Intermediate Macroeconomics

Introduction to Economic Fluctuations

The IS curve

Today's Outline – Part I

- facts about the business cycle
- how the short run differs from the long run
- an introduction to aggregate demand
- an introduction to aggregate supply in the short run and long run
- how the model of aggregate demand and aggregate supply can be used to analyze the short-run and long-run effects of "shocks."

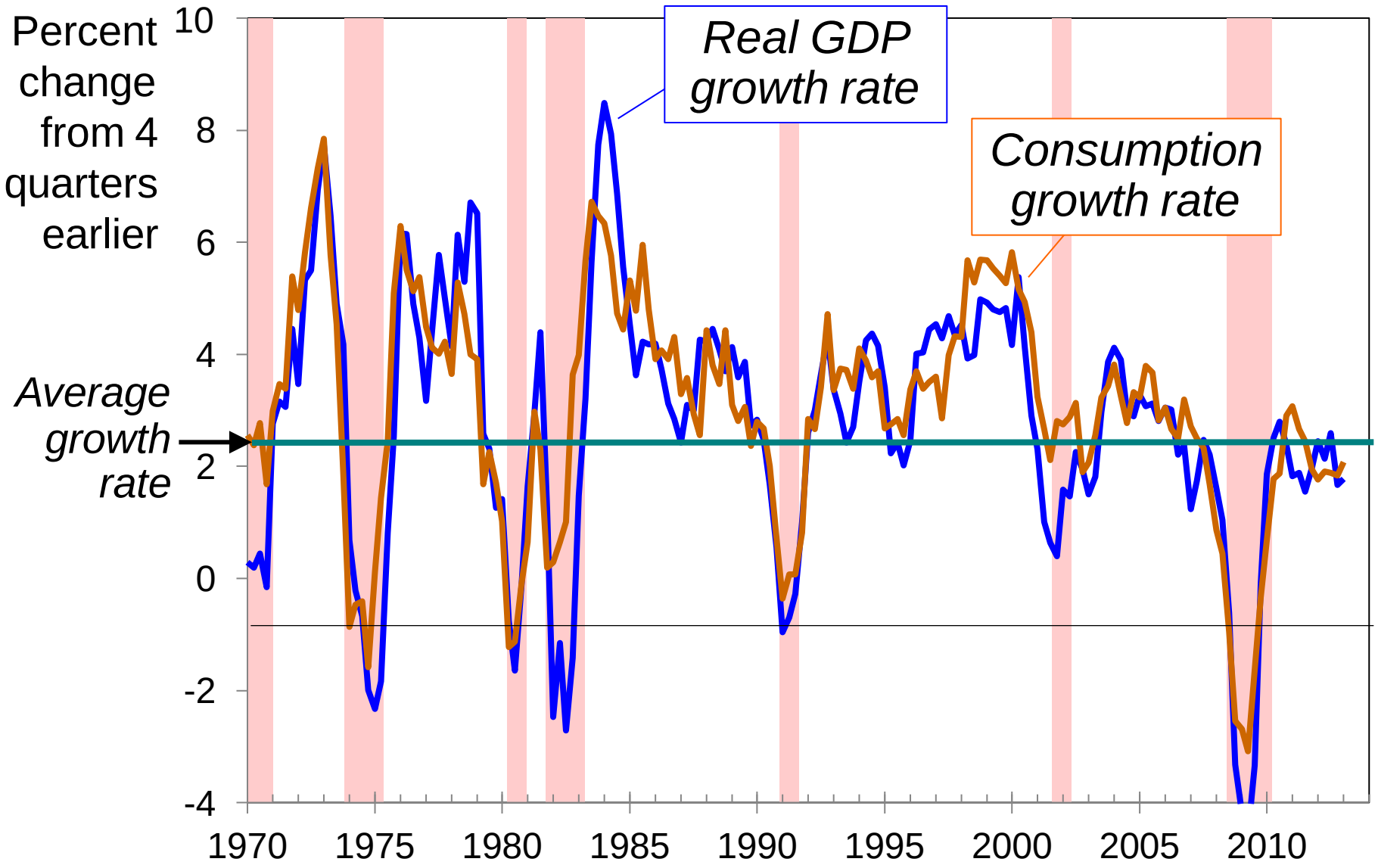
Readings

§ Required reading: Mankiw, chapter 10

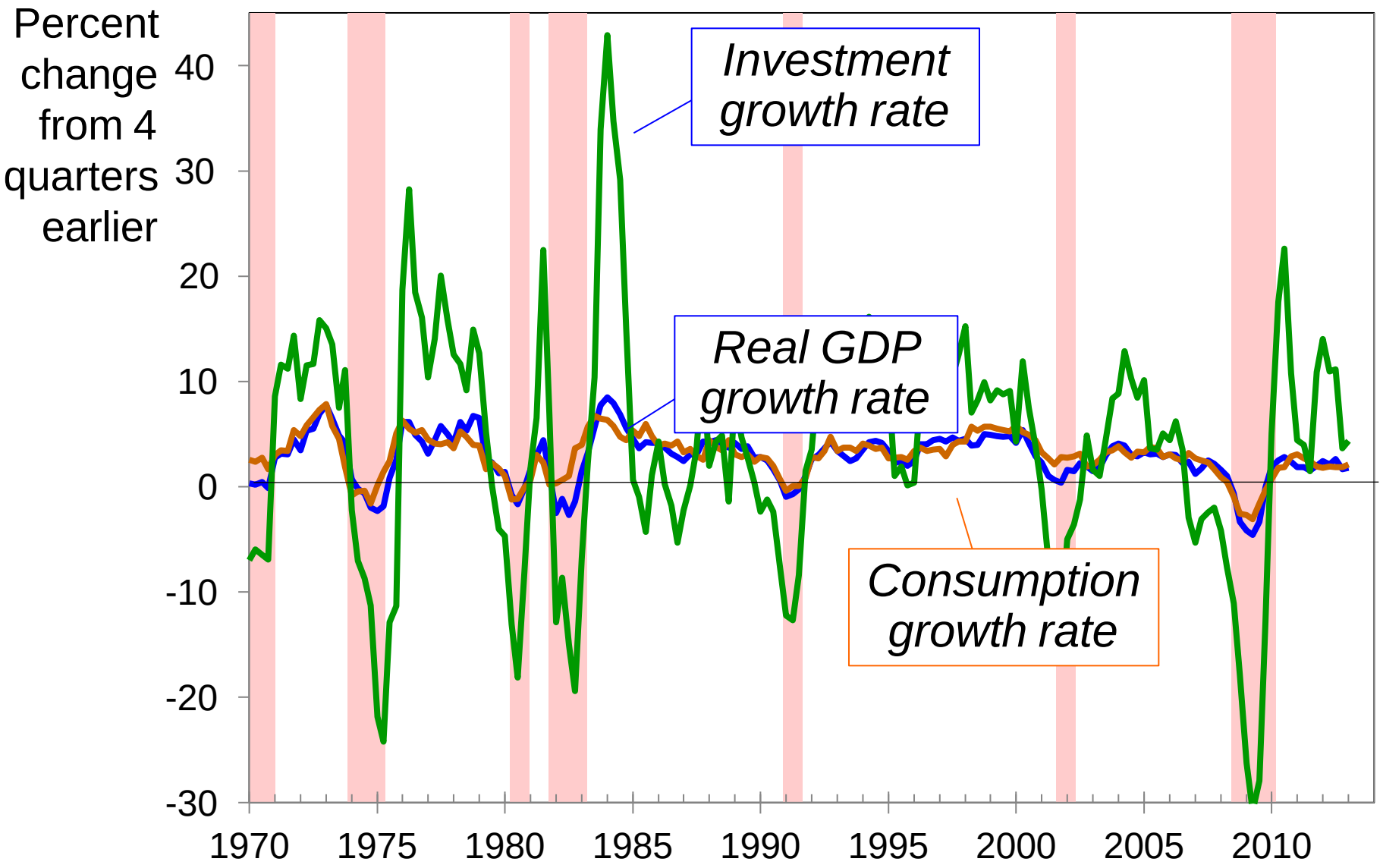
Facts about the business cycle

- GDP growth averages 3–3.5 percent per year over the long run with large fluctuations in the short run.
- Consumption and investment fluctuate with GDP, but consumption tends to be less volatile and investment more volatile than GDP.
- Unemployment rises during recessions and falls during expansions.
- **Okun's law**: the negative relationship between GDP and unemployment.

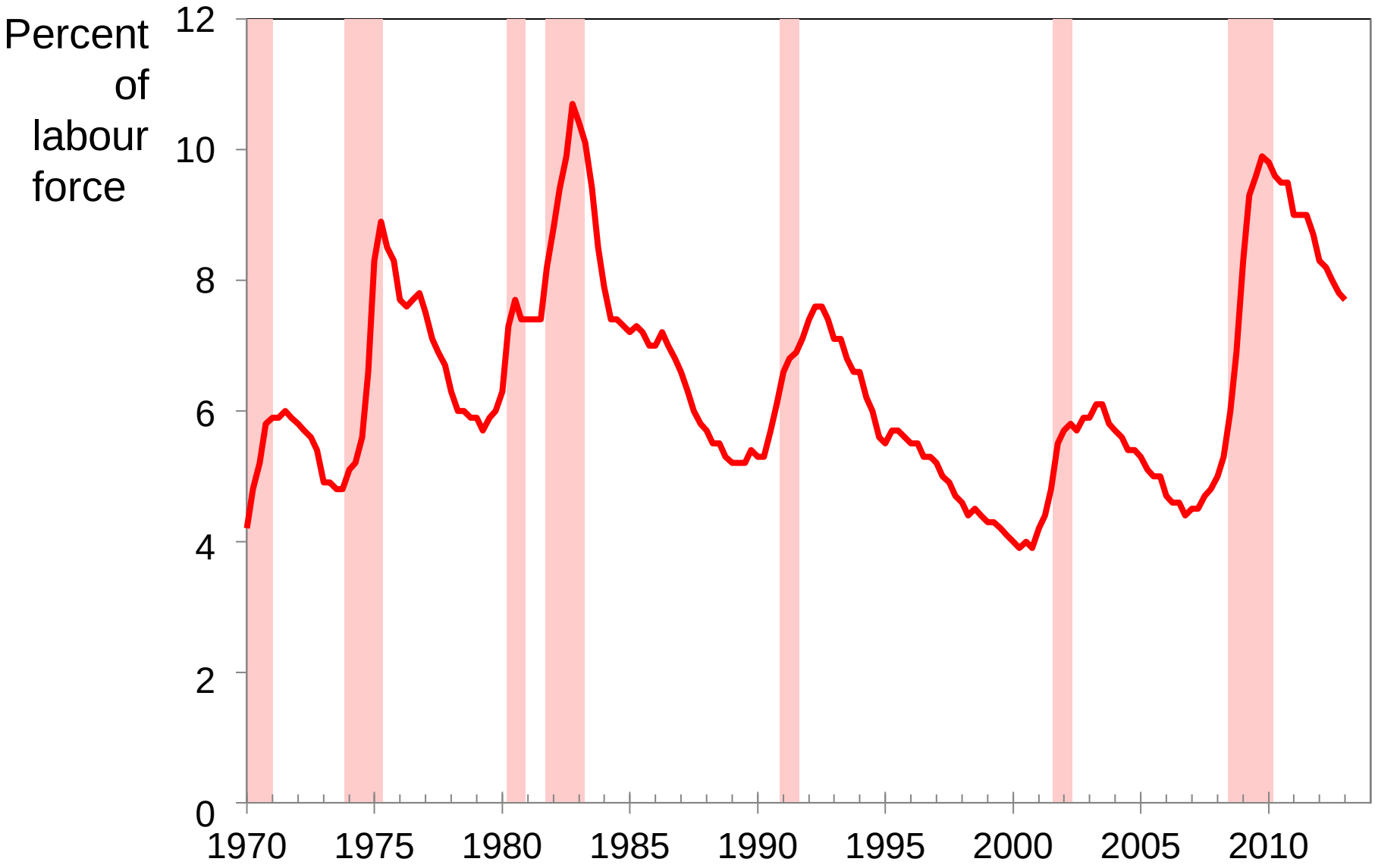
Growth rates of real GDP and consumption US



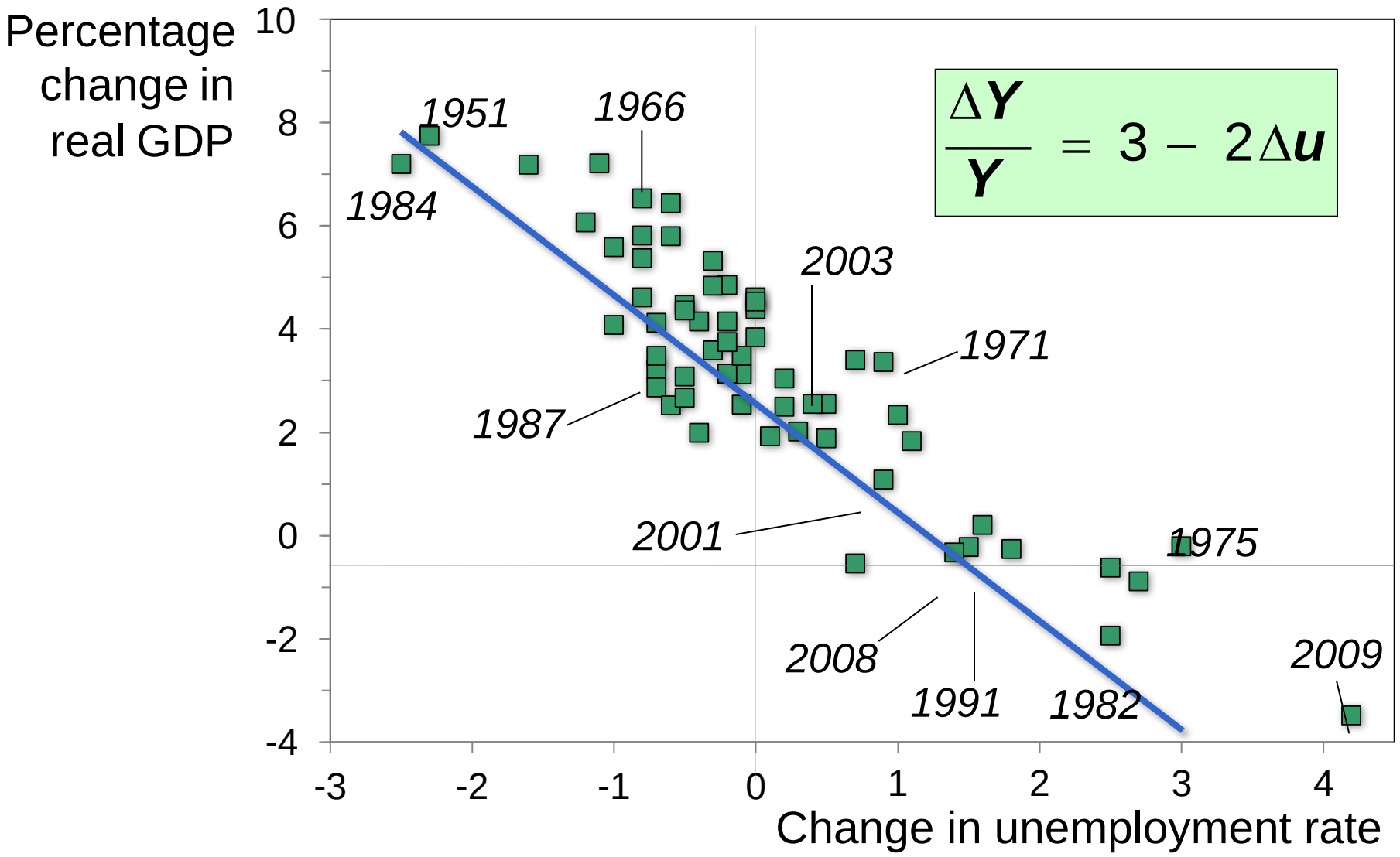
Growth rates of real GDP, cons. and investment US



Unemployment US



Okun's Law


Percentage change in real GDP
10
8
6
4
2
0
-2
-4
-3
-2
-1
0
1
2
3
4
Change in unemployment rate
$\frac{\Delta Y}{Y} = 3 - 2\Delta u$
1951
1966
1984
2003
1971
1987
2001
1975
2008
1991
1982
2009

Time horizons in macroeconomics

§ Long run

Prices are flexible, respond to changes in supply or demand.

§ Short run

Many prices are "sticky" at a predetermined level.

The economy behaves differently when prices are sticky.

Recap of classical macro theory

§ Output is determined by the supply side:
  – supplies of capital, labour
  – technology

§ Changes in demand for goods & services (***C***, ***I***, ***G***) only affect prices, not quantities.

§ Assumes complete price flexibility.

§ Applies to the long run.

When prices are sticky…

…output and employment also depend on demand, which is affected by:

- fiscal policy (***G*** and ***T***)
- monetary policy (***M***)
- other factors, like exogenous changes in ***C*** or ***I***

The model of aggregate demand and supply

§ The paradigm most mainstream economists and policymakers use to think about economic fluctuations and policies to stabilize the economy

§ Shows how the price level and aggregate output are determined

§ Shows how the economy's behaviour is different in the short run and long run

Aggregate demand

§ The aggregate demand curve shows the relationship between the price level and the quantity of output demanded.

§ For now, we use a simple theory of aggregate demand based on the quantity theory of money.

§ Next week we will develop the theory of aggregate demand in more detail.

The Quantity Equation as Aggregate Demand

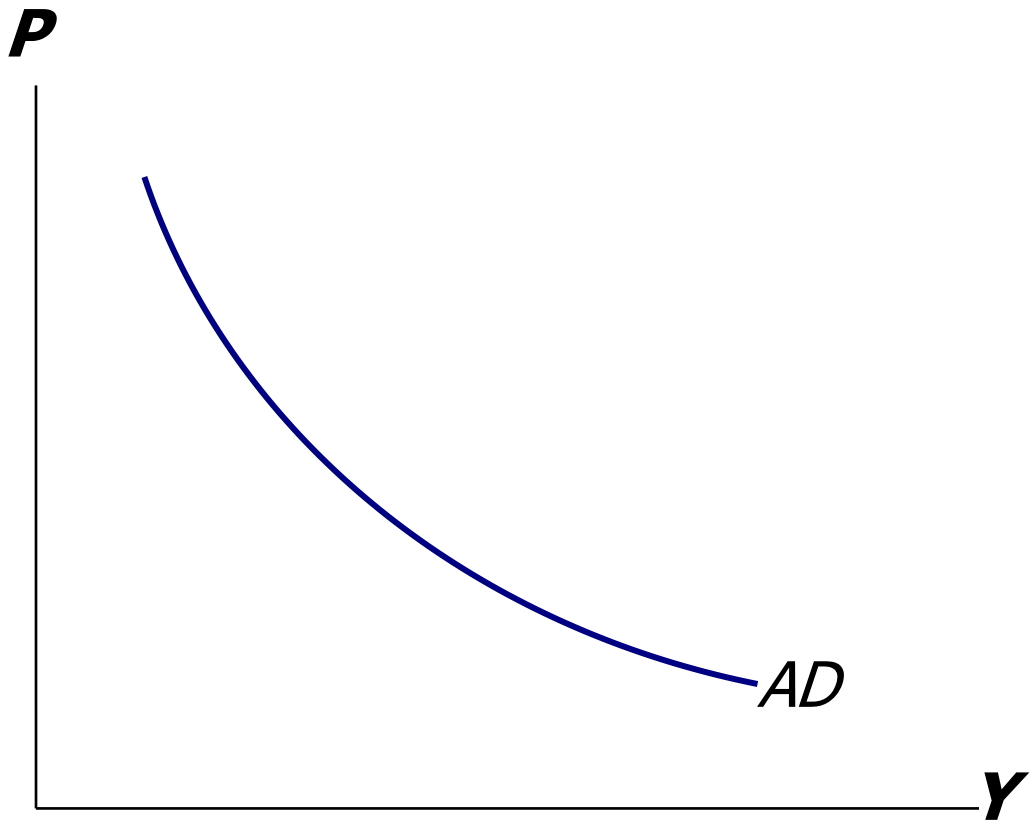
- Recall the quantity equation

$$MV = PY$$

- For given values of M and V, this equation implies an inverse relationship between P and Y…

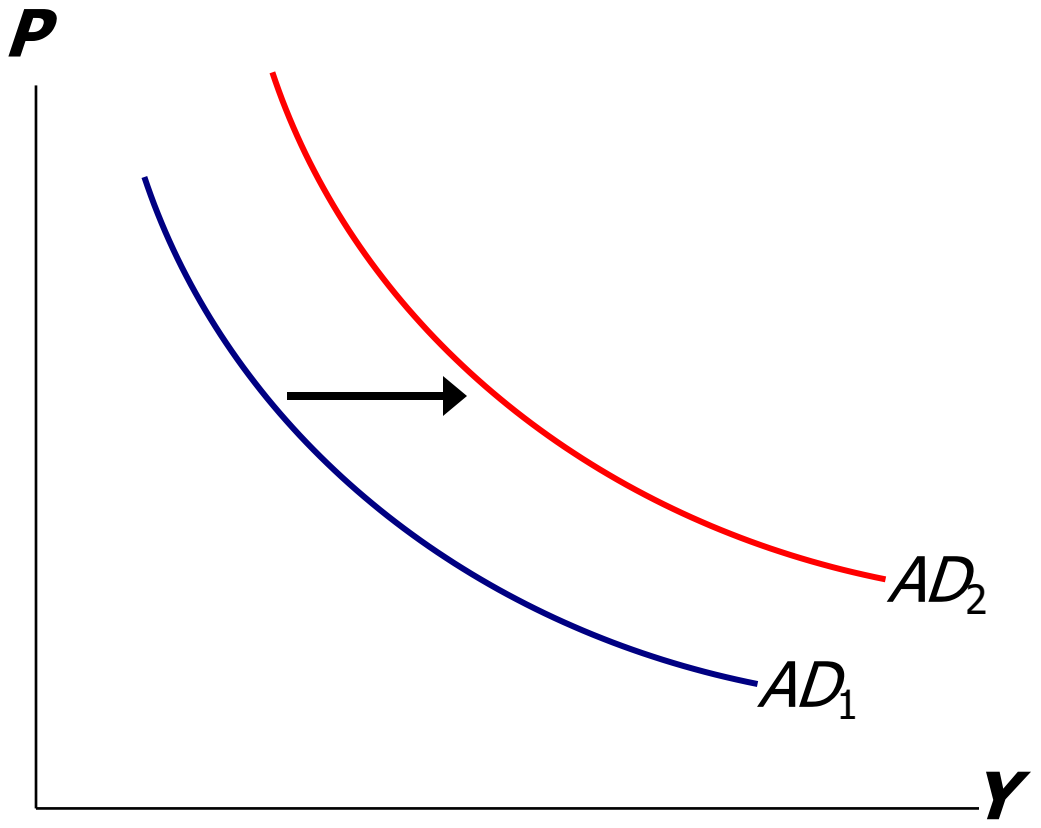
The downward-sloping *AD* curve

An increase in the price level causes a fall in real money balances (***M/P***), causing a decrease in the demand for goods & services.



Shifting the *AD* curve

An increase in the money supply shifts the *AD* curve to the right.



Aggregate supply in the long run

§ Recall from last week:

In the long run, output is determined by factor supplies and technology

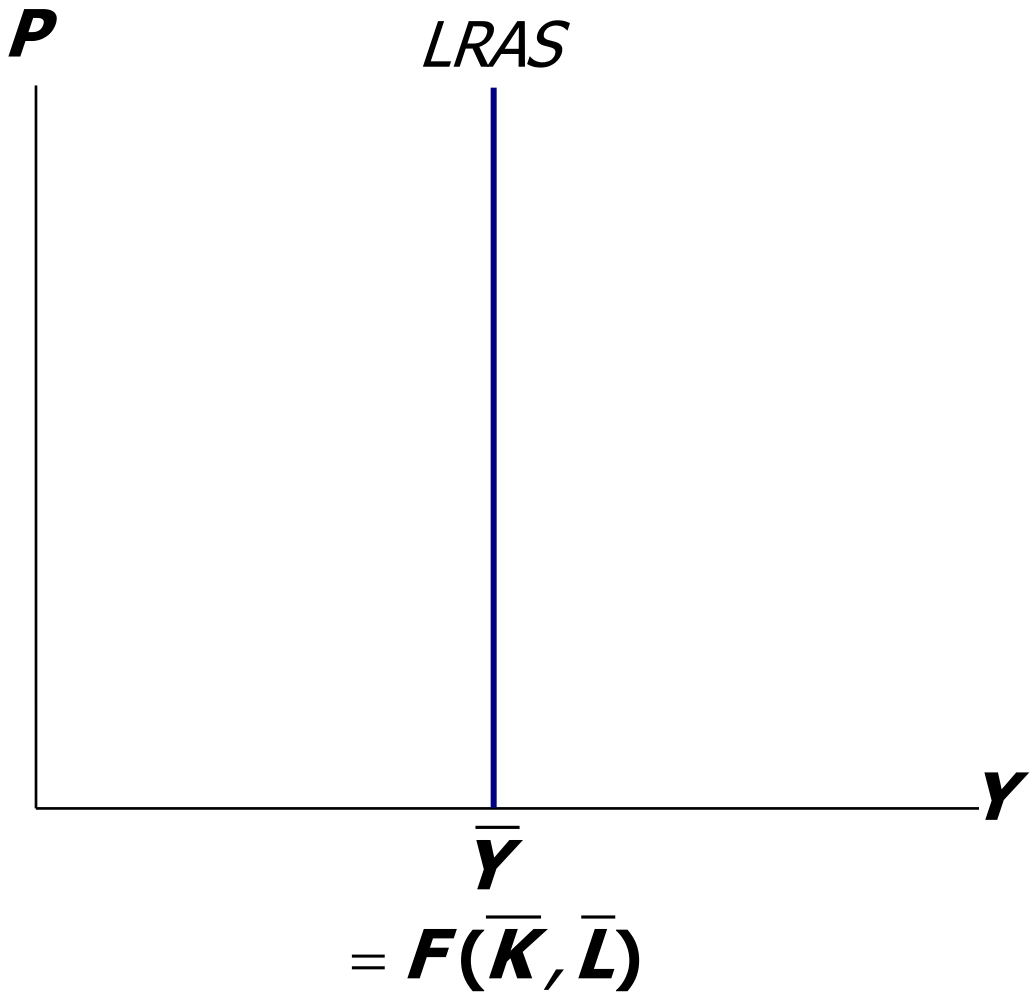
$$\bar{Y} = F(\bar{K}, \bar{L})$$

$\bar{Y}$ is the **full-employment** or **natural** level of output, at which the economy's resources are fully employed.

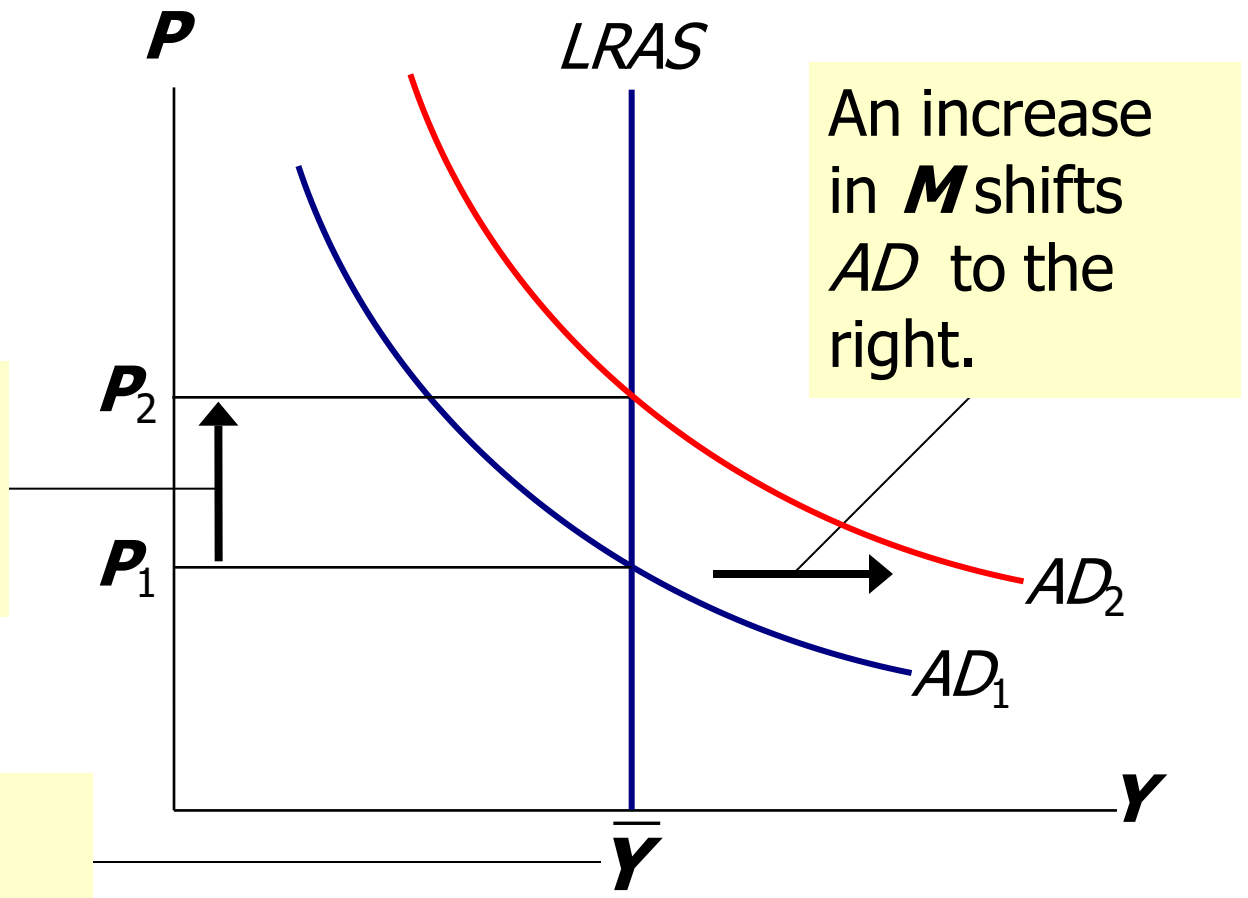
"Full employment" means that unemployment equals its natural rate (not zero).

The long-run aggregate supply curve

$\bar{Y}$ does not depend on P, so *LRAS* is vertical.



Long-run effects of an increase in *M*



Aggregate supply in the short run

§ Many prices are sticky in the short run.

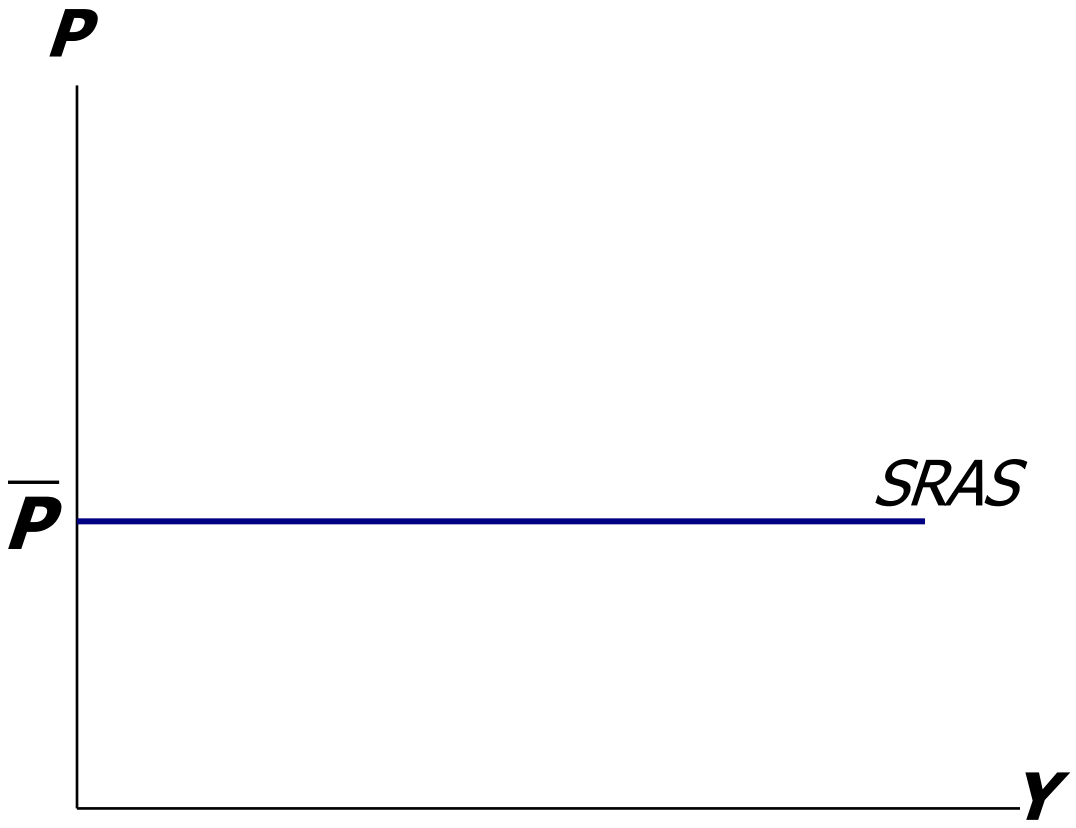
§ We assume that
- all prices are stuck at a predetermined level in the short run.
- firms are willing to sell as much at that price level as their customers are willing to buy.

§ Therefore, the short-run aggregate supply (*SRAS*) curve is horizontal:

The short-run aggregate supply curve

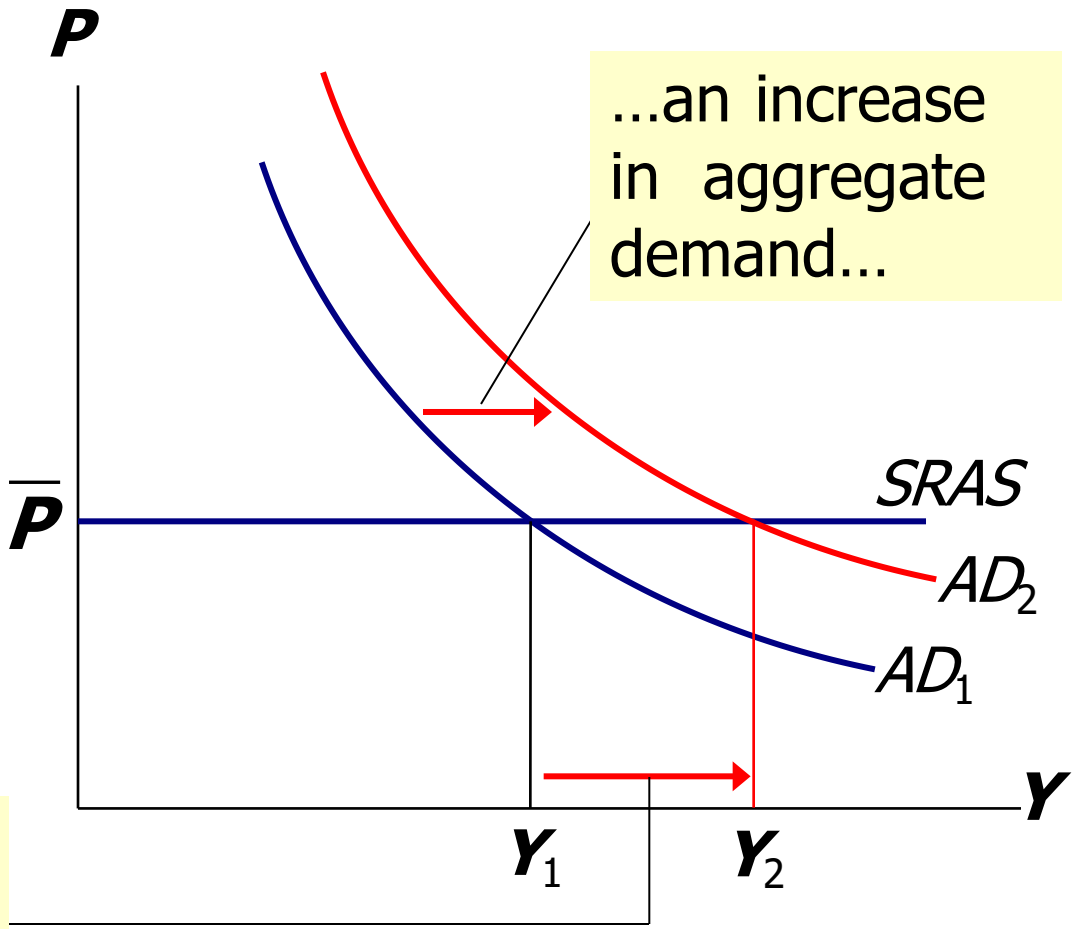
The *SRAS* curve is horizontal:

The price level is fixed at a predetermined level, and firms sell as much as buyers demand.



Short-run effects of an increase in *M*

In the short run when prices are sticky,…



…causes output to rise.

From the short run to the long run

Over time, prices gradually become "unstuck."
When they do, will they rise or fall?

In the short-run equilibrium, if	then over time, ***P*** will…
$Y > \bar{Y}$	*rise*
$Y < \bar{Y}$	*fall*
$Y = \bar{Y}$	*remain constant*

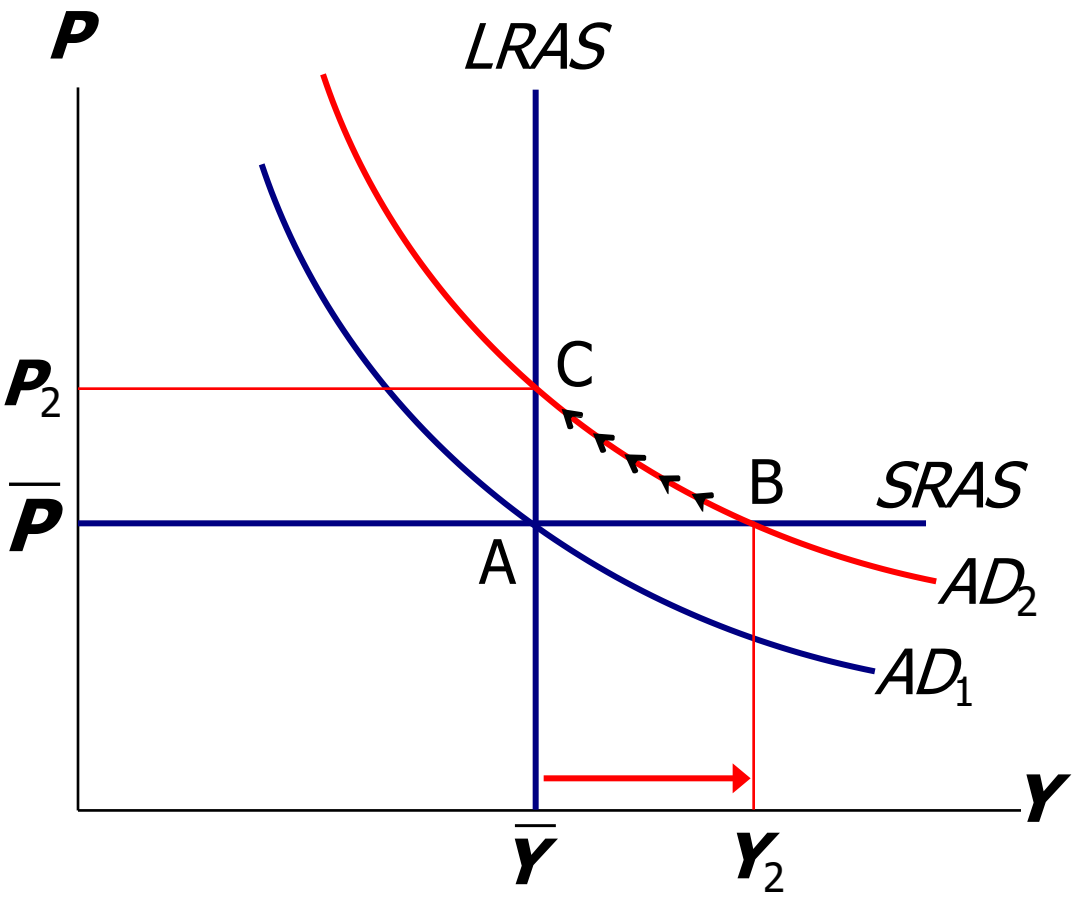
The adjustment of prices is what moves the economy to its long-run equilibrium.

The SR & LR effects of $\Delta M > 0$

A = initial equilibrium

B = new short-run equilibrium after Central Bank increases M

C = long-run equilibrium



Stabilization policy

- **shocks**: exogenous changes in aggregate supply or demand
- Shocks temporarily push the economy away from full employment.
- **Stabilization policy**: policy actions aimed at reducing the severity of short-run economic fluctuations.

Demand shocks

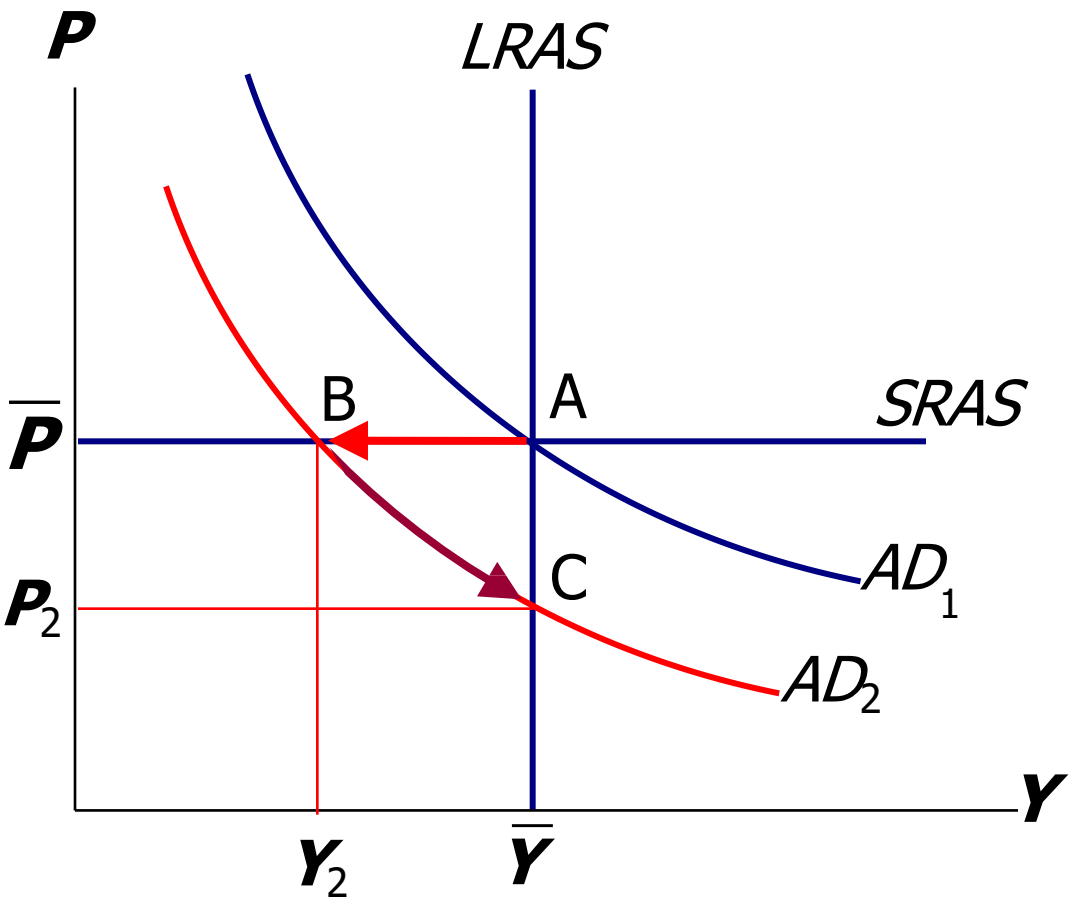
§ Example: exogenous decrease in velocity

If the money supply is held constant, a decrease in V means people will be using their money in fewer transactions, causing a decrease in demand for goods and services.

The effects of a negative aggregate demand shock

AD shifts left, depressing output and employment in the short run.

Over time, prices fall and the economy moves down its demand curve toward full employment.



Supply shocks

- A **supply shock** alters production costs, affects the prices that firms charge. (also called **price shocks**)
- Examples of *adverse* supply shocks:
  - Bad weather reduces crop yields, pushing up food prices.
  - Workers unionize, negotiate wage increases.
  - New environmental regulations require firms to reduce emissions. Firms charge higher prices to help cover the costs of compliance.
- *Favourable* supply shocks lower costs and prices.

CASE STUDY: The 1970s oil shocks

§ Early 1970s: OPEC coordinated a reduction in the supply of oil.

§ Oil prices rose

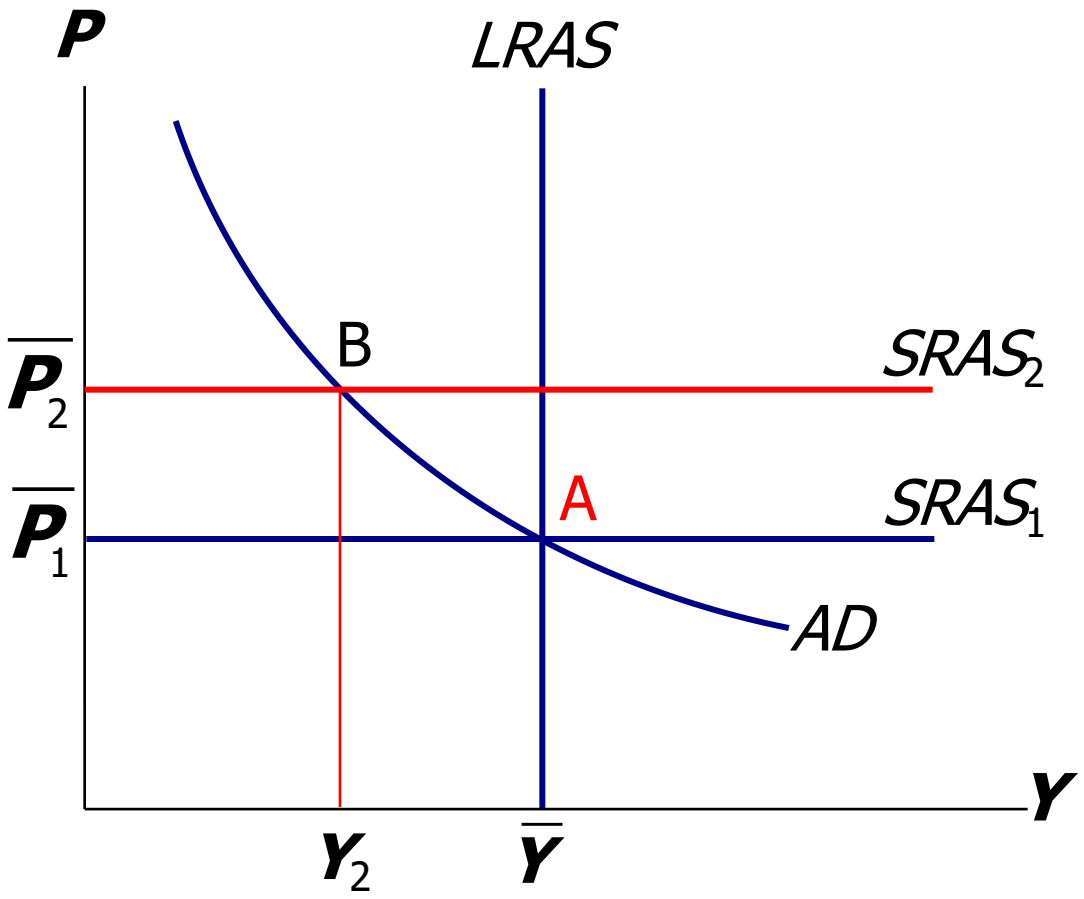
11% in 1973
68% in 1974
16% in 1975

§ Such sharp oil price increases are supply shocks because they significantly impact production costs and prices.

CASE STUDY: The 1970s oil shocks

The oil price shock shifts *SRAS* up, causing output and employment to fall.

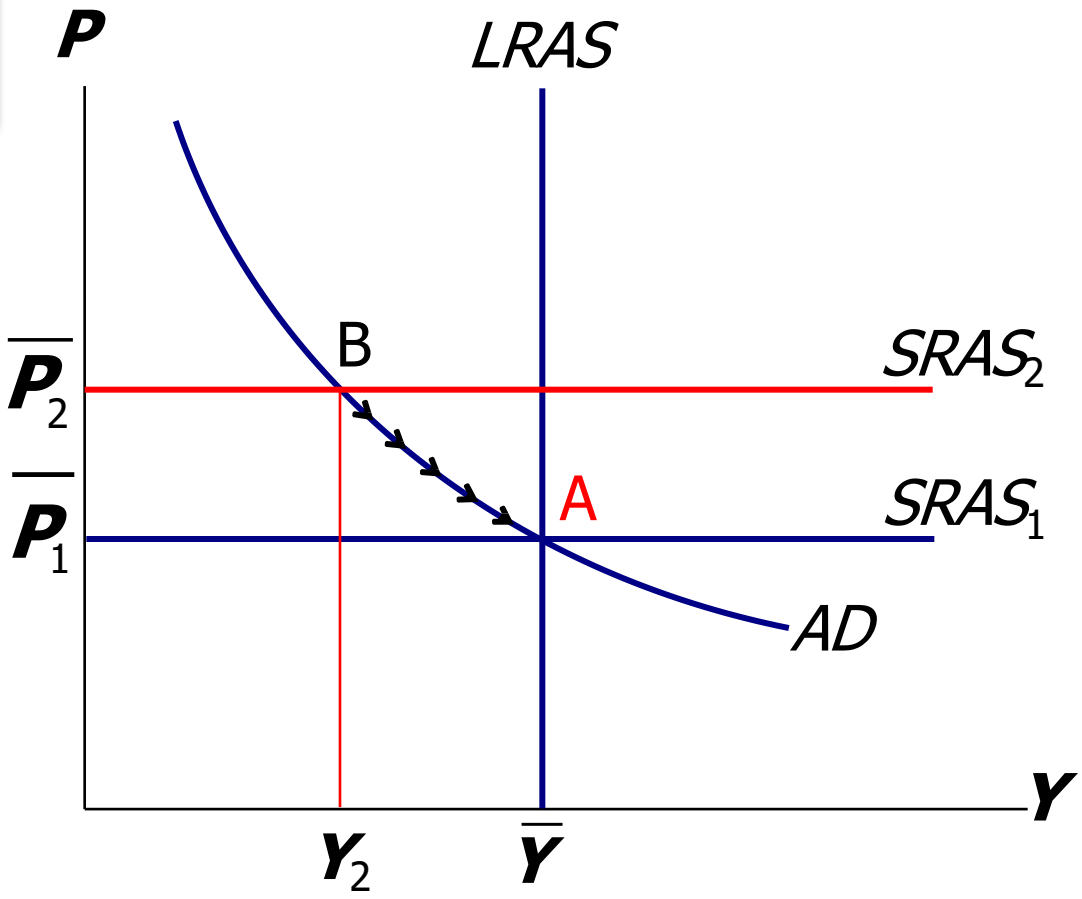
There is **stagflation** – combination of falling output and inflation.



CASE STUDY: The 1970s oil shocks

Option 1. No stabilization

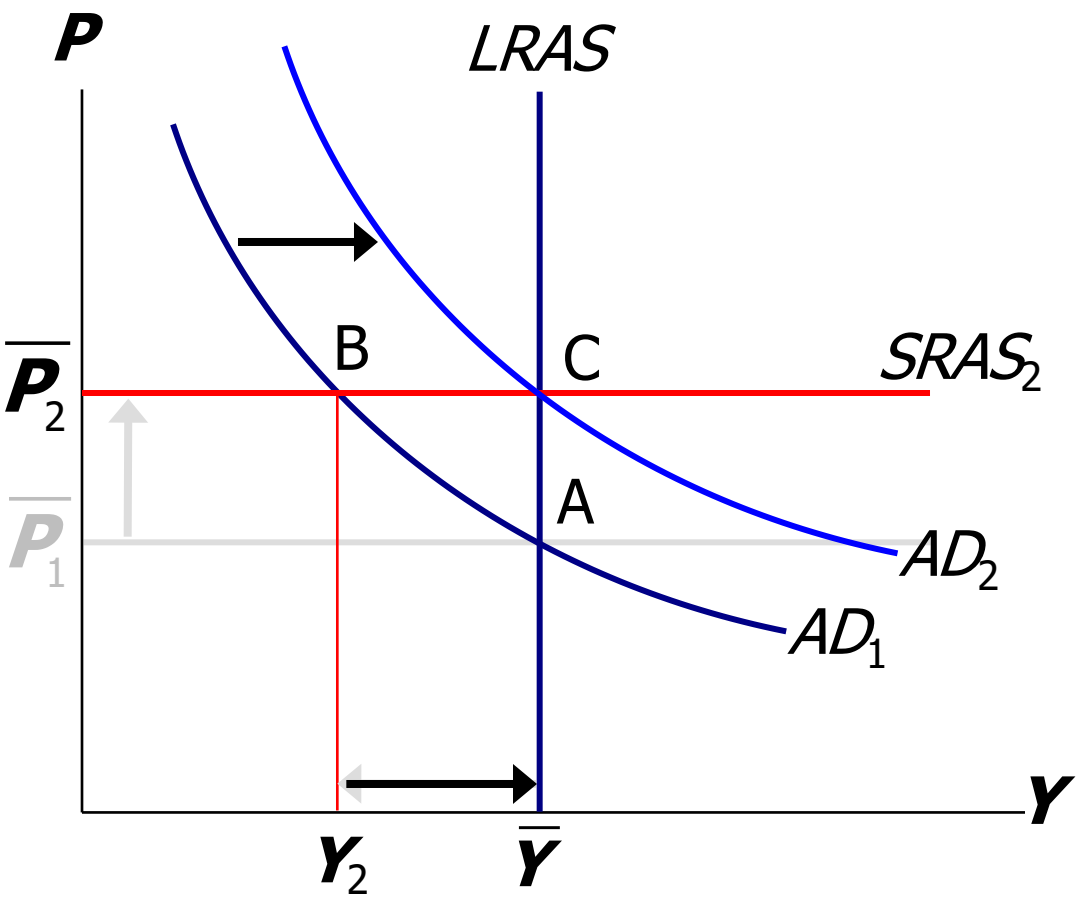
In the absence of further price shocks, prices will fall over time and the economy moves back toward full employment.



CASE STUDY: The 1970s oil shocks

Option 2. The central bank accommodates the shock by raising aggregate demand.

P is permanently higher, but ***Y*** remains at its full-employment level.



Summary

- Long run: prices are flexible, output and employment are always at their natural rates, and the classical theory applies.

  Short run: prices are sticky, shocks can push output and employment away from their natural rates.
- Aggregate demand and supply: a framework to analyze economic fluctuations
- The aggregate demand curve slopes downward.
- The long-run aggregate supply curve is vertical, because output depends on technology and factor supplies, but not prices.
- The short-run aggregate supply curve is horizontal, because prices are sticky at predetermined levels.

Summary

- Shocks to aggregate demand and supply cause fluctuations in GDP and employment in the short run
- The central bank can attempt to stabilize the economy with monetary policy

Today's Outline – Part II

- the *IS* curve and its relation to:
  - the Keynesian cross
  - the loanable funds model

Readings

§ Required reading: Mankiw, chapter 11

Context

- The first part of the lecture 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

§ Now we will start developing 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 the *SRAS* curve is horizontal).

The Keynesian cross

§ A simple closed-economy model in which income is determined by expenditure.
(due to John Maynard Keynes)

§ Notation:

I = planned investment

PE = ***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: $I = \bar{I}$

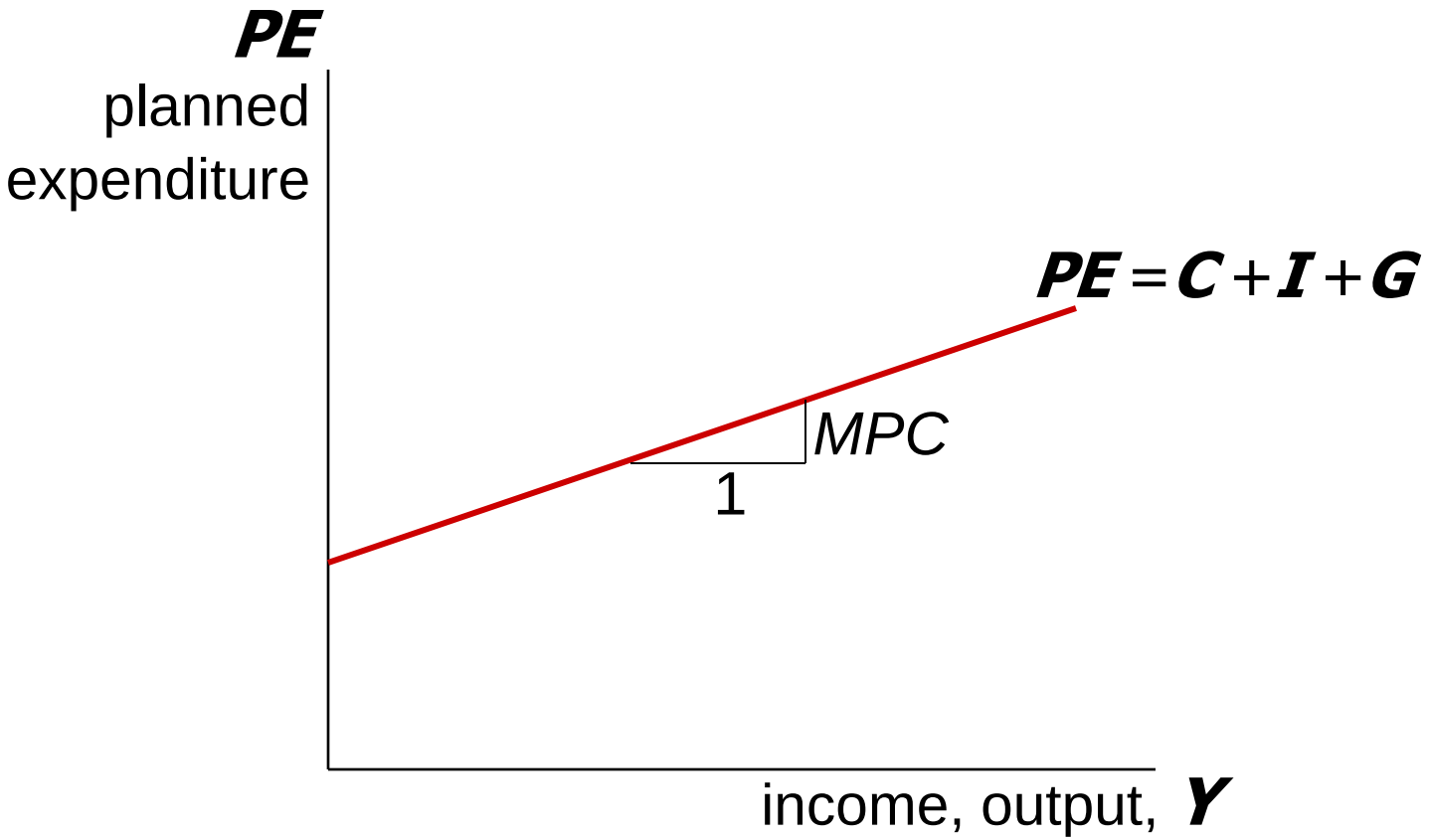
planned expenditure: $PE = C(Y - \bar{T}) + \bar{I} + \bar{G}$

equilibrium condition:

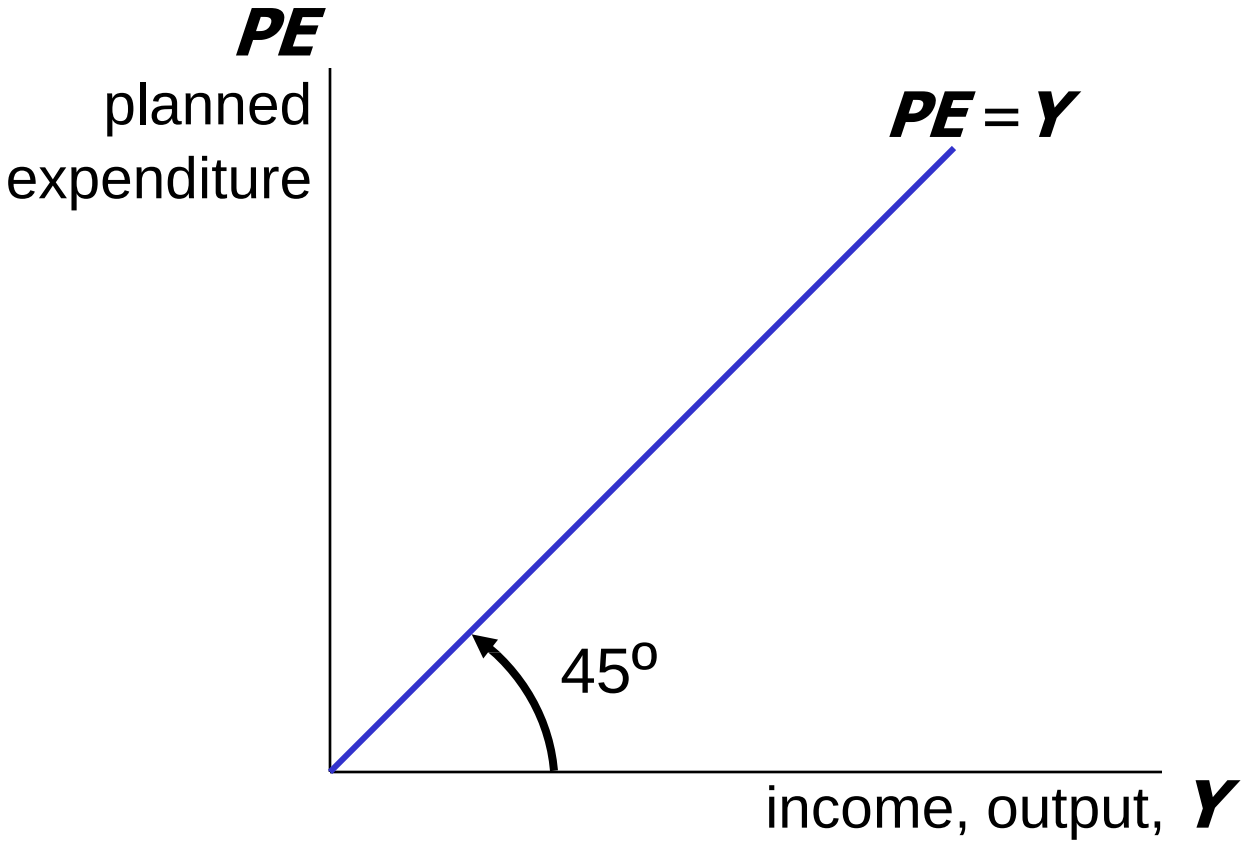
actual expenditure = planned expenditure

$$Y = PE$$

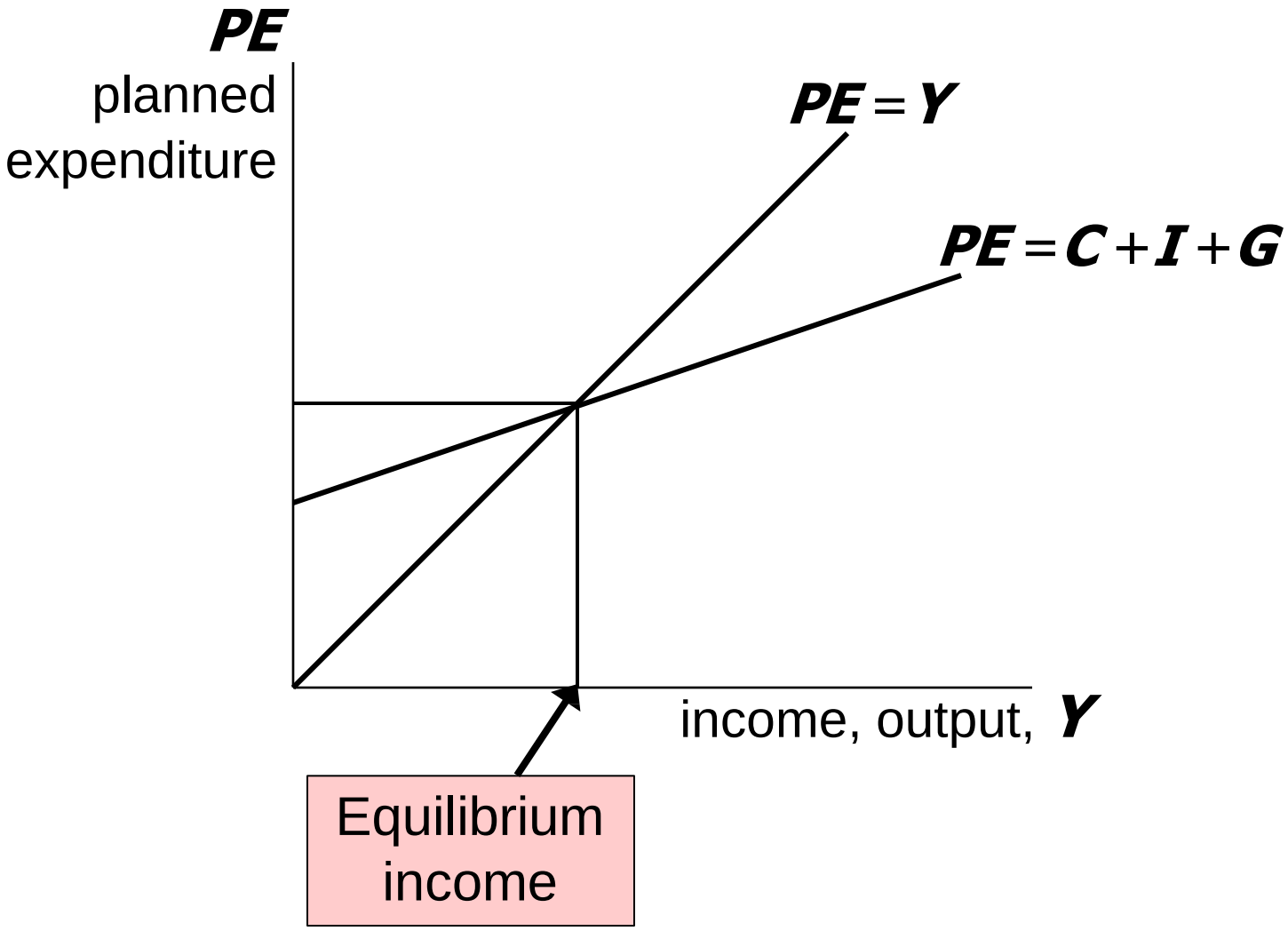
Graphing planned expenditure



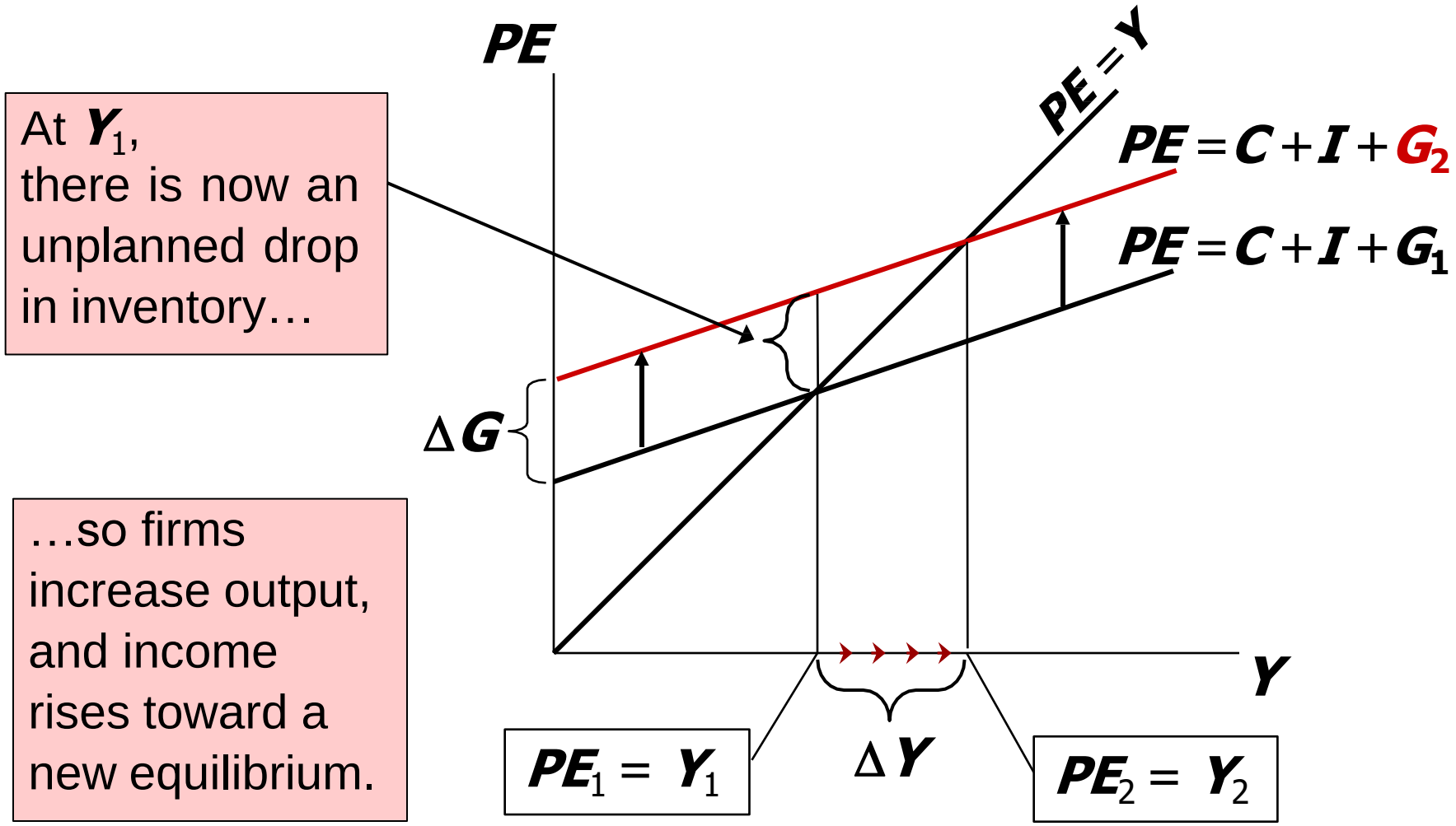
Graphing the equilibrium condition



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 $\Delta C = \text{MPC} \times \Delta Y$

Collect terms with ΔY on the left side of the equal 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 government purchases multiplier equals

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

Example: If *MPC* = 0.8, then

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

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.

Why the multiplier is greater than 1

- Example: the government spends and additional £100 million on defense $\Delta G = £100$ *million*
- The revenue of defense firms increases by £100 million, all of which becomes income to workers, managers, shareholders, etc. Hence, $\Delta Y = \Delta G = £100$ *million.*
- The workers, managers, shareholders, etc, are also consumers and increase consumption by a fraction MPC of the extra income. $\Delta C = MPC \times £100$
- This additional consumption becomes income for the firms who provide the goods and services being consumed.

Why the multiplier is greater than 1

- This extra income will be distributed to consumers, managers, shareholders, etc, who again increase their consumption by a fraction MPC of the extra income.
- The process continues and the total increase in income is:

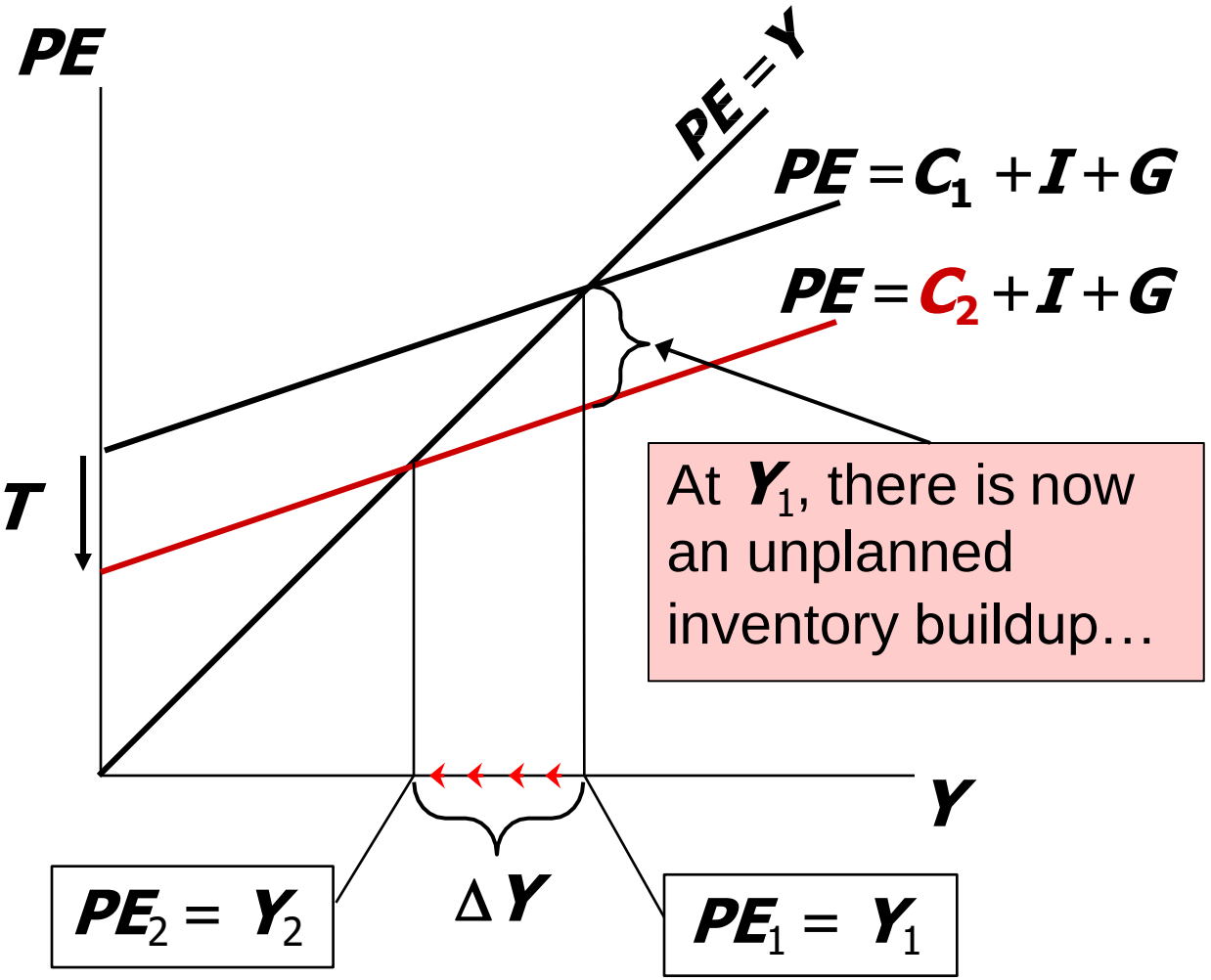
$$\Delta Y = \Delta G + MPC \times \Delta G + MPC^2 \times \Delta G + MPC^3 \times \Delta G + \cdots$$
$$= \frac{1}{1 - MPC} \times \Delta G$$

An increase in taxes

Initially, the tax increase reduces consumption and therefore ***PE***:

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

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



At Y_1, there is now an unplanned inventory buildup…

Solving for ΔY

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

equilibrium 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***:

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

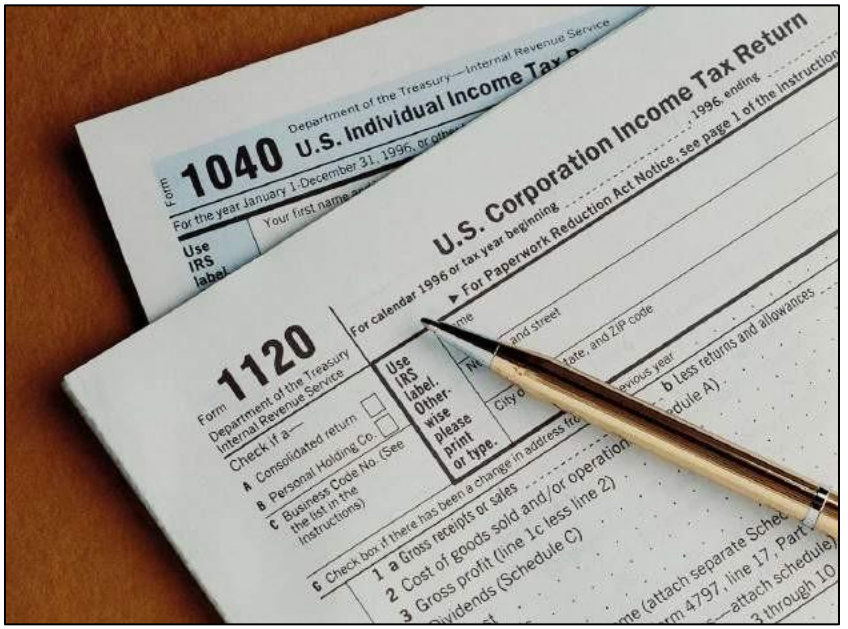
If *MPC* = 0.8, then the tax multiplier equals

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

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***.

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:

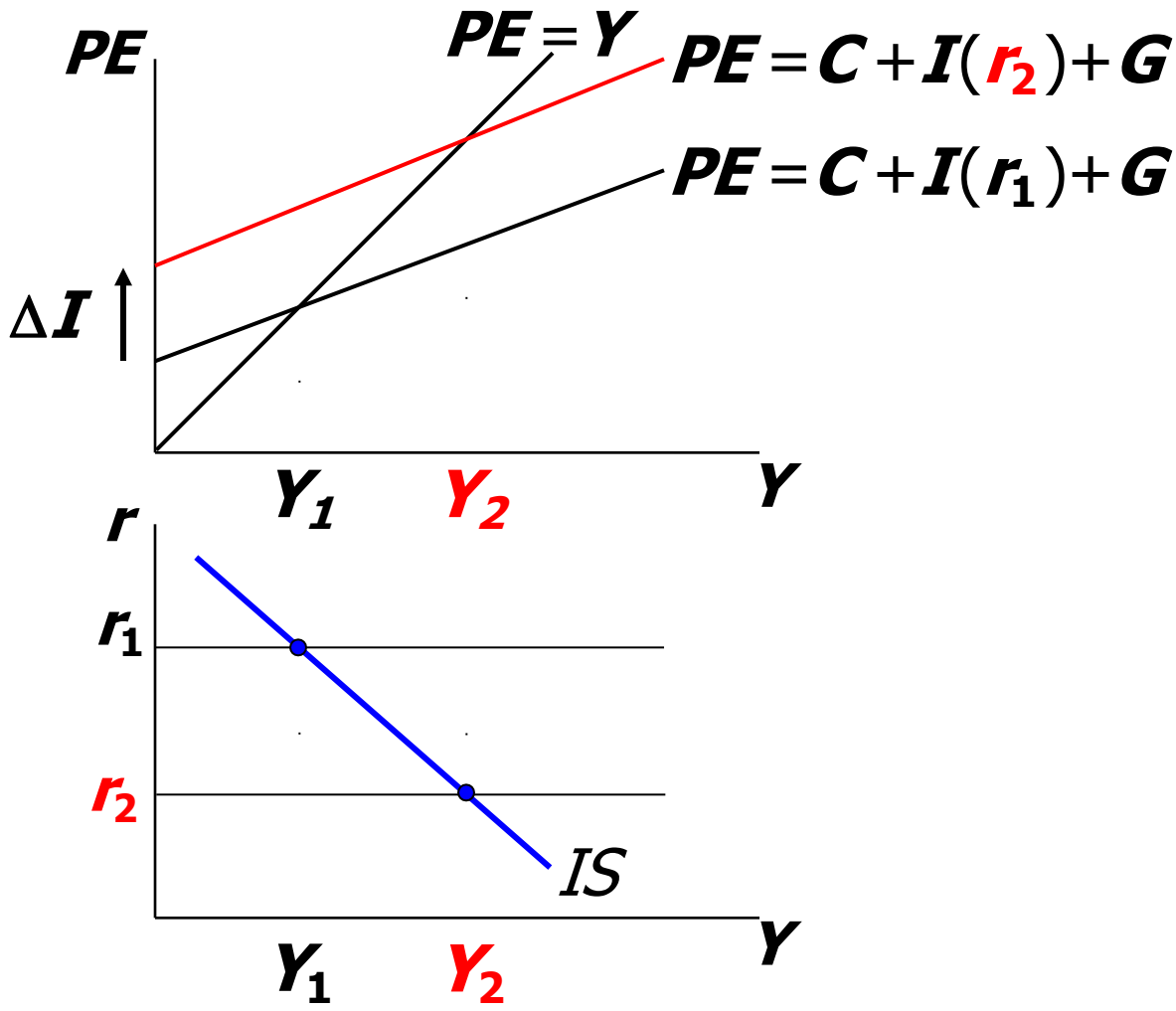
$$Y = C(Y - \overline{T}) + I(r) + \overline{G}$$

Deriving the *IS* curve

$\downarrow r \Rightarrow \uparrow I$

$\Rightarrow \uparrow PE$

$\Rightarrow \uparrow Y$



Why the *IS* curve is negatively sloped

§ A fall in the interest rate motivates firms to increase investment spending, which drives up total planned spending (***PE***).

§ To restore equilibrium in the goods market, output (a.k.a. actual expenditure, ***Y***) must increase.

The *IS* curve and the loanable funds model

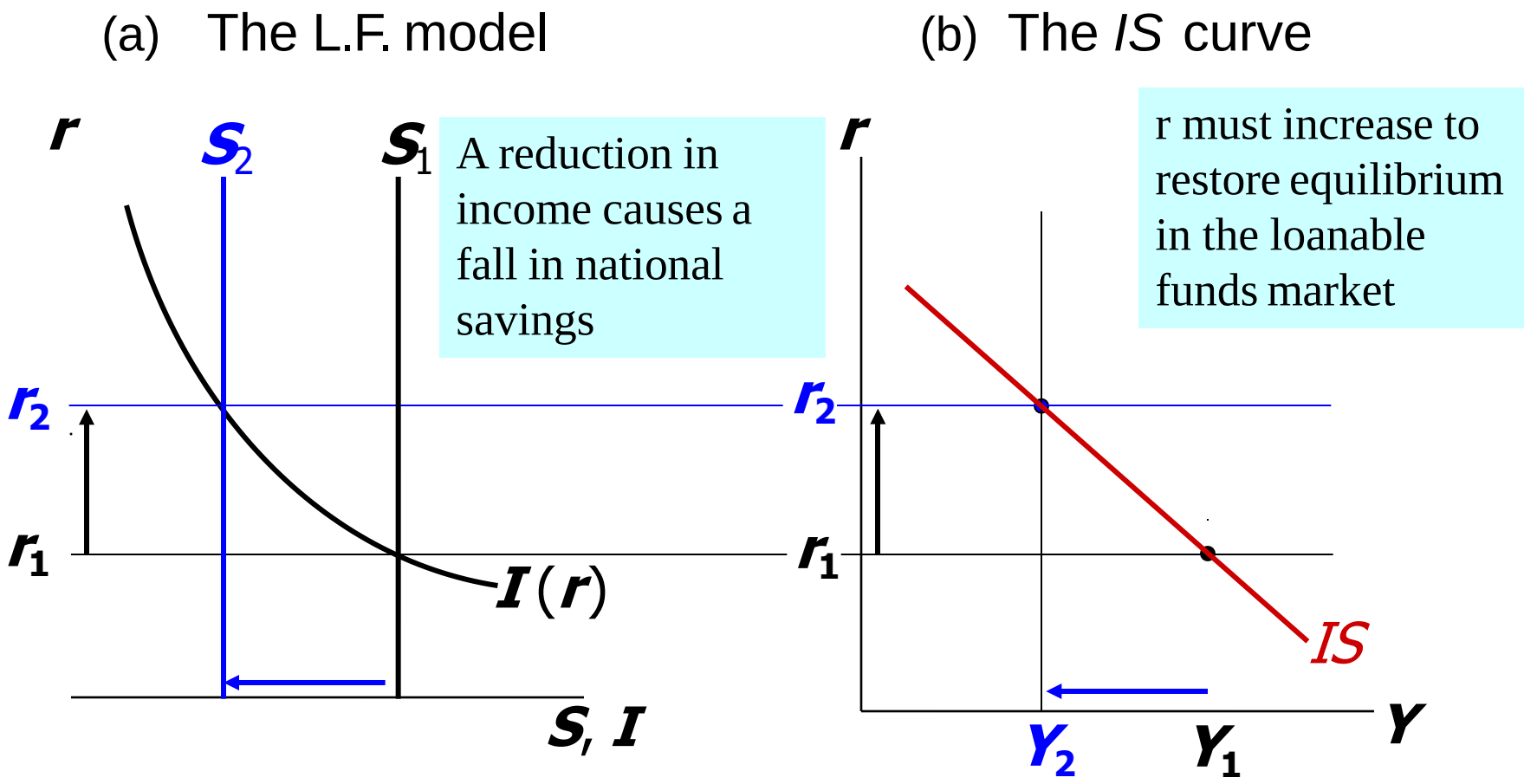
- The IS curve gets its name from equilibrium in the loanable funds market (which we studied last week)

  I (Investment) = S (Saving)

  S=Y-C-G

- The *IS* curve shows all combinations of r and Y such that investment (I) equals saving (S)

The *IS* curve and the loanable funds model



Shifting the *IS* curve: ΔG

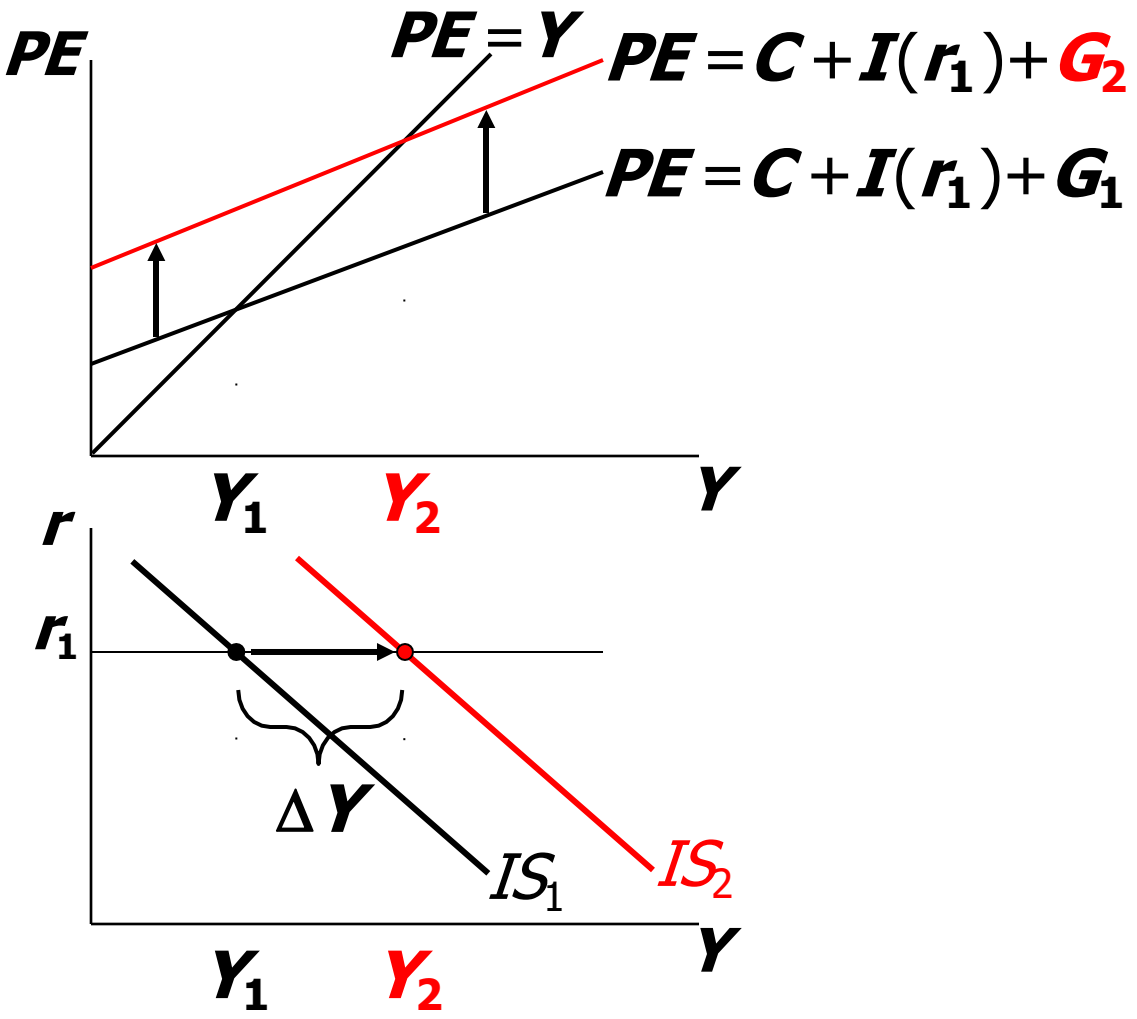
At any value of r,

$\uparrow G \Rightarrow \uparrow PE \Rightarrow \uparrow Y$

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

The horizontal distance of the *IS* shift equals

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



NOW YOU TRY

Shifting the IS curve: ΔT

- Use the diagram of the Keynesian cross or loanable funds model to show how an increase in taxes shifts the IS curve.
- Determine the size of the shift.

ANSWERS

Shifting the IS curve: ΔT

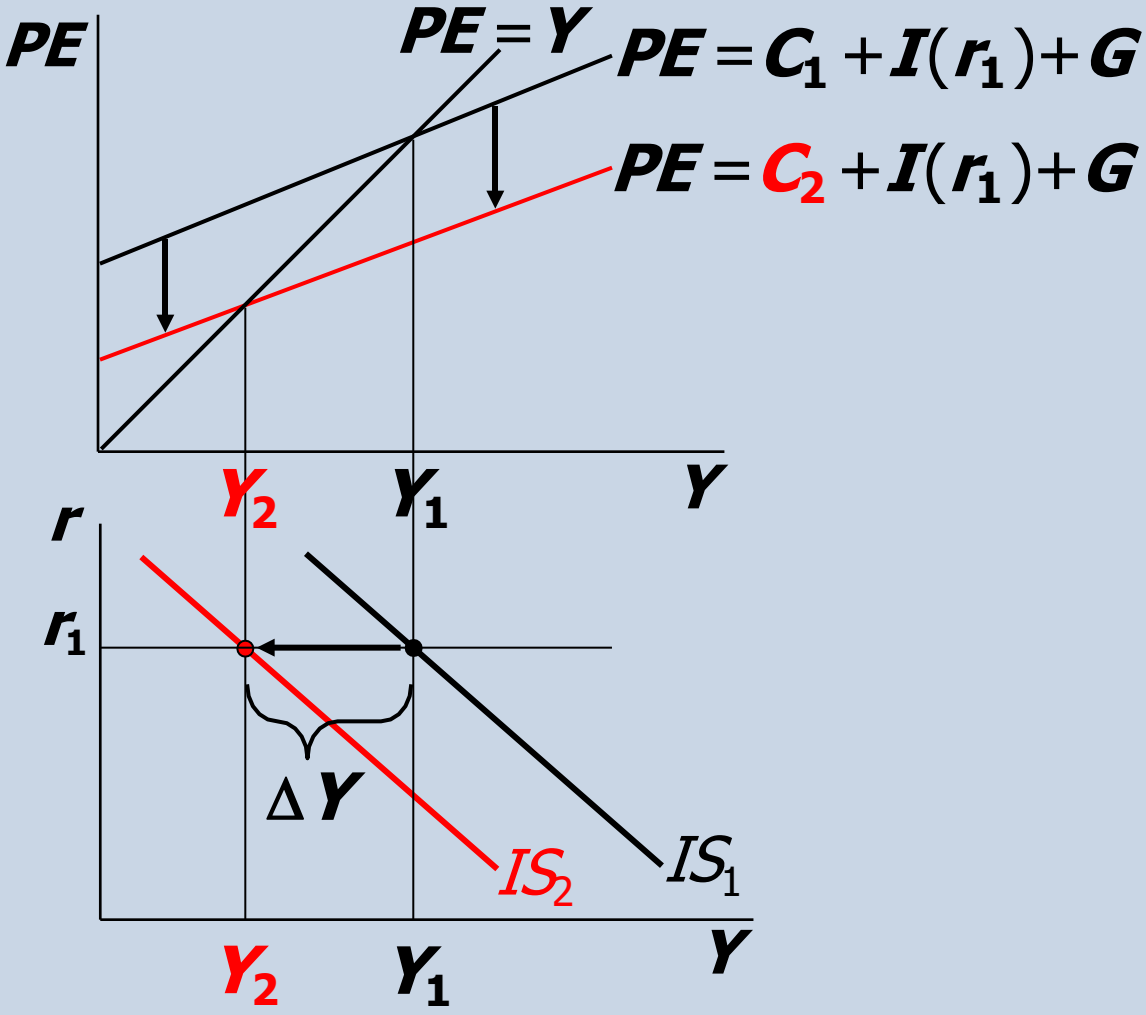
At any value of r,

$\uparrow T \Rightarrow \downarrow C \Rightarrow \downarrow PE$

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

The horizontal distance of the *IS* shift equals

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



Summary

1. Keynesian cross
   - basic model of income determination
   - takes fiscal policy & investment as exogenous
   - fiscal policy has a multiplier effect on income
2. *IS* curve
   - comes from the Keynesian cross when planned investment depends negatively on the interest rate
   - shows all combinations of ***r*** and ***Y*** that equate planned expenditure with actual expenditure on goods & services
   - shows all combinations of ***r*** and ***Y*** such that investment (I) equals saving (S)