

Course 4: Goods and Financial Markets: the IS-LM Model

Intermediate Macroeconomics, Econ 102

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IS-LM Model

- So far, we have looked at two markets separately:
 - ▶ The **goods market** (Course 2)
 - ▶ The **financial markets** (Course 3)
- We now look at these two markets together with the help of the so-called IS-LM model:
 - ▶ We follow a path first traced by 2 economists: John Hicks (Hicks (1937)) and Alvin Hansen (Hansen (1949)), in the late 30s and early 40s.
 - ▶ This formalization is meant to capture the main ideas in Keynes (1936).
 - ▶ To what extent the IS-LM actually does capture these ideas is still a matter of controversy.

- 1 The Goods Market and the IS Relation
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Back to the Goods Market

- Recall that the equilibrium in the goods market was coming from the condition that production Y be equal to the demand for goods Z . We called this relation the IS equation, because it may be derived starting from **Investment=Saving** ($I=S$). Demand was given by:

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

- Note that here we do not assume that the consumption function is linear:

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

- In equilibrium, demand equals output $Y = Z$ and thus:

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

Back to the Goods Market

- In fact, this was an oversimplification. Investment is not constant, and equal to \bar{I} , but it depends on:
 - ▶ The **level of sales**. (positively) In order to meet increasing sales, a firm needs to buy new machines, build an additional plant, etc.
 - ▶ The **interest rate**. (negatively) The interest rate determines the cost of capital. Investment will be undertaken only if the net present value of future profits allow to pay for the cost of investment. The higher the interest rate, the more one discounts future payoffs, and therefore the less likely it is that new investment might be profitable.
- This is modeled as:

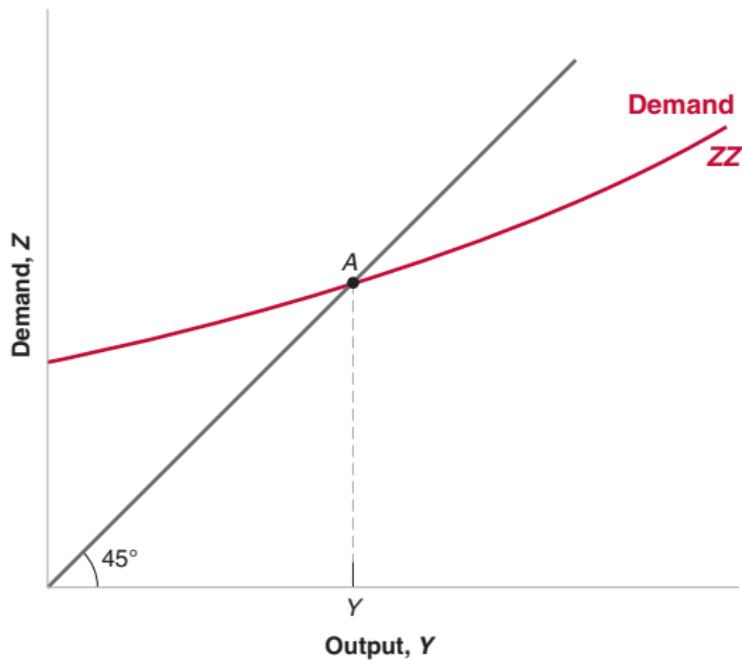
$$I = I(Y, i), \quad \frac{\partial I}{\partial Y} > 0, \quad \frac{\partial I}{\partial i} < 0.$$

An aside

- Reality is even more complex than in the book, in that consumption in fact depends on the interest rate as well. Consumption depends on the interest rate for two reasons:
 - ▶ Intertemporal substitution: when the interest rate is higher, the substitution effect makes people want to save more (substitution effect).
 - ▶ Redistributive effects: a lower interest rate is good for debtors who have a higher marginal propensity to consume. For example, homeowners with an Adjustable Rate Mortgage (ARM), and those with a Fixed Rate Mortgage (FRM) who are able to refinance.
- For these two important reasons, the interest rate impacts agents' consumption. Thus, we should in principle write consumption in the following way:

$$C = C(Y - T, i).$$

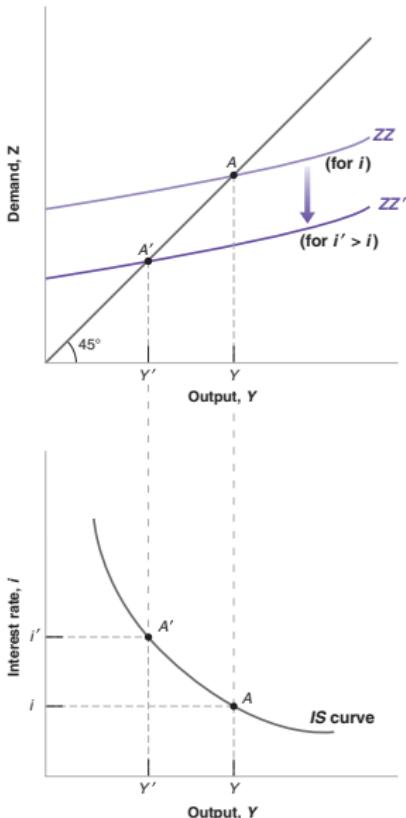
Equilibrium in the Goods Market



The new (ZZ) schedule

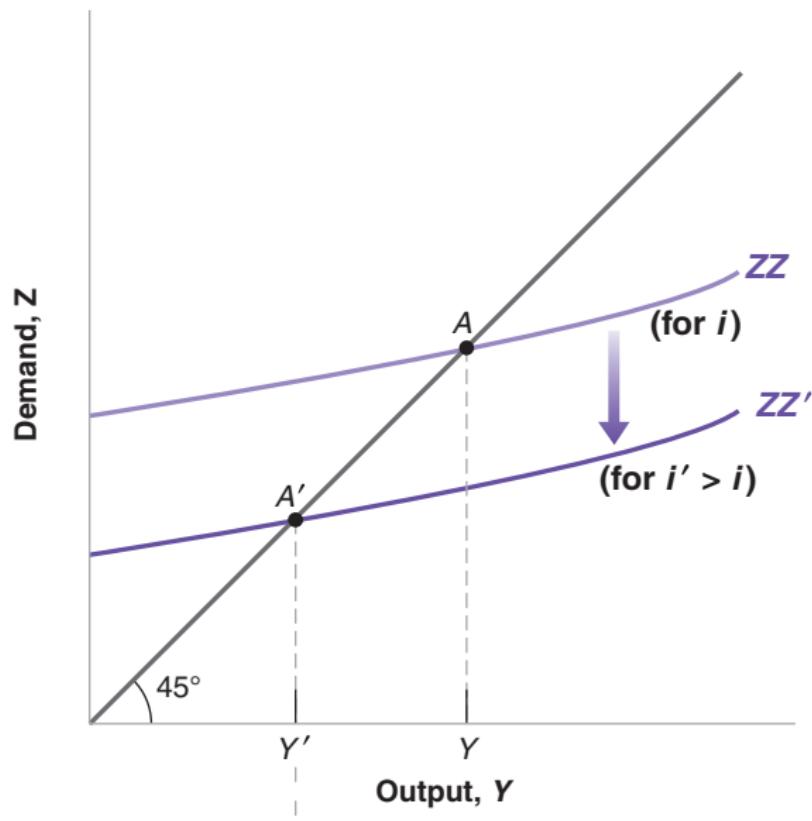
- The previous “keynesian cross” comes from the analysis of the goods market that we did during Lecture 2.
- One difference is that the multiplier effect now comes from two sources:
 - ▶ an increase in output raises consumption through $C = C(Y - T)$.
 - ▶ an increase in output raises investment through the “sales effect”: $I = I(Y, i)$.
- Moreover, we do not assume that the relationships between C and Y on the one hand, C and I on the other hand are linear. Therefore, the (ZZ) demand schedule is not a line, but a curve.
- It is assumed that (ZZ) is flatter than the 45° line. (the slope is everywhere lower than 1)

The IS Curve

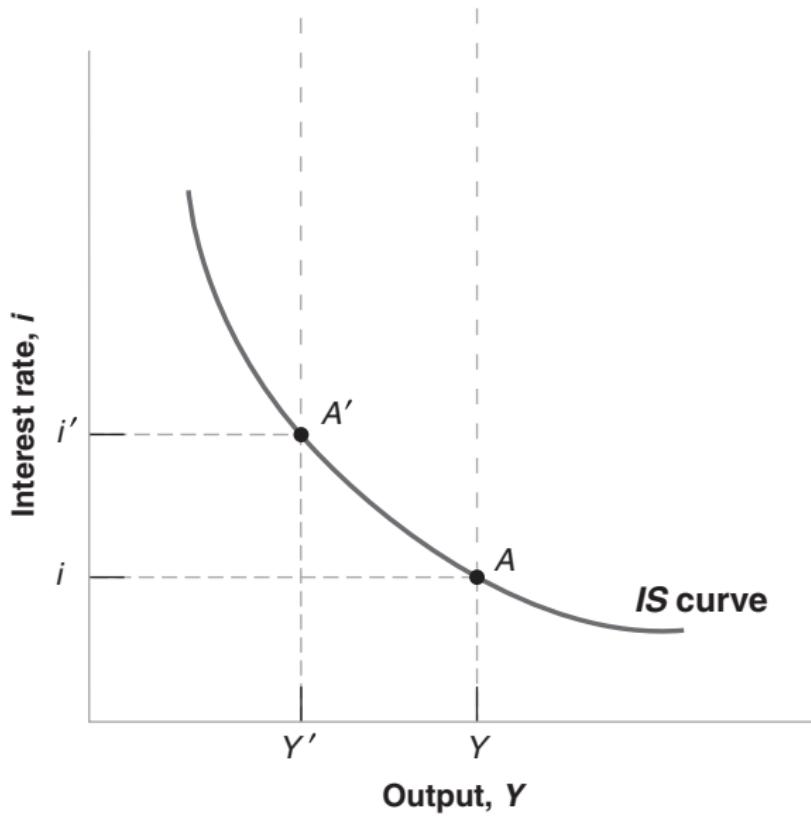


- The first panel shows that a decrease in the interest rate leads to an increase in investment through $I = I(Y, i)$, and therefore an increase in demand (in fact, if one accounts for $C = C(Y - T, i)$, then there is also a positive effect on consumption).
- Then, a further rise in output occurs through the multiplier effect: more output Y leads to both:
 - ▶ more consumption through $C = C(Y - T)$
 - ▶ more investment through $I = I(Y, i)$
- The IS curve reflects **direct + indirect** effects.

Change in the interest rate



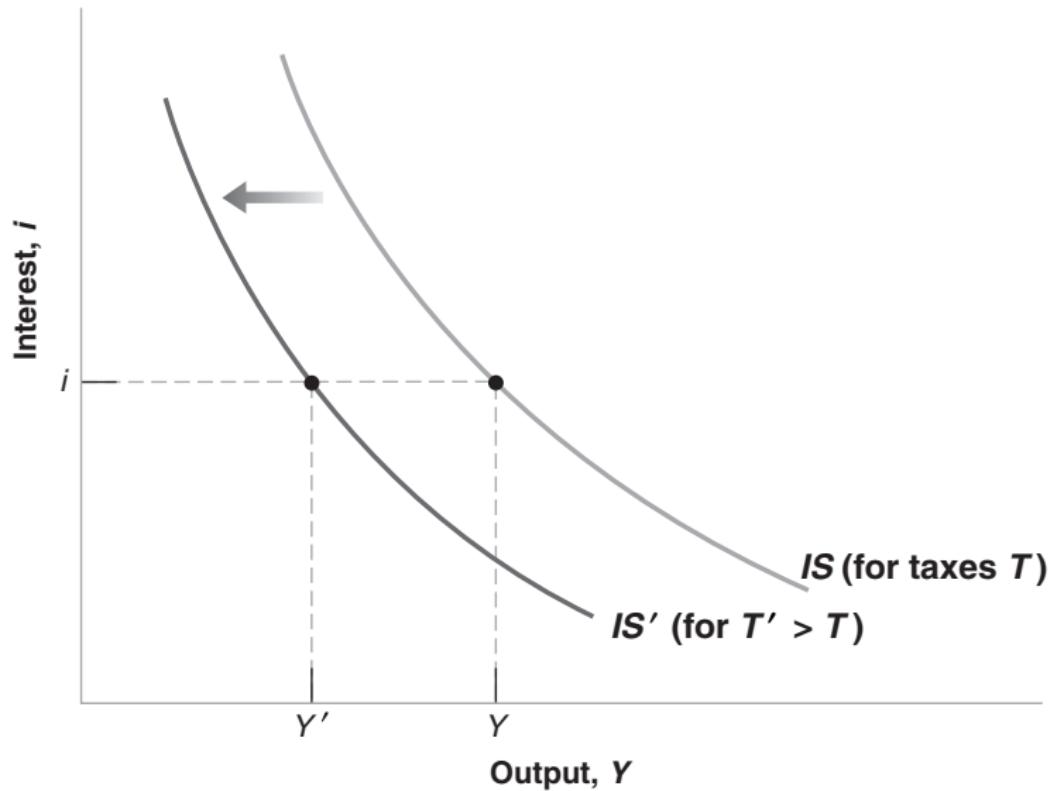
The IS Curve



Shifts in the IS Curve

- A shift in the IS curve occurs through:
 - ▶ a change in T .
 - ▶ or a change in G .
- Given an interest rate i , a decrease in taxes T leads to:
 - ① A rise in disposable income $Y - T$.
 - ② A rise in consumption $C(Y - T)$.
 - ③ An increase in the demand for goods, and therefore an increase in output Y .
 - ④ An increase in consumption $C(Y - T)$ and in investment $I(Y, i)$.

Shifts of the IS Curve



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Financial Markets

- We saw in the previous lecture that the interest rate i is determined by the equality of the supply and of the demand for money:

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

- Note that this is the most simple version of the money market equilibrium we saw previously, where only currency was used for payments. You now know how to modify that expression:
 - ▶ to allow for checkable deposits only, then:

$$H = \theta \times \$Y \times L(i).$$

- ▶ to allow for checkable deposits coexisting with currency. Then:

$$H = [c + \theta(1 - c)] \times \$Y \times L(i).$$

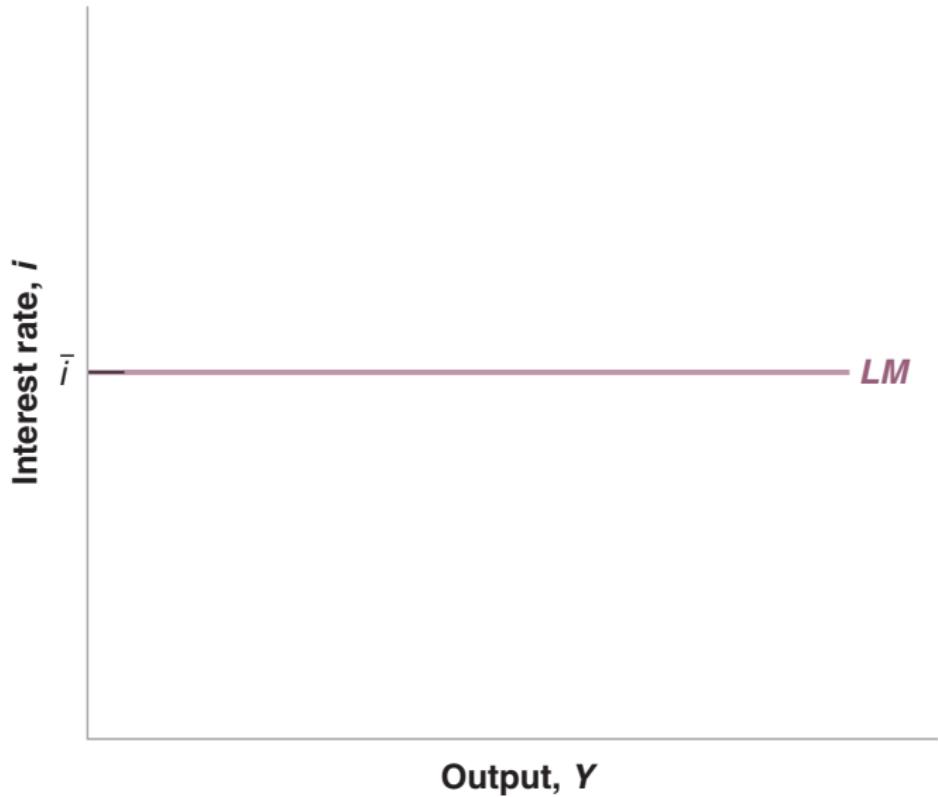
Financial Markets

- It will be more convenient to write this equation in real terms, using real income $Y = \$Y/P$ which is nominal income $\$Y$ divided by the price level P . Therefore:

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

- Importantly, we take the price level as **fixed in the short run**.
- Finally, we assume that the central bank chooses not the money stock but the **level of the interest rate $i = \bar{i}$, adjusting M to achieve that objective**.
- Then, $i = \bar{i}$ is independant of output. This is the (LM) "curve".**
- Important note: the (LM) curve is sometimes viewed as a relationship between real output and the interest rate, conditional on a constant money supply. Here, we consider a simpler and more realistic version of the model. Some economists, such as David H. Romer, name the curve we have the (MP) curve, to avoid confusion with earlier versions of the (LM) curve (Romer (2000)).

The LM Curve



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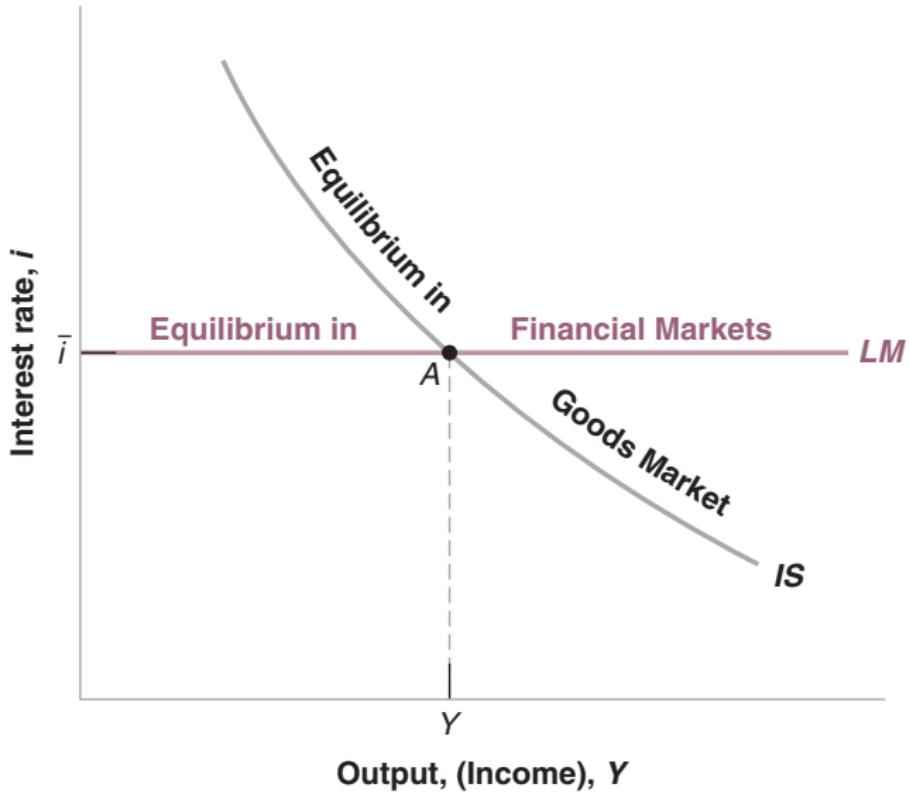
Putting the (IS) and (LM) relations together

- The (IS) equation follows from goods market equilibrium. The (LM) relation follows from financial market equilibrium. They must both hold:

$$Y = C(Y - T) + I(Y, i) + G$$
$$i = \bar{i}.$$

- Together they determine output.
- Any point* on the downward sloping IS curve corresponds to equilibrium in the goods market.
- Any point* on the horizontal LM curve corresponds to equilibrium in financial markets.
- Only at* their intersection (point A) are both equilibrium relations satisfied.

The IS-LM Model

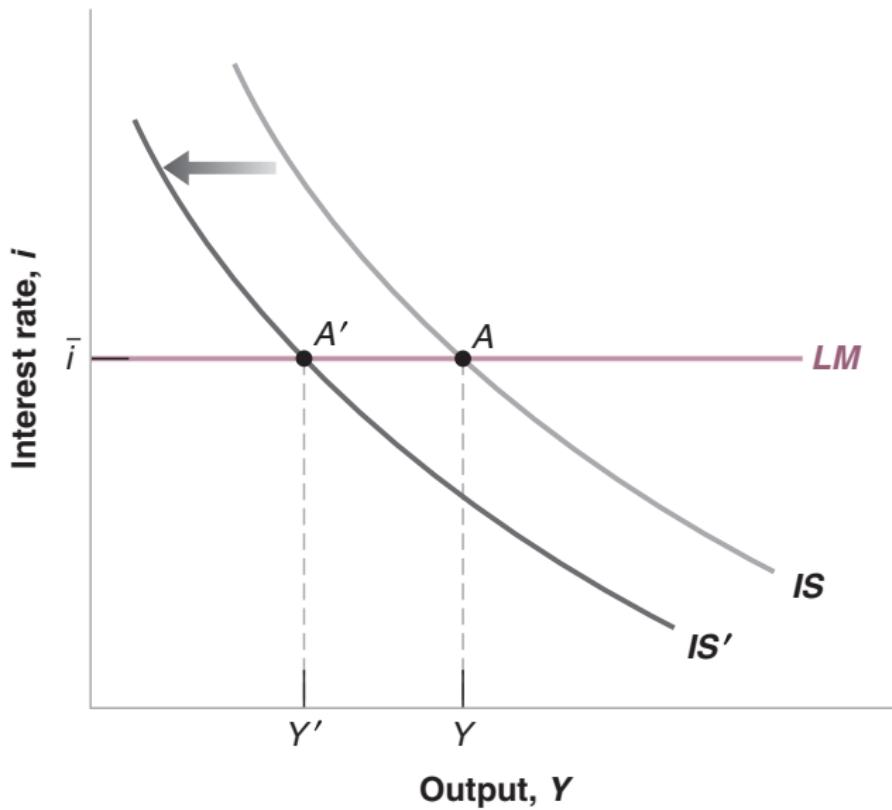


Comparative statics

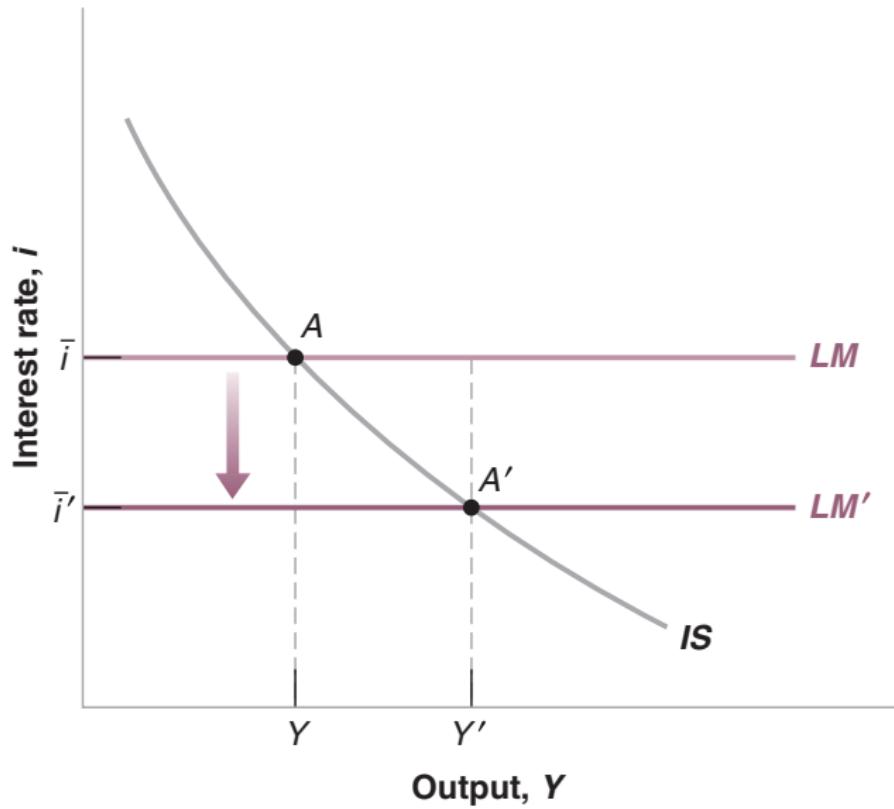
- Steps for analyzing the effects of changes in policy or exogenous variables:
 - ① Does it shift the IS curve and/or the LM curve?
 - ② What does this do to equilibrium output and the equilibrium interest rate?
 - ③ Describe the effects in words.
- Effects of fiscal policy. Example: an increase in taxes. Note: one could in fact only analyze the **goods market**...
- Effects of monetary policy. Example: a decrease in the nominal interest rate. Note: here one needs the LM curve. Although comparative statics with respect to i would work, too:

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

The Effects of an Increase in Taxes



The Effects of a Decrease in the Interest Rate

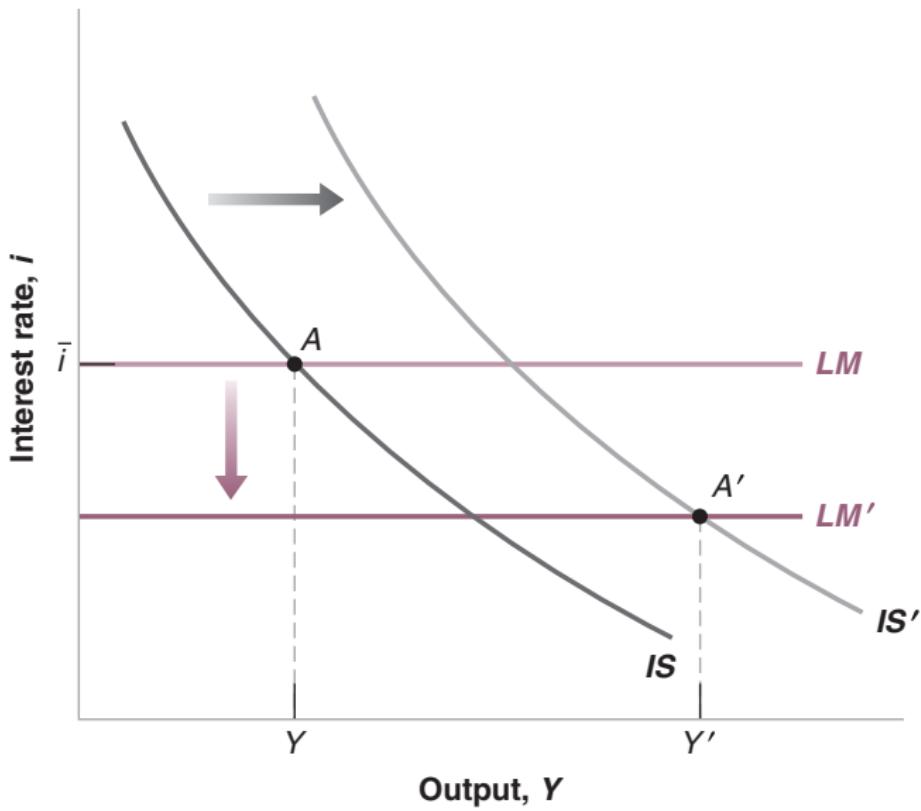


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Using a Policy Mix

- We have looked so far at monetary and fiscal policy in isolation. In practice, the two are often used together.
- **Monetary-fiscal policy mix** is the combination of monetary and fiscal policies.
- Suppose that the economy is in a recession and output is too low. Then, both fiscal and monetary policies can be used to increase output.

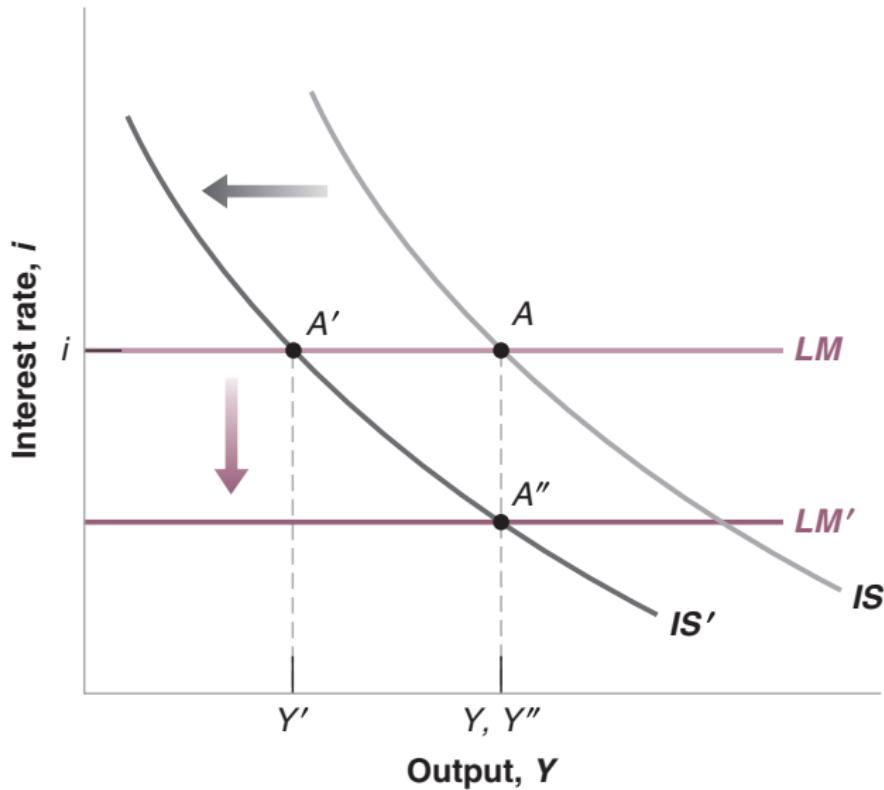
The Effects of a Combined Fiscal and Monetary Expansion



Another Policy Mix

- Sometimes, the right policy mix is instead to use two policies in opposite directions, for example combining:
 - ▶ a fiscal consolidation.
 - ▶ a monetary expansion.
- One example is if the government is currently running a large budget deficit and would like to reduce it, but that it does not want to trigger a recession.

Fiscal Consolidation + Monetary Expansion



Is deficit reduction good or bad for investment?

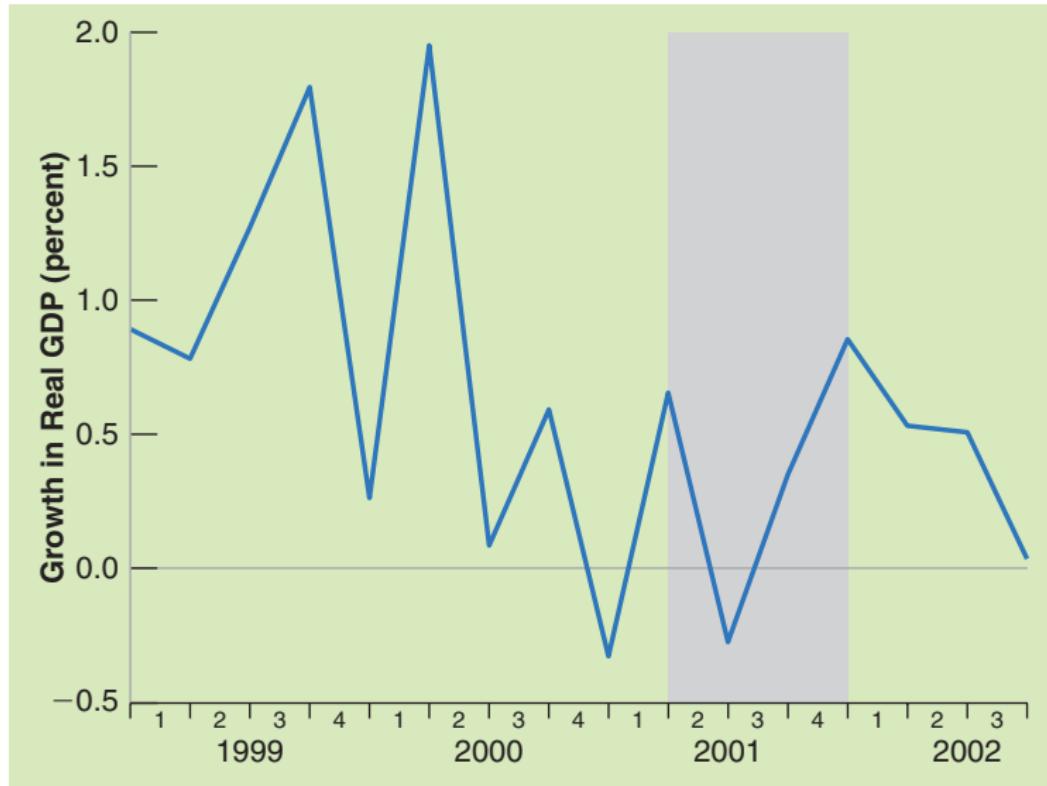
- The basic argument typically goes as follows: “private saving” goes either towards financing the government deficit or financing investment.
- Therefore, if one decreases the government deficit, then there will be more investment, right?
- Unfortunately, this argument is **wrong**. The reason is that if deficit reduction is not accompanied by a fall in the interest rate, then output decreases. By implication, so does investment, which depends on output. What is going on then?
- The reason is that equilibrium in the goods market implies:

$$I = S + (T - G).$$

- Given private saving S , it is indeed the case that less deficit should increase investment. The trouble with this reasoning is that a fiscal contraction affects private saving as well: lower output leads to lower income, and so lower saving.

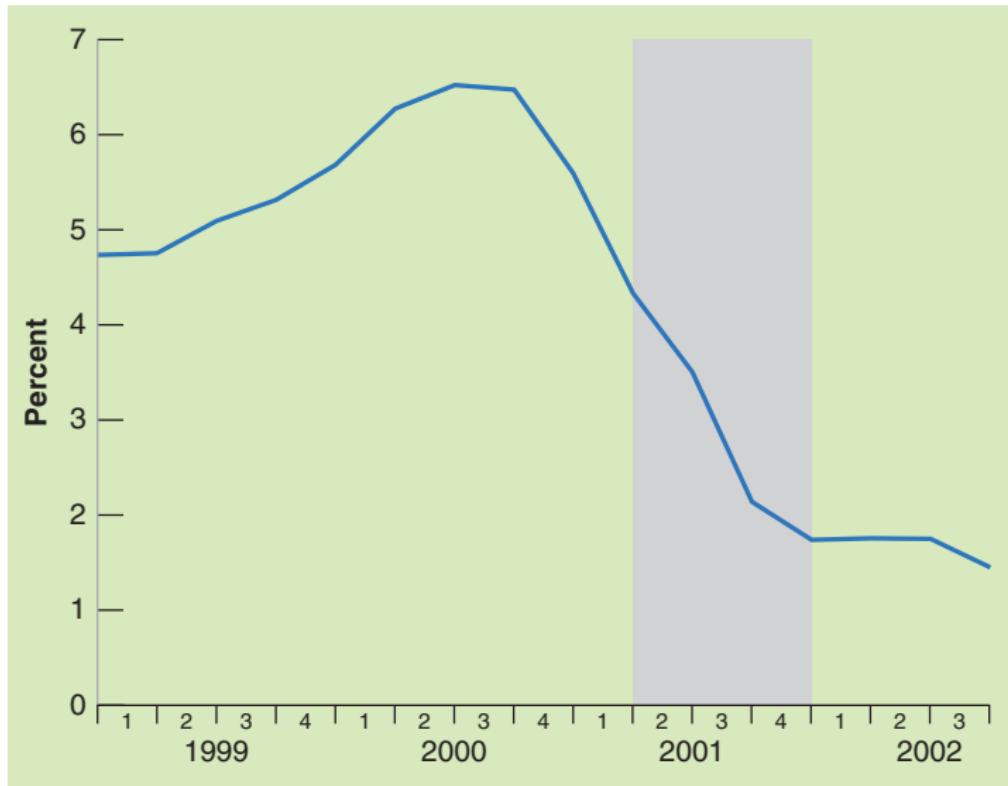
The US Recession of 2001: Some Data

US Growth rate



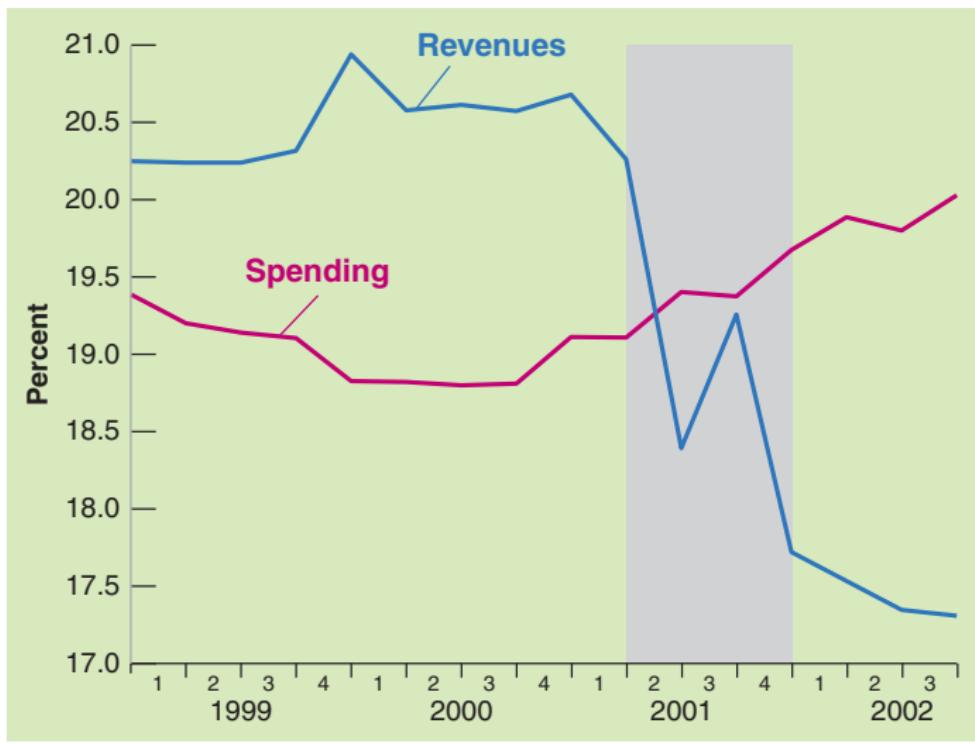
The US Recession of 2001: Some Data

Federal Funds Rate



The US Recession of 2001: Some Data

US Federal Government Revenues and Spending (% of GDP)



The US Recession of 2001

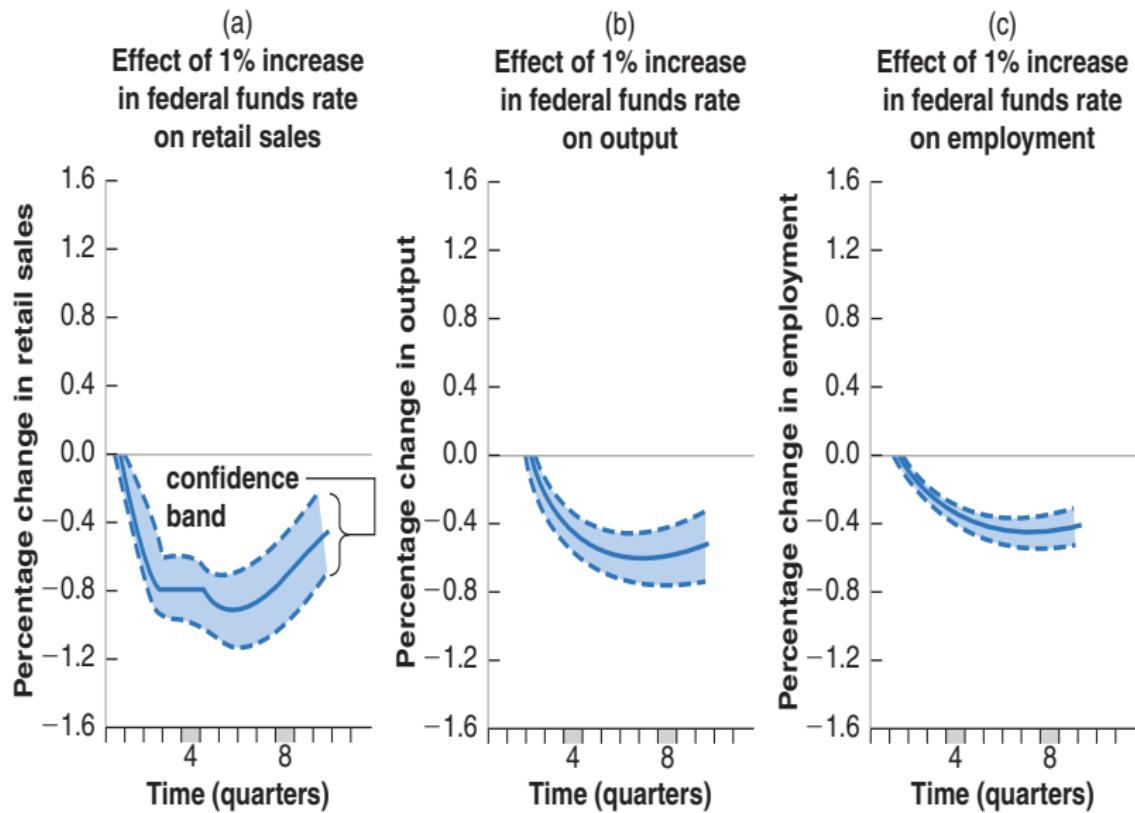
- In 1992, the US economy embarked on a long expansion which lasted until 2000.
- In 2000, the expansion came to an end: there was a **sharp fall in investment demand**. Recession started in March 2001 and ended in December 2001. The cause was **not** 9/11.
- Alan Greenspan, then chairman of the Fed, blamed it on the end of a period of “irrational exuberance”.
- Firms had been overoptimistic about future demand, and had excess capacity.
- Bush was elected on a platform promising lower taxes (primarily for high income households), which meant an accommodative fiscal policy (although look at Exercise 7 p 65).
- Revenues fell because of a fall in GDP (“automatic stabilizers”), and particularly lower taxation of stock market gains. Spending increased mostly on defense and homeland security after 9/11.

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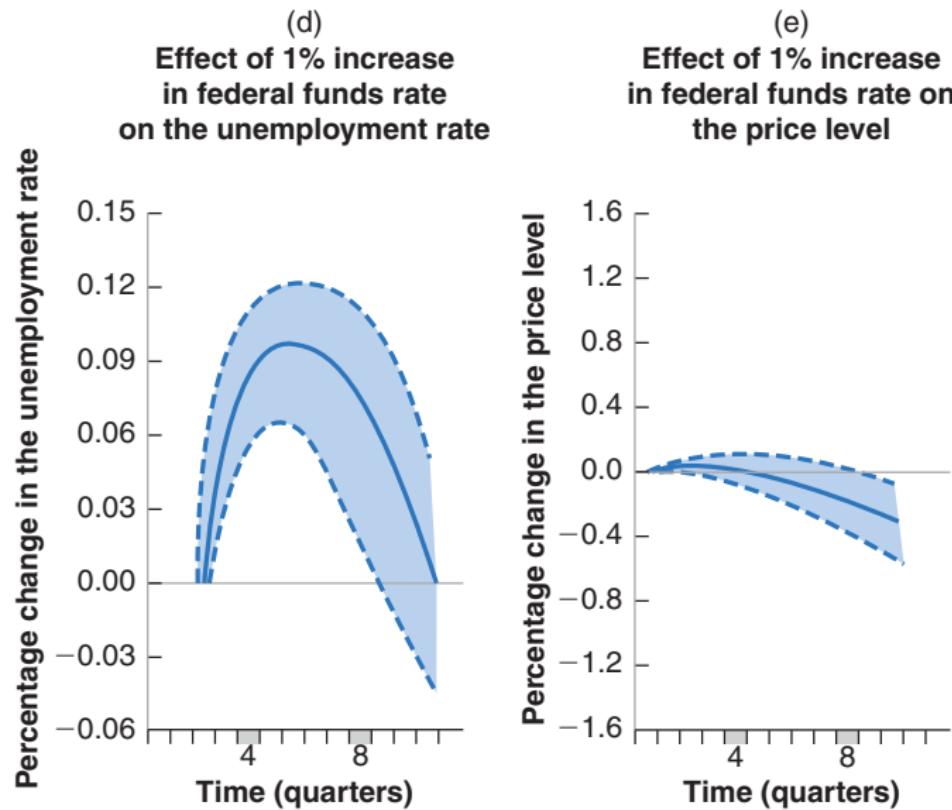
Testing the theory

- We have so far ignored dynamics. Of course, all of this does not occur instantaneously !
- One option is to build a more complex macroeconomic model, involving lags, expectations, time to build, etc. Central banks, Treasury departments, international organizations (the IMF, the World Bank) around the world use these models to evaluate the impacts of policies.
- Another option is to simply look at the data. Using econometrics allows two things:
 - ▶ First, econometrics allow to test the theory against the data: is it true that raising the federal funds rate reduces output through a fall in investment?
 - ▶ Second, econometrics allow to get at accurate dynamic responses, which are always hard to get through a simplified economic model.
- Many academic papers study the empirical effects of monetary shocks: Christiano et al. (1996), Christiano et al. (1999), Romer and Romer (2004).

Effects of an Increase in the Fed Funds Rate



Effects of an Increase in the Fed Funds Rate



Effects of an increase in the Fed Funds Rate

- The previous results suggest that an increase in the Fed Funds Rate of 1% leads to:
 - ▶ a decrease in **retail sales** of -0.9% after 5 quarters. (Panel (a))
 - ▶ a slower decrease in **output**, reaching a maximum of -0.7% after 8 quarters. (Panel (b)) The slower decrease is suggestive of inventory investment. (Panel (b))
 - ▶ a slow decrease in **employment**, reaching -0.5% after 8 quarters.
 - ▶ an increase in the **unemployment rate**, by about 0.09% (Panel (d))
 - ▶ a slow decrease in the **price level** (Panel (e)): the price level is unchanged for the first 6 quarters or so. After 6 quarters the price level appears to decline slightly.
- Note that this finding of fixed prices squares well with the assumptions of the IS-LM model. In the medium run however, the price level becomes important.
- We will investigate the medium run starting from Lecture 5, until Lecture 8.

Bibliography I

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