CHAPTER 10

Aggregate Demand I: Building the *IS-LM* Model

MACROECONOMICS SIXTH EDITION

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PowerPoint® Slides by Ron Cronovich

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

Context

- 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

Elements of the Keynesian Cross

consumption function: $C = C(Y - T)$

govt policy variables: $G = \bar{G}, \quad T = \bar{T}$

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

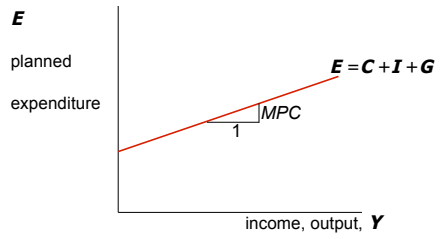
planned expenditure: $E = C(Y - \bar{T}) + \bar{I} + \bar{G}$

equilibrium condition:

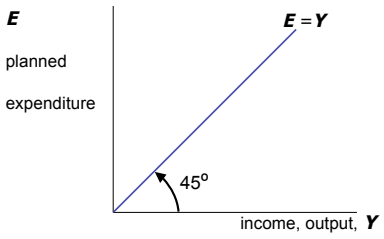
actual expenditure = planned expenditure

$Y = E$

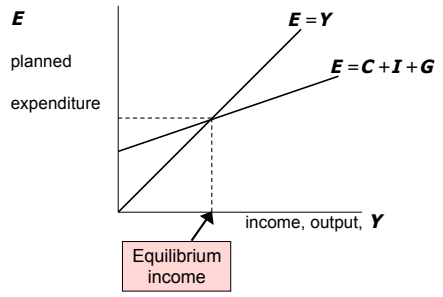
Graphing planned expenditure



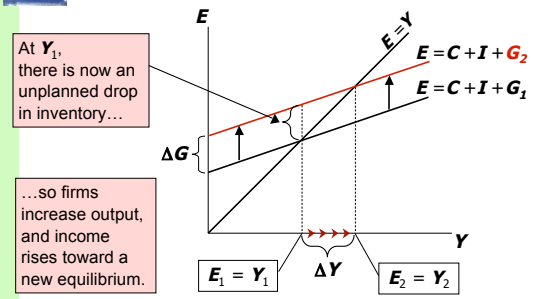
Graphing the equilibrium condition



The equilibrium value of income



An increase in government purchases



Solving for ΔY

$Y = C + I + G$ equilibrium condition

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

$= \Delta C + \Delta G$ because I exogenous

$= \text{MPC} \times \Delta Y + \Delta G$ because $\Delta C = \text{MPC}\,\Delta Y$

Collect terms with ΔY on the left side of the equals sign:

$(1 - \text{MPC}) \times \Delta Y = \Delta G$

Solve for ΔY:

$$\Delta Y = \left(\frac{1}{1 - \text{MPC}}\right) \times \Delta G$$

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

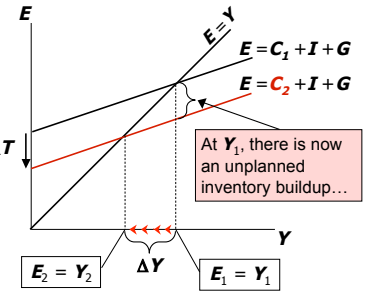
- Initially, the increase in G causes an equal increase in Y: $\Delta Y = \Delta G$.
- But $\uparrow Y \Rightarrow \uparrow C$
  $\Rightarrow$ further $\uparrow Y$
  $\Rightarrow$ further $\uparrow C$
  $\Rightarrow$ further $\uparrow Y$
- So the final impact on income is much bigger than the initial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

An increase in taxes

Initially, the tax increase reduces consumption, and therefore E:

$\Delta C = -\text{MPC}\,\Delta T$

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



At Y_1, there is now an unplanned inventory buildup…

Solving for ΔY

$\Delta Y = \Delta C + \Delta I + \Delta G$ eq'm condition in changes

$= \Delta C$ I and G exogenous

$= \text{MPC} \times (\Delta Y - \Delta T)$

Solving for ΔY: $(1 - \text{MPC}) \times \Delta Y = -\text{MPC} \times \Delta T$

Final result:

$$\Delta Y = \left(\frac{-\text{MPC}}{1 - \text{MPC}} \right) \times \Delta T$$

The tax multiplier

def: the change in income resulting from a \$1 increase in T:

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

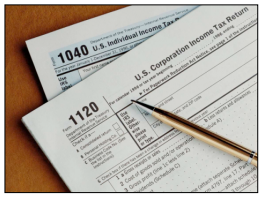
If $MPC = 0.8$, then the tax multiplier equals

$$\frac{\Delta Y}{\Delta T} = \frac{-0.8}{1 - 0.8} = \frac{-0.8}{0.2} = -4$$

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:

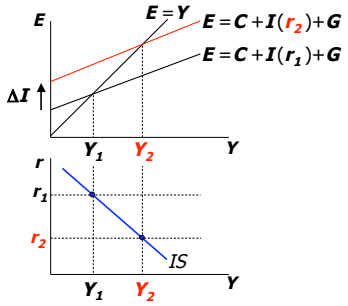
$$Y = C(Y - \overline{T}) + I(r) + \overline{G}$$

Deriving the *IS* curve

$\downarrow r \Rightarrow \uparrow I$

$\Rightarrow \uparrow E$

$\Rightarrow \uparrow Y$



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…

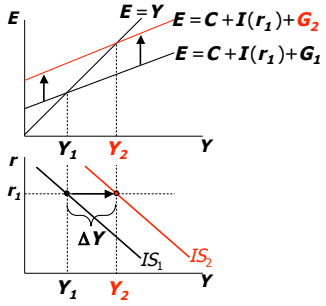
Shifting the *IS* curve: ΔG

At any value of r, $\uparrow G \Rightarrow \uparrow E \Rightarrow \uparrow Y$

…so the *IS* curve shifts to the right.

The horizontal distance of the *IS* shift equals

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



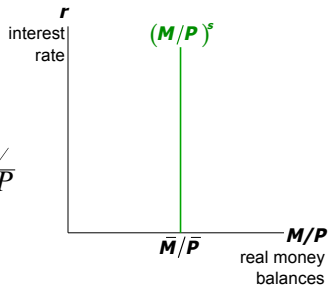
The Theory of Liquidity Preference

- 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:

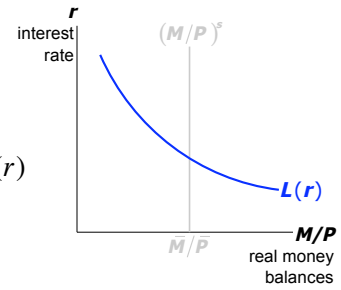
$$(M/P)^s = \overline{M}/\overline{P}$$



Money demand

Demand for real money balances:

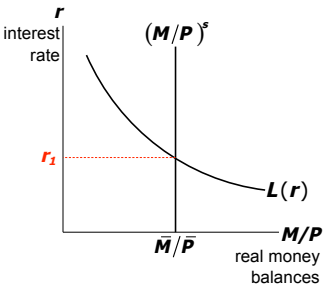
$$(M/P)^d = L(r)$$



Equilibrium

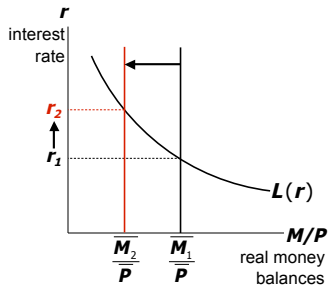
The interest rate adjusts to equate the supply and demand for money:

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



How the Fed raises the interest rate

To increase *r*, Fed reduces *M*



CASE STUDY: Monetary Tightening & Interest Rates

- Late 1970s: π > 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: π = 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

	short run	long run
model	Liquidity preference *(Keynesian)*	Quantity theory, Fisher effect *(Classical)*
prices	sticky	flexible
prediction	$\Delta i > 0$	$\Delta i < 0$
actual outcome	8/1979: i = 10.4% 4/1980: i = 15.8%	8/1979: i = 10.4% 1/1983: i = 8.2%

The *LM* curve

Now let's put *Y* back into the money demand function:

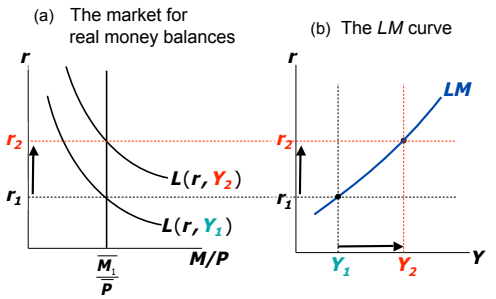
$$(M/P)^d = L(r, Y)$$

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:

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

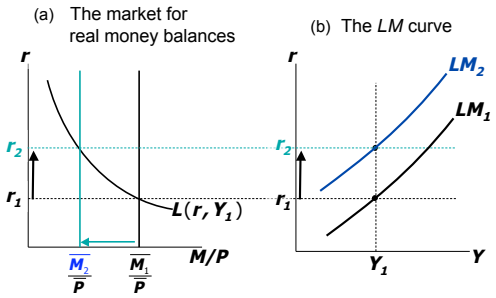
Deriving the *LM* curve



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 ΔM shifts the *LM* curve



Exercise: Shifting the LM curve

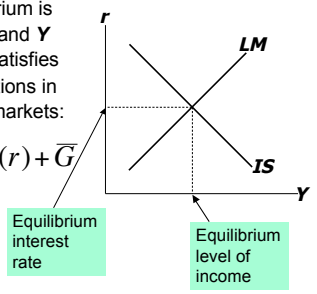
- Suppose a wave of credit card fraud causes consumers to use cash more frequently in transactions.
- Use the liquidity preference model to show how these events shift the *LM* curve.

The short-run equilibrium

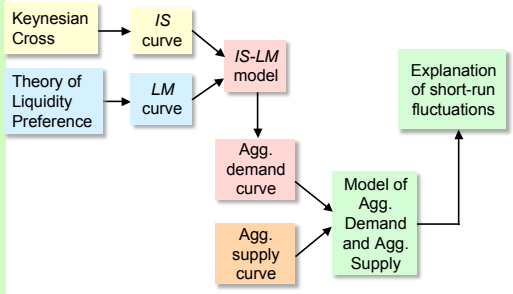
The short-run equilibrium is the combination of r and Y that simultaneously satisfies the equilibrium conditions in the goods & money markets:

$$Y = C(Y - \bar{T}) + I(r) + \bar{G}$$

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



The Big Picture



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

Chapter Summary

Theory of Liquidity Preference

- basic model of interest rate determination
- takes money supply & price level as exogenous
- an increase in the money supply lowers the interest rate

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

Chapter Summary

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.