

The IS Curve

— Week 8 —

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Summary

- 1 Setting Up the Economy
- 2 Deriving the IS Curve
- 3 Using the IS Curve
- 4 Microfoundations of the IS Curve
- 5 Required reading

I – Setting Up the Economy

The national income accounting identity

- 1 Implies that the total resources available to the economy equal total uses
- 2 One equation with six unknowns

$$\begin{array}{ccccccc}
 & & \text{Consumption} & & \text{Investment} & & \text{Government} \\
 & & \swarrow & & \swarrow & & \swarrow \\
 & & & & & & \text{purchases} \\
 & & & & & & \\
 Y_t + IM_t = & C_t + I_t + G_t + EX_t \\
 \uparrow & \uparrow & & & & & \\
 \text{Production} & \text{Imports} & & & & &
 \end{array}$$

How each variable is determined?

$$C_t = \bar{a}_c \bar{Y}_t$$

$$G_t = \bar{a}_g \bar{Y}_t$$

$$EX_t = \bar{a}_{ex} \bar{Y}_t$$

$$IM_t = \bar{a}_{im} \bar{Y}_t$$

$$\frac{I_t}{\bar{Y}_t} = \bar{a}_i - \bar{b}(R_t - \bar{r})$$

Consumption and Friends

- 1 Consumption C , government purchases G , exports EX , and imports IM depend on the economy's potential output
- 2 Each of these components of GDP is a constant fraction of potential output
 - 1 the fraction is a parameter
- 3 Potential output is smoother than actual GDP.
- 4 The equation depends on potential output.
 - 1 Shocks to income are “smoothed” to keep consumption steady.

Actual output depends on potential output

$$Y_t = C_t + I_t + G_t + EX_t - IM_t$$

$$C_t = \bar{a}_c \bar{Y}_t$$

$$G_t = \bar{a}_g \bar{Y}_t$$

$$IM_t = \bar{a}_{im} \bar{Y}_t$$

$$EX_t = \bar{a}_{ex} \bar{Y}_t$$

Each of these components is just some fixed share of *potential* GDP, \bar{Y}_t

The Investment Equation

A term weighting the difference between the real interest rate and the MPK

Marginal Product of Capital (MPK)

$$\frac{I_t}{\bar{Y}_t} = \bar{a}_i - \bar{b}(R_t - \bar{r})$$

The share of potential output that goes to investment

Real interest rate

The Marginal Product of Capital (MPK)

- ① Is an exogenous variable
- ② If the MPK **is low** relative to the real interest rate
 - ① Firms should save money and not invest in capital
- ③ If the MPK **is high** relative to the real interest rate
 - ① Firms should borrow and invest in capital
- ④ In the short run, the MPK and the real interest rate can be different.
 - ① Installing capital to equate the two takes time.

A summary of the equations

TABLE 11.1

The Setup of the Economy for the IS Curve

Endogenous variables: $Y_t, C_t, I_t, G_t, EX_t, IM_t$

National income identity: $Y_t = C_t + I_t + G_t + EX_t - IM_t$

Consumption: $C_t = \bar{a}_c \bar{Y}_t$

Government purchases: $G_t = \bar{a}_g \bar{Y}_t$

Exports: $EX_t = \bar{a}_{ex} \bar{Y}_t$

Imports: $IM_t = \bar{a}_{im} \bar{Y}_t$

Investment: $\frac{I_t}{\bar{Y}_t} = \bar{a}_i - \bar{b} (R_t - \bar{r})$

Exogenous variables/parameters: $\bar{Y}_t, \bar{r}, \bar{a}_c, \bar{a}_i, \bar{a}_g, \bar{a}_{ex}, \bar{a}_{im}, \bar{b}$

Exogenous for now (until next chapter): R_t

II – Deriving the IS Curve

Start with the national income accounting identity

- 1 Divide the national income accounting identity by potential output.

$$\frac{Y_t}{\bar{Y}_t} = \frac{C_t}{\bar{Y}_t} + \frac{I_t}{\bar{Y}_t} + \frac{G_t}{\bar{Y}_t} + \frac{EX_t}{\bar{Y}_t} - \frac{IM_t}{\bar{Y}_t}$$

[2.] Substitute the five equations into this equation

$$\frac{Y_t}{\bar{Y}_t} = \bar{a}_c + \bar{a}_i - \bar{b}(R_t - \bar{r}) + \bar{a}_g + \bar{a}_{ex} - \bar{a}_{im}$$

2.

Recall the definition of short-run output

$$\tilde{Y}_t \equiv \frac{Y_t - \bar{Y}_t}{\bar{Y}_t}$$

Recall the definition of short-run output

- Applying that definition to the previous equation, we will get

$$\underbrace{\frac{Y_t}{\bar{Y}_t} - 1}_{\tilde{Y}_t} = \underbrace{\bar{a}_c + \bar{a}_i + \bar{a}_g + \bar{a}_{ex} - \bar{a}_{im} - 1}_{\bar{a}} - \bar{b}(R_t - \bar{r})$$

- Simplifying the equation for the IS curve

$$\tilde{Y}_t = \bar{a} - \bar{b}(R_t - \bar{r})$$

Summarizing the IS equation

- 1 The gap between the real interest rate and the MPK is what matters for output fluctuations.
- 2 The parameter \bar{a}

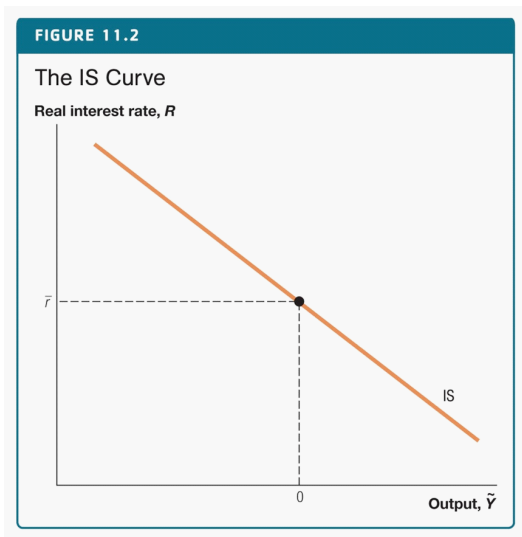
$$\bar{a} = \underbrace{\bar{a}_c + \bar{a}_i + \bar{a}_g + \bar{a}_{ex} - \bar{a}_{im}}_{=1 \text{ in equilibrium (without shocks)}} - 1$$

- 1 Is called the aggregate demand **shock**
- 2 Will equal zero when potential output is equal to actual output

III – Using the IS Curve

The Basic IS Curve

- 1 When $\bar{a} = 0$, and $R_t = \bar{r}$, then $\tilde{Y} = 0$.



The Effect of a Change in the Interest Rate

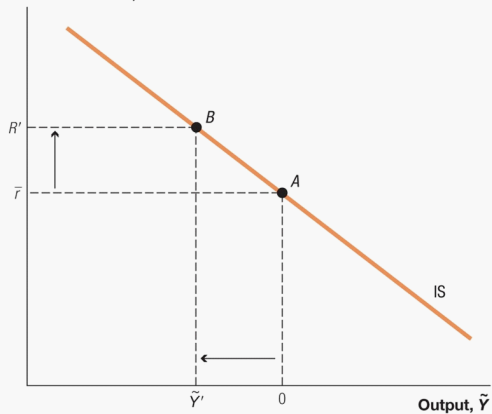
- ① When the **real interest rate** changes, the economy will move **along** the IS curve.
- ② An increase in the interest rate causes the economy to move up the IS curve: short-run output declines
- ③ Why?
 - ① raises borrowing costs
 - ② reduces demand for investment
 - ③ reduces output below potential
- ④ By how much?
 - ① If the sensitivity to the interest rate were higher, the IS curve would be flatter

The Effect of a Change in the Interest Rate

FIGURE 11.3

An Increase in the Real Interest Rate to R'

Real interest rate, R



An Aggregate Demand Shock

- 1 Suppose that information technology improvements create an investment boom
- 2 The aggregate demand shock parameter will increase.
- 3 Output is higher at every interest rate and the IS curve shifts right.
- 4 For any given real interest rate R_t , output is higher

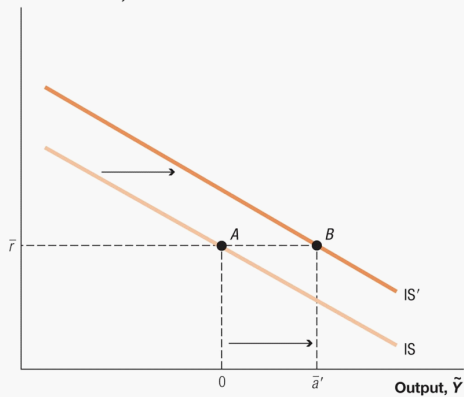
$$\tilde{Y}_t = \bar{a} - \bar{b}(R_t - \bar{r})$$

Demand shock
parameter

An Aggregate Demand Shock

FIGURE 11.4

An Aggregate Demand Shock

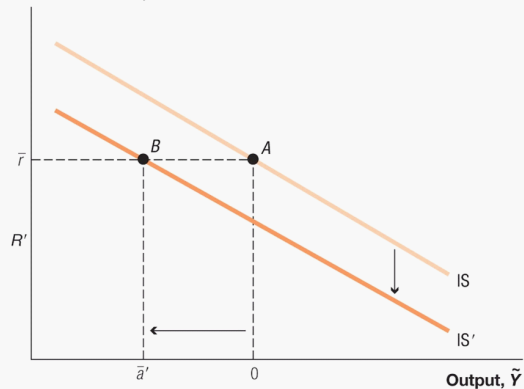
Real interest rate, R 

Pessimistic consumers

FIGURE 11.8

Pessimistic Consumers

Real interest rate, R



Imagine that Japan enters into a recession

- 1 The aggregate demand parameter for exports declines.
- 2 The IS curve shifts to the left
- 3 Thus the Japanese recession has an international effect.
- 4 We could shock any of the other aggregate demand parameters.

IV – Microfoundations of the IS Curve

We will cover only one point in this section: the "Permanent Income Model of Consumption" and the multiplier

The "Permanent Income" model of consumption

- 1 Permanent Income
 - 1 Constant stream of income that has the same present discounted value of the actual income stream.
- 2 Consumption is likely to depend on permanent income
 - 1 May respond to temporary changes in income.
- 3 We can modify the consumption equation to include a term that is proportional to short-run output.

$$\frac{C_t}{\bar{Y}_t} = \bar{a}_c + \bar{x}\tilde{Y}_t$$

Solving for the IS curve (with Permanent Income)

- 1 Will yield a similar result
- 2 Now includes a multiplier on the aggregate demand shock and interest rate terms:
- 3 the multiplier is larger than one

$$\tilde{Y} = \underbrace{\frac{1}{1 - \bar{x}}}_{\text{multiplier}} \times \underbrace{(\bar{a} - \bar{b}(R_t - \bar{r}))}_{\text{original IS curve}}$$

With a multiplier

- 1 Aggregate demand shocks will increase short-run output by more than one-for-one.
- 2 A shock will “multiply” through the economy and will result in a larger effect.
- 3 If short-run output falls with a multiplier
 - 1 Consumption falls
 - 2 Which leads to short-run output falling
 - 3 Consumption falls again
- 4 “Virtuous circle” or “vicious circle”

V – Required readings

Required reading

For this week you are required to read **Read Chapter 11** of our adopted textbook.



Charles I. Jones (2014). *Macroeconomics, Third Edition*, W. W. Norton & Company.