

A CLOSED ECONOMY IN THE LONG (MEDIUM) RUN

- For a closed economy, the national income identity is written as

$$Y = C(Y - T) + I(r) + G$$

- the left hand side of the equation is the total supply of goods and services in the economy, and the right hand side of the equation is the total demand for these goods and services

- * Y is produced with the following production function

$$Y = F(K, L)$$

where F is the production technology that determines how much output is produced from given amounts of capital and labor

- * C is the private consumption demand. It is a function of the total disposable income of households: $Y - T$
- * G is the government consumption demand
- * I is the investment demand, and it is negatively related with the real interest rate. (This is because the firms only invest if the return from a project is higher than the cost of borrowing money from the banks, which is the real interest rate. Hence, when real interest rate increases, the number of profitable projects and so the total investment reduces)

- *In the long-run we assume that*

- *The supply of goods and services are fixed: \bar{Y}*
- *So that the interest rate brings the demand for goods and services into an equilibrium with their supply*

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

- *There is no role for money on the real economy*

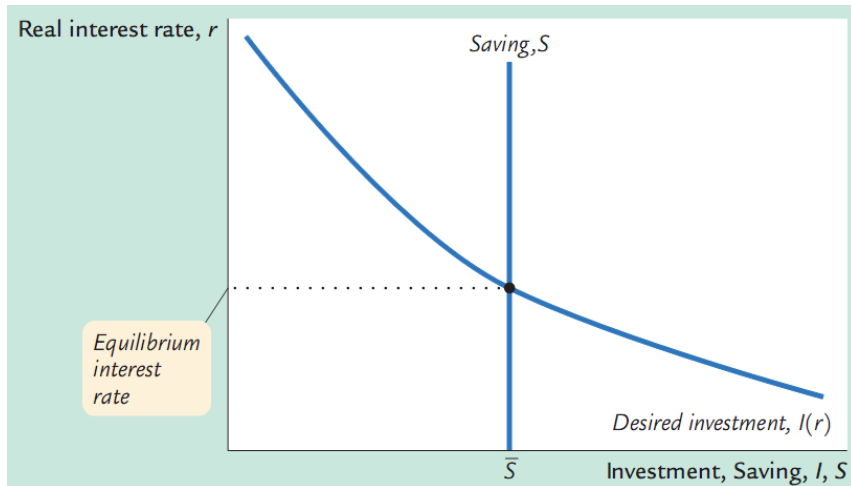
A Loanable-Funds Interpretation of the IS Curve

- Let's rearrange the national income identity in a way that

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

where the variables are in nominal terms and

- Y is the national income
- $[\bar{Y} - \bar{T} - C(\bar{Y} - \bar{T})]$ is the *private saving*
- $(\bar{T} - \bar{G})$ is the *public saving*
- The interpretation is that in a closed economy the money that is the sum of private and public savings is used for investment

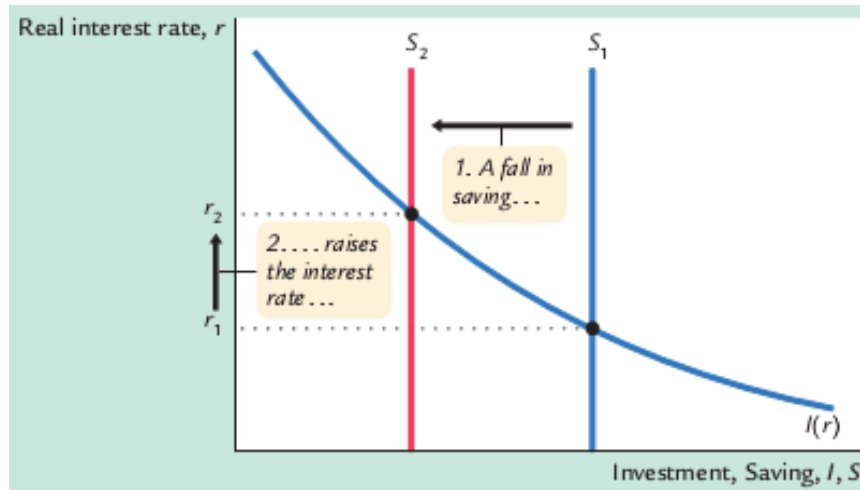


- Equilibrium real interest rate: When $r < r^*$, the demand of investors for loanable funds is more than their supply. Therefore households claim higher interest rates: r rises. When $r > r^*$, savings are more than what firms want to invest: r need to fall.

An Increase in the Government Purchases

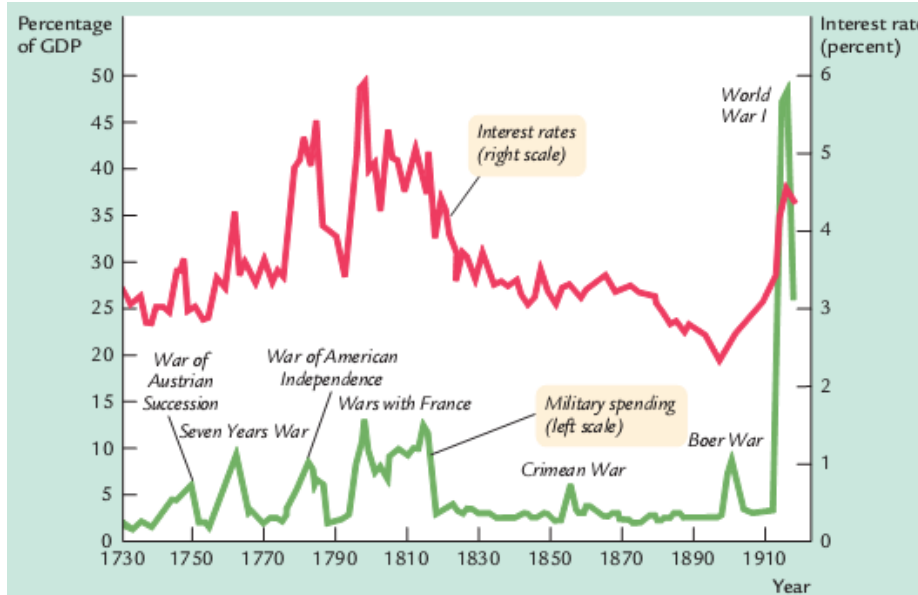
- The increase in government purchases means a reduction in national saving and must be met by an equal decrease in investment, which requires interest rate to rise

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



Case Study: Wars and Interest Rates in the United Kingdom

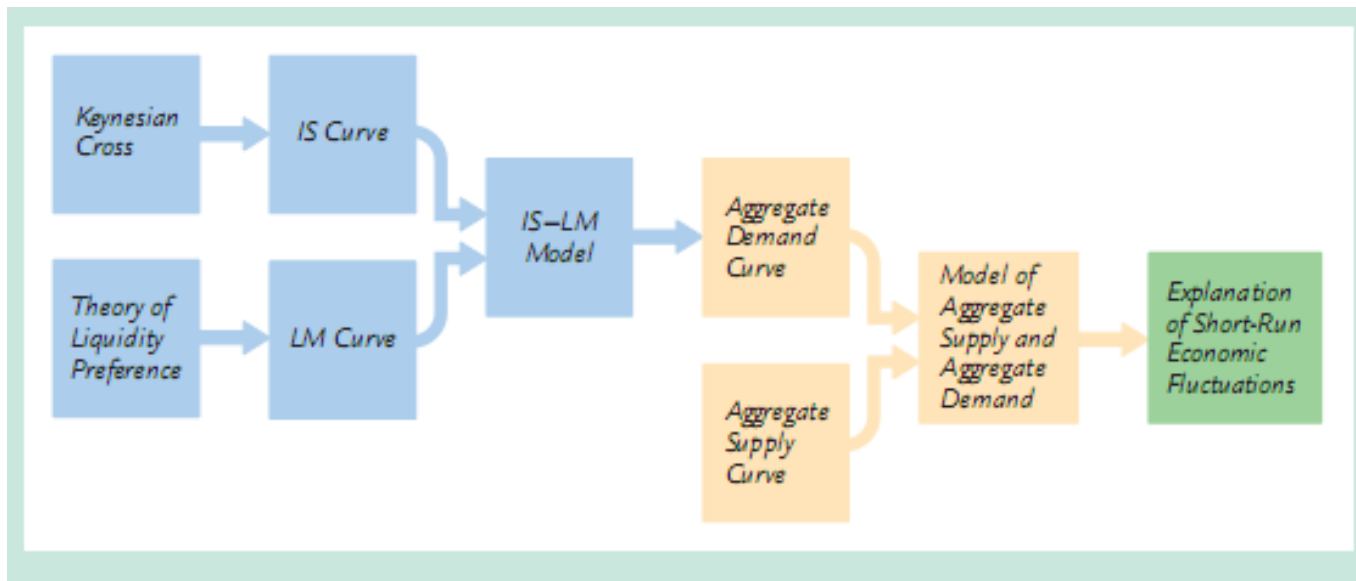
- The following figure shows that the interest rate tended to rise when military spending—government expenditure—rose in the UK



A CLOSED ECONOMY IN THE SHORT RUN

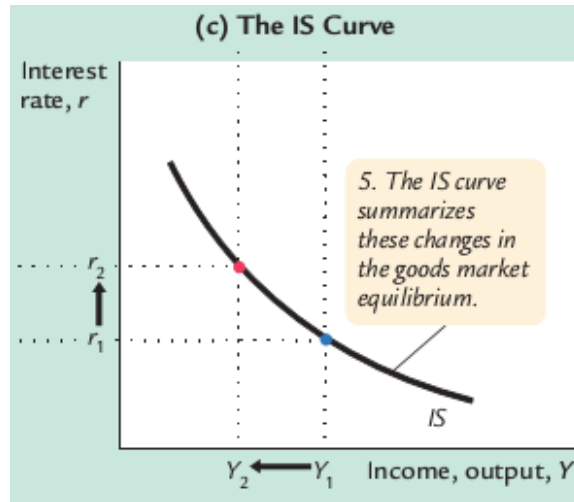
- *In the short-run we do not assume that supply of goods and services are fixed; therefore, we need a supply equation*
- *In the short-run there is a role for money on the aggregate demand. Hence, we need to consider the money market, together with the goods market, to build the aggregate demand curve*

- We use IS-LM model to explain the short-term fluctuations in economies

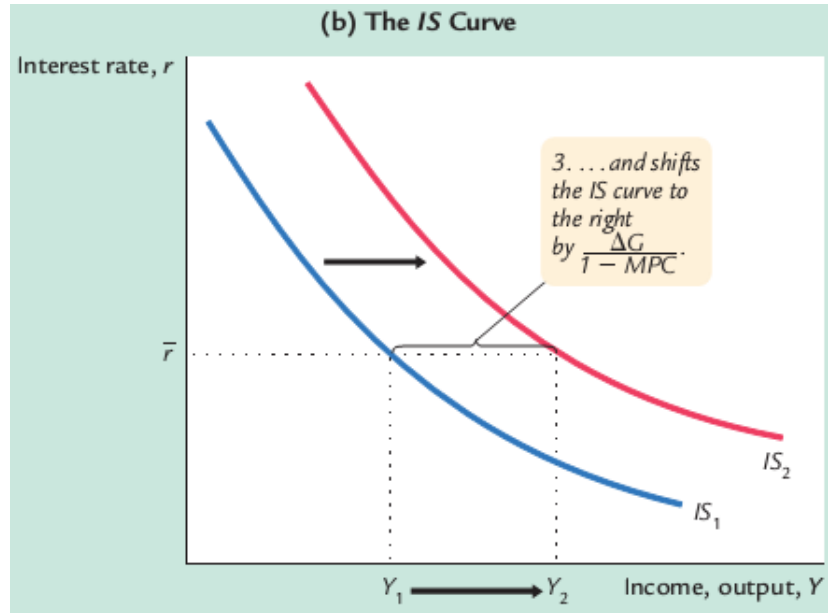


The Goods Market and the IS Curve

- Remember that: $Y = C(Y - T) + I(r) + G$. Given \bar{C} and \bar{G} , the higher the interest rate, the less demand for investment and so the lower demand for Y . The IS curve plots this negative relationship

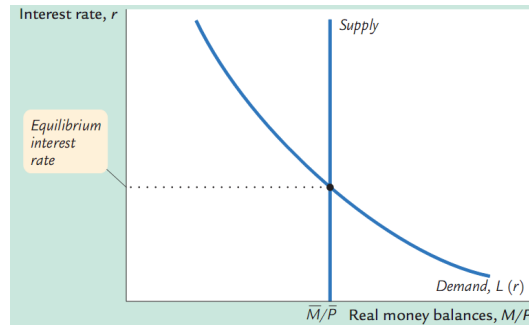


- An increase in government purchases raises the total demand for any given interest rate. Therefore, the IS curve shifts to the right



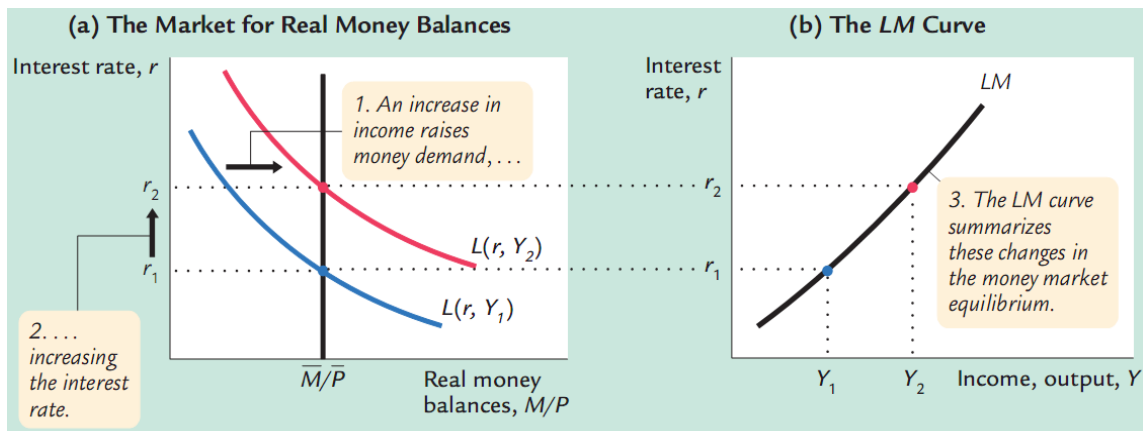
The Money Market and the LM Curve

- *Theory of liquidity preference:* Assume that there is a fixed supply of real money balances: $(M/P)^s = \bar{M}/\bar{P}$. The demand for money depends negatively on the interest rate: $(M/P)^d = L(r)$. Therefore, interest rate brings the supply and the demand in to a balance



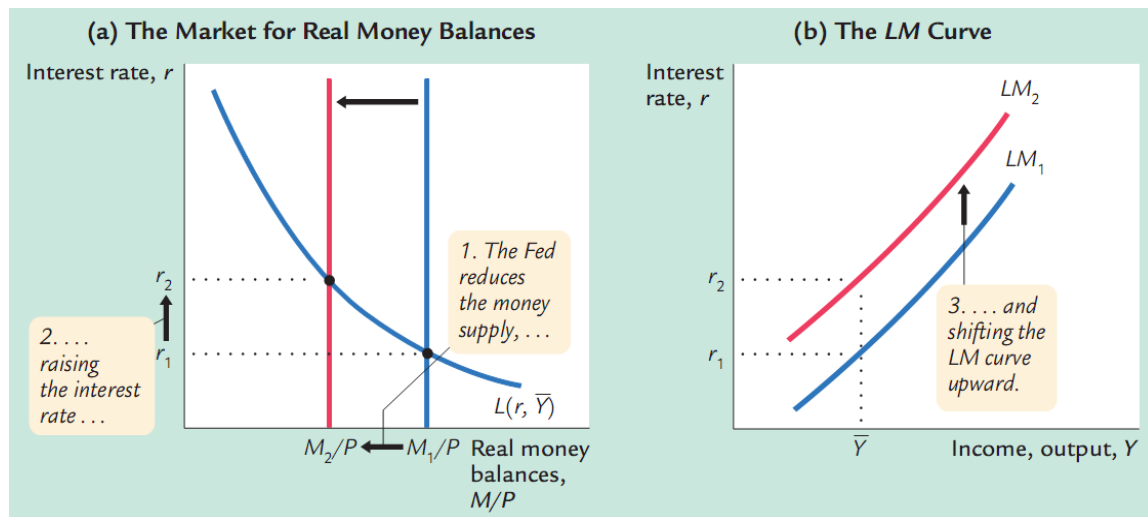
- If $r > r^*$, individuals convert some of the excess supply of money into interest-bearing assets; hence, the interest rates reduce

- The money demand depends also on income: $(M/P)^d = L(r, Y)$
- If income increases, it shifts the money demand curve to the right



- The LM curve shows combinations of interest rate and income that are consistent with equilibrium in the money market

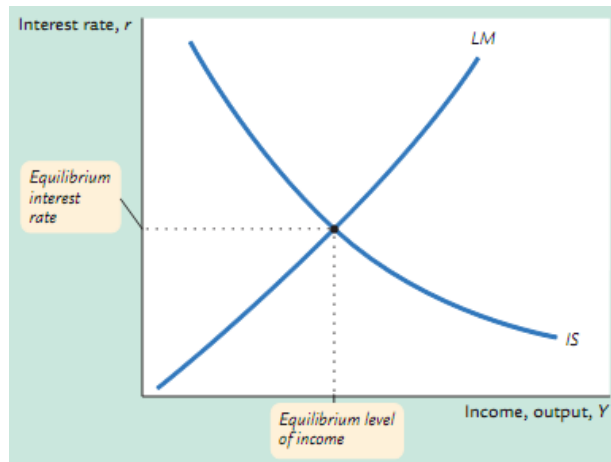
- To counteract against a reduction in the money supply, the interest rate should rise and decreases the demand for real money balances



- Hence, for any level of income the interest rate is higher

The Equilibrium

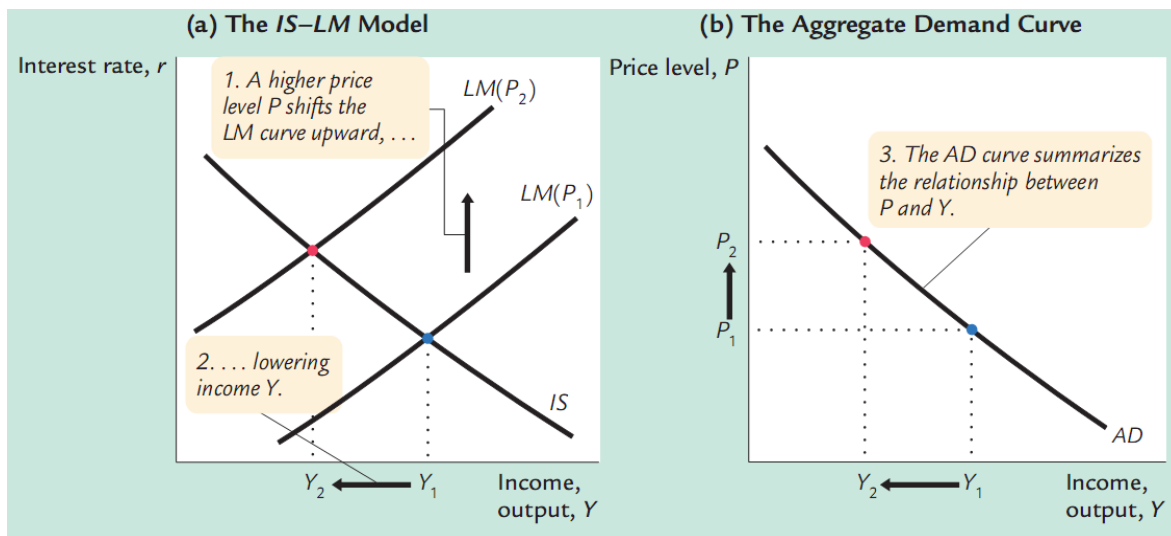
- $Y = C(Y - T) + I(r) + G$ (IS) and $M/P = L(r, Y)$ (LM)



- Interest rate, by influencing both investment and money demand, links the two halves of the IS-LM model

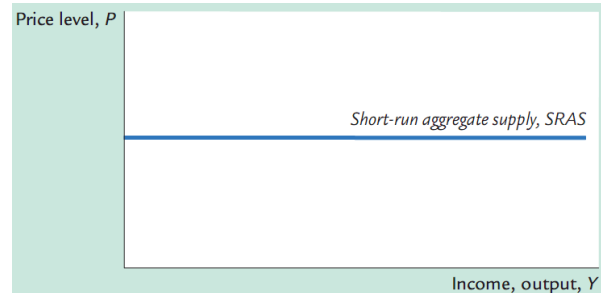
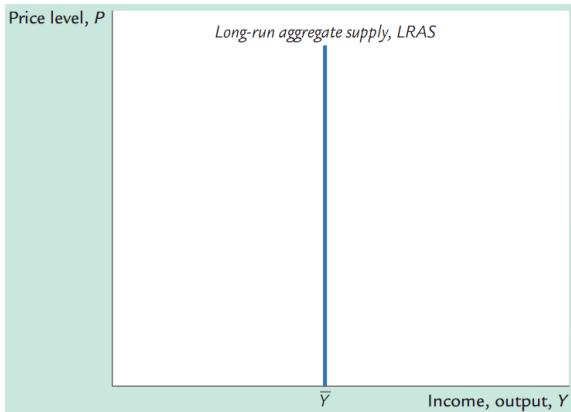
IS–LM as a Theory of Aggregate Demand

- For any given money supply M , a higher price level P reduces the supply of real money balances M/P and shifts the LM curve to the left, which reduces equilibrium income



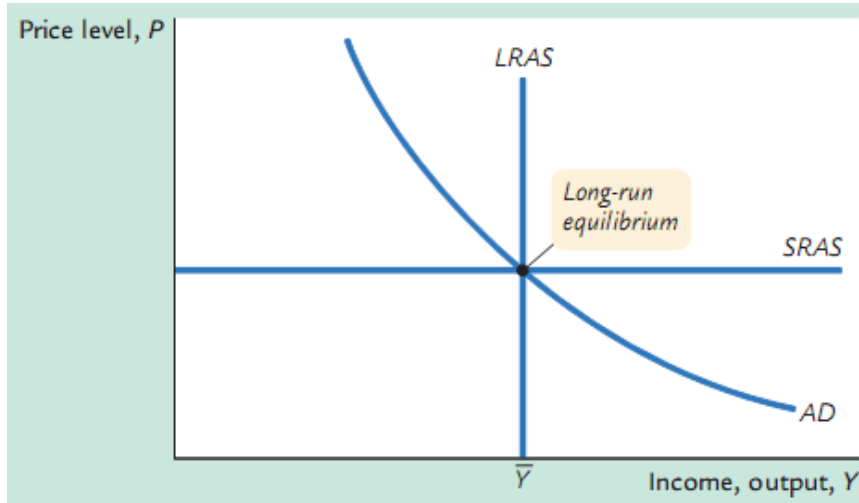
Aggregate Supply

- In the long run, as you would remember the level of output (aggregate supply) is determined by the amounts of capital, labor and the available technology; it does not depend on the price level.
- However in the short run, output supply is very sensitive to price level.

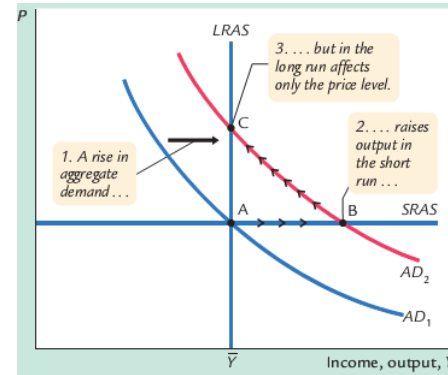
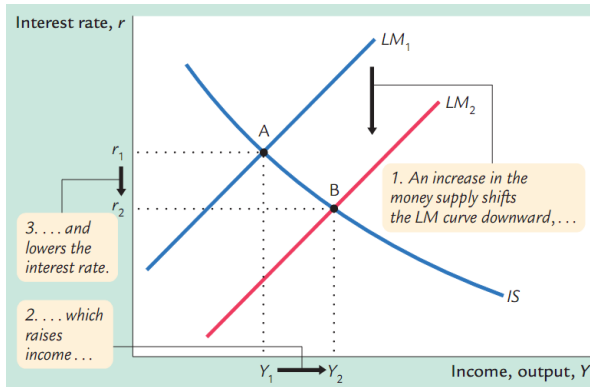


The Long Run Equilibrium in the AS-AD Model

The economy is at the intersection of the long-run aggregate supply curve and the aggregate demand curve. Because prices have adjusted to this level, the short-run aggregate supply curve crosses this point as well

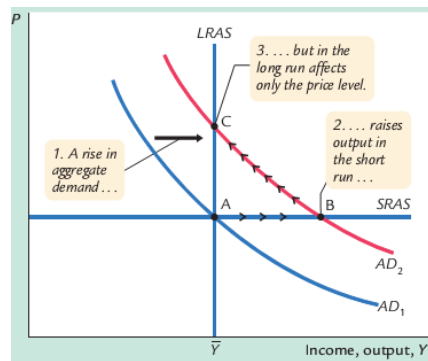
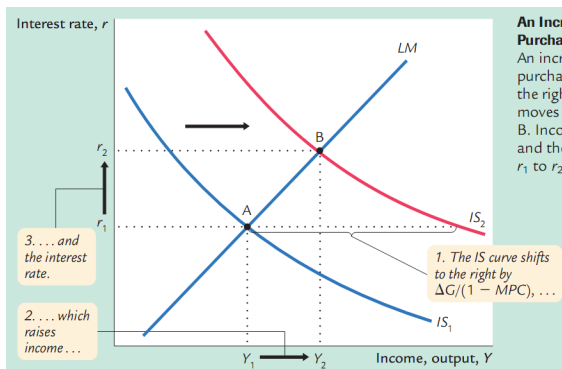


An Increase in the Money Supply



- Short-Run (A to B): Increase in the money supply lowers the interest rate, which stimulates investment and expands the total demand
- Long-Run (B to C): Prices adjust to the increase in demand. LM curve shifts to the left. The economy once again is on Y_1 , with the same real interest rate. Only the price level is affected in the long run

An Increase in the Government Purchases



- Short-Run (A to B): IS curve to the right. The rise in income (Y) increases the money demanded at every interest rate. Interest rate rises, reducing investment and also partly Y
- Long-Run (B to C): Prices adjust to the increase in demand. LM curve shifts to the left. The economy is on Y_1 again. Interest rate and the price level are permanently higher, investment is lower

What Happens in the Long-Run?

- *General Information:* Remember that money does not appear in the national income identity ($Y = C + I + G$) but in the real money balances: $(M/P)^d = L(r, Y)$.
- In the long-run, for any level of output the changes in the price level (P) are proportional to the changes in money supply (M). Thus, monetary policy is ineffective on the real economy.
- In our long run analysis, we also assume that for each level of production (\bar{Y}), the government parameters (\bar{G} and \bar{T}) are fixed. Hence, private consumption, which depends on the disposable income ($\bar{Y} - \bar{T}$) is also fixed. Therefore, only the real interest rate, by affecting the

investment, can bring the national income identity in to a balance

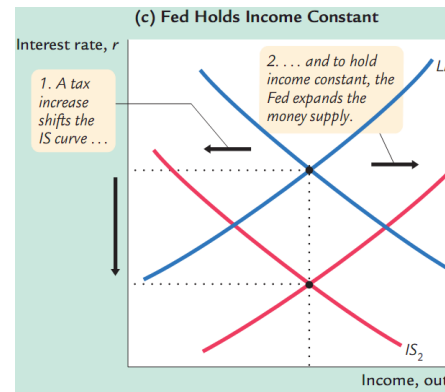
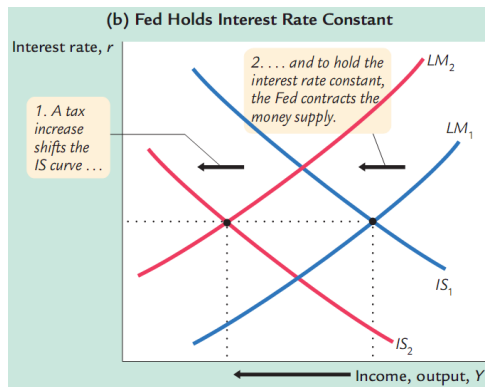
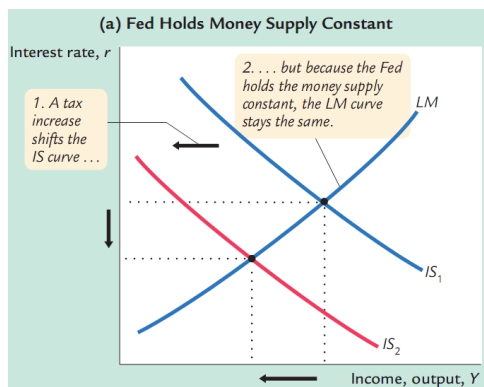
$$\bar{Y} = C(\bar{Y} - \bar{T}) + I(r^*) + \bar{G}$$

- An increase in the government consumption (expansionary fiscal policy) increase the demand for goods and services. As supply is fixed, such an increase in demand can only be met by decrease in investment

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

which requires interest rate to rise

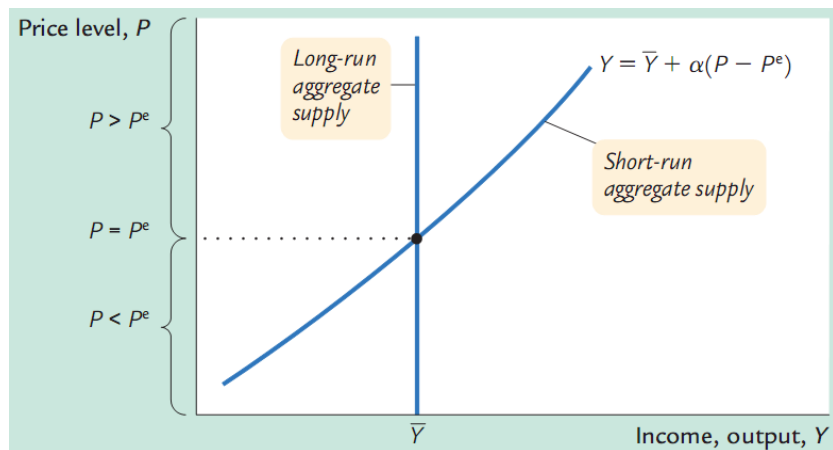
The Interaction Between Monetary and Fiscal Policies



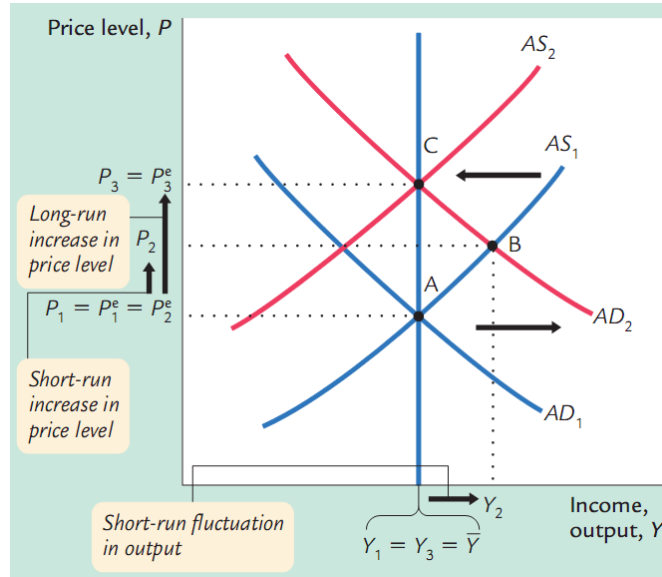
- If taxes are increased (graph a), the central banks may lower money supply and bring the interest rate to its previous level-causing a significant decline in output (graph b), or increase the money supply and bring the output to its previous level-causing a significant decline in interest rates and (increase in inflation) (graph c)

Aggregate Supply

- Previously we assumed horizontal the short-run aggregate supply curve, representing the extreme situation in which all prices are fixed
- More realistic approach is to take upward sloping supply curve, i.e. when price level increases, aggregate supply increases as well



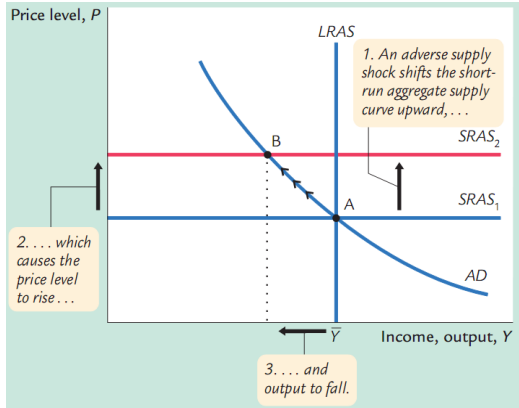
An Increase in the Aggregate Demand



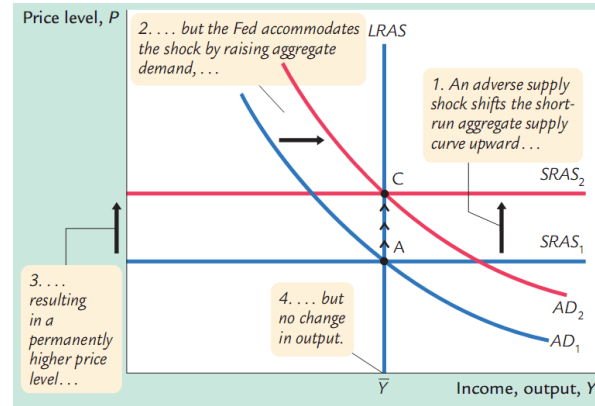
- The economy begins in a long-run equilibrium, point A
- When aggregate demand increases unexpectedly, the price level rises from P_1 to P_2 . Because the price level P_2 is above the expected price level P_2^e , the economy moves along the short-run aggregate supply curve from point A to point B
- In the long run, the expected price level rises to P_3^e , causing the short-run aggregate supply curve to shift upward. The economy returns to a new long-run equilibrium, point C, where output is back at its natural rate

Shocks to Aggregate Supply

An Adverse Supply Shock



Accommodating an Adverse Supply Shock



- On the left figure, an adverse supply shock leaves the economy with lower output and higher prices, i.e. that for each level of output there is higher price level
- On the right figure, the adverse supply shock is confronted by increas-

ing the demand (either through a fiscal or monetary policy). This brings output to its previous level, but the prices are permanently higher.

A note on Monetary Policy: The increase in demand that we see on the right graph in the previous slide can be caused by an increase in the money supply by Central Banks. The drawback of this option is that the price level is permanently higher. But if the supply shock is a temporary one, then AD curve can be shifted to its previous position. In general, the trade-off between inflation and output is a very well recognized feature of the monetary policy

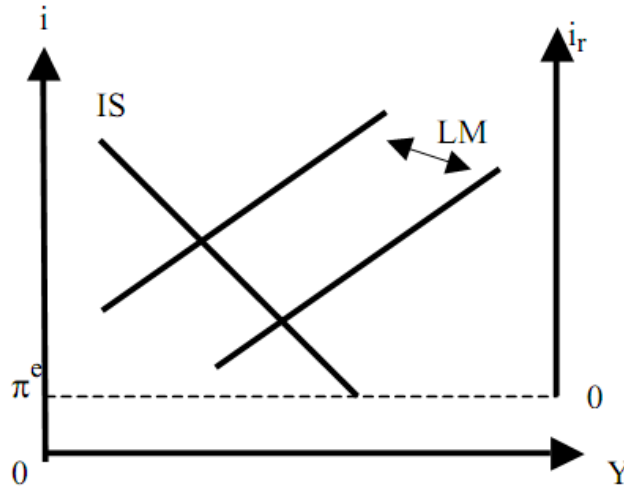
Complementary Analysis on the Short-Run Effects of Monetary Policy in a Closed Economy Model

- The two equations used: $Y = C(Y - T) + I(r) + G$ (IS) & $M/P = L(r, Y)$ (LM)
- In fact, the cost of holding money in your pocket is the nominal interest rate. Hence, money demand depends on the nominal interest rate

$$M/P = L(i, Y)$$

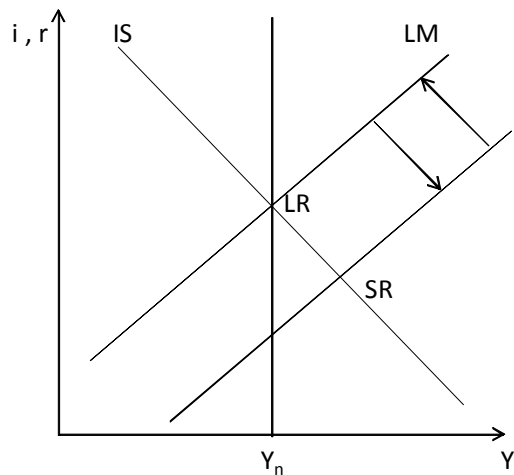
- The problem is that goods market depends on the real interest rate (r), and the money market depends on the nominal interest rate (i).

$$M/P = L(i, Y) = L(r + \pi^e, Y)$$



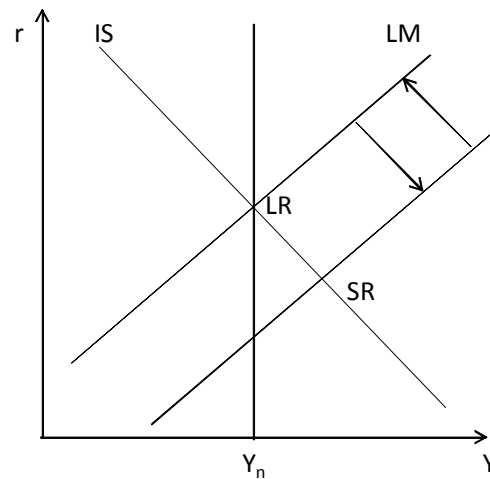
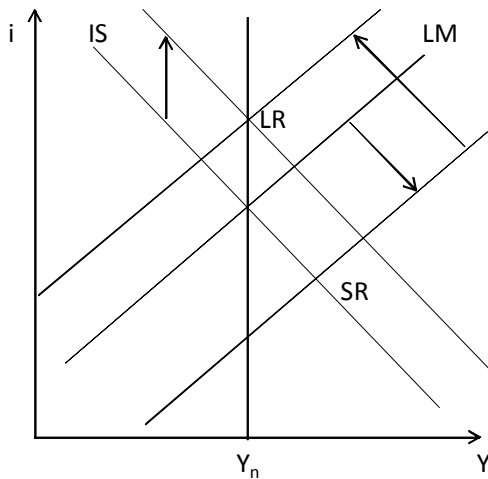
- The left axis shows the nominal interest rate, and the right one shows the real interest rate. LM curve can be drawn for any of the two
- *Note:* The decline in the nominal interest rates through increase in money supply is called the liquidity effect.

Example 1: One-time increase in the money stock.



- Since it is a one time increase, it does not affect the inflation expectations. So nominal or real interest rates can be used on the diagram
- Initially LM curve shifts to the right, then as prices increases, the LM curve shifts to the left until it returns to its initial position

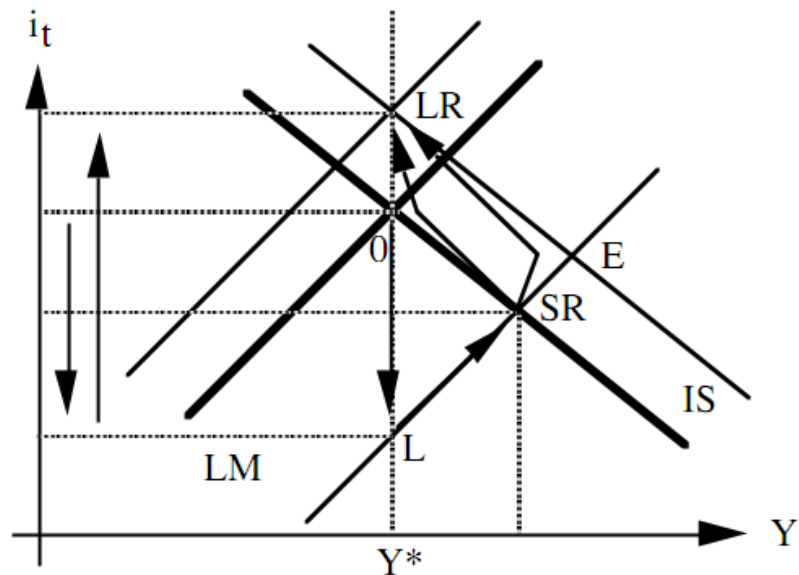
Example 2: Consider a permanent increase in the money growth rate from zero to some positive value



- This means the money stock is increased repeatedly, forever. Each time, the LM curve shifts to the right. The initial impact is the same as in Example 1

- Money supply increase create permanent inflation; hence, the demand for money decreases according to the condition: $M/P = L(r + \pi^e, Y)$
- Therefore P has to rise to satisfy the equation. Hence, P increases faster than M. LM curve shifts to the left of its initial position
- At that point, prices and money supply increase at the same rate
- Even though the real interest rate is back to its original value, an increase in inflation brings the IS curve to the higher nominal interest rate for each r
- So the nominal interest rate also increases by the money growth rate, i.e. the Fisher effect (the one-for-one relation between the inflation rate and the nominal interest rate: $i = r + \pi^e$) applies
- And the more accurate form of the Fisher Effect is: $i = r + \pi^e$

How Short is the Short Run?

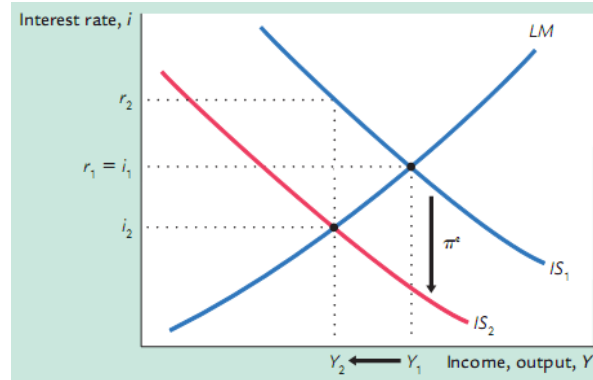


1. The Liquidity Effect: Financial markets react much more quickly than goods markets to economic changes (within minutes rather than

months). An expansionary open market operation that increases the money supply will immediately increase the demand for bonds and reduce the interest rate. Hence, the economy will initially jump to a point off the IS-curve, i.e., from point 0 to point L in the IS-LM diagram below

2. The Income Effect: Lower interest rates encourage investment, which raises output. The income effect refers to the movement along the LM curve from point L to point SR. Standard IS-LM analysis ignores point L and moves directly from 0 to SR.
3. The distinction between “instantaneous” liquidity effects and “short-run” macro effects is worth remembering for financial market analysis.

Could the Depression Happen Again?: Expected Deflation in the IS–LM Model



- An expected deflation (a negative value of π^e) raises the real interest rate for any given nominal interest rate, and this depresses investment spending. The reduction in investment shifts the IS curve downward. The level of income falls from Y_1 to Y_2 . The nominal interest rate falls from i_1 to i_2 , and the real interest rate rises from r_1 to r_2