The IS-LM model

The economy in the short run

The short run

- Movements in output are largely driven by movements in aggregate demand.
- Output on the supply side is assumed to be infinitely elastic. The aggregate supply curve in the economy is flat, so that the price level can be taken as constant at a predetermined level.
- Two endogenous variables: the level of output, and the interest rate.

Assumptions

- All firms produce the same good. Thus, we can look at the goods market in general without having to focus on the linkages across markets for different goods.
- The aggregate price level is constant at a predetermined level.
- The economy is closed, so there are no exports and no imports. This is a useful benchmark for the case of an open economy.

The goods market

- In a closed economy, the total demand for goods consists of private consumption, purchases of investment goods by firms, and government spending. Hence,

$$Z = C + I + G$$

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The behaviour of consumption

- Consumption is postulated to depend linearly and positively on disposable income, and the marginal propensity to consume, c_1, lies between zero and one. Thus,
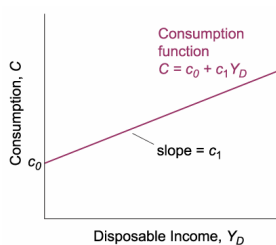
$$C = c_0 + c_1(Y - T)$$

- The intercept, c_0, is a minimum level of consumption when disposable income is equal to zero.

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The consumption function

Consumption function
$C = c_0 + c_1 Y_D$

Consumption, C

c_0

slope = c_1

Disposable Income, Y_D

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The behaviour of investment

- Investment depends linearly and negatively on the interest rate. The higher the interest rate, the greater are interest payments on borrowed funds. Hence, noting that $a_0>0$, $a_1>0$,

$$I = a_0 - a_1 i$$

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Government spending

- Government spending and taxes are given exogenously and together they describe the stance of fiscal policy.
- "If the government adopts a more expansionary fiscal policy, what will happen to output and the interest rate?"

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Goods market equilibrium

- Equilibrium condition: output should be equal to total demand. Hence,

$$Y = C + I + G$$

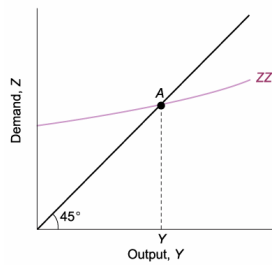$$Y = c_0 + c_1(Y - T) + a_0 - a_1 i + G$$

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The IS curve

- It is the locus of all possible combinations of output, Y, and the interest rate, i, that bring the goods market into equilibrium.
- Rewriting aggregate demand:

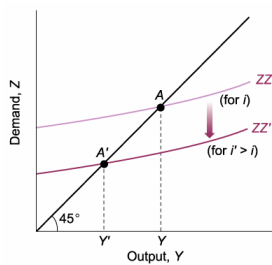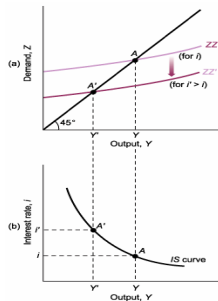$$Z = (c_0 + a_0 - a_1 i + G - c_1 T) + c_1 Y$$

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Goods market equilibrium

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What if the rate of interest is higher?

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The IS curve

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The money market

- Money supply, M^s, is determined exogenously by the central bank.
- Real money demand depends positively on output, and negatively on the interest rate. Hence,
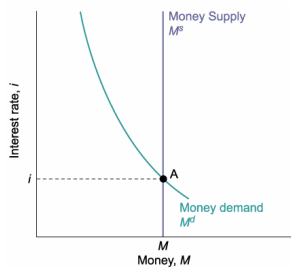
$$\frac{M}{P} = L(Y, i)$$

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Money market equilibrium

- Money market equilibrium requires that real money supply equals real money demand. Hence,
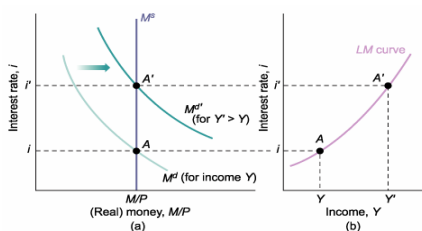
$$\frac{M^s}{P} = \frac{M}{P} = L(Y, i)$$

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Money market equilibrium
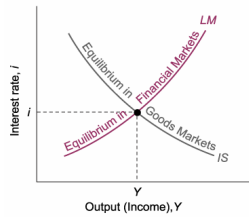
What if output is higher? The LM curve

Market equilibrium

- Market equilibrium occurs when the goods market and the money market are in equilibrium simultaneously.
- Graphically, the only point where both markets are simultaneously in equilibrium is the intersection between the IS curve and the LM curve.
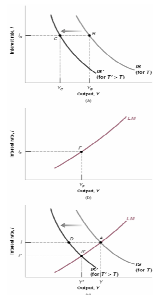
Market equilibrium

Fiscal policy

- Expansionary fiscal policy: increase in G or decrease in T.
- Restrictive fiscal policy: decrease in G or increase in T.
- Changes in G and T only affect the goods market equation, so only the IS curve will shift as a consequence of the change in an exogenous variable.
- The LM curve does not shift.

An increase in taxes

Results

- As a result of higher taxes, the level of output decreases, and the interest rate decreases.
- Conversely, greater government spending would increase the level of output and also the interest rate.
- Yet, output does not increase by as much as the fiscal stimulus. Why?

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The crowding-out effect

- Government expenditures crowd out private spending!
- The increase in G increases aggregate demand, thereby increasing money demand. The interest rate rises to maintain money market equilibrium, thereby decreasing investment.
- Taking account of the general equilibrium shows that the multiplier of government expenditures is smaller than if we had considered the goods market in isolation.
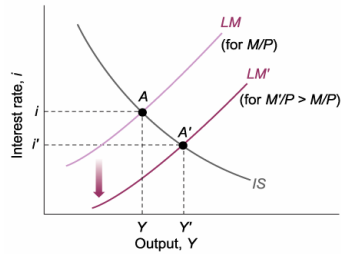
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Monetary policy

- Expansionary monetary policy: increase in nominal money supply.
- Restrictive monetary policy: decrease in nominal money supply.
- Changes in the supply of money enter only in the money market equation, so only the LM curve shifts.
- The IS curve does not shift.

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An increase in money supply

Interest rate, i — Output, Y

LM (for M/P)
LM' (for $M'/P > M/P$)
IS

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Results

- An increase in the money supply brings about a higher level of output and a lower interest rate.
- Can we offset the crowding-out effect? Yes, by exploiting the opposite effects of fiscal policy and monetary policy on the interest rate. Graphically?

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The liquidity trap

- In practice, there is a limit to what monetary policy can achieve: nominal interest rates cannot go below zero! This is known as the *zero bound* on nominal interest rates.
- In the money market there is a point where the interest rate reaches zero; a further increase in money supply does not reduce the interest rate, and investment does not increase anymore!

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The liquidity trap
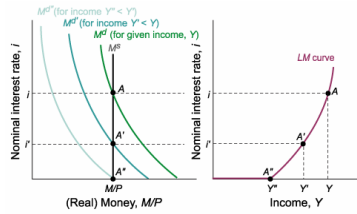
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The liquidity trap

- The increase in money supply falls in a liquidity trap: people are willing to hold more money but at the same (zero) interest rate!
- Any solution? When the LM curve is flat, fiscal policy is fully effective and there is no crowding-out effect! Increased government spending and lower taxes will shift the IS curve to the right, thereby increasing output.
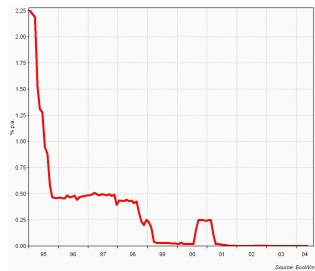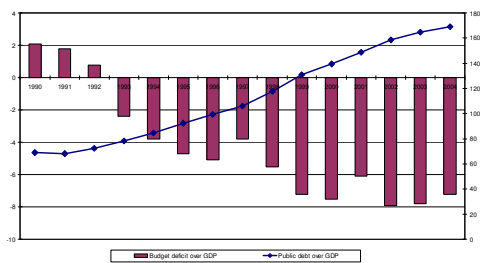
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The liquidity trap
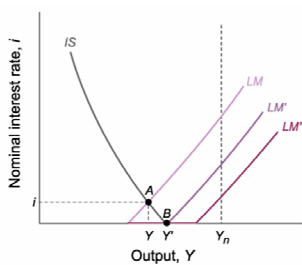
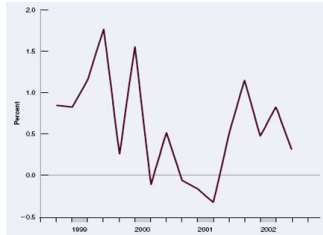30

An example: Japan

An example: Japan

The 2001 recession

- We use the IS-LM model to understand the evolution of the economic recession in the United States in 2001.
- In 2001 the growth rate of the economy was negative for three consecutive quarters.

The recession in 2001…

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The cause and the response…

- Initially, there was a sharp exogenous contraction of investment, so the IS curve shifted to the left and output was lower while unemployment was rising.
- The Federal Reserve, the central bank in the United States, reacted promptly and increased money supply so as to reduce the interest rate.
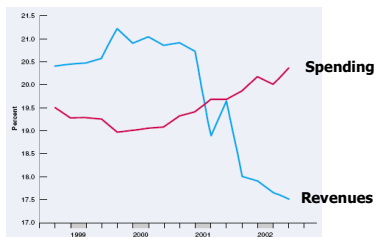
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An expansionary monetary policy…
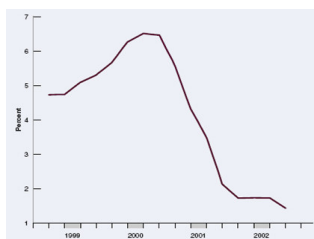
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The response…

- The Bush administration also reacted by adopting a more expansionary fiscal policy, i.e. by lowering taxes and increasing government spending.
- As a result, the budget deficit soared!
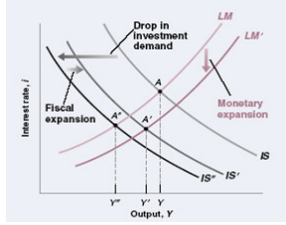
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A widening budget deficit…

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Putting the pieces together…

- To summarise, a large exogenous fall in demand in 2001 led to a recession with rising unemployment.
- The central bank reacted by adopting a more expansionary policy, and the federal government reduced taxes and increasing spending.
- Soon after the beginning of the recession, the economy started to pick up again!

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The IS-LM model at work