

FETP/MPP8/Macroeconomics/Riedel

General Equilibrium in the Short Run II—The IS-LM model

The IS-LM Model

Like the AA-DD model, the IS-LM model is a general equilibrium model, which derives the conditions for simultaneous equilibrium in goods and financial markets.

What differentiates the IS-LM model from the AA-DD model is that the interest rate (R), instead of the exchange rate (E), is endogenous together with the level of income (Y).

Like the AA-DD model, we are in the short-run, where prices (P) are fixed and income (Y) is determined by aggregate demand (A).

The IS-LM model, like the AA-DD model, allows us to examine the effects of monetary, fiscal and exchange rate policies under varying circumstances.

We start with a simple closed economy version of the model and then introduce the complications that arise from openness.

Throughout we assume the exchange rate floats freely (i.e. is freely determined in the market for foreign exchange). In the next lecture we consider the case of a country (like Vietnam) that fixes its exchange rate. As we will see, it makes a big difference!!!

Derivation of Goods Market Equilibrium

Goods market equilibrium is where aggregate supply (GDP= Y) is equal to planned, or desired, expenditure ($A = C + I + G$):

$$Y = A = C + I + G$$

$$S = (Y - T) - C$$

$$S = I + G - T$$

Recall our theories of C , I , and G :

$$C = c(Y - T)$$

$$I = I(\bar{R}) = \bar{I}$$

$$G = \bar{G}$$

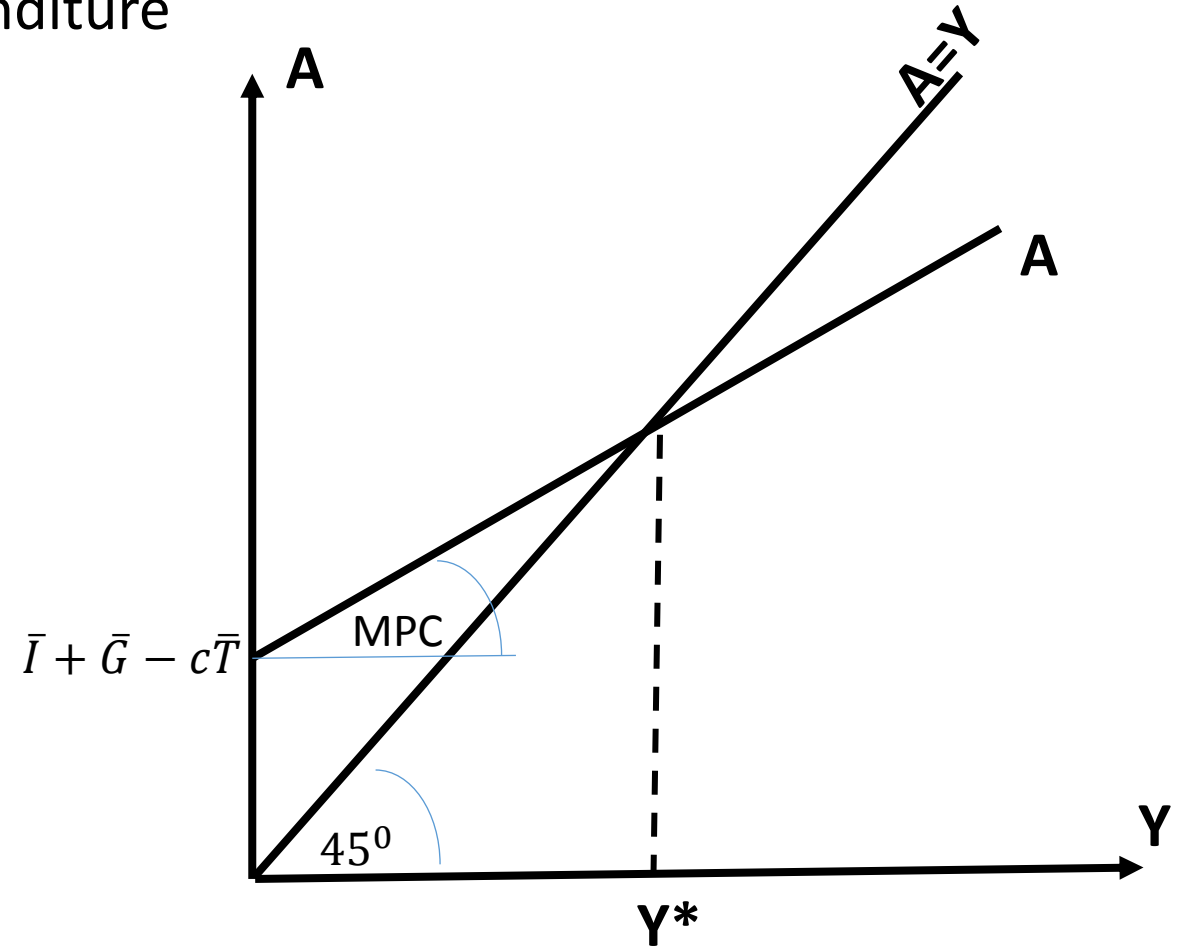
$$T = \bar{T}$$

The equilibrium condition is:

$$Y = A = c(Y - \bar{T}) + \bar{I} + \bar{G}$$

Solving for equilibrium (Y), we get:

$$Y^* = \frac{1}{1 - c} (\bar{I} + \bar{G} - c\bar{T})$$



The multiplier

Suppose that there is an exogenous increase in government spending ($G \uparrow$), all other things unchanged.

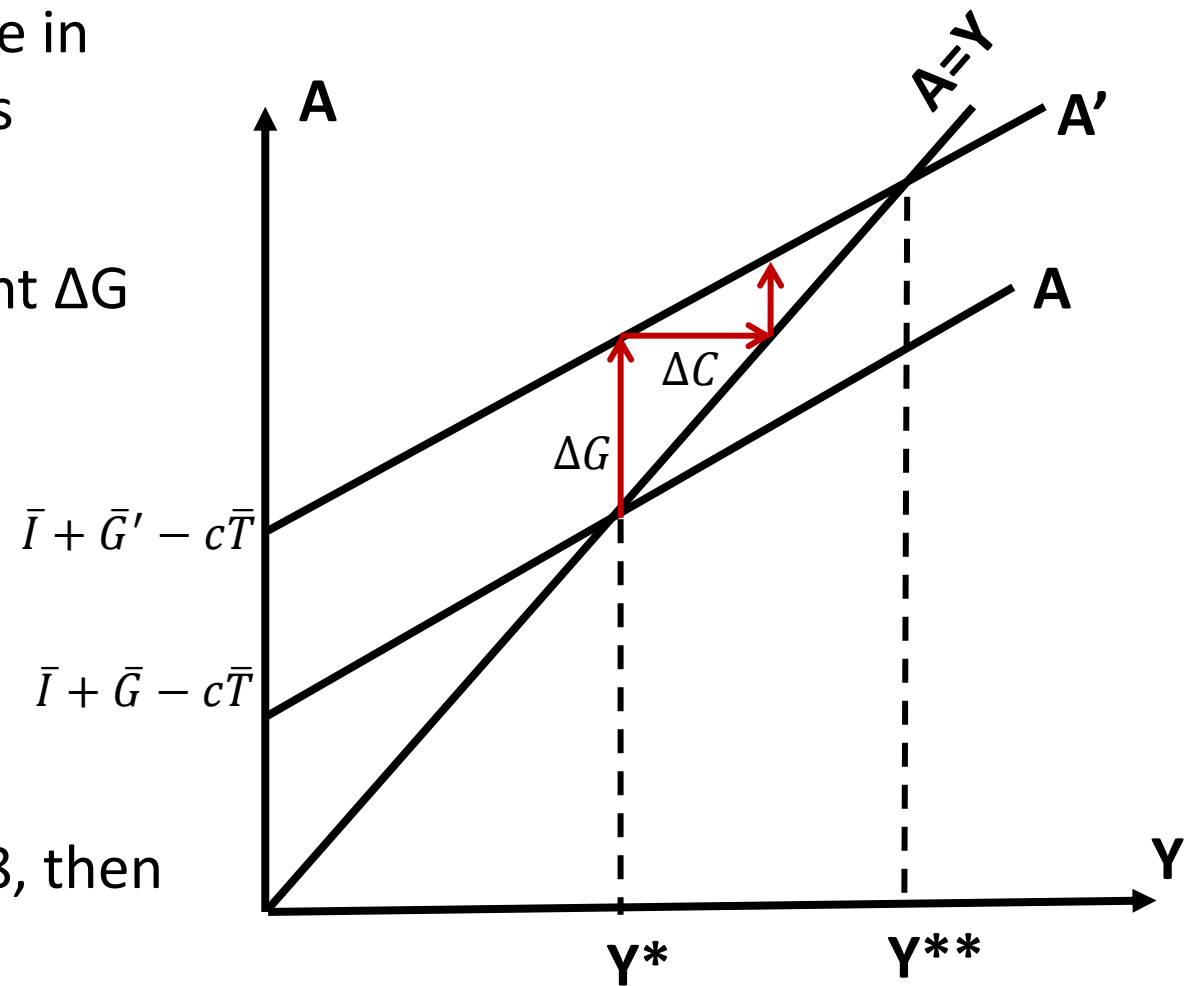
1. The A curve shifts upward by the amount ΔG
2. $A > Y \Rightarrow Y \uparrow$
3. $Y \uparrow \Rightarrow C \uparrow \Rightarrow Y \uparrow \Rightarrow C \uparrow \Rightarrow \dots$

In at the new equilibrium:

$$\Delta Y = \frac{1}{1 - c} \cdot \Delta G$$

If the marginal propensity to consume is 0.8, then

$$\Delta Y = 5 \times \Delta G$$



Shifts in the IS Curve

Suppose that there is an exogenous decline in the interest rate. Since investment is assumed to be a negative function of the interest rate, investment spending will increase ($I \uparrow$).

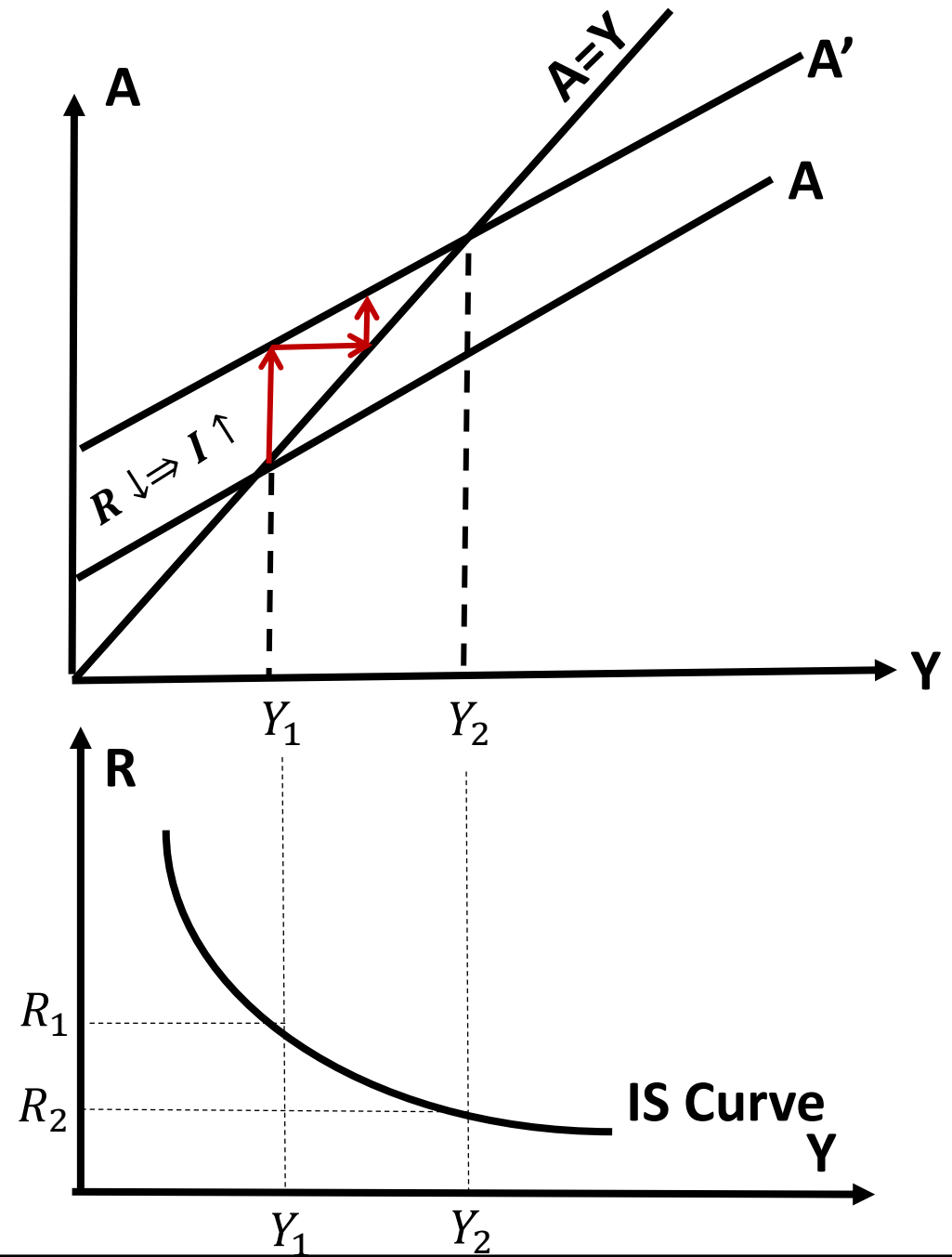
Just as in the case of $G \uparrow$ there will be a multiplier effect on equilibrium income.

The equilibrium income level at every interest rate, all other exogenous variables (G, T) constant, is shown by the IS Curve.

The IS curve represents the equilibrium relationship between R and Y in the goods market.

The IS Curve shifts in response to ΔG and ΔT

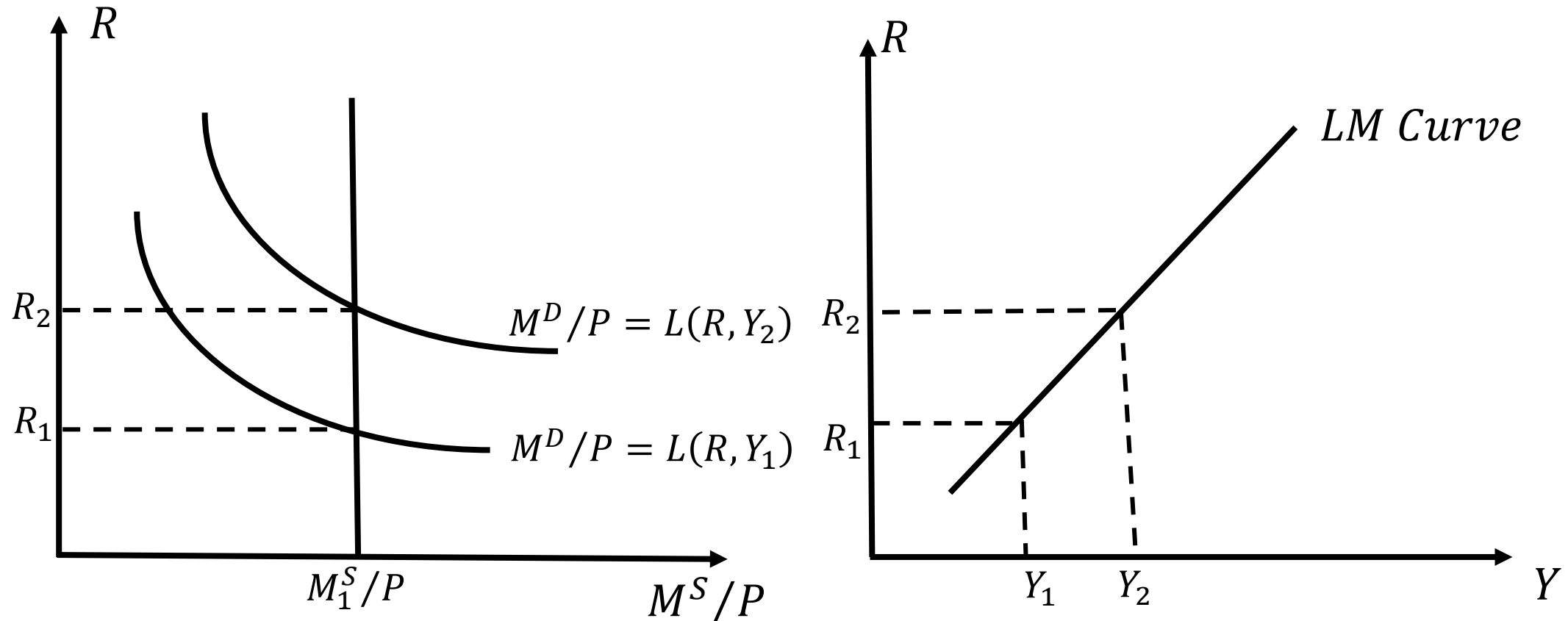
If $G \uparrow$ or $T \downarrow \Rightarrow IS \uparrow$ If $G \downarrow$ or $T \uparrow \Rightarrow IS \downarrow$



Derivation of the LM Curve

Recall the condition for equilibrium in the domestic money market: $M^S/P = L(R, Y)$. Real money balances (M/P) are a negative function of the interest rate (R), and a positive function of real GDP (Y). If $Y \uparrow$ the $R \uparrow$ to clear the market (see Figure A)

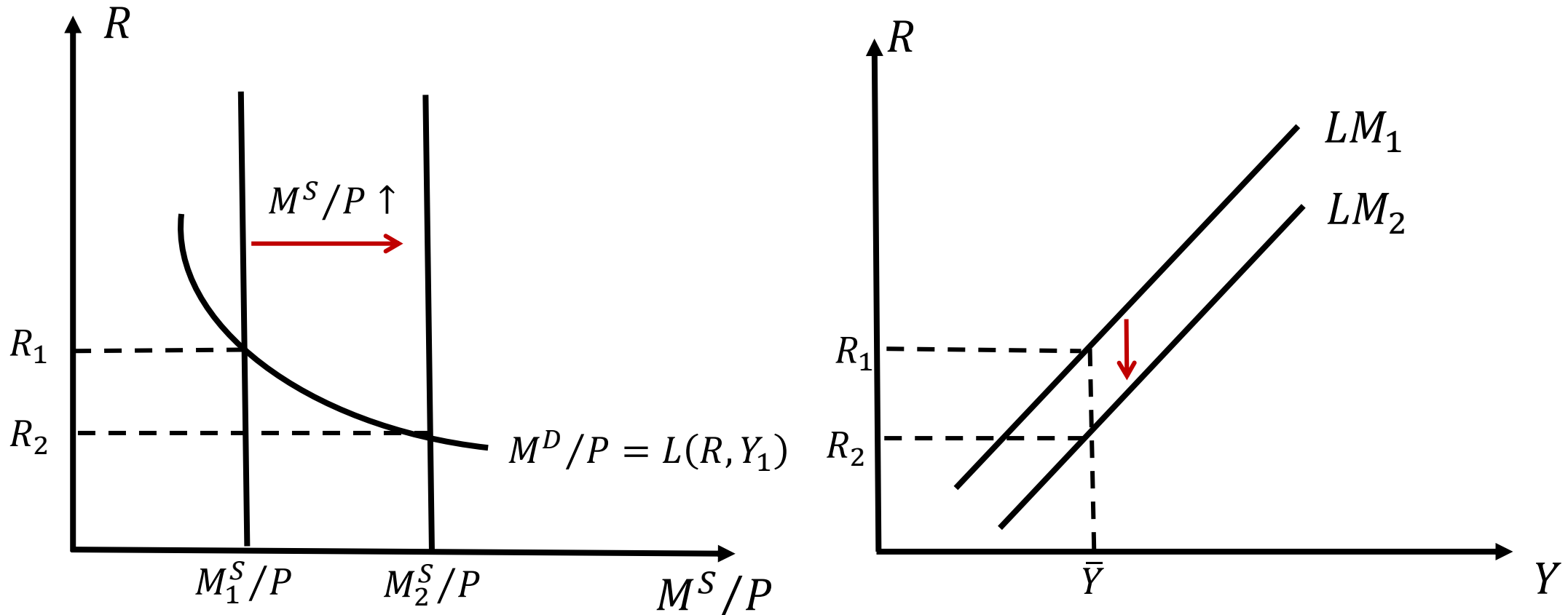
The LM-Curve represents the equilibrium interest rate for every income level, given the money supply and price level.



Shifts in the LM Curve

In deriving the LM Curve, we held money supply and the price level constant to find the equilibrium relationship between R and Y . If the money supply or price level change, then the LM Curve shifts: $M^S \uparrow \downarrow \Rightarrow LM \downarrow \uparrow$ and $P \uparrow \downarrow \Rightarrow LM \uparrow \downarrow$.

Here we illustrate how, when $M^S \uparrow$ the interest rate fall, given the level of income \bar{Y} .



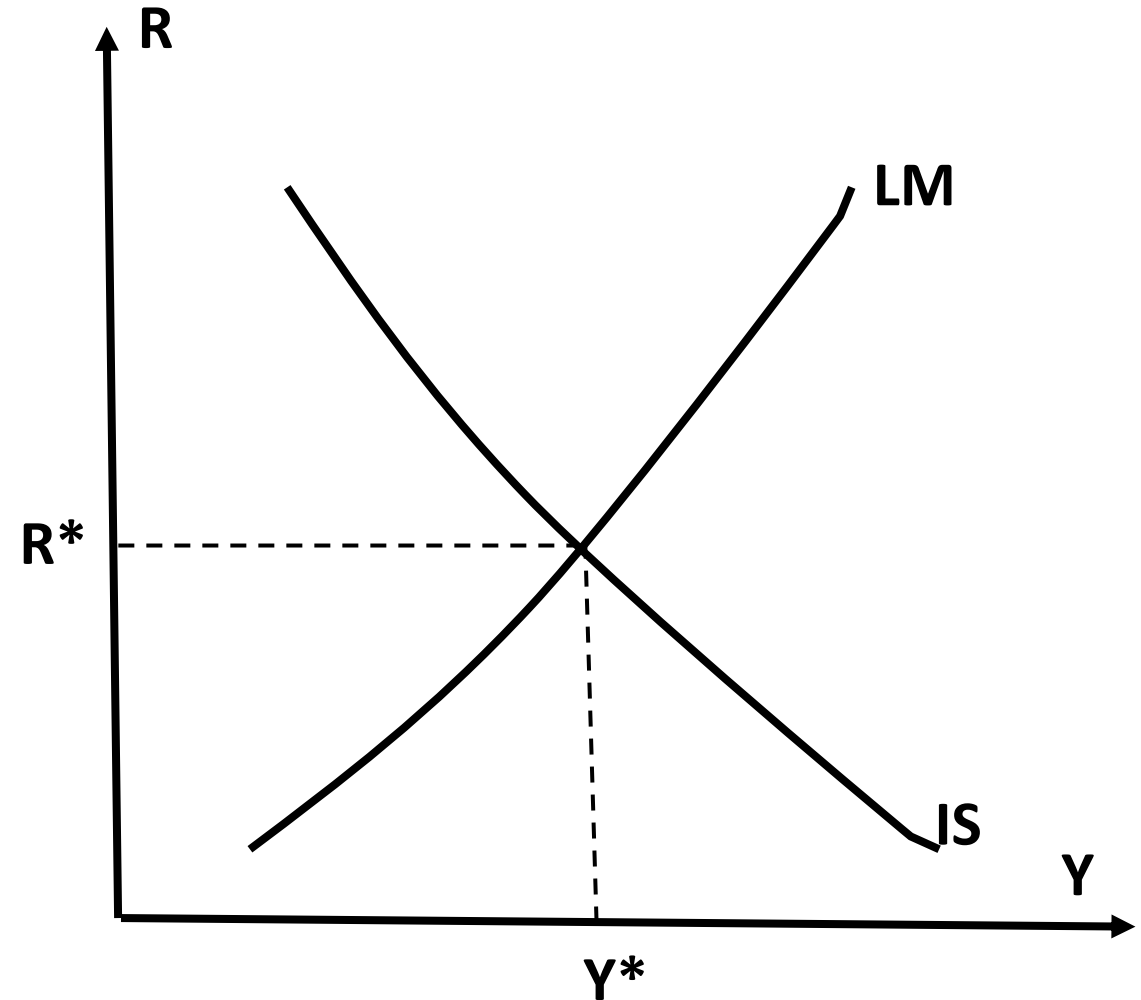
Equilibrium in the IS-LM Model

The short-run equilibrium obtains when two conditions are met:

(1) $Y = C(Y - T) + I(R) + G \Rightarrow IS \text{ Curve}$

(2) $M^S/P = L(R, Y) \Rightarrow LM \text{ Curve}$

The intersection of the IS and LM curves represents simultaneous equilibrium in the market for goods and services and the market for real money balances for given values of government spending, taxes, the money supply and the price level.



Monetary and Fiscal Policy in the IS-LM Model

Figure 1 illustrates the effect on the level of income and employment (Y) of a fiscal expansion ($G \uparrow$ or $T \downarrow$). The effect on Y depends on monetary policy.

- If the central bank (CB) keeps money supply constant, R rises, crowding-out private investment.
- If the central bank keep the interest rate constant, then it has to raise M^S , shifting LM outward. At “c” we have the combined effect of $G \uparrow$ and M^S .

Figure 2 shows the effect of a monetary expansion, which shifts LM downward. The interest rate initially falls to “b,” but then investment increases and income rises until a new equilibrium is established at “c”.

Note: both monetary and fiscal policy are effective instruments of demand management, but they have very different effects on the structure of the economy.

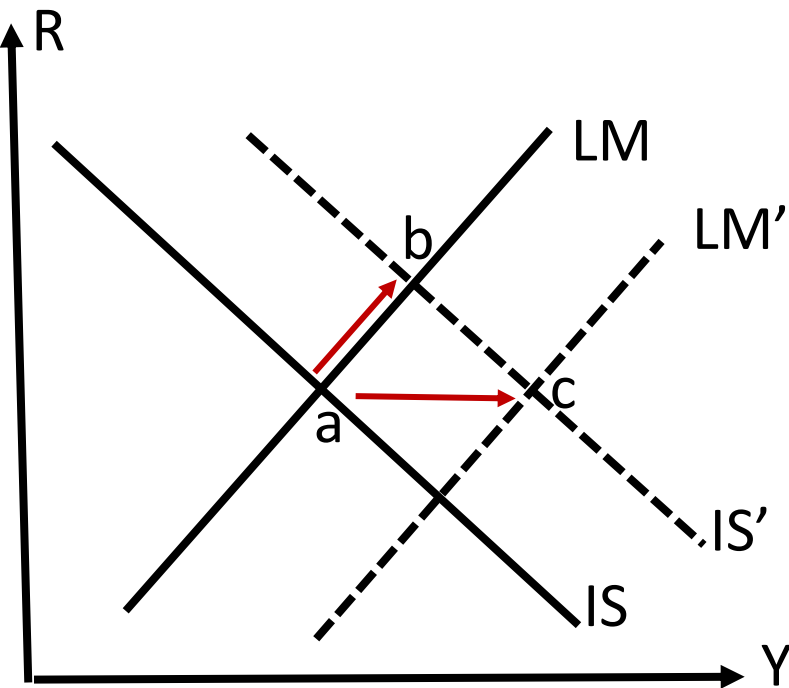


Figure 1

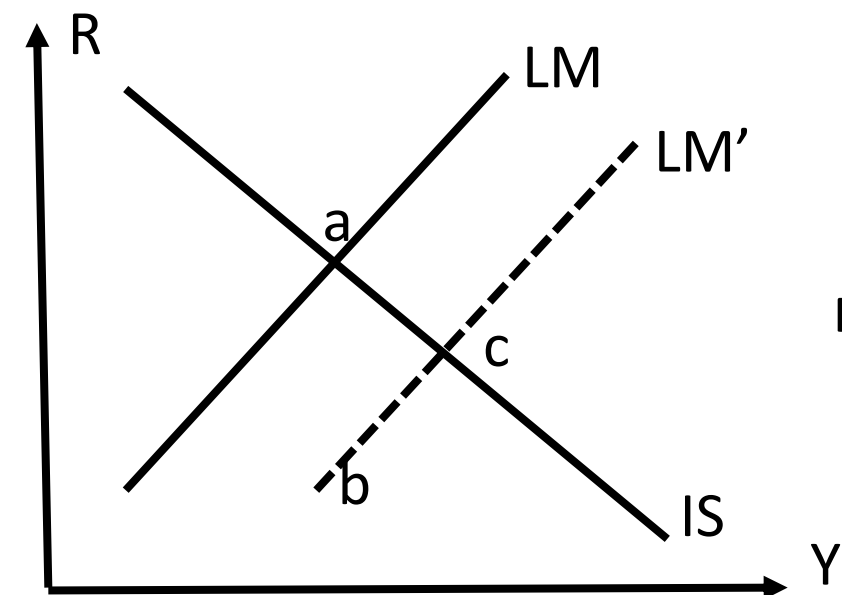


Figure 2

Price effects and the derivation of AD Curve

Figure 1. We start from equilibrium at “a” (Y_1, R_1).
What happens if the price level (P) rises?

- Other things equal, As $P \uparrow$, real money supply falls, pushing up interest rates ($R \uparrow$).
- As $R \uparrow$, investment and possibly consumption fall (represented by movement up the IS Curve).
- As $(I + C) \downarrow$ real output falls from Y_1 to Y_2
- All these effects arise from a rise in the price level from P_1 to P_2 .

Figure 2 shows the relation between the price level and aggregate level of output. This relation between the price of goods and the quantity of goods demanded is the aggregate demand curve (AD).

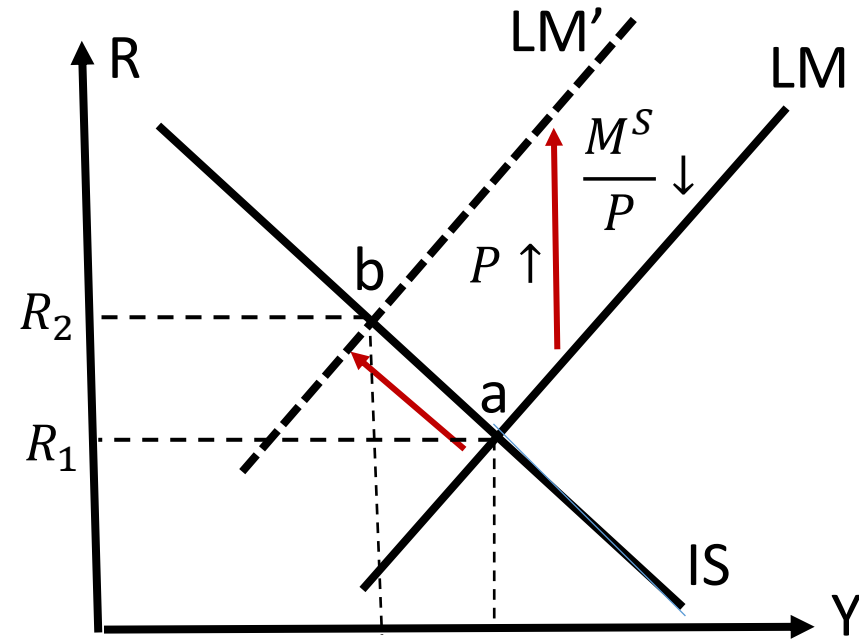


Figure 1

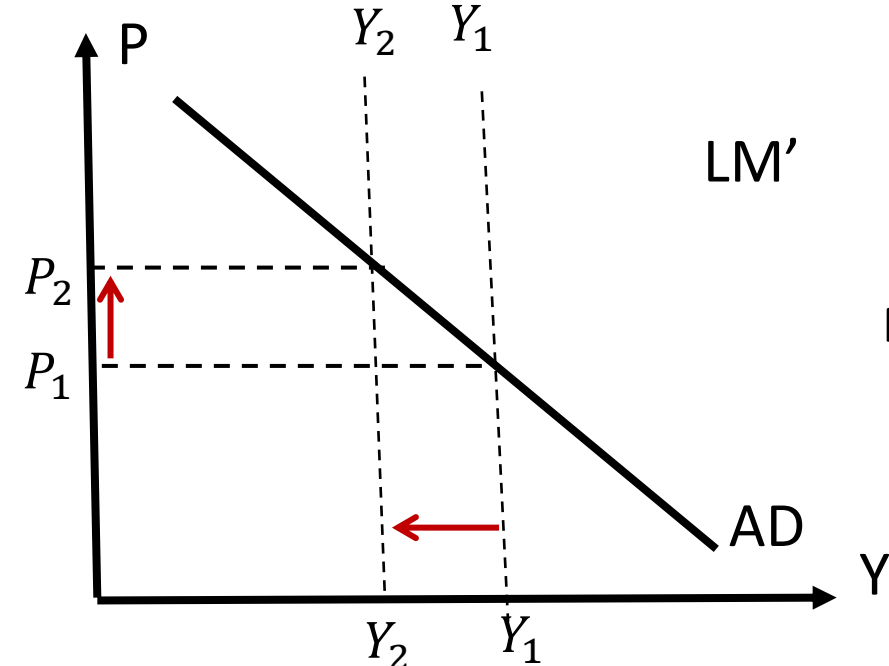


Figure 2

The effect of a monetary expansion on the AD Curve

Starting from equilibrium at “a” (Y_1, R_1). What happens if there is a monetary expansion ($M^S \uparrow$)?

Figure 1:

- A rise the money supply cause an outward shift in the LM Curve.
- The interest rate falls and investment and consumption increase, causing movement down the IS Curve from “a” to “b”.
- At the new equilibrium (b) the interest rate is lower and income is higher.

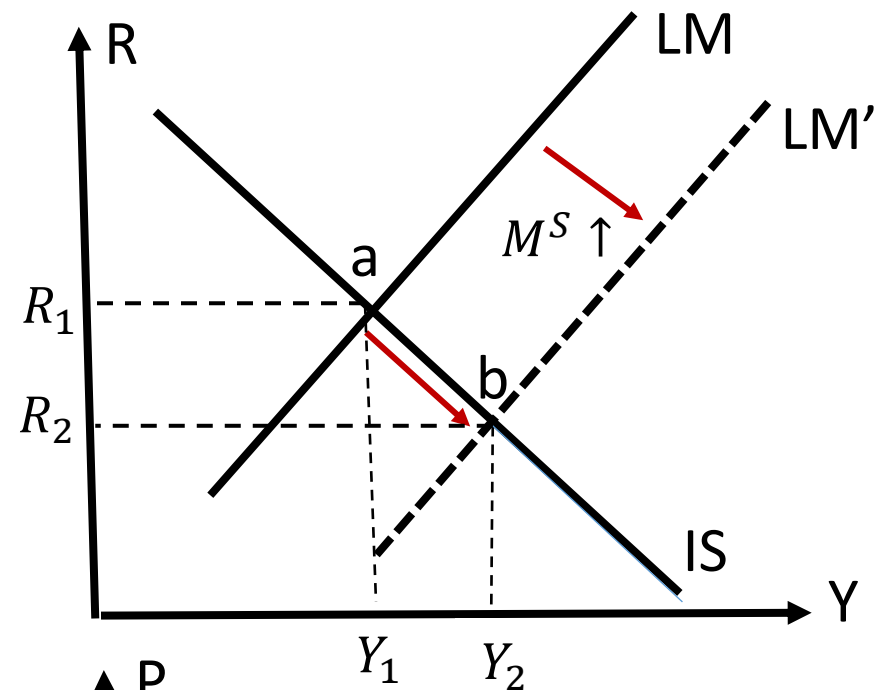


Figure 1

Figure 2:

- Monetary expansion leads an outward shift in the AD Curve.

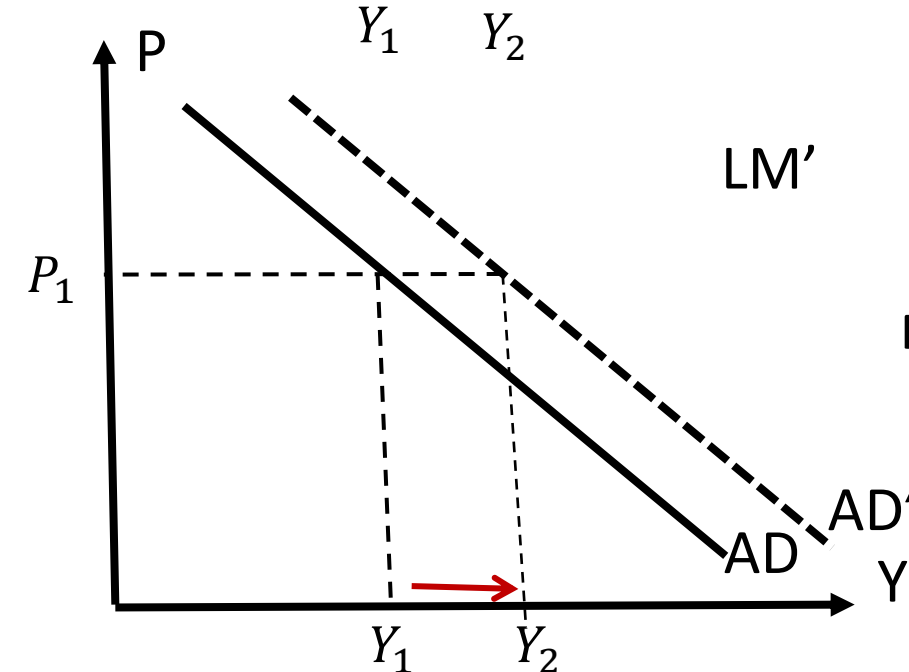


Figure 2

The effect of a fiscal expansion on the AD Curve

Starting from equilibrium at “a” (Y_1, R_1). What happens if there is a fiscal expansion ($G \uparrow$ or $T \downarrow$)?

Figure 1:

- An increase in government spending causes the IS to shift outward, increasing output (Y).
- As income rises, the demand for money increases, leading to a rise in the interest rate.
- As the interest rate rises, investment and consumption decline, offsetting part of the expansionary effect of government spending.

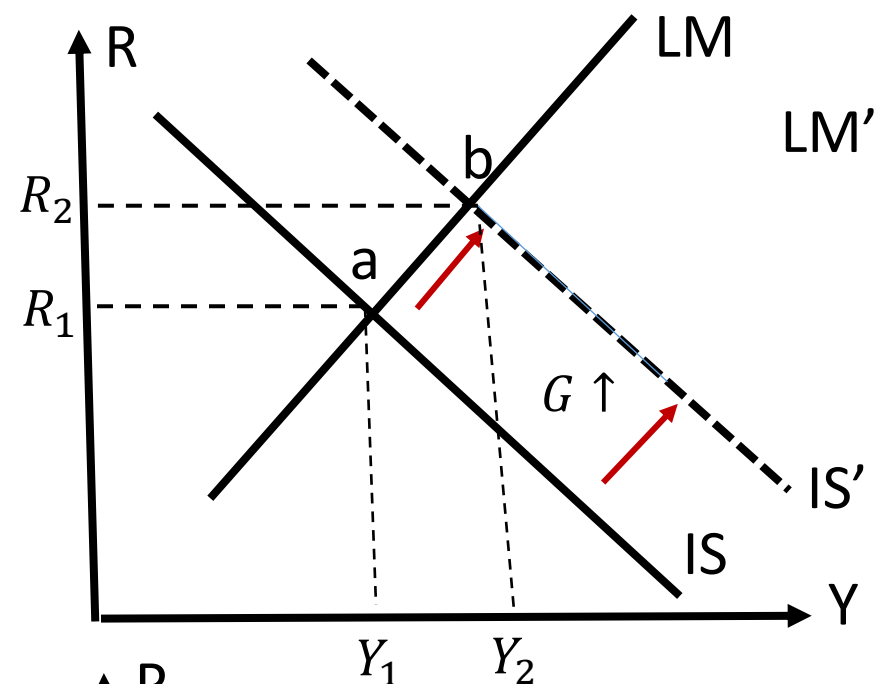


Figure 1

Figure 2:

- As with a monetary expansion, a fiscal expansion leads to outward shift in the AD Curve, but again the effect on the structure of the economy is different.

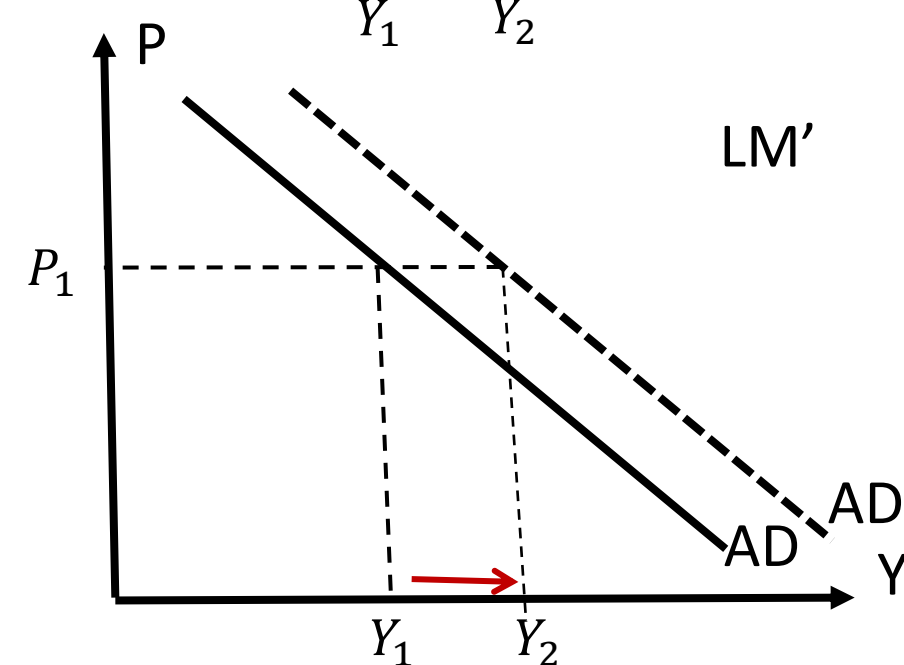


Figure 2

Equilibrium in the Short and Long Run

In the long-run, output is at the full-employment level (\bar{Y}). In the short-run, aggregate demand may fall short of \bar{Y} in which case the economy is below the full-employment level (Y_1).

Eventually unemployment will lead to falling wages and falling prices. As prices fall, real money balances rise, interest rates fall and the economy is restored to full employment (from “a” to “b”).

The stickiness of prices in the short-run, is what causes unemployment and requires demand management policies (monetary and fiscal policies) to keep the economy at full employment according to Keynesian macro theory.

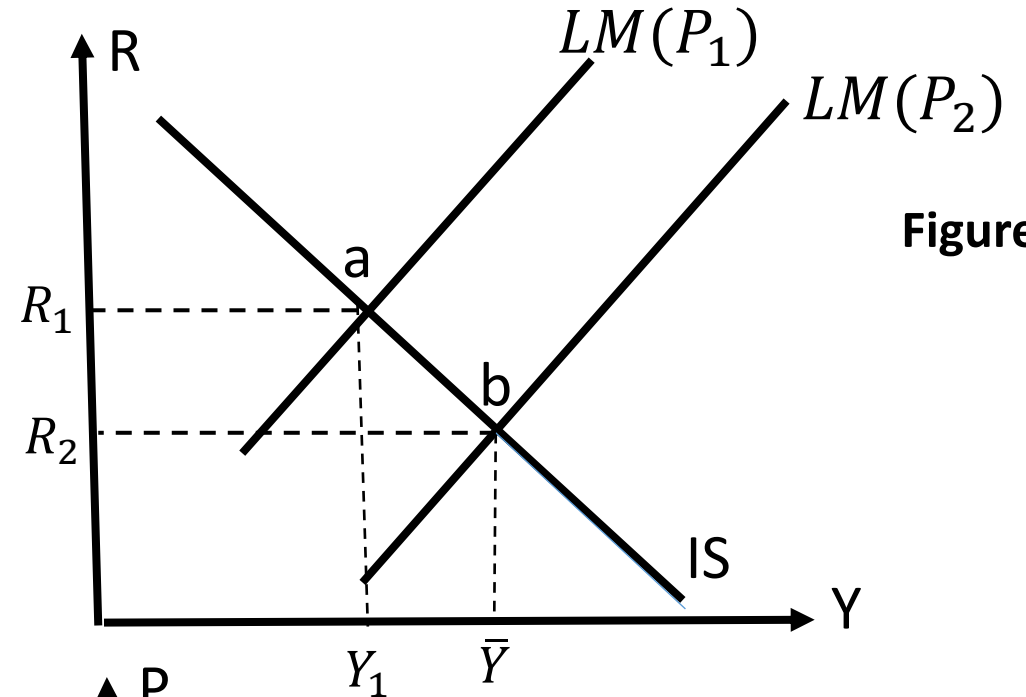


Figure 1

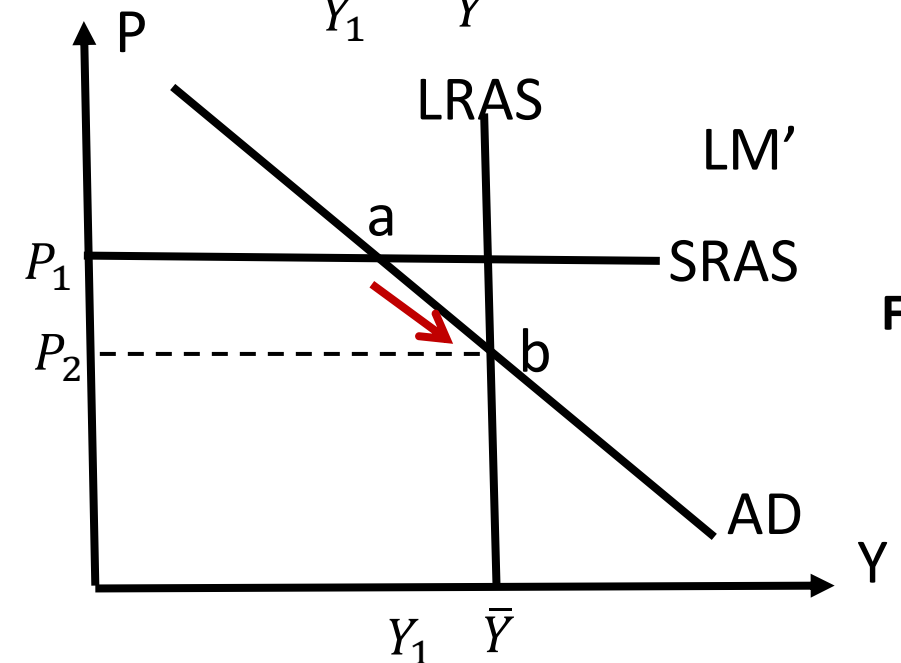


Figure 2

Government spending and inflation

Suppose the economy is at full employment (\bar{Y}), but for political reasons the government desires to increase spending ($G \uparrow$) and finances the increase in spending by “printing money” ($M^S \uparrow$). This policy is represented in Figure 1 by outward shifts in the IS and LM curves. Equilibrium shifts from “a” to “b”.

As illustrated in Figure 2, the economy is now operating above full-employment, which puts pressure on wages and prices to rise. As prices rise, real money balance fall, driving up the interest rate and discouraging investment and consumption spending. The government sector has crowded out the private sector with, in all likelihood, negative consequences.

What happens if the central bank tries to keep interest rates from rising????

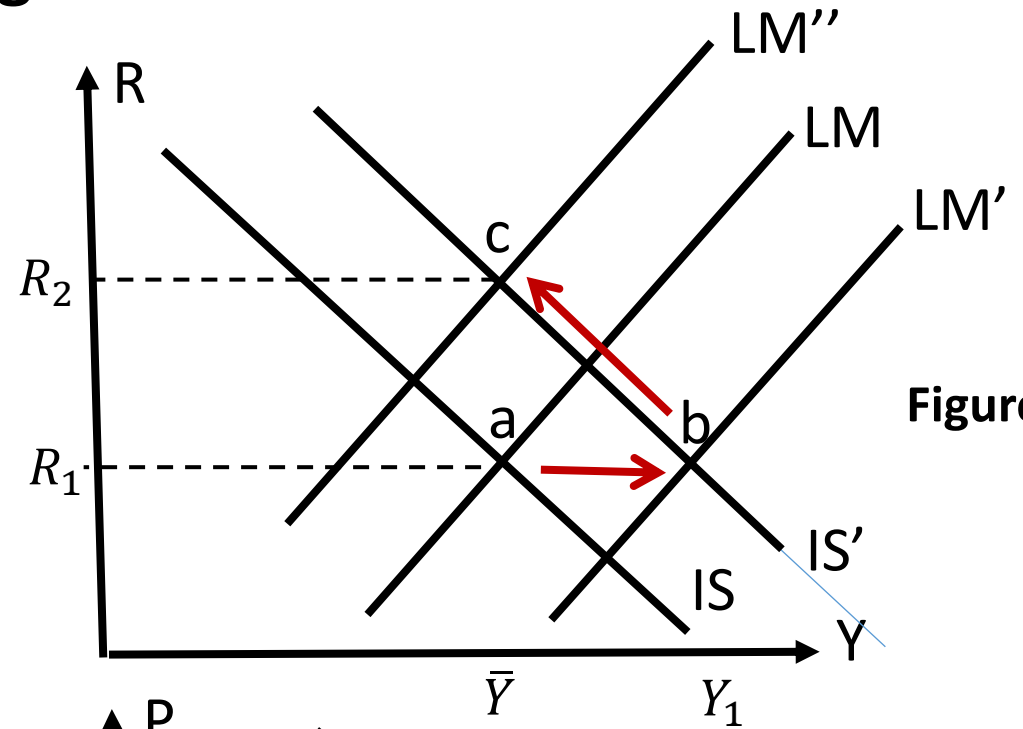


Figure 1

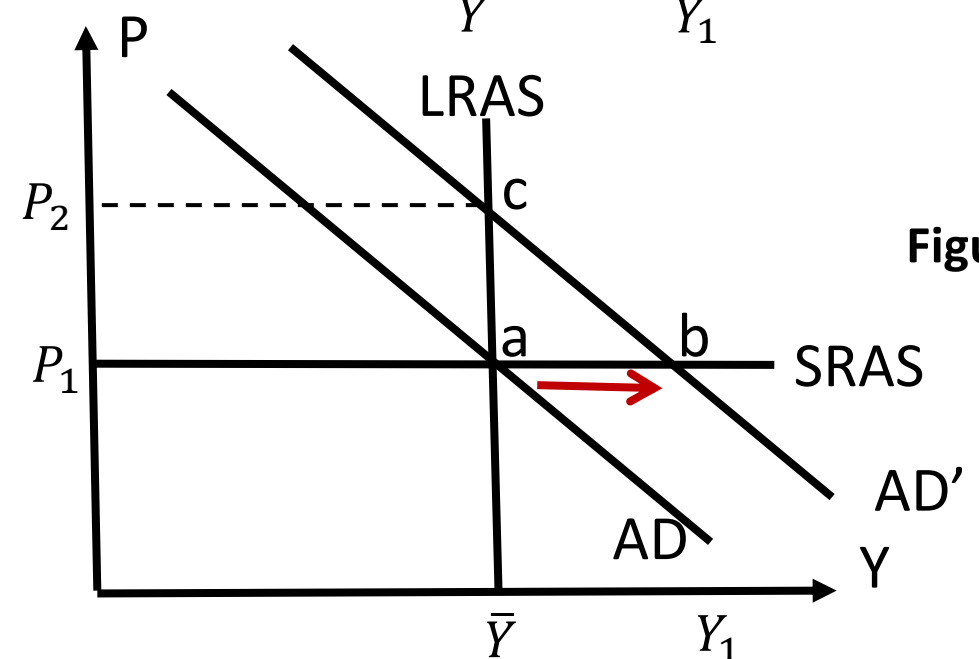


Figure 2

Supply Shocks and Stagflation

Suppose the economy is at a full-employment equilibrium “a” when a global commodity price boom occurs. The commodity price boom constitutes a negative supply shock causing an upward shift in the SRAS curve. A new equilibrium obtains at which prices are higher and output and employment are lower at “b”, a condition known as “stagflation.”

Eventually wages and prices in the domestic economy will fall and full employment output will be restored at “a”.

But the government may be tempted to stimulate employment by a monetary expansion, shifting AD outward. Full employment is restored, but at a permanently higher prices level. **What has caused inflation—the price shock or its monetization?**

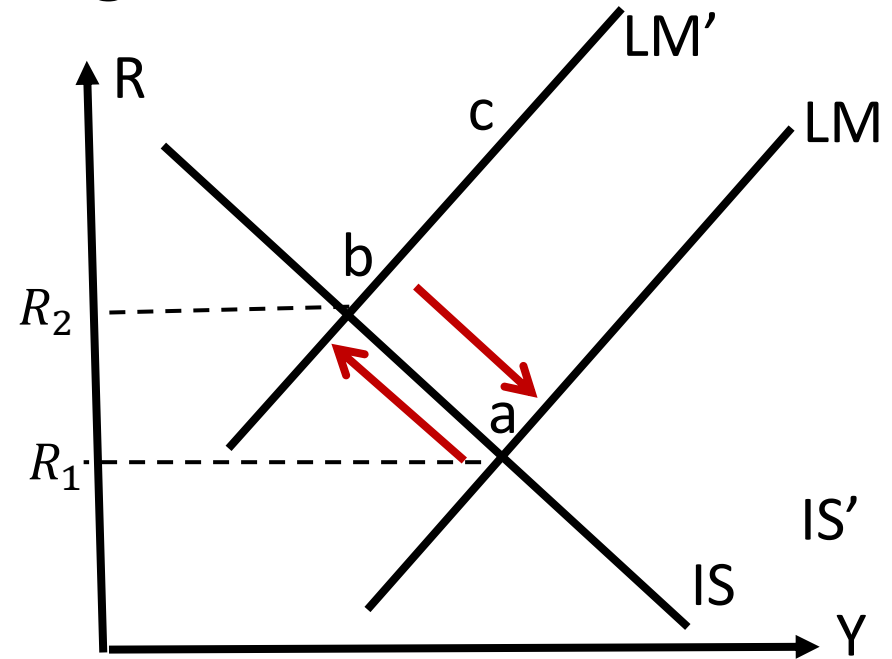


Figure 1

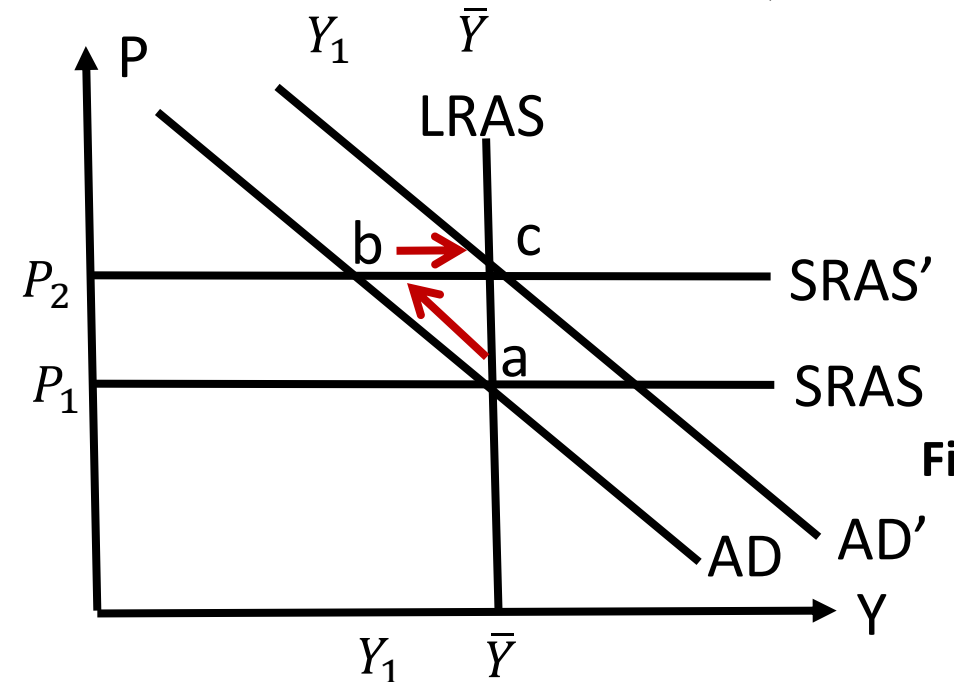


Figure 2

Core versus Headline Inflation

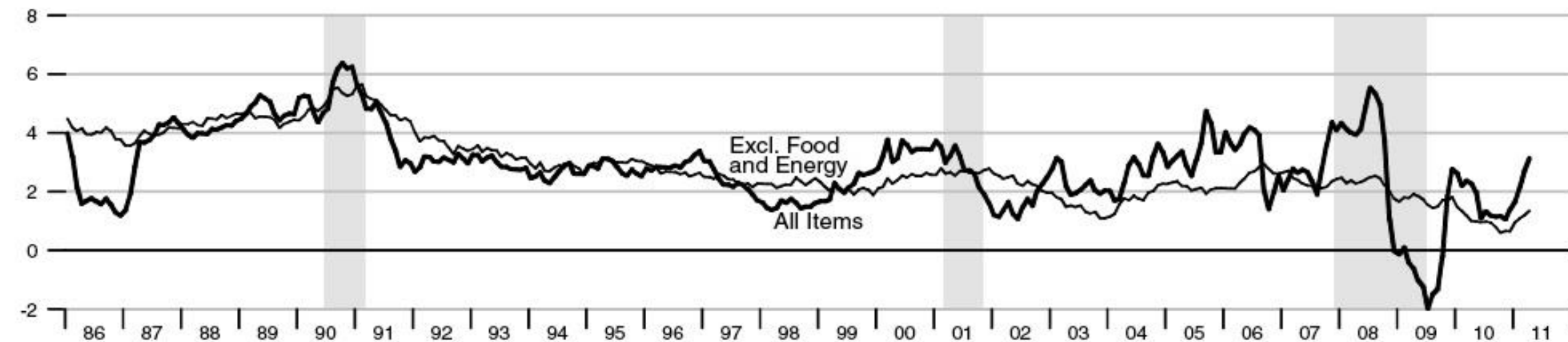
Some economist argue that monetary policy should focus on “core inflation” not “headline inflation.” Headline inflation is the rate of change of all prices, while core inflation is the rate of change of all prices excluding food and energy prices.

One argument against core inflation is that if people spend more on food and energy, they spend less on other goods, which puts downward pressure on the prices of other goods and leads to an understatement of inflationary pressure in the economy.

Headline and Core Inflation in the US: 1986-2011

Consumer Price Index

Percent change from year ago

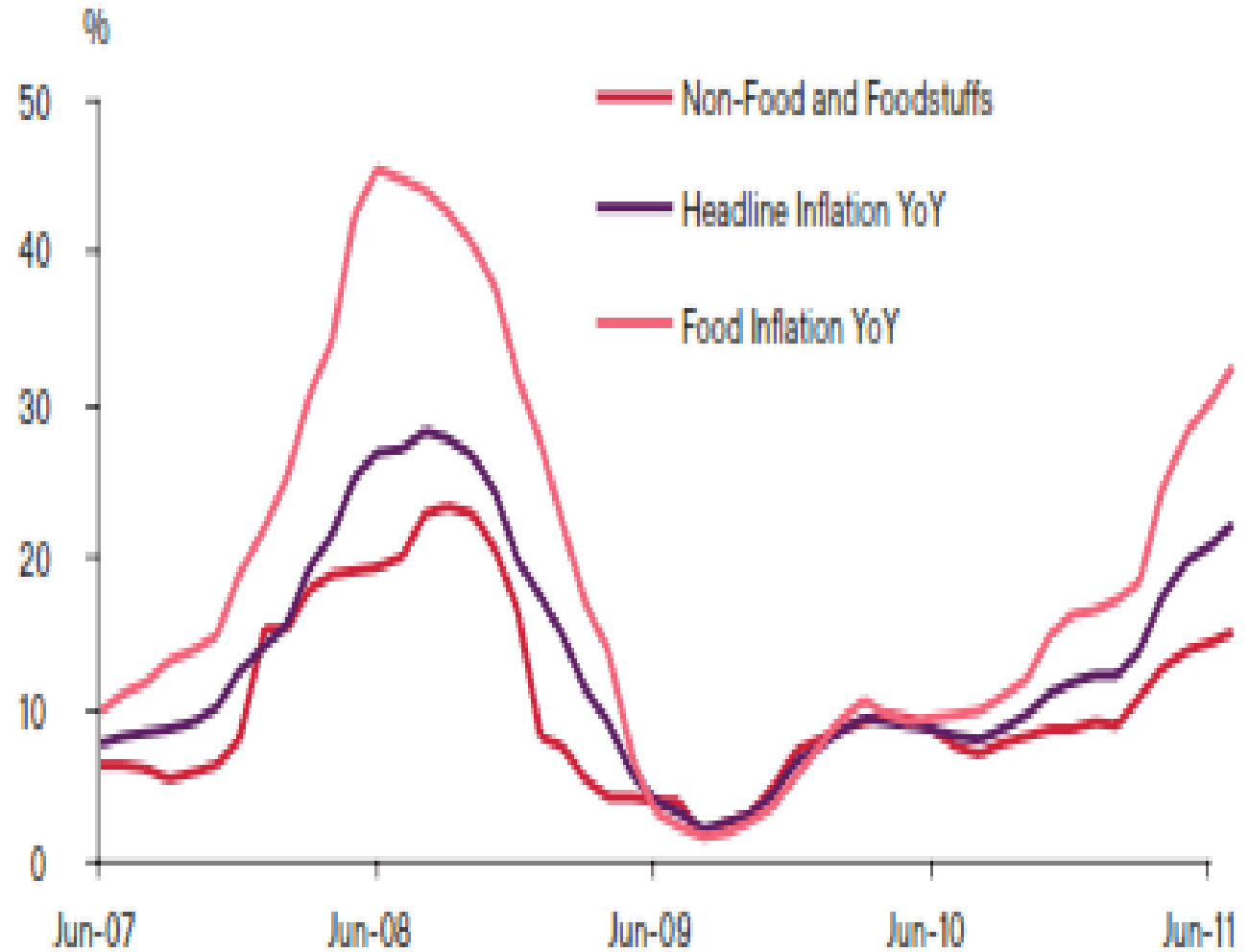


Core versus Headline Inflation in Vietnam: 2007-2011

Analysts of Vietnam's economy usually distinguish between headline and core inflation on the premise that inflation in food and energy is not a macroeconomic problem.

But is that premise correct?

- Are not food prices also subject to monetary influences?
- Is not headline inflation a valid indicator of inflationary pressure in the economy?
- As the figure shows, headline and non-food inflation are closely related.



Source: GSO, Dragon Capital

Derivation of Goods Market Equilibrium in an Open Economy

In an open economy we have to add net exports (NX = X-M) to aggregate demand (A):

$$A = C + I + G + NX$$

To our theories of C, I, and G we now add one for NX:

$$C = c(Y - T)$$

$$I = I(\bar{R}) = \bar{I}$$

$$G = \bar{G}$$

$$T = \bar{T}$$

$$NX = NX(\bar{E})$$

$$\bar{I} + \bar{G} + \bar{NX}' - c\bar{T}$$

$$\bar{I} + \bar{G} + \bar{NX} - c\bar{T}$$

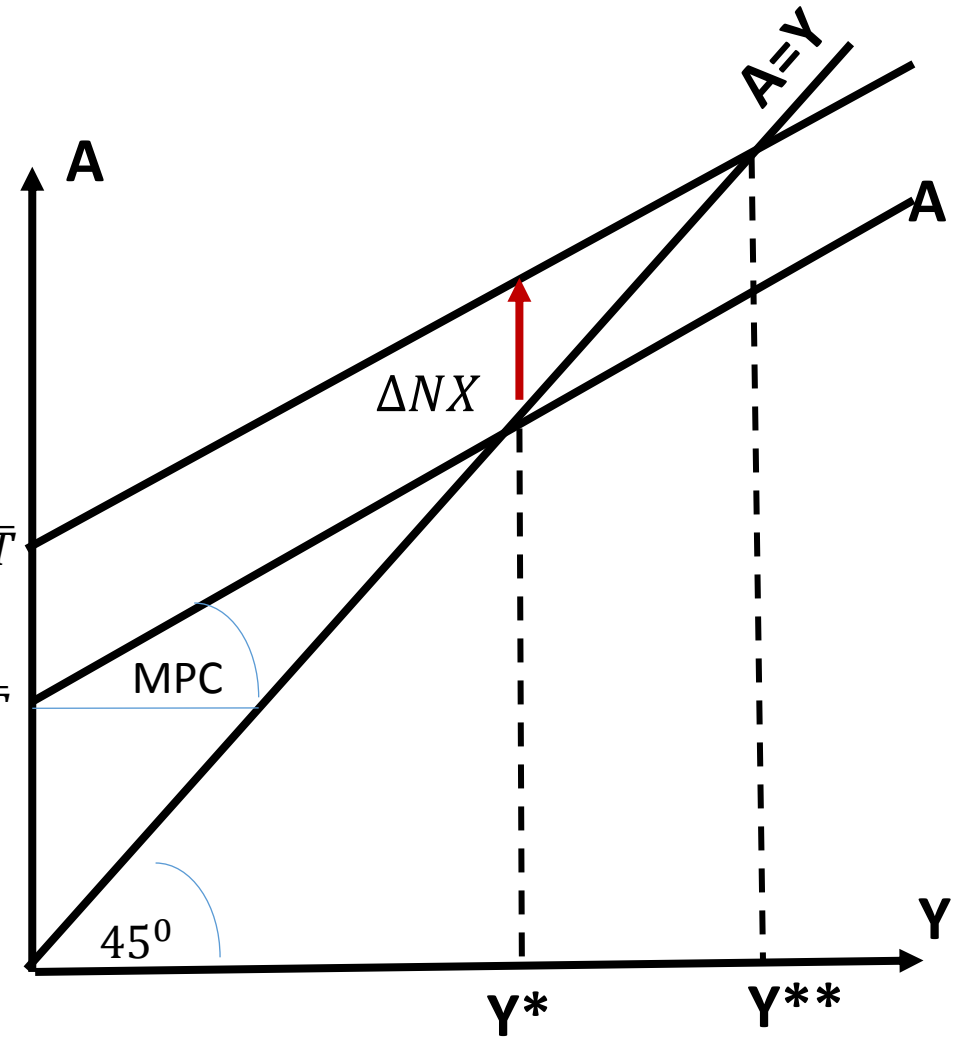
The equilibrium condition is:

$$Y = A = c(Y - \bar{T}) + \bar{I} + \bar{G} + NX$$

Solving for equilibrium (Y), we get:

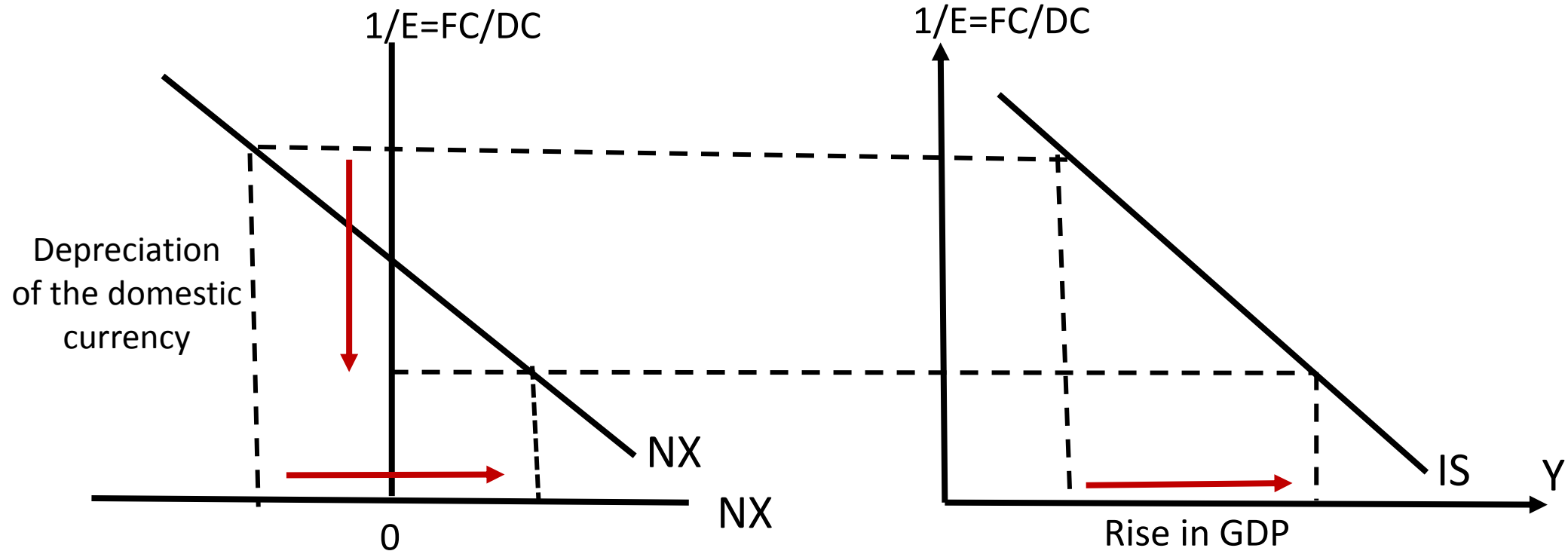
$$Y^* = \frac{1}{1 - c} (\bar{I} + \bar{G} + \bar{NX} - c\bar{T})$$

$$\Delta Y = \frac{1}{1 - c} \cdot \Delta NX$$



The Open Economy Version of IS Curve

As illustrated in the slide above, a rise in NX leads to a rise in Y. Our theory is that NX depends on the exchange rate (E). A rise in E, defined (as usual) as the domestic currency (DC) price of foreign currency (FC), rises (i.e. depreciation of the domestic currency) NX rise. In the illustration below, we use $1/E$, the foreign currency price of domestic currency), so a fall in $1/E$ is a depreciation of the domestic currency and is expected to lead to a rise in NX and Y.



The Open Economy Version of LM Curve

In Figure 1, we have the standard LM Curve, representing money market equilibrium.

$$M^S/P = L(R, Y)$$

If our country is small, and we assume it can borrow or lend what it desires at the world interest rate (R^*), then $R=R^*$

In Figure 2, the LM^* Curve is vertical because the exchange rate does not enter as a determinant of money market equilibrium. Given the R^* , LM^* determines the equilibrium level of income (Y^*).

Note: a rise in R^* will lead to a higher Y^* . Why?

Because as R^* rises the domestic currency depreciates, $(1/E) \downarrow \Rightarrow NX \uparrow \Rightarrow Y \uparrow$.

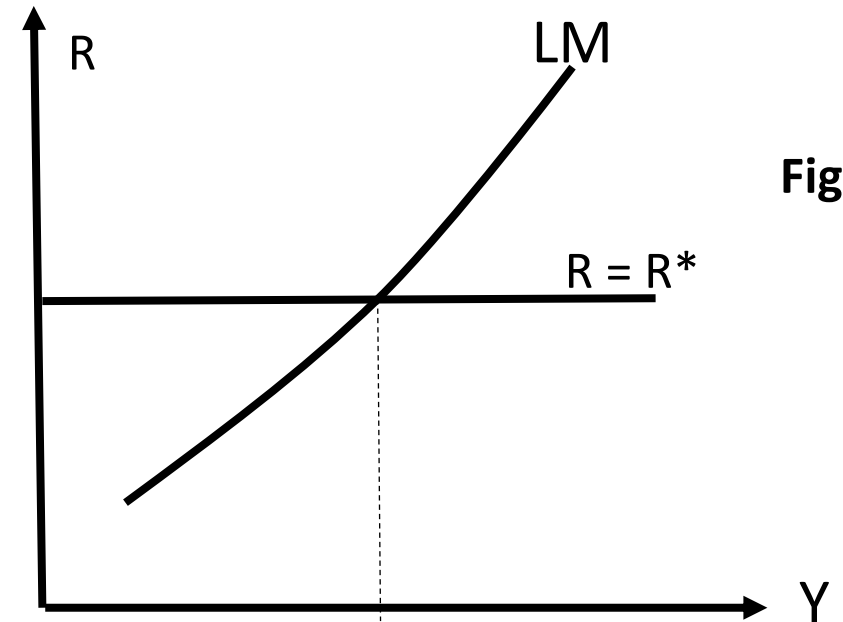


Figure 1

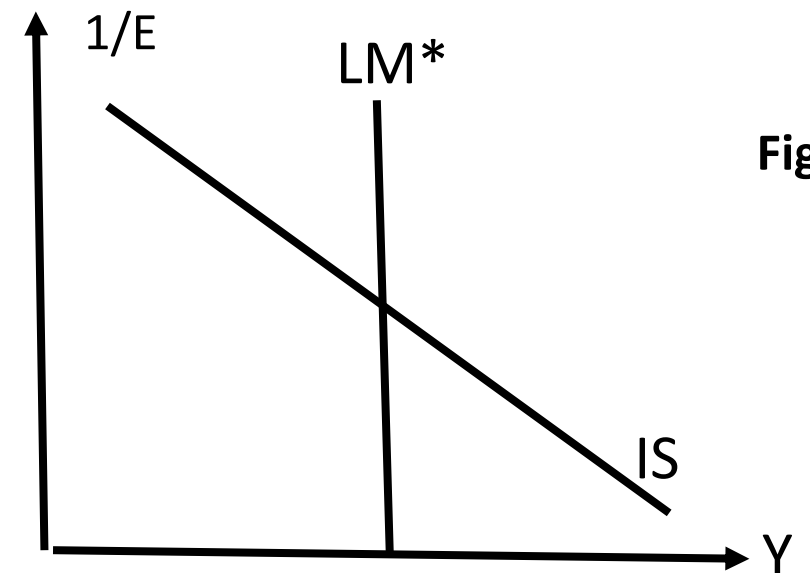


Figure 2

Monetary and Fiscal Policy in the Open Economy IS-LM Model

Figure 1 illustrates the effect of a fiscal expansion ($G \uparrow$ or $T \downarrow$) in an open economy. The fiscal expansion has no effect on income (Y) because currency appreciation reduces aggregate demand by an amount equivalent to the increase in aggregate demand from the fiscal expansion. The government sector simply crowds out the external sector.

Figure 2 illustrates the effect of a monetary expansion ($M^S \uparrow$) in an open economy. The monetary expansion has a positive impact on Y because it induces a depreciation of the domestic currency which raises NX and hence aggregate demand.

Note: Our analysis has been confined to the case of a country with a floating (market determined) exchange rate. As we will see (next lecture), policy effect is very different when the exchange rate is fixed!

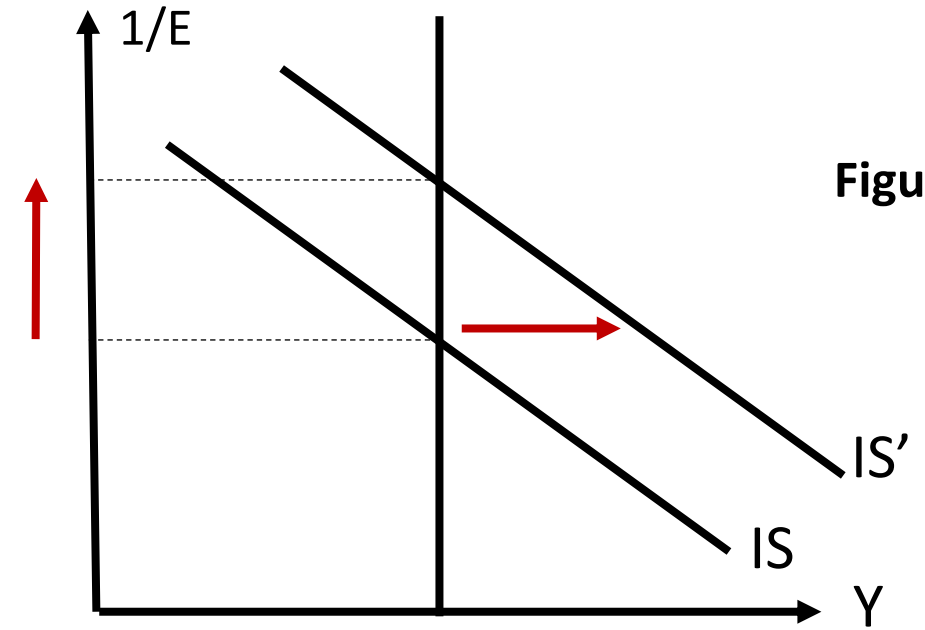


Figure 1

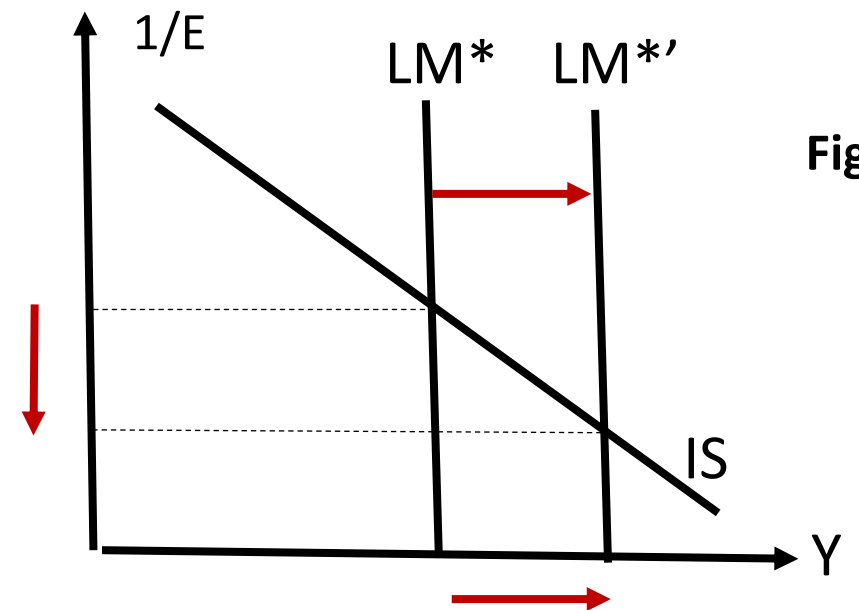


Figure 2

An Overview

