Introduction to Macroeconomics

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Outline

These slides follow the original slides of Quijano/Quijano that accompany the Blanchard textbook.

The goods market and the IS relation

Equilibrium in the goods market exists when production Y equals the demand for goods Z. This condition is called the **IS relation**.

In the simple model developed before, the interest rate did not affect the demand for goods. The equilibrium condition was given by:

$$Y = c_0 + c_1(Y - T) + \bar{I} + G.$$

In this section, demand will be modelled as depending on i. This channel is provided by endogenous investment demand.

Investment function

Investment depends primarily on two factors:

1. The expected future level of sales. This unknown quantity is approximated by current sales Y. Dependence is positive $(+)$;
2. The interest rate, as it determines the cost of investment. Dependence is negative $(-)$.

These ideas imply an investment function:

$$\begin{array}{rcl} I & = & I(Y, i) \\ & & (+, -) \end{array}$$

Aggregate demand with endogenous investment

Taking into account the investment relation, aggregate demand in the goods market Z becomes:

$$Z = c_0 + c_1(Y - T) + I(Y, i) + G.$$

For a given value of the interest rate i, demand is an increasing function of output, for two reasons:

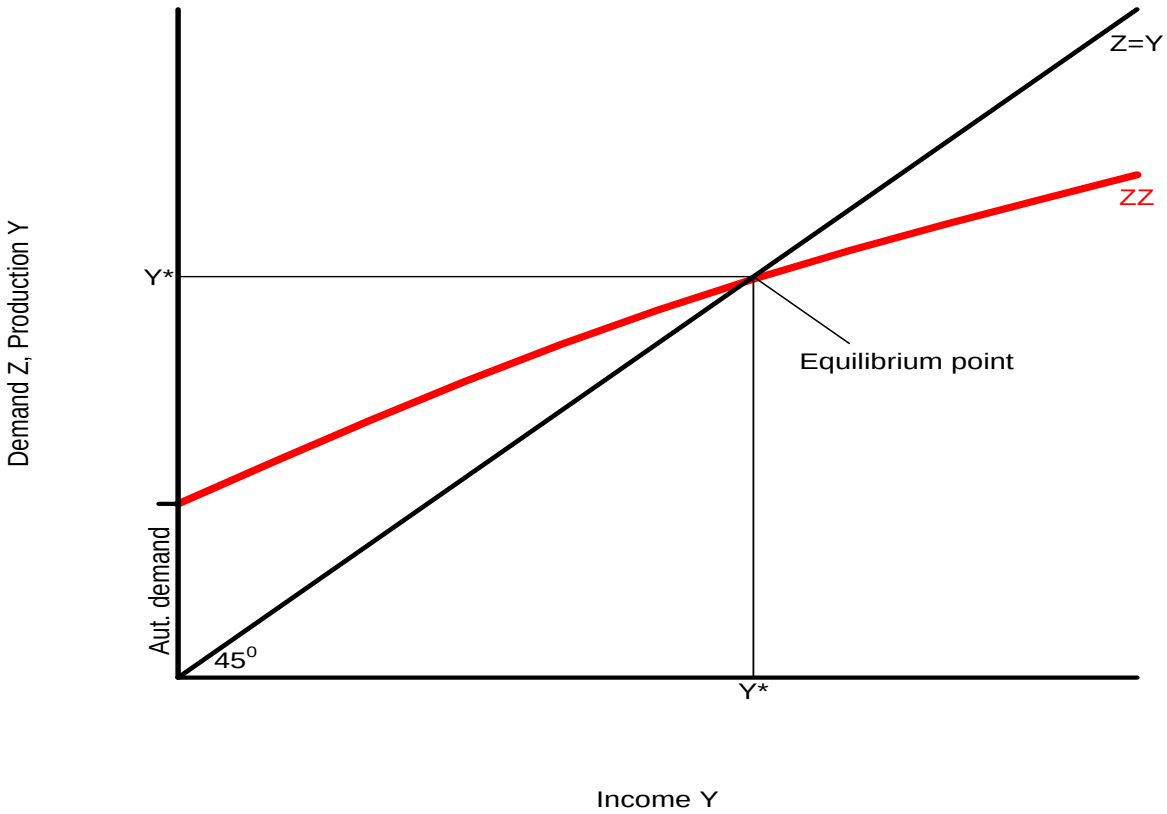
1. An increase in output leads to an increase in income and also to an increase in disposable income;
2. An increase in output also leads to an increase in investment.

The ZZ curve with endogenous investment

Note two characteristics of the aggregate demand curve as a function of income or output (ZZ curve):

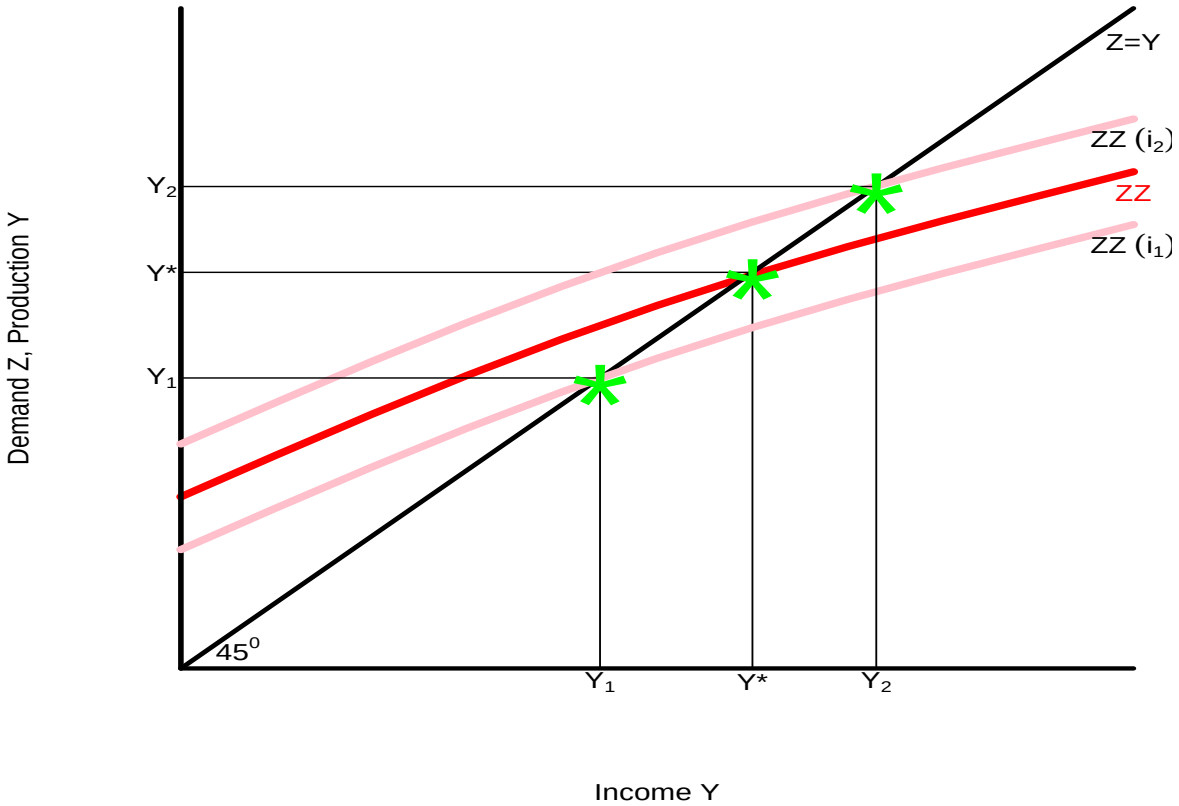
1. Because no specific functional form is assumed for the investment function $I(Y, .)$, the ZZ curve is, in general, a curve rather than a line;
2. ZZ is drawn flatter than a 45–degree line, as it is assumed that an increase in output Y leads to a less than one-for-one increase in demand Z.

The ZZ curve with endogenous investment: graph



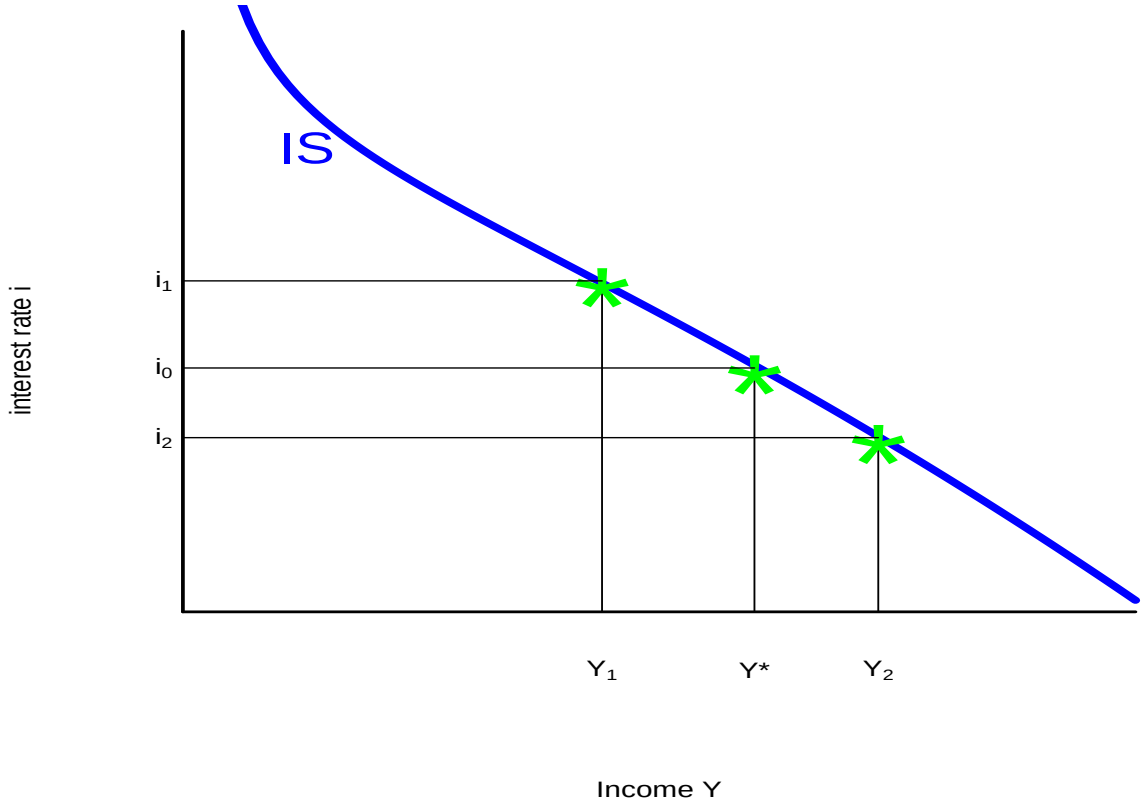
Note that the interest rate i is assumed as given for this curve.

Equilibria for varying interest rates



For lower interest, i_2, equilibrium Y is higher, and for higher interest, i_1, equilibrium Y is lower.

The 'derivation' of the IS curve



If equilibria are evaluated for *all* interest rates, we obtain a falling curve in an (Y, i)–diagram. This curve of equilibria in the (Y, i) diagram is called the **IS curve**.

From the ZZ curve to the IS curve: words

- An increase (decrease) in the interest rate decreases (increases) the demand for goods at any level of output, leading to a decrease (increase) in the equilibrium level of output;
- Equilibrium in the goods market implies that an increase (decrease) in the interest rate leads to a decrease (increase) in output. The IS curve is therefore downward sloping.

Shifts of the IS curve

The drawn IS curve takes as given the values of taxes T and of government spending G. Changes in either T or G will shift the IS curve (move it to a parallel location).

Changes in factors that *decrease the demand for goods*, given the interest rate, shift the IS curve to the left (*inward*). Changes in factors that *increase the demand for goods*, given the interest rate, shift the IS curve to the right (*outward*).

Remember the LM relation

In the financial market, the equilibrium interest rate is determined by the equality of the supply of and the demand for money:

$$M = \$Y \cdot L(i).$$

Thus, i is a function of M (money, exogenous) and $\$Y$ (nominal income, determined in the goods market), but this function is not given explicitly but rather implicitly.

The relation between Y and i is called the LM curve. One can show that i is an increasing function of Y.

Real money

Nominal income $\$Y$ can be written as $\$Y = Y \cdot P$, with P the general price level (such as a GDP deflator). Thus, also

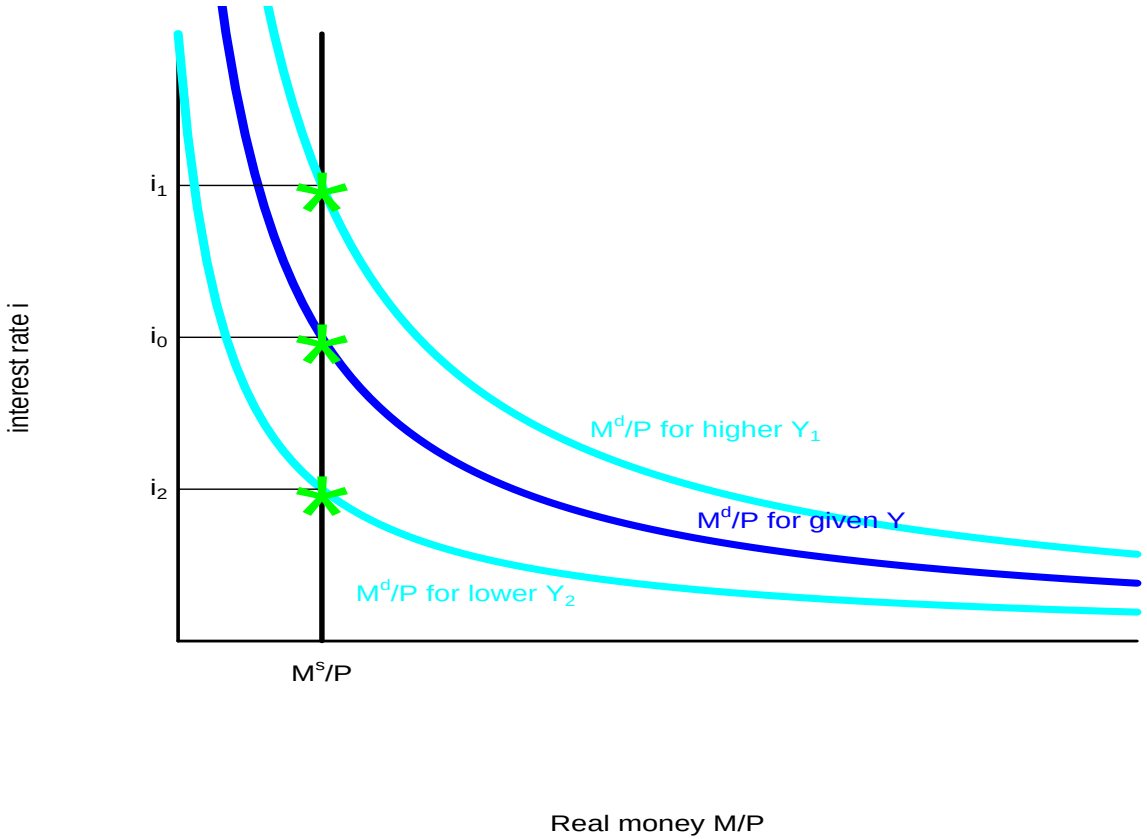
$$M = \$Y \cdot L(i) = Y \cdot P \cdot L(i)$$

can be written as

$$\frac{M}{P} = Y \cdot L(i).$$

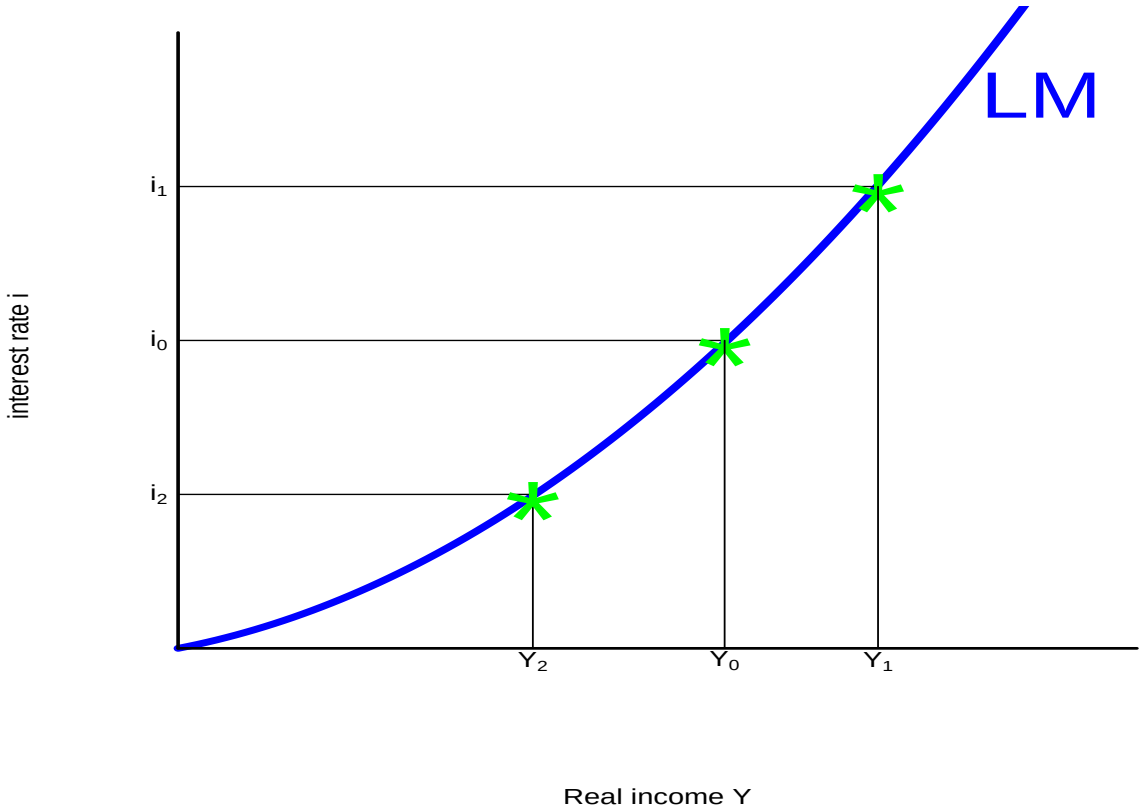
The term on the left M/P is often called 'real money'. This equation means that real money demand equals real money supply.

Equilibria for varying income



Lower real income implies less demand for real money and a lower i. Higher real income implies more real money demand and a higher i.

The 'derivation' of the LM curve



If equilibria are evaluated for *all* income levels, we obtain a rising curve in an (Y, i)–diagram. This curve of equilibria in the (Y, i) diagram is called the **LM curve**.

From the money demand curve to the LM curve: words

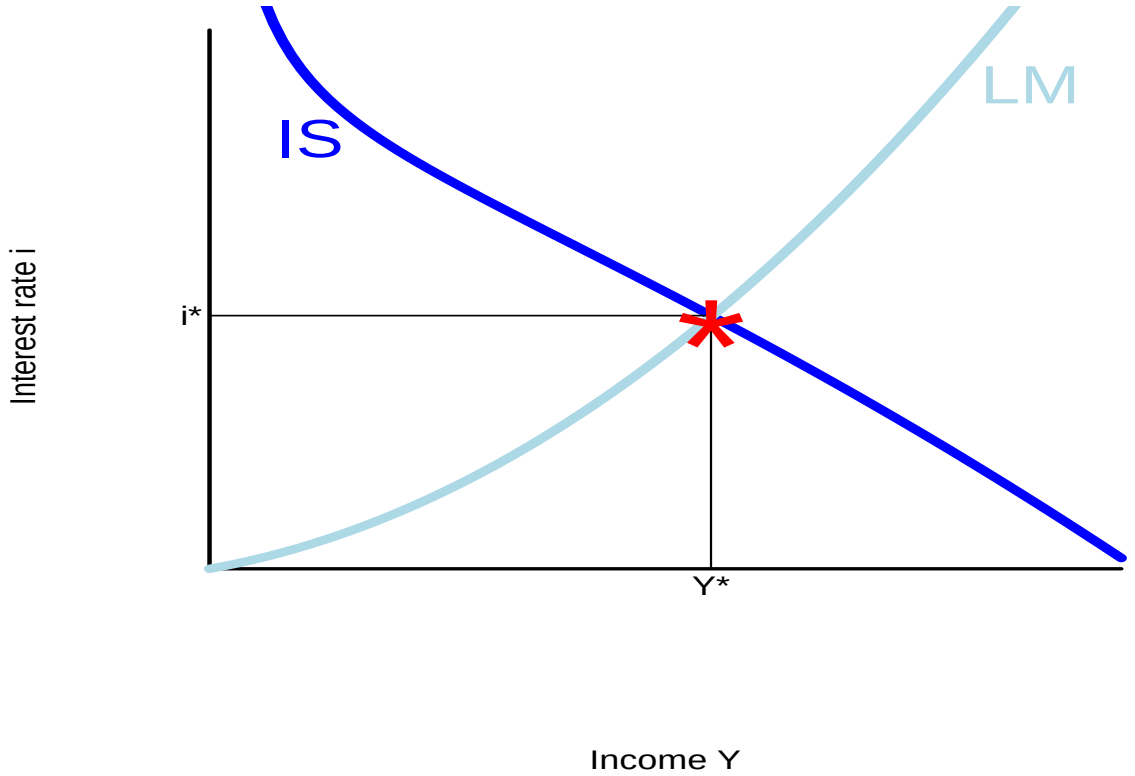
- An increase (decrease) in income (=output) leads to a higher (lower) money demand;
- At given money supply, this increased (decreased) money demand leads to an increase (decrease) in the interest rate;
- Equilibrium in the financial market implies that an increase (decrease) in output leads to an increase (decrease) in the interest rate. The LM curve is therefore upward sloping, just the opposite of the IS curve for the goods market.

Shifts of the LM curve

The drawn LM curve takes as given the values of the money supply M and of the price level P. Changes in either M or P will shift the LM curve (move it to a parallel location).

Contractions in real money caused either by monetary contractions or by increased prices, at given output, shift the LM curve up (*inward*). *Expansions* in real money either caused by monetary expansions or by falling prices, at given output, shift the LM curve down (*outward*).

The IS-LM diagram



The IS curve contains all equilibria in the goods market. The LM curve contains all equilibria in the financial market. Only their intersection point (Y^*, i^*) is an equilibrium for both markets.

Deriving the IS curve: formal aspects

The goods market equilibrium satisfies the equation

$$Y = c_0 + c_1(Y - T) + I(Y, i) + G.$$

This defines an implicit relation between Y and i given T and G. Under certain conditions, this can be represented explicitly as

$$Y = f_{IS}(i; T, G),$$

which is the IS (investment equals saving) curve, a decreasing function of i.

Deriving the LM curve: formal aspects

The financial market equilibrium satisfies the equation

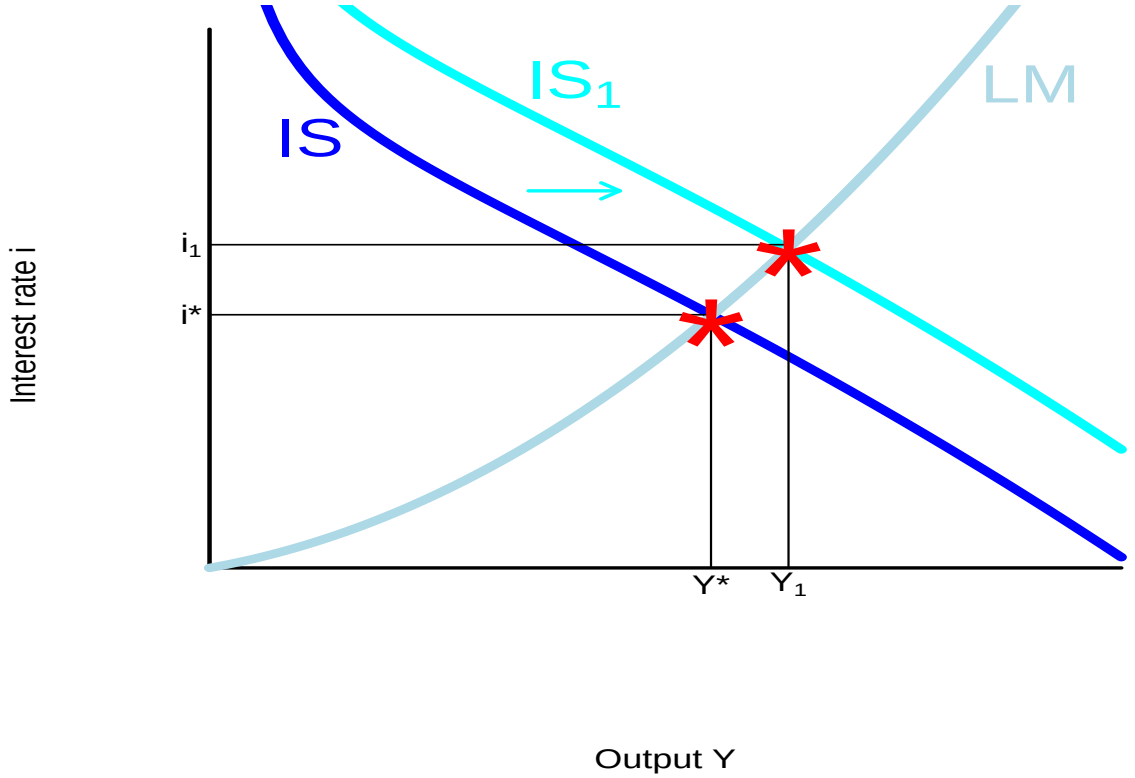
$$\frac{M}{P} = Y \cdot L(i).$$

This defines an implicit relation between i and Y given M and P. Under conditions, this can be reformulated explicitly as

$$i = f_{LM}(Y; M/P),$$

which is the LM (liquidity equals money) curve, an increasing function of Y.

Fiscal expansion in the IS-LM diagram



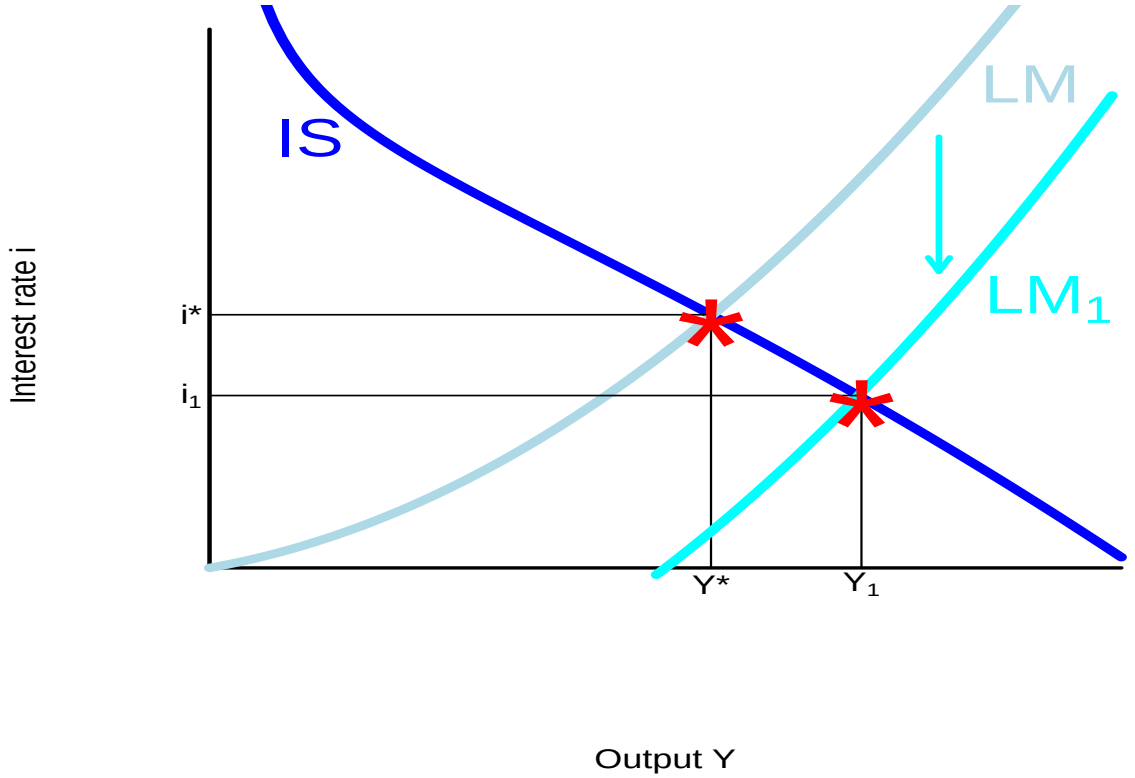
A fiscal expansion ($G \uparrow$ or $T \downarrow$) shifts the IS curve right (outward). The LM curve remains in place. Equilibrium Y and i increase.

How do variables react to a fiscal expansion?

A fiscal expansion can be implemented by raising G or by decreasing T:

- $Y \uparrow$ and $i \uparrow$ follow directly;
- C depends on $Y_D = Y - T$. $Y_D \uparrow$, hence $C \uparrow$. The effect is stronger for a tax-based expansion;
- I depends on Y (has increased) positively and on i (has increased) negatively. The reaction of I is uncertain;
- I/Y often decreases. G/Y decreases in a tax-based expansion, while C/Y then often increases.

Monetary expansion in the IS-LM diagram



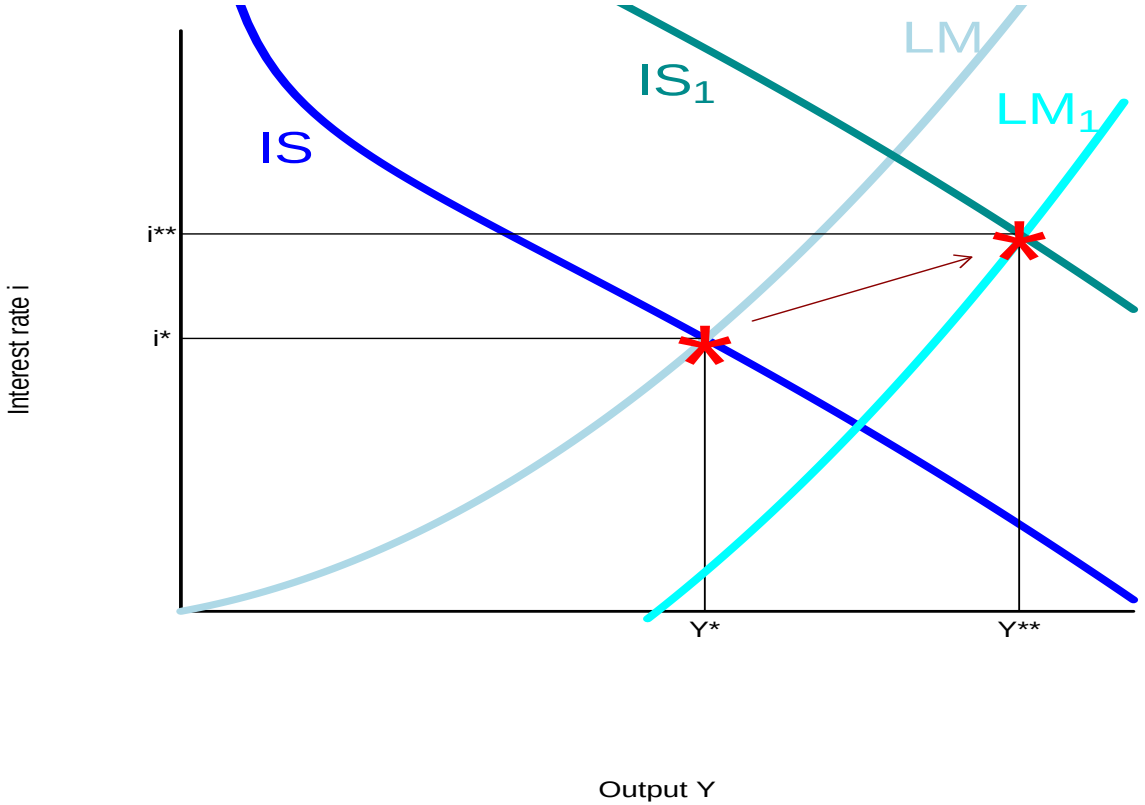
A monetary expansion ($M^s \uparrow$) shifts the LM curve down (outward). The IS curve remains in place. Equilibrium Y increases, while i decreases.

How do variables react to a monetary expansion?

A monetary expansion can only be implemented by the central bank who raises M. Falling P has similar effects:

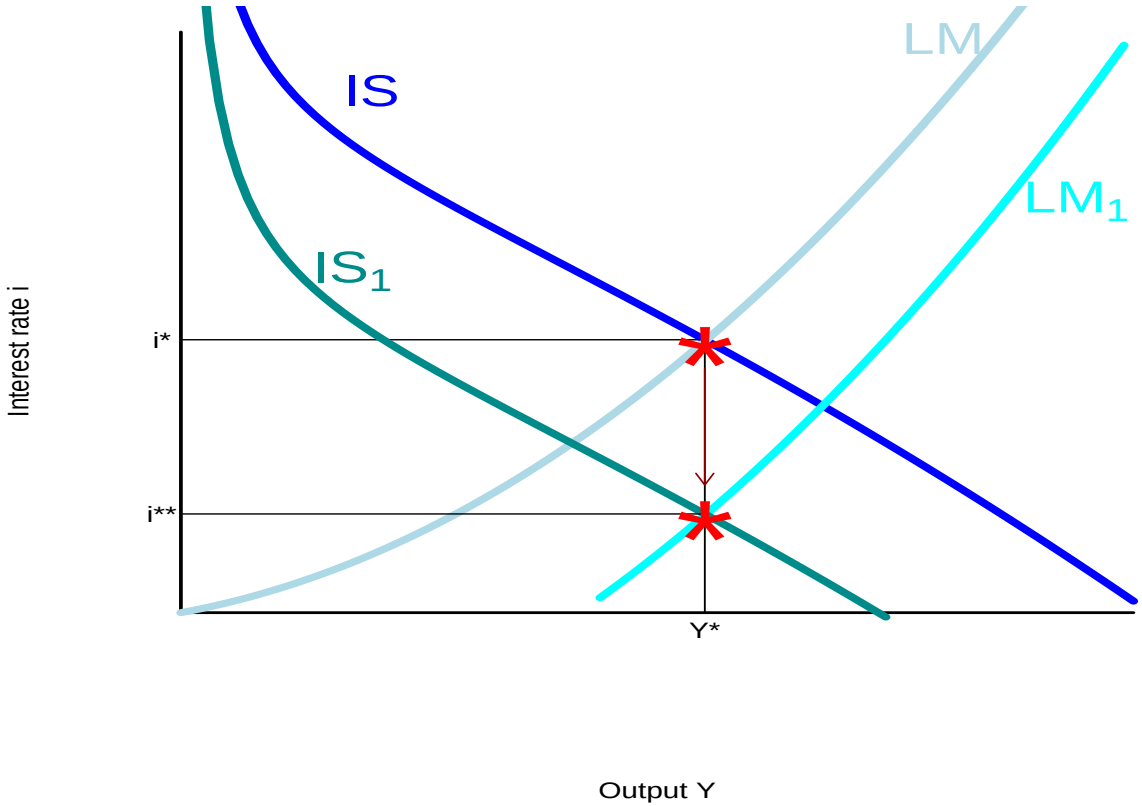
- $Y \uparrow$ and $i \downarrow$ follow directly;
- C depends on $Y_D = Y - T$. $Y_D \uparrow$, hence $C \uparrow$.
- I depends on Y (has increased) positively and on i (has decreased) negatively. The reaction of I is positive;
- G/Y decreases, while often C/Y and I/Y increase.

A policy mix can attain any given target



Starting from any existing equilibrium (Y^*, i^*), any targeted combination (Y^{**}, i^{**}) can be attained by coordinated fiscal and monetary policy.

Policy mix: consolidation supported by the central bank



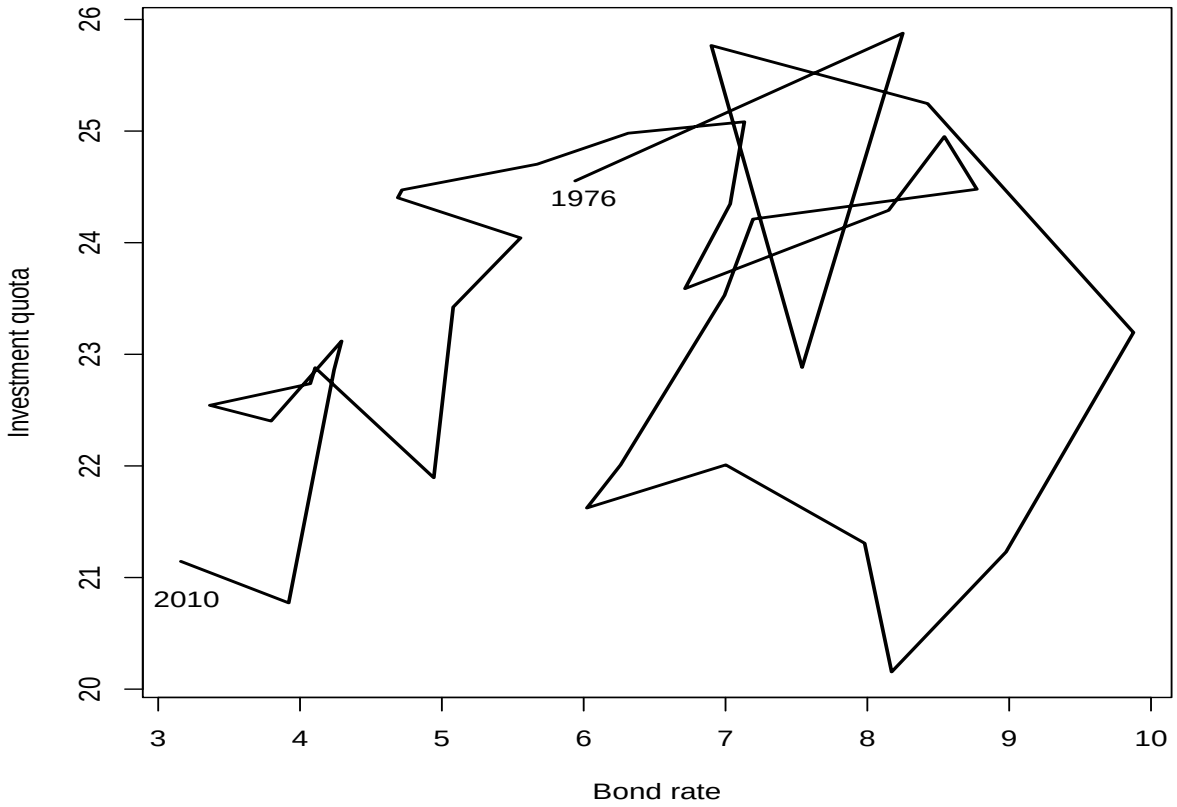
Fiscal consolidation need not lead to lower output, if the central bank supports it by a monetary expansion. The new interest rate will be lower.

Consolidation supported by monetary expansion: summary

The government achieves its budget consolidation by reducing G or by increasing T. The central bank cooperates and increases its money supply. Eventually, Y remains constant but i has decreased. The composition of demand has changed:

- C and C/Y are unchanged if government has cut spending. They are lower if taxes have been increased;
- I and I/Y are now higher, due to the lower i at constant Y. This is often seen as beneficial;
- G and G/Y are unchanged in a tax-based consolidation. They are lower by definition if spending has been cut.

Empirical evidence: investment and interest



The investment quota I/Y does not react negatively to the interest rate, as it should according to the model. The impression does not change if real interest rates are used.