (3)$$

- a. Autonomous consumption ($\bar{C} > 0$) represents all of the factors other than Y^D that affects C . (Ex., wealth)
- b. The marginal propensity to consume ($0 \leq MPC < 1$) reflects the change in consumption from an additional dollar of disposable income.

B. Planned Investment Spending

1. Types of investment

- a. Fixed investment includes capital investment by firms and residential investment by households.
- b. Inventory investment is the change in inventory holdings by firms. (Inventory investment = this year's inventories – last year's inventories.)

2. Planned investment spending is negatively related to the real interest rate (r).

- a. A higher real interest rate raises borrowing costs, which discourages firms from investing.
- b. Even if a firm self-finances its investment, it must forgo the real interest rate it would have earned on bonds.

3. The investment function

$$I = \bar{I} - d \times (r + \bar{f}). \quad (4)$$

- a. The parameter $d > 0$ represents the responsiveness of investment to the real interest rate.
- b. Financial frictions ($\bar{f} > 0$) represent the costs associated with barriers that keep financial markets from functioning efficiently. (Ex., A rise in asymmetric information problems is denoted by a higher \bar{f} .)
- c. Autonomous investment ($\bar{I} > 0$) represents all of the factors besides financial frictions and the real interest rate that affect investment. (Ex., Business expectations)

C. Government purchases and taxes

1. Government purchases are independent of Y and r

$$G = \bar{G}. \quad (5)$$

2. The government imposes lump-sum taxes on households

$$T = \bar{T}. \quad (6)$$

D. Net Exports

1. Net exports decline as the real interest rate rises because a higher real interest rate drives up the value of the domestic currency. That higher value raises export prices and decreases import prices, which causes net exports to fall.

2. The net exports function

$$NX = \bar{NX} - x \times r. \quad (7)$$

- a. The parameter $x > 0$ represents the responsiveness of net exports to the real interest rate.
- b. Autonomous net exports (\bar{NX}) represents all the factors other than the real interest rate that affect net exports. (Ex., Foreign income, trade restrictions)

Goods Market Equilibrium

A. Solving for the Goods Market Equilibrium

1. Start with the income identity (1)

$$Y = C + I + G + NX. \quad (8)$$

2. Substitute the equations for consumption (3), investment (4), government spending (5), taxes (6) and net exports (7) into the income identity.

$$Y = \bar{C} + MPC \times (Y - \bar{T}) + \bar{I} - d \times (r + \bar{f}) + \bar{G} + \bar{NX} - x \times r. \quad (9)$$

3. Solve for Y

$$Y = \bar{C} + MPC \times (Y - \bar{T}) + \bar{I} - d \times (r + \bar{f}) + \bar{G} + \bar{NX} - x \times r$$

$$Y = \bar{C} + \bar{I} + \bar{G} + \bar{NX} - d \times \bar{f} - MPC \times \bar{T} + MPC \times Y - (d + x) \times r$$

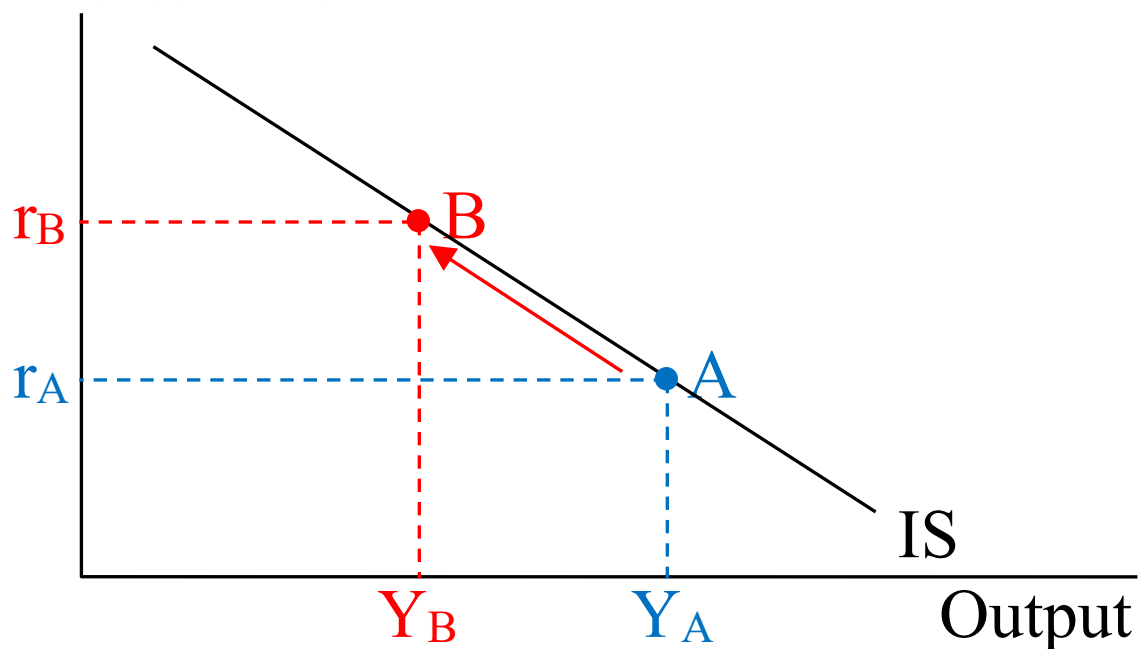
$$Y \times (1 - MPC) = \bar{C} + \bar{I} + \bar{G} + \bar{NX} - d \times \bar{f} - MPC \times \bar{T} - (d + x) \times r$$

$$Y = \frac{\bar{C} + \bar{I} + \bar{G} + \bar{NX} - d \times \bar{f} - MPC \times \bar{T}}{1 - MPC} - \frac{d + x}{1 - MPC} \times r. \quad (10)$$

B. Deriving the IS curve

1. The IS curve shows the relationship between aggregate output and the real interest rate when the goods market is in equilibrium.
2. The IS curve is downward sloping because a higher real interest rate reduces investment and net exports, which pushes down output. [$r \uparrow \rightarrow (I \downarrow \ \& \ NX \downarrow) \rightarrow Y \downarrow$]

Real interest rate



C. Example: Suppose the economy is described by the following information:

$$Y = C + I + \bar{G} + NX$$

$$C = \bar{C} + MPC \times (Y - \bar{T})$$

$$I = \bar{I} - d \times (r + \bar{f})$$

$$NX = \bar{NX} - x \times r.$$

Let $\bar{C} = 1.4$, $\bar{I} = 1.2$, $\bar{G} = 3.0$, $\bar{NX} = 1.3$, $\bar{T} = 3.0$,
 $MPC = 0.6$, $d = 3$, $x = 1$, $\bar{f} = 0.1$, and $r = 0.10$.

1. Derive the equation for the IS curve

$$Y = \bar{C} + \text{MPC} \times (Y - \bar{T}) + \bar{I} - d \times (r + \bar{f}) + \bar{G} + \bar{NX} - x \times r$$

$$Y = 1.4 + 0.6 \times (Y - 3.0) + 1.2 - 3 \times (r + 0.1) + 3.0 + 1.3 - 1 \times r$$

$$Y = [1.4 - 1.8 + 1.2 - 0.3 + 3.0 + 1.3] + 0.6 \times Y - (3+1) \times r$$

$$Y - 0.6 \times Y = 4.8 - 4 \times r$$

$$0.4 \times Y = 4.8 - 4 \times r$$

$$Y = 4.8/0.4 - (4/0.4) \times r$$

$$Y = 12 - 10 \times r$$

2. Calculate output

$$Y = 12 - 10 \times r$$

$$Y = 12 - 10 \times 0.10$$

$$Y = 12 - 1$$

$$Y = 11$$

3. Calculate consumption

$$C = \bar{C} + \text{MPC} \times (Y - \bar{T})$$

$$C = 1.4 + 0.6 \times (11 - 3)$$

$$C = 1.4 + 4.8$$

$$C = 6.2$$

4. Calculate investment

$$I = \bar{I} - d \times (r + \bar{f})$$

$$I = 1.2 - 3 \times (0.10 + 0.1)$$

$$I = 1.2 - 0.6$$

$$I = 0.6$$

5. Calculate net exports

$$\text{NX} = \bar{\text{NX}} - x \times r$$

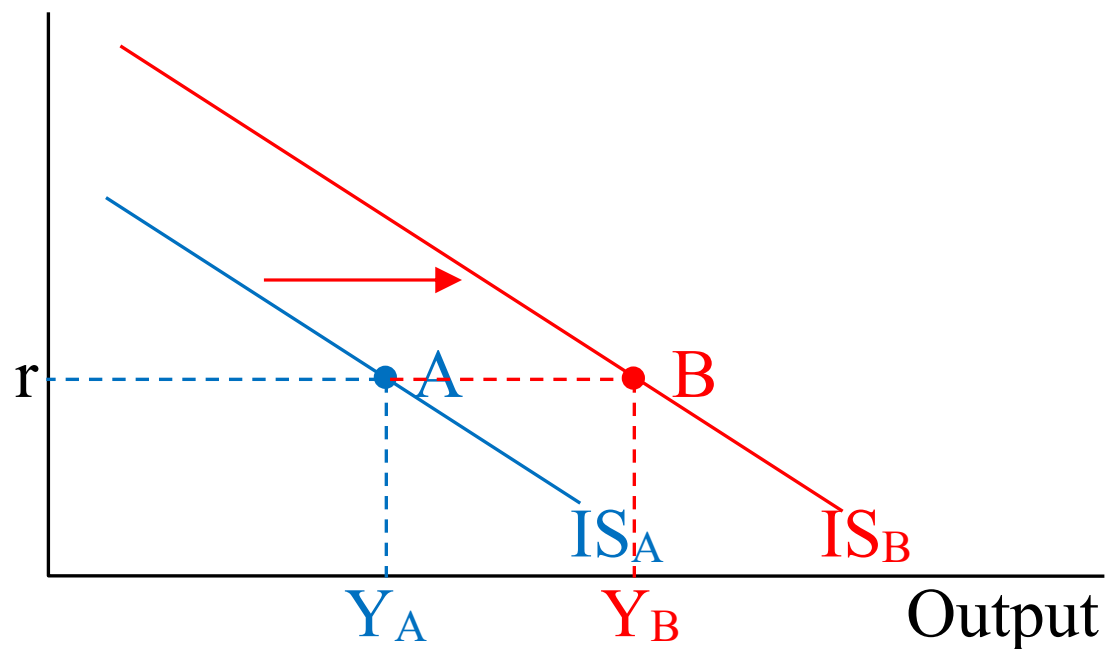
$$\text{NX} = 1.3 - 1 \times 0.10$$

$$\text{NX} = 1.2$$

Shifting the IS Curve

- A. An increase in output in the goods market shifts the IS curve to the right.

Real interest rate



B. Several factors increase output and shift the IS curve to the right.

1. An increase in autonomous consumption (\bar{C})

a. Higher wealth or improved expectations for the economy

b. $\bar{C} \uparrow \rightarrow Y \uparrow$

2. An increase in autonomous investment (\bar{I})

a. Improved expectations for the economy

b. $\bar{I} \uparrow \rightarrow Y \uparrow$

3. An increase in government spending (\bar{G})

a. Government spending is set exogenously by the government.

b. $\bar{G} \uparrow \rightarrow Y \uparrow$

4. A decrease in taxes (\bar{T})

a. Taxes are set exogenously by the government.

b. $T \downarrow \rightarrow Y^D \uparrow \rightarrow C \uparrow \rightarrow Y \uparrow$

5. An increase in autonomous net exports (\bar{NX})

a. An increase in foreign income

b. $\bar{NX} \uparrow \rightarrow Y \uparrow$

6. A decrease in financial frictions (\bar{f})

a. Less asymmetric informational problems in financial markets

b. $\bar{f} \downarrow \rightarrow I \uparrow \rightarrow Y \uparrow$