

macro

Topic 9:
Aggregate Demand I
 (chapter 10)

macroeconomics
 fifth edition

N. Gregory Mankiw

PowerPoint® Slides
 by Ron Cronovich

© 2002 Worth Publishers, all rights reserved

Motivation

- The Great Depression caused a rethinking of the Classical Theory of the macroeconomy. It could not explain:
 - Drop in output by 30% from 1929 to 1933
 - Rise in unemployment to 25%
- In 1936, J.M. Keynes developed a theory to explain this phenomenon.
- We will learn a version of this theory, called the 'IS-LM' model.

CHAPTER 10 Aggregate Demand I slide 1

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 is negatively related to output

CHAPTER 10 Aggregate Demand I slide 2

Context

- This chapter develops the IS-LM model, the theory that yields the aggregate demand curve.
- We focus on the short run and assume the price level is fixed.

CHAPTER 10 Aggregate Demand I

slide 3

The Keynesian Cross

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

CHAPTER 10 Aggregate Demand I

slide 4

Elements of the Keynesian Cross

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

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

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

planned expenditure:

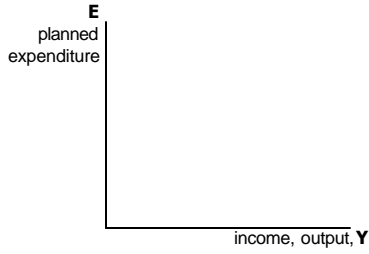
Equilibrium condition:

Actual expenditure = Planned expenditure

CHAPTER 10 Aggregate Demand I

slide 5

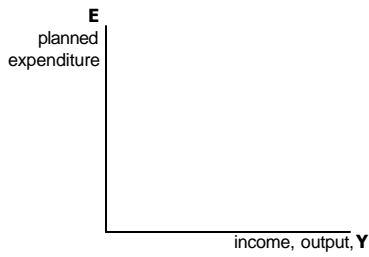
Graphing planned expenditure



CHAPTER 10 Aggregate Demand I

slide 6

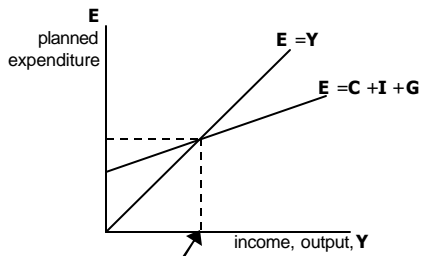
Graphing the equilibrium condition



CHAPTER 10 Aggregate Demand I

slide 7

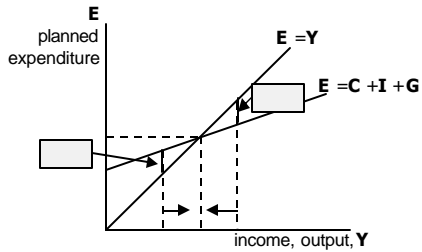
The equilibrium value of income



CHAPTER 10 Aggregate Demand I

slide 8

The equilibrium value of income



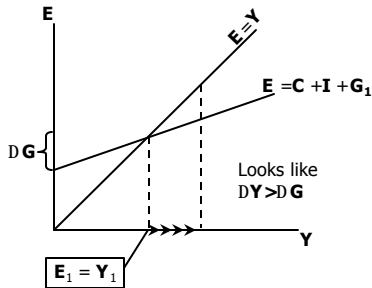
$E > Y$: _____ inventories: must produce more.

$E < Y$: _____ inventories: must produce less.

CHAPTER 10 Aggregate Demand I

slide 9

An increase in government purchases



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

CHAPTER 10 Aggregate Demand I

slide 10

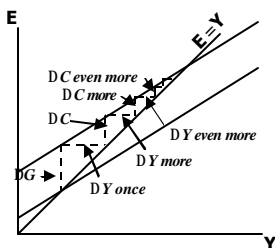
Why the multiplier is greater than 1

- Def: Government purchases multiplier: $\frac{\Delta Y}{\Delta G}$
- Initially, the increase in G causes an equal increase in Y : $DY = DG$.
- But $\uparrow Y \Rightarrow \uparrow C$
 \Rightarrow further $\uparrow Y$
 \Rightarrow further $\uparrow C$
 \Rightarrow further $\uparrow Y$
- So the government purchases multiplier will be _____.

CHAPTER 10 Aggregate Demand I

slide 11

An increase in government purchases



CHAPTER 10 Aggregate Demand I

slide 12

Sum up changes in expenditure

$$\begin{aligned} \Delta Y &= \Delta G + (\text{MPC} \cdot \Delta G) + \text{MPC} (\text{MPC} \cdot \Delta G) \\ &\quad + \text{MPC} (\text{MPC} (\text{MPC} \cdot \Delta G)) + \dots \\ &= \Delta G + (\text{MPC}^1 \Delta G) + (\text{MPC}^2 \Delta G) + (\text{MPC}^3 \Delta G) \dots \end{aligned}$$

This is a standard geometric series from algebra:

So the multiplier is:

$$\frac{\Delta Y}{\Delta G} =$$

CHAPTER 10 Aggregate Demand I

slide 13

Solving for ΔY

$$\begin{aligned} Y &= C + I + G && \text{equilibrium condition} \\ \Delta Y &= \Delta C + \Delta I + \Delta G && \text{in changes} \\ &= \Delta C + \Delta G && \text{because } I \text{ exogenous} \\ &= \text{MPC} \times \Delta Y + \Delta G && \text{because } \Delta C = \text{MPC} \Delta Y \end{aligned}$$

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

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

Finally, solve for ΔY :

CHAPTER 10 Aggregate Demand I

slide 14

Algebra example

Suppose consumption function: $C = a + b(Y - T)$

where a and b are some numbers (MPC= b)

and other variables exogenous:

$$I = \bar{I}, T = \bar{T}, G = \bar{G}$$

Use Goods market equilibrium condition:

$$Y = C + I + G$$

CHAPTER 10 Aggregate Demand I

slide 15

Algebra example

$$Y = C + I + G$$

$$Y = a + b(Y - \bar{T}) + \bar{I} + \bar{G}$$

Solve for Y : $Y - bY = a - b\bar{T} + \bar{I} + \bar{G}$

$$(1 - b)Y = a - b\bar{T} + \bar{I} + \bar{G}$$

$$Y = \frac{1}{1 - b}\bar{G} + \frac{1}{1 - b}\bar{I} + \frac{a}{1 - b} - \frac{b}{1 - b}\bar{T}$$

So if $b = \text{MPC} = 0.75$, multiplier =

CHAPTER 10 Aggregate Demand I

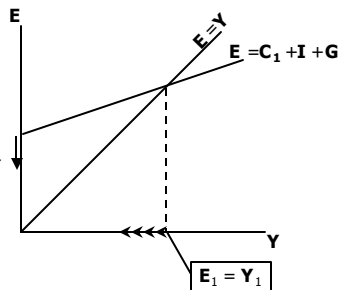
slide 16

An increase in taxes

Initially, the tax increase reduces consumption, and therefore E

DC = _____

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



CHAPTER 10 Aggregate Demand I

slide 17

Tax multiplier

Define tax multiplier:

Can read the tax multiplier from the algebraic solution above:

$$Y = \frac{1}{1-b}G + \frac{1}{1-b}I + \frac{a}{1-b} - \frac{b}{1-b}T$$

So: $\Delta Y = \left(\frac{-b}{1-b}\right) (\Delta T)$ where **b** is the MPC.

If **b**=0.75, tax multiplier =

CHAPTER 10 Aggregate Demand I

slide 18

Solving for ΔY

$$\begin{aligned}\Delta Y &= \Delta C + \Delta I + \Delta G && \text{eq'm condition in changes} \\ &= \Delta C && \mathbf{I} \text{ and } \mathbf{G} \text{ exogenous} \\ &= \text{MPC} \times (\Delta Y - \Delta T)\end{aligned}$$

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

Final result:

CHAPTER 10 Aggregate Demand I

slide 19

The Tax Multiplier

Question: how is this different from the government spending multiplier considered previously?

The tax multiplier:

...is _____:

An increase in taxes reduces consumer spending, which reduces equilibrium income.

...is _____:

(in absolute value) 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**.

CHAPTER 10 Aggregate Demand I

slide 20

A question to consider:

- Using the Keynesian Cross, what would be the effect of an increase in investment on the equilibrium level of income/output.

CHAPTER 10 Aggregate Demand I

slide 21

Building the IS curve

def:

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

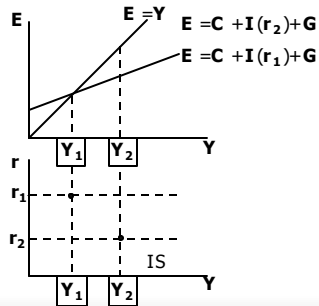
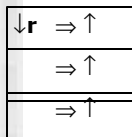
The equation for the IS curve is:

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

CHAPTER 10 Aggregate Demand I

slide 22

Deriving the IS curve



CHAPTER 10 Aggregate Demand I

slide 23

Understanding the IS curve's slope

- The IS curve is negatively sloped.
- Intuition:
A fall in the interest rate motivates firms to increase investment spending, which drives up total planned spending (E).
To restore equilibrium in the goods market, output (a.k.a. actual expenditure, Y) must increase.

CHAPTER 10 Aggregate Demand I

slide 24

Fiscal Policy and the IS curve

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

CHAPTER 10 Aggregate Demand I

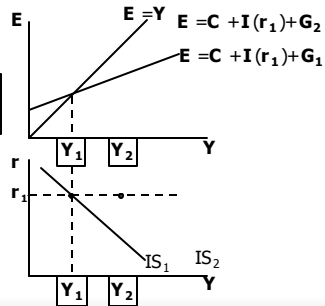
slide 25

Shifting the IS curve: DG

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

$\Delta Y =$ _____



CHAPTER 10 Aggregate Demand I

slide 26

Algebra example for IS curve

Suppose the expenditure side of the economy is characterized by:

$$C = 95 + 0.75(Y-T)$$

$$I = 100 - 100r$$

$$G = 20, T = 20$$

Use the goods market equilibrium condition

$$Y = C + I + G$$

$$Y = 215 + 0.75(Y-20) - 100r$$

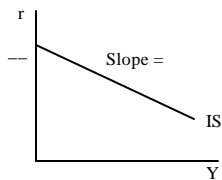
IS: _____ or write as

IS: _____

CHAPTER 10 Aggregate Demand I

slide 27

Graph the IS curve



$$IS: r = 2 - 0.0025Y$$

CHAPTER 10 Aggregate Demand I

slide 28

Slope of IS curve

Suppose that investment expenditure is "more responsive" to the interest rate:

$$I = 100 - 100r - 200r$$

Use the goods market equilibrium condition

$$Y = C + I + G$$

$$Y = 215 + 0.75(Y-20) - 200r$$

$$0.25Y = 200 - 200r$$

IS: $Y = 800 - 800r$ or write as

IS: $r = 1 - 0.00125Y$ (slope is lower)

So this makes the IS curve _____. A fall in r raises I _____, which raises Y _____.

CHAPTER 10 Aggregate Demand I

slide 29

Building the LM Curve: 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.

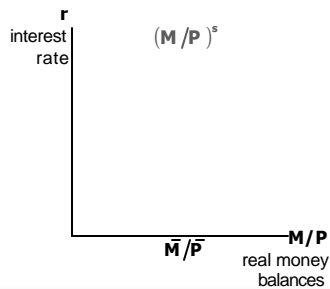
CHAPTER 10 Aggregate Demand I

slide 30

Money Supply

The supply of real money balances is fixed:

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



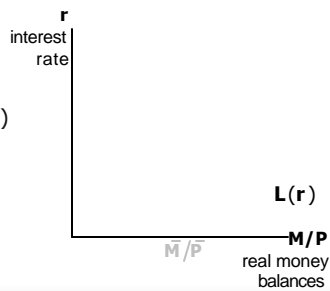
CHAPTER 10 Aggregate Demand I

slide 31

Money Demand

Demand for real money balances:

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



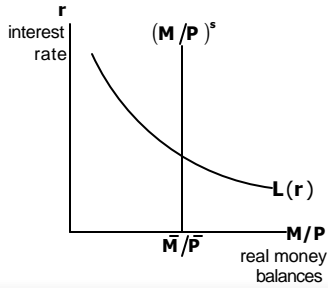
CHAPTER 10 Aggregate Demand I

slide 32

Equilibrium

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

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

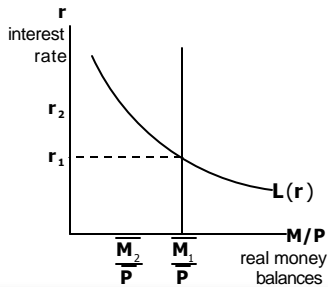


CHAPTER 10 Aggregate Demand I

slide 33

How the Fed raises the interest rate

To increase r ,
Fed reduces M



CHAPTER 10 Aggregate Demand I

slide 34

CASE STUDY

Volcker's Monetary Tightening

- Late 1970s: $\pi > 10\%$
- Oct 1979: Fed Chairman Paul Volcker announced 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 interest rates?

CHAPTER 10 Aggregate Demand I

slide 35

Volcker's Monetary Tightening, *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: $i = 15.8\%$	1/1983: $i = 8.2\%$

slide 36

The LM curve

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

$$\left(\frac{M}{P}\right)^d = L(r, Y)$$

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

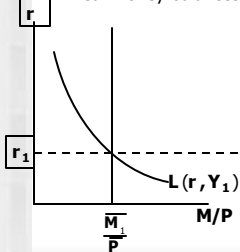
The equation for the LM curve is:

CHAPTER 10 Aggregate Demand I

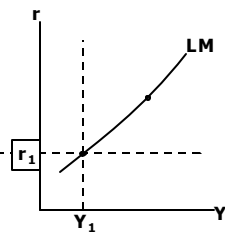
slide 37

Deriving the LM curve

(a) The market for real money balances



(b) The LM curve



CHAPTER 10 Aggregate Demand I

slide 38

Understanding the LM curve's slope

- The LM curve is positively sloped.
- Intuition:
 - 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.

CHAPTER 10 Aggregate Demand I

slide 39

Deriving LM curve with algebra

Suppose a money demand: $(M/P)^d = eY - fr$

- Where e describes the responsiveness of money demand to changes in income.
- And f describes responsiveness to interest rate.

Suppose money supply: $(M/P)^s = \bar{M}/\bar{P}$

Use money market equilibrium condition:

$$(M/P)^s = (M/P)^d$$

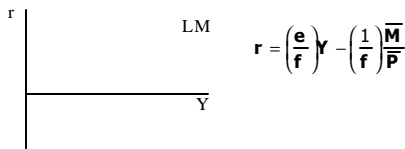
$$\text{So: } \bar{M}/\bar{P} =$$

or write as:

CHAPTER 10 Aggregate Demand I

slide 40

Graph the LM curve



A steep LM curve (_____) means that a rise in output implies a _____ to maintain equilibrium.

Causes of this:

Money demand is _____ to interest rate (f is small)

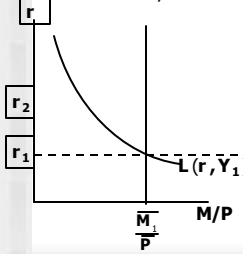
Money demand _____ to output (e large)

CHAPTER 10 Aggregate Demand I

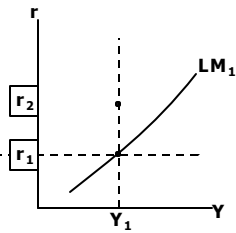
slide 41

How DM shifts the LM curve

(a) The market for real money balances



(b) The LM curve

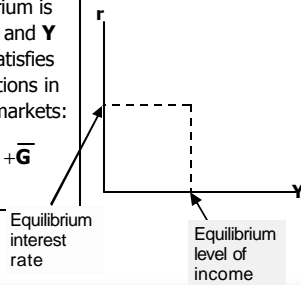


The short-run equilibrium

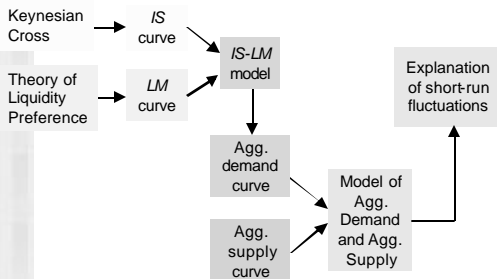
The short-run equilibrium is the combination of r and Y that simultaneously satisfies the equilibrium conditions in the goods & money markets:

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

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



The Big Picture



Chapter summary

1. Keynesian Cross
 - basic model of income determination
 - takes fiscal policy & investment as exogenous
 - fiscal policy has a multiplied impact on income.
2. 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 10 Aggregate Demand I

slide 45

Chapter summary

3. 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
4. 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 10 Aggregate Demand I

slide 46

Chapter summary

5. 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.

CHAPTER 10 Aggregate Demand I

slide 47
