

# Chapter 10

## Aggregate Demand I

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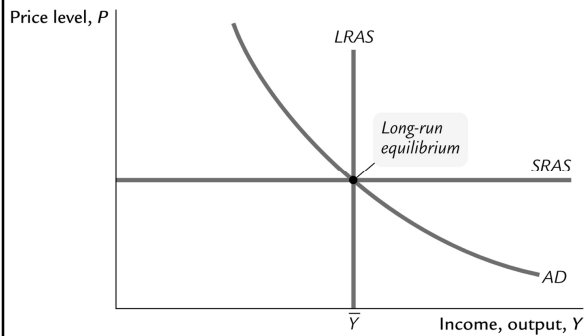
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### Learning Objectives

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

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## Learning Objectives

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

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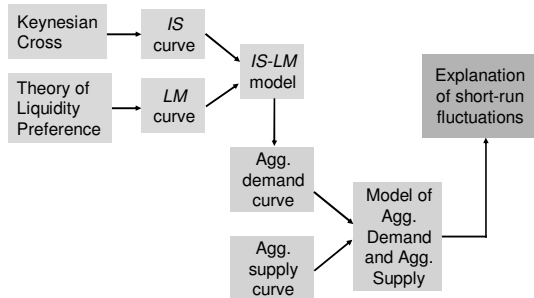
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## The Big Picture



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## 1. The IS Curve

### 1.1 The Keynesian Cross

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

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

### **Equilibrium condition:**

Actual expenditure = Planned expenditure

$$Y = E$$

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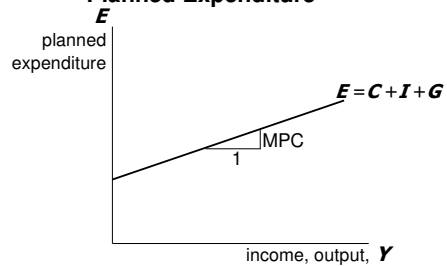
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## 1.1 The Keynesian Cross

Planned Expenditure



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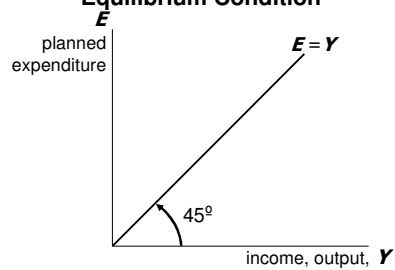
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## 1.1 The Keynesian Cross

Equilibrium Condition



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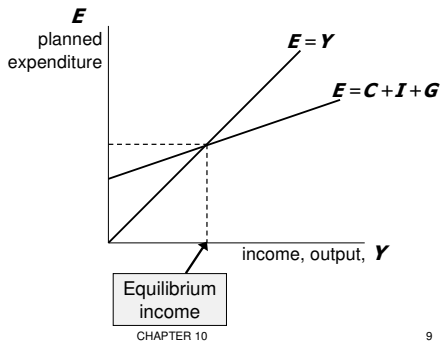
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## 1.1 The Keynesian Cross




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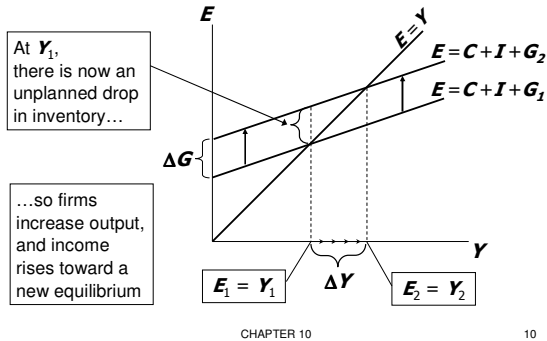
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## 1.1 The Keynesian Cross

An increase in government purchases




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## 1.1 The Keynesian Cross

An increase in government purchases

$$\begin{aligned}
 Y &= C + I + G && \text{equilibrium condition} \\
 \Delta Y &= \Delta C + \Delta I + \Delta G && \text{in changes} \\
 &= \Delta C + \Delta G && \text{because } I \text{ exogenous} \\
 &= \text{MPC} \times \Delta Y + \Delta G && \text{b.c. } \Delta C = \text{MPC} (\Delta Y - \Delta T)
 \end{aligned}$$

Collect terms with  $\Delta Y$  on the left side of the equals sign:

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

Finally, solve for  $\Delta Y$ :

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

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### 1.1 The Keynesian Cross

The government purchases multiplier

**Definition:** the increase in income resulting from a **1 unit** increase in **G**.

In this model, the **G** multiplier equals

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

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### 1.1 The Keynesian Cross

The government purchases multiplier

**Example:** MPC = 0.8

$$\begin{aligned}\Delta Y &= \frac{1}{1 - MPC} \Delta G \\ &= \frac{1}{1 - 0.8} \Delta G = \frac{1}{0.2} \Delta G = 5 \Delta G\end{aligned}$$

The increase in **G** causes income to increase by 5 times as much!

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

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### 1.1 The Keynesian Cross

The government purchases multiplier

Why is the multiplier 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  $\Delta G$ .

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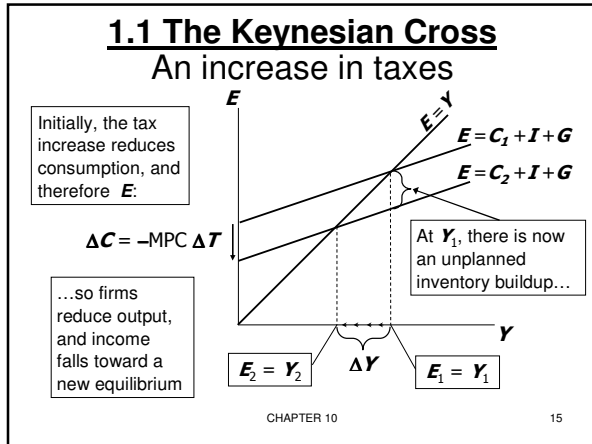
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### 1.1 The Keynesian Cross

#### An increase in taxes

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

$= \Delta C$      $I$  and  $G$  exogenous

$= MPC \times (\Delta Y - \Delta T)$

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

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

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### 1.1 The Keynesian Cross

#### The tax multiplier

**Definition:** the change in income resulting from a 1 unit increase in  $T$ :

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

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

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

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## 1.1 The Keynesian Cross

### The tax multiplier

...is *negative*:

An increase in taxes reduces consumer spending, which reduces equilibrium 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  $G$ .

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## 1.2 Defining and Deriving the IS Curve

### 1.2.1 Using Keynesian Cross and Investment Function

**Definition:** 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:

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

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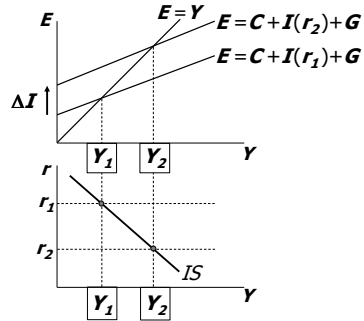
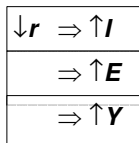
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## 1.2 Defining and Deriving the IS Curve

### 1.2.1 Using Keynesian Cross and Investment Function



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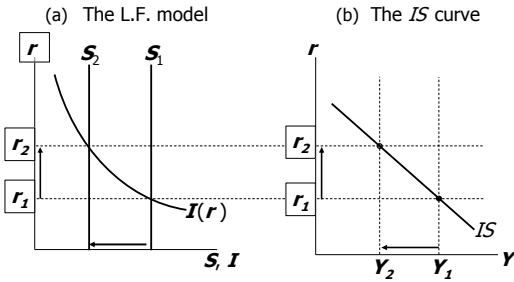
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**1.2 Defining and Deriving the IS Curve**  
**1.2.2 Using Loanable Funds Approach**




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**1.2 Defining and Deriving the IS Curve**

- 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.

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**1.3 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...

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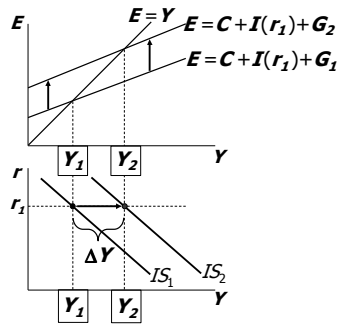
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### 1.3 Fiscal Policy and the IS Curve

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



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## 2. The LM Curve

### 2.1 The Theory of Liquidity Preference

- A simple theory in which the interest rate is determined by money supply and money demand. (due to Keynes again)

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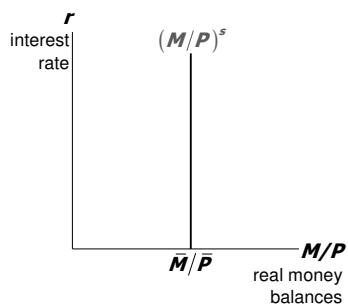
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### 2.1 The Theory of Liquidity Preference

The supply of  
 real money  
 balances  
 is fixed:

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



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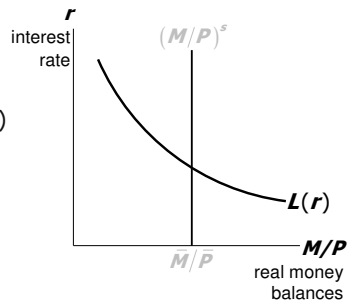
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## 2.1 The Theory of Liquidity Preference

Demand for real money balances:

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



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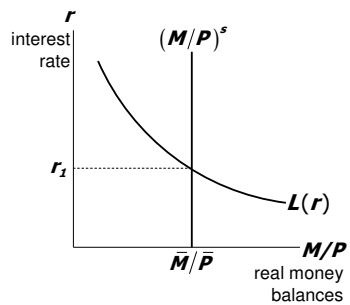
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## 2.1 The Theory of Liquidity Preference

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

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



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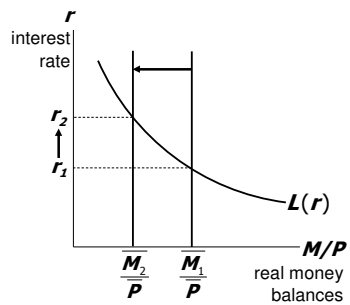
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## 2.1 The Theory of Liquidity Preference A change in money supply

To increase  $r$ ,  
Fed reduces  
 $M$



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## 2.2 Defining and Deriving the LM Curve

### 2.2.1 Using Theory of Liquidity Preference

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:

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

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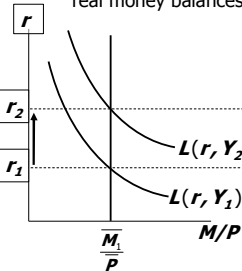
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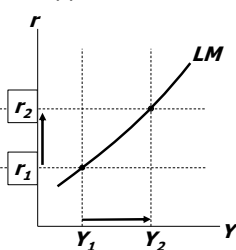
## 2.2 Defining and Deriving the LM Curve

### 2.2.1 Using Theory of Liquidity Preference

(a) The market for real money balances



(b) The LM curve



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## 2.2 Defining and Deriving the LM Curve

### 2.2.2 Using Quantity Equation

- Quantity Equation

$$MV=PY$$

- Quantity Theory of money assumes constant velocity  $\rightarrow$  vertical LM curve
- If we adjust it so that  $V=V(r)$  then we get the upward sloping LM curve again.

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## 2.2 Defining and Deriving the LM Curve

- 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.

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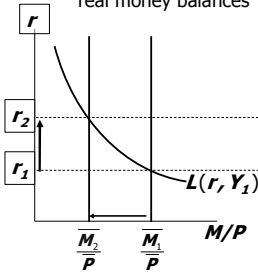
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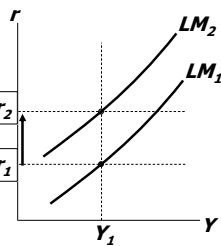
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## 2.3 Monetary Policy and the LM Curve

(a) The market for real money balances



(b) The LM curve



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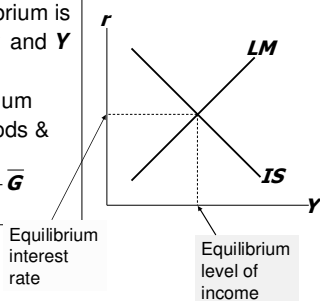
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## 3. The short-run equilibrium

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

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

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



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## **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

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## **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

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## **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.

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## **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
- learn about the Great Depression using our models

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