In this chapter, you will learn...

- the IS curve, and its relation to
  - the Keynesian cross
- the LM curve, and its relation to
  - the theory of liquidity preference
- how the IS-LM model determines income and the interest rate in the short run when \( P \) is fixed

Context

- Chapter 9 introduced the model of aggregate demand and aggregate supply.
- Long run
  - prices flexible
  - output determined by factors of production & technology
  - unemployment equals its natural rate
- Short run
  - prices fixed
  - output determined by aggregate demand
  - unemployment negatively related to output

This chapter develops the IS-LM model, the basis of the aggregate demand curve.

- We focus on the short run and assume the price level is fixed (so, SRAS curve is horizontal).
- This chapter (and chapter 11) focus on the closed-economy case.
- Chapter 12 presents the open-economy case.

The Keynesian Cross

- A simple closed economy model in which income is determined by expenditure.
  (due to J.M. Keynes)
- Notation:
  - \( I \) = planned investment
  - \( E = C + I + G \) = planned expenditure
  - \( Y \) = real GDP = actual expenditure
- Difference between actual & planned expenditure = unplanned inventory investment

consumption function: \[ C = C(Y - T) \]

Govt policy variables: \[ G = \bar{G}, \quad T = \bar{T} \]

for now, planned investment is exogenous: \[ I = \bar{I} \]

planned expenditure: \[ E = C(Y - \bar{T}) + \bar{I} + \bar{G} \]

Equilibrium condition:
- actual expenditure = planned expenditure
  - \[ Y = E \]
CHAPTER 10 Aggregate Demand I

Graphing planned expenditure

\[ E = C + I + G \]  
planned expenditure

MPC

income, output, \( Y \)

Graphing the equilibrium condition

\[ E = Y \]  
planned expenditure

45°

income, output, \( Y \)

The equilibrium value of income

\[ E = Y \]  
planned expenditure

Equilibrium income

income, output, \( Y \)

An increase in government purchases

At \( Y_1 \), there is now an unplanned drop in inventory...

...so firms increase output, and income rises toward a new equilibrium.

\[ E_1 = Y_1 \]

\[ \Delta Y \]

\[ E_2 = Y_2 \]

The government purchases multiplier

Definition: the increase in income resulting from a $1 increase in \( G \).

In this model, the govt purchases multiplier equals

\[ \frac{\Delta Y}{\Delta G} = \frac{1}{1 - \text{MPC}} \]

Example: If MPC = 0.8, then

\[ \frac{\Delta Y}{\Delta G} = \frac{1}{1 - 0.8} = 5 \]

An increase in \( G \) causes income to increase 5 times as much!
**Why the multiplier is greater than 1**

- Initially, the increase in $G$ causes an equal increase in $Y$: $\Delta Y = \Delta G$.
- But $\Delta Y \Rightarrow \Delta C \Rightarrow \Delta Y \Rightarrow \Delta C \Rightarrow \Delta Y$.
- So the final impact on income is much bigger than the initial $\Delta G$.

**An increase in taxes**

Initially, the tax increase reduces consumption, and therefore $E$.

$\Delta Y = \Delta C + \Delta I + \Delta G$

eq'm condition in changes

$I$ and $G$ exogenous

$\Delta C = -MPC \Delta T$

so firms reduce output, and income falls toward a new equilibrium

At $Y_1$, there is now an unplanned inventory buildup...

Final result:

$\Delta Y = \frac{-MPC}{1 - MPC} \times \Delta T$

**The tax multiplier**

...is negative:
A tax increase reduces $C$, which reduces income.

...is greater than one (in absolute value):
A change in taxes has a multiplier effect on income.

...is smaller than the govt spending multiplier:
Consumers save the fraction $(1 - MPC)$ of a tax cut, so the initial boost in spending from a tax cut is smaller than from an equal increase in $G$.

**Exercise:**

- Use a graph of the Keynesian cross to show the effects of an increase in planned investment on the equilibrium level of income/output.
The IS curve

def: a graph of all combinations of \( r \) and \( Y \) that result in goods market equilibrium

i.e. actual expenditure (output) = planned expenditure

The equation for the IS curve is:

\[
Y = C(Y - T) + I(r) + G
\]

Fiscal Policy and the IS curve

- We can use the IS-LM model to see how fiscal policy (\( G \) and \( T \)) affects aggregate demand and output.
- Let’s start by using the Keynesian cross to see how fiscal policy shifts the IS curve...

Shifting the IS curve: \( \Delta G \)

At any value of \( r \), \( \Delta G \Rightarrow \Delta E \Rightarrow \Delta Y \)

so the IS curve shifts to the right.

The horizontal distance of the IS shift equals

\[
\Delta Y = \frac{1}{1-MPC} \Delta G
\]

The Theory of Liquidity Preference

- Due to John Maynard Keynes.
- A simple theory in which the interest rate is determined by money supply and money demand.

Money supply

The supply of real money balances is fixed:

\[
\left( \frac{M}{P} \right)^\gamma = \bar{M} / \bar{P}
\]
Money demand

Demand for real money balances:

\( (M/P)^d = L(r) \)

Equilibrium

The interest rate adjusts to equate the supply and demand for money:

\( \bar{M}/\bar{P} = L(r) \)

How the Fed raises the interest rate

To increase \( r \), Fed reduces \( M \)

CASE STUDY: Monetary Tightening & Interest Rates

- Late 1970s: \( \pi > 10\% \)
- Oct 1979: Fed Chairman Paul Volcker announces that monetary policy would aim to reduce inflation
- Aug 1979-April 1980: Fed reduces \( M/P \), 8.0%
- Jan 1983: \( \pi = 3.7\% \)

How do you think this policy change would affect nominal interest rates?

Monetary Tightening & Rates, cont.

The effects of a monetary tightening on nominal interest rates

<table>
<thead>
<tr>
<th>Model</th>
<th>Prices</th>
<th>Prediction</th>
<th>Actual outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquidity preference</td>
<td>Sticky</td>
<td>( \Delta \pi &gt; 0 )</td>
<td>8/1979: ( i = 10.4% ), ( 4/1980: i = 15.8% ), 1/1983: ( i = 8.2% )</td>
</tr>
<tr>
<td>Quantity theory, Fisher effect (Classical)</td>
<td>Flexible</td>
<td>( \Delta \pi &lt; 0 )</td>
<td></td>
</tr>
</tbody>
</table>

The LM curve

Now let’s put \( Y \) back into the money demand function:

\( (M/P)^d = L(r,Y) \)

The LM curve is a graph of all combinations of \( r \) and \( Y \) that equate the supply and demand for real money balances.

The equation for the LM curve is:

\( \bar{M}/\bar{P} = L(r,Y) \)
Deriving the LM curve

(a) The market for real money balances

(b) The LM curve

\[ \frac{M}{P} = L(r, Y) \]

\[ r = r_2 \]

\[ Y = Y_2 \]

Why the LM curve is upward sloping

- An increase in income raises money demand.
- Since the supply of real balances is fixed, there is now excess demand in the money market at the initial interest rate.
- The interest rate must rise to restore equilibrium in the money market.

How \( \Delta M \) shifts the LM curve

Exercise: Shifting the LM curve

- Suppose a wave of credit card fraud causes consumers to use cash more frequently in transactions.
- Use the liquidity preference model to show how these events shift the LM curve.

The short-run equilibrium

The short-run equilibrium is the combination of \( r \) and \( Y \) that simultaneously satisfies the equilibrium conditions in the goods & money markets:

\[ Y = C(Y - T) + I(r) + G \]

\[ \frac{M}{P} = L(r, Y) \]

The Big Picture

Keynesian Cross

IS curve

LM curve

Explanation of short-run fluctuations

Model of Agg. Demand and Agg. Supply
**Preview of Chapter 11**

In Chapter 11, we will
- use the IS-LM model to analyze the impact of policies and shocks.
- learn how the aggregate demand curve comes from IS-LM.
- use the IS-LM and AD-AS models together to analyze the short-run and long-run effects of shocks.
- use our models to learn about the Great Depression.

**Chapter Summary**

Keynesian cross
- basic model of income determination
- takes fiscal policy & investment as exogenous
- fiscal policy has a multiplier effect on income.

IS curve
- comes from Keynesian cross when planned investment depends negatively on interest rate
- shows all combinations of $r$ and $Y$ that equate planned expenditure with actual expenditure on goods & services

LM curve
- comes from liquidity preference theory when money demand depends positively on income
- shows all combinations of $r$ and $Y$ that equate demand for real money balances with supply

IS-LM model
- Intersection of IS and LM curves shows the unique point $(Y, r)$ that satisfies equilibrium in both the goods and money markets.