Chapter 9

The IS-LM/AD-AS Model:
A General Framework for Macroeconomic Analysis

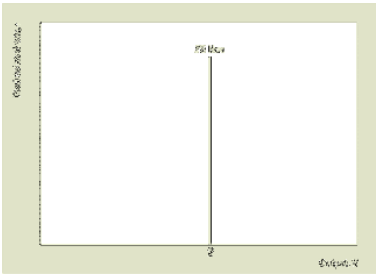
Chapter 9. Introduction

- This chapter integrates the elements of our model that were separately presented in chapters 3,4, and 7, covering labor, goods, and asset markets.
- It develops a graphical depiction of our theory that is called the IS-LM/AD-AS model.
  - IS and LM refer to two equilibrium conditions in the model (investment equals saving; money demand, or liquidity preference, equals money supply).
  - AD and AS refer to aggregate demand and aggregate supply.

The FE Line

- I will be using some diagrams that plot the real rate of interest, *r,* and output *Y* on the axes.
- Recall that labor market equilibrium determines a quantity of labor, which, via the production function, determines a full-employment level of output.
  - Since that level of output presumably does not depend on the rate of interest, we can plot the full-employment line as a vertical line in a diagram in which *r* and *Y* appear on vertical and horizontal axes.

Figure 9.1 **The *FE* line**



FE Curve Shifters

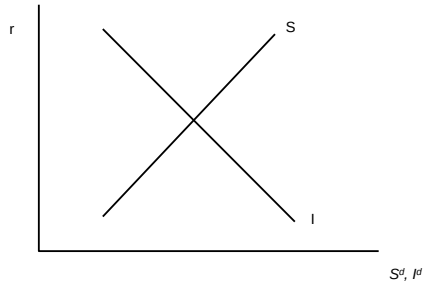
Variable Increases	**FE Curve Shifts**
Productivity	Right
Labor Supply (Population)	Right
Capital Stock	Right

Deriving the IS Curve

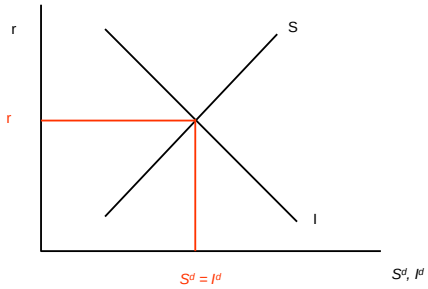
- Recall the Goods Market Equilibrium Condition:

$$S^d = I^d$$

Goods Market Equilibrium



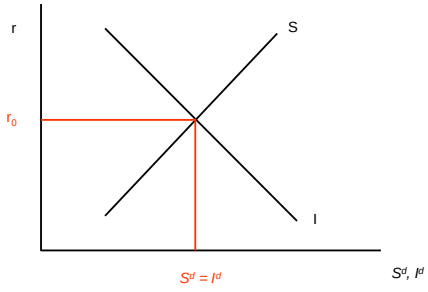
Goods Market Equilibrium



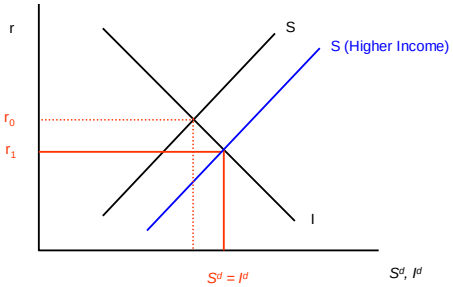
Consider a Rise in Income

- As income rises, the desired saving curve shifts right, and the equilibrium rate of interest falls as we slide down the desired investment curve (next slide).

Goods Market Equilibrium



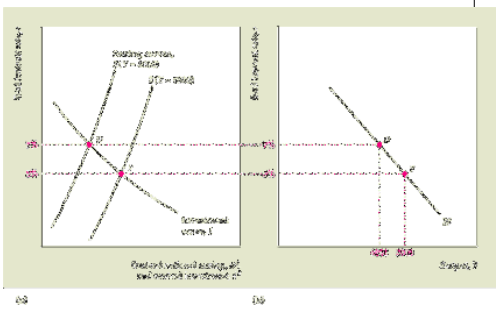
Goods Market Equilibrium



Deriving IS

- The previous slide shows that as income varies and goods market equilibrium is maintained, a higher value of income is associated with a lower value of the expected real interest rate
- Plot the income-interest rate pairs that satisfy the goods market equilibrium condition to get the IS curve
  - The inverse relationship between income and interest rate implies that the IS curve is downward sloping

Figure 9.2 **Deriving the *IS* curve**



Shifting IS

- Recall that IS was derived by considering how the desired saving curve moved along the desired investment curve as income changed.
- Suppose a shock (say a government spending increase) causes saving to decline *at each level of income*
  - Then the interest rate is higher at each level of income.
  - Then we must redraw IS, with higher *r* for each level of *Y*. IS has shifted to the right.
- For other shocks that shift saving or investment schedules, we can also infer how IS shifts.

IS Curve Shifters

Variable Increases	**IS Curve Shifts**
Expected Future Output	Right
Wealth	Right
Government Spending	Right
Taxes	None (Ricardian) or Left
Expected future *MPK*	Right
Effective Tax Rate on *K*	Left

The LM Curve

- The IS plots income interest-rate pairs such that desired spending is equal to output, or desired saving is equal to desired investment
- We will now derive the LM curve, which plots income-interest rate pairs such that the quantity of money demanded is equal to the quantity of money supplied.

Money Market Equilibrium Revisited

Recall this formulation of the money demand curve:

$$\frac{M^d}{P} = L(Y, r + \pi^e)$$

In equilibrium:

$M = M^d$, so:

$$\frac{M}{P} = L(Y, r + \pi^e)$$

The LM Curve

Consider the preceding equation:

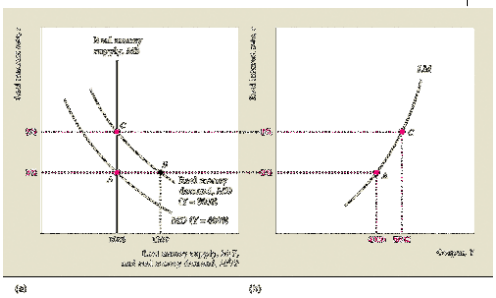
$$\frac{M}{P} = L(Y, r + \pi^e)$$

For given values of M, P, and and π^e, this gives values of Y and r compatible with the money market equilibrium condition.

Plotting those (Y, r) points will yield the LM Curve.

A diagrammatic derivation of LM follows. Note the upward slope.

The Derivation of LM



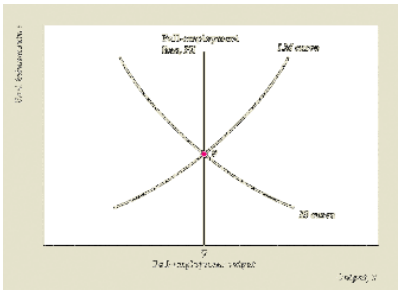
LM Curve Shifters

Variable Increases	LM Curve Shifts
Nominal Money Supply	Right
Price Level	Left
Expected Inflation	Right
Nominal interest rate on money i^m	Left
Anything Else Increasing the Demand for Money	Left

General Equilibrium in the IS-LM Model

- In general equilibrium, all markets satisfy their respective equilibrium conditions.
  - Labor, Goods, and Money Markets Must all be in equilibrium.
- The logic of general equilibrium:
  - The labor market determines output.
  - Given output (income) the goods market then determines an interest rate.
  - Given output, the interest rate, and the expected inflation rate, then the money market determines the price level.

General Equilibrium in the IS-LM Model (Diagram)



Equilibrium: A Coincidence?

- Labor Market equilibrium requires that the economy be on the FE line
- Goods Market equilibrium requires that the economy be on the IS Curve
- Money Market equilibrium requires that the economy be on the LM Curve
- General equilibrium requires that the economy be on all three curves simultaneously
- Does this require a happy coincidence? (No)

Review on Equilibrium

- To review, output is determined by the FE line
- Given output the intersection of IS and FE determines the interest rate
- Finally, the price level adjusts so that LM intersects both IS and FE

Timing of Movement to Equilibrium

- Our model, as formulated, does not tell us the order in which variables move—we just infer that the economy moves from one equilibrium to another (after a shock).
- Here are some thoughts on timing:
  - Interest rates (and financial markets generally) adjust very quickly
  - Nominal (and real) wages adjust slowly (often wages are set for long periods of time
  - Prices may also adjust slowly
  - The goods market adjusts with intermediate speed (we often see unanticipated inventory movements, but firms may alter production before revising prices)

A Look Ahead: Keynesian and Classical Views

- We will say much more about "Keynesian" and "Classical" macroeconomic theories
- Keynesians emphasize the short-term rigidity of prices and wages
- Classical economists emphasize that all markets reach equilibria rather quickly

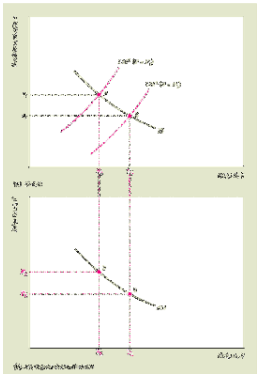
Aggregate Demand and Aggregate Supply

- We have now specified a complete model
- However, sometimes it is convenient to look at the model differently—with a different diagram
- We next introduce AD and AS curves
  - These curves plot output, *Y*, and the price level, *P*.
  - These diagrams allow us to focus attention on the determination of the price level, which was not directly visible in the IS-LM diagram.

The AD Curve

- Consider the IS-LM diagram.
- A given LM curve is drawn for a fixed level of *P*.
- If *P* changes, then the LM curve shifts.
- Consider various levels of *P*.
  - For each price level, draw the appropriate LM curve
  - The sequence of IS-LM intersections determines Y values to be associated with each level of *P*.
- Plotting these *P*-*Y* pairs yields the aggregate demand (AD) curve.

Deriving AD



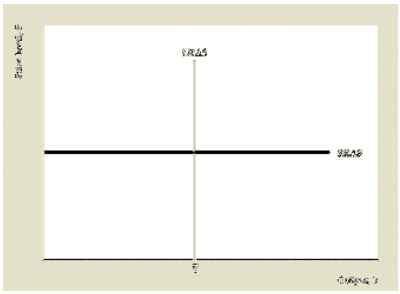
The Long Run Aggregate Supply Curve

- When all markets clear, we are in long-run equilibrium.
  - Note: This is not necessarily a matter of time. In the classical model, when all markets equilibrate instantaneously, then we reach the long-run immediately.
- The AS curve plots output supplied versus the price level.
- Output supplied is determined by the labor market and the production function; it is the full employment level of output, $\bar{Y}$.
- Output supplied does not vary with *P*, so the AS curve is vertical at $\bar{Y}$.

Aggregate Supply in the Short-Run

- Assume that the short-run is a time frame in which the price level is fixed, and the quantity of output is determined by demand (whatever that level may be)
- So the AS curve is horizontal at a given price level
- Our original labor market equilibrium model has been discarded for the short run
  - The short-run horizontal AS curve is really only a feature of Keynesian interpretations of our theory

AS: Long Run and Short Run



Long-run and Short-run Equilibria

- In long-run equilibrium, the economy must be on AD, SRAS, and LRAS.
- In a short-run equilibrium, the economy must be on AD and SRAS.
- To go to a new long-run equilibrium, price (and SRAS) must shift.
- Note that our assumptions now make it clear that an increase in AD can lead to an increase in output in the short-run, but an increase in price in the long-run
- The vertical long-run supply illustrates the money neutrality property
  - Increases in *M*, causing increases in AD, do not change output, but they do change *P*.

AD Shifters

- Any variable that shifts IS or LM, with the exception of *P*, will also shift AD
- The direction of the shift is determined by whether the IS-LM diagram shows an increase in income as a result of the shift in the IS-LM diagram: if IS and LM intersect at a higher level of income, then the AD curve shifts to the right.
  - At any price level, if IS and AD determine a higher level of income, then that price level is now associated with a higher level on income on AD.

LRAS Shifters

- The LRAS curve will change when the full employment level of output changes
- This means that it is shifted by the same variables that shift the FE Curve:
  - Productivity
  - Labor supply
  - Capital stock

SRAS Shifters

- The SRAS curve shifts only when the price level changes from one “fixed” level to another
  - This period price might be fixed at a given level, but in a future period it might be fixed at some other level

Upcoming Chapters

- In the next two chapters, we will use the IS-LM / AS-AD model to illustrate short- and long-run consequences of a variety of shocks to the economy

The End