LECTURE 4: GOODS AND FINANCIAL MARKETS: THE IS-LM MODEL*

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This lecture studies how output and interest rate are determined simultaneously in the short run. On one hand, we had assumed that production (i.e. the supply of goods) responds to demand without changes in price, i.e., price is fixed, so output is determined by demand. On the other, interest rate affects demand and hence output through investment and output affects interest rate through money demand. Therefore, it is necessary to consider the simultaneous equilibrium in the goods and financial markets.

1 THE GOODS MARKET AND THE IS RELATION

We relax the assumption made so far that interest rate does not affect the demand for goods by looking at the effect of interest rate on investment in our model of equilibrium in the goods market.

Investment, sales, and the interest rate. Investment depends primarily on two factors: the level of sales and the interest rate. We continue to assume that inventory investment is zero, so sales and production are always equal. Then we may write the investment relation as

$$I = \underset{(+,-)}{I}(Y, i) \tag{1.1}$$

where Y denotes sales (or production). That is, an increase in production (or sales) leads to an increase in investment, and an increase in interest rate leads to a decrease in investment.

Determining output. The condition for equilibrium in the goods market requires that the supply of goods (i.e. production) be equal to the demand for goods, i.e.

$$Y = C(Y - T) + I(Y, i) + G \tag{1.2}$$

The above equation is the expanded IS relation. For a given interest rate i, demand is an increasing function of output for two reasons:

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These are notes that I used by myself to lecture from and for educational purposes only. The material presented here is largely based upon the undergraduate textbook by Blanchard and Johnson (2012), *Macroeconomics*, 6th Edition, Prentice Hall. Please do NOT circulate.

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- An increase in output leads to an increase in income and thus disposable income, which in turn leads to an increase in consumption.
- An increase in output also leads to an increase in investment.

See Figure 1 Below.[1] Note that the ZZ curve should be drawn flatter than the 45-degree line because the empirical evidence suggests that the sum of increases in consumption and investment due to an increase in output is less than one-for-one.

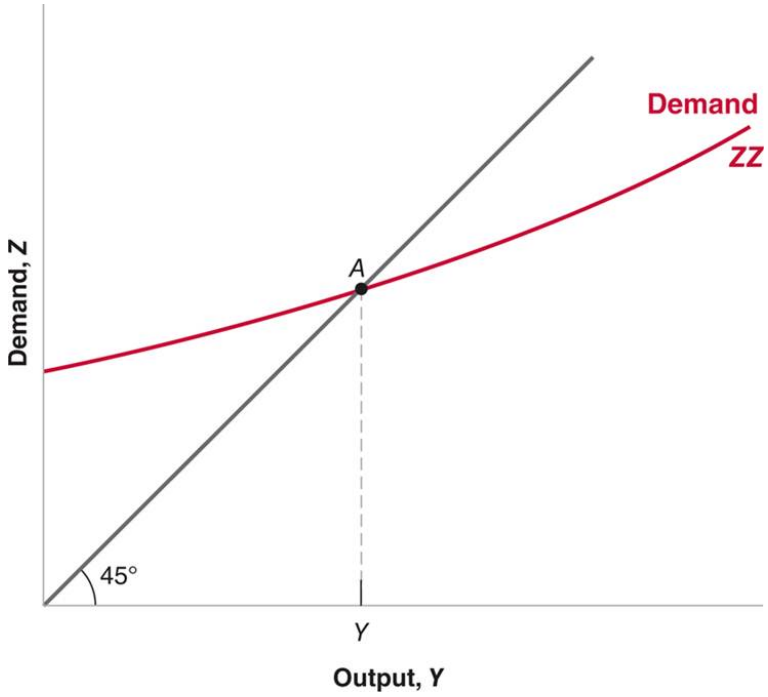

Figure 1. Equilibrium in the goods market

Deriving the IS curve. We consider what happens if the interest rate changes. An increase in the interest rate decreases investment. The decrease in investment leads to a decrease in demand and hence output, which further decreases consumption and investment through the multiplier effect. Here both interest rate and output are treated as endogenous and their relation can be represented by the downward-sloping **IS curve**. See Figure 2 below.

Shifts of the IS curve. We consider an increase in taxes. At a given interest rate, disposable income decreases, leading to a decrease in consumption, leading in turn to a decrease in the demand for goods and hence equilibrium output. In other words, the IS curve shifts to the left. See Figure 3 below. The same holds for a decrease in government spending. Here both taxes and government spending are treated as exogenous.

[1] Here we do not impose the linearity assumption on the functional forms of consumption and investment relations, so the ZZ curve is not necessarily linear.

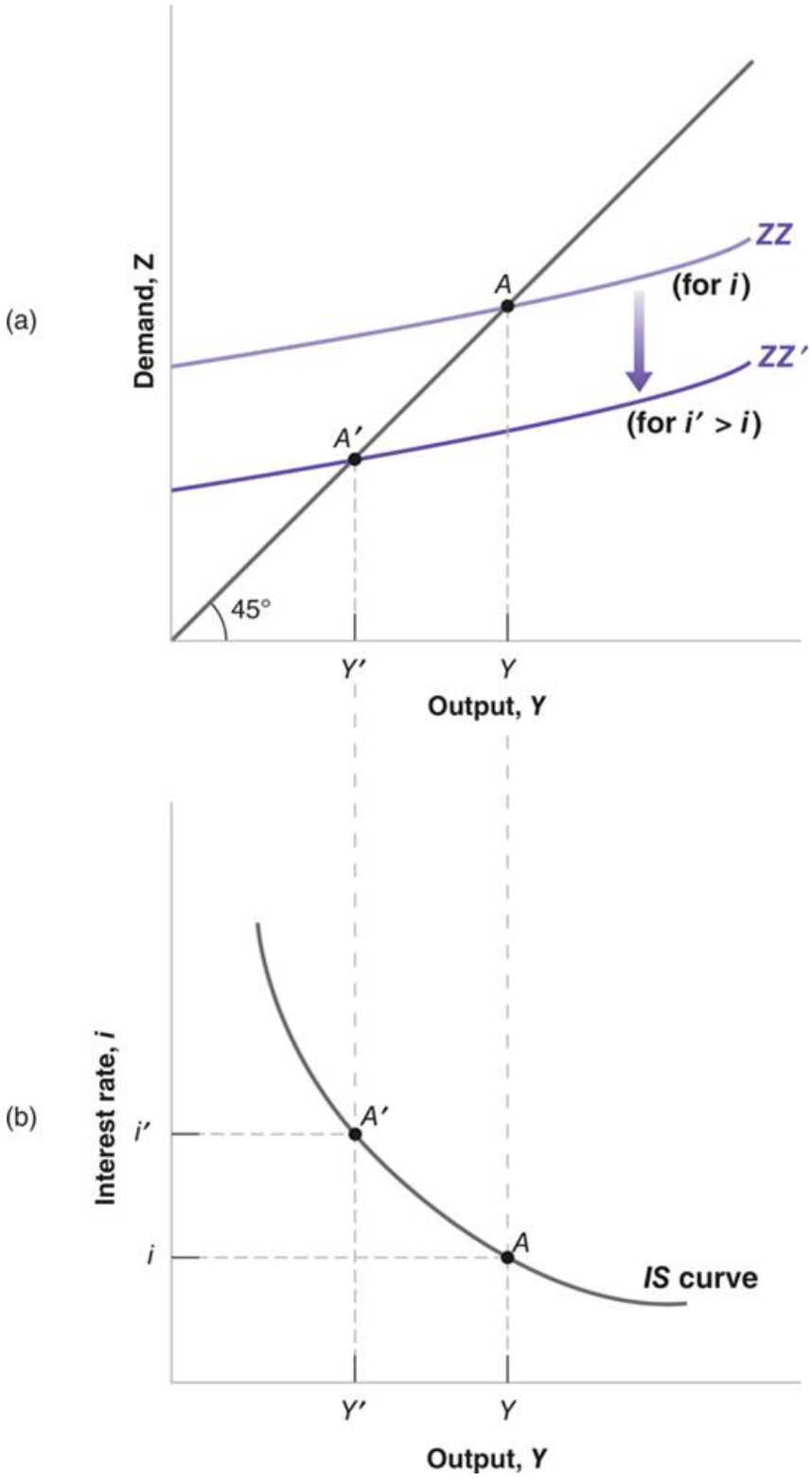

Figure 2. Derivation of the IS curve

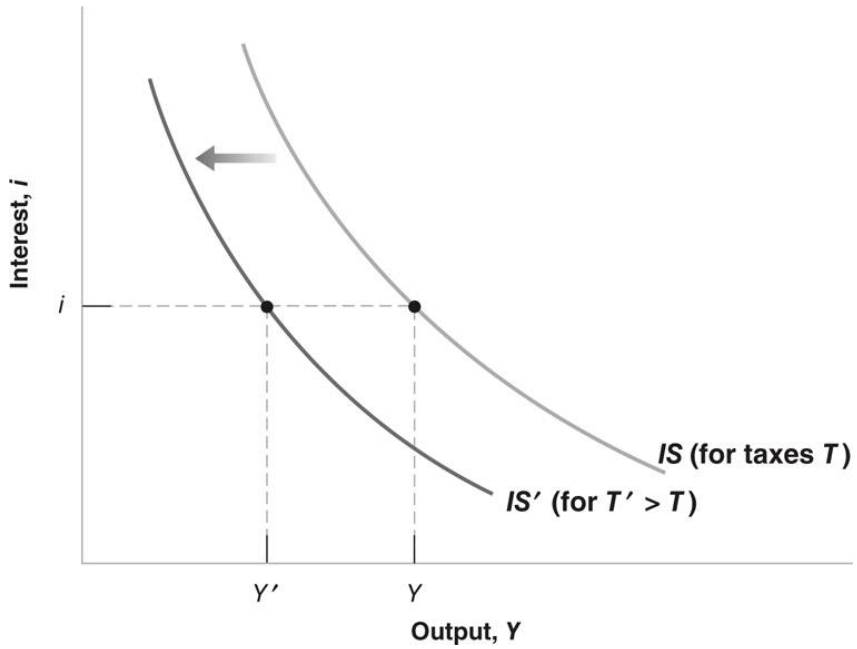

Figure 3. Shifts of the IS curve

2 FINANCIAL MARKETS AND THE LM RELATION

Real money, real income, and the interest rate. The equilibrium condition in financial markets can be restated as the real money supply—the money stock in terms of goods—equals the real money demand, which depends on real income, Y, and the interest rate, i:

$$\frac{M}{P} = YL(i) \tag{2.1}$$

Recall that P denotes the general price level measured by, e.g. GDP deflator or CPI.

Deriving the LM curve. We consider what happens if the real income changes. An increase in real income leads people to increase their demand for real money at any given interest rate. Since the real money supply is given, the interest rate must go up until the real money demand is equal to the unchanged real money supply. Again both interest rate and output are treated as endogenous and their relation can be represented by the upward-sloping **LM curve**. See Figure 4 below.

Shifts of the LM curve. We consider an increase in the nominal money supply. Given the fixed price level, the real money supply increases. At any level of income, the interest rate consistent with equilibrium in financial markets is lower. In other words, the LM curve shifts down. See Figure 5 below. The same holds for a decrease in price level. Here both nominal money supply and price level are treated as exogenous.

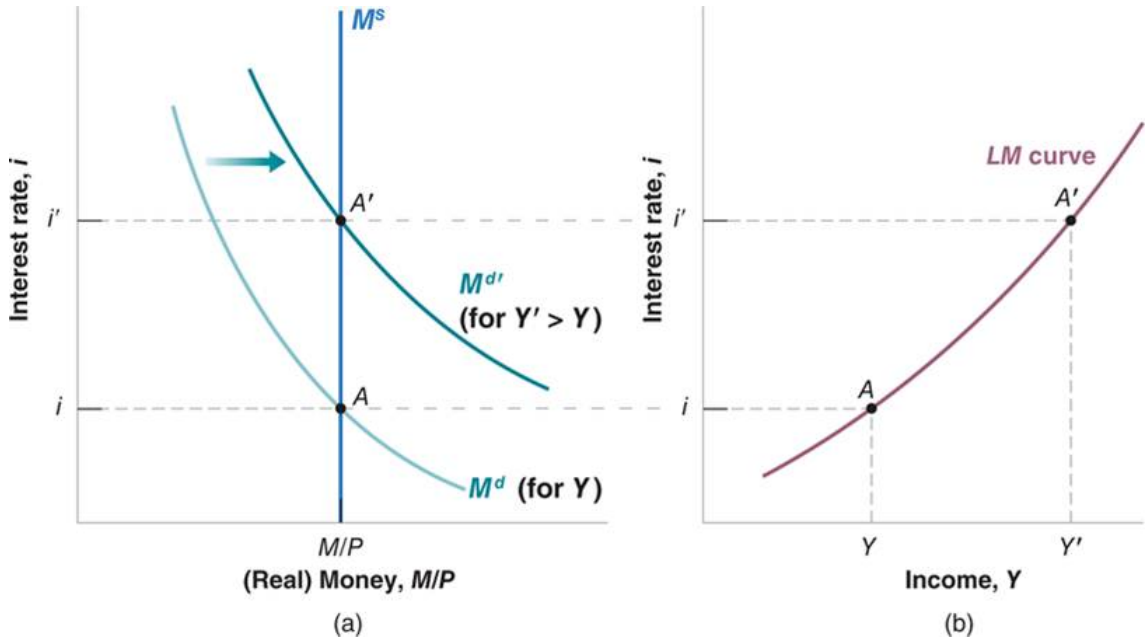

Figure 4. Derivation of the LM curve

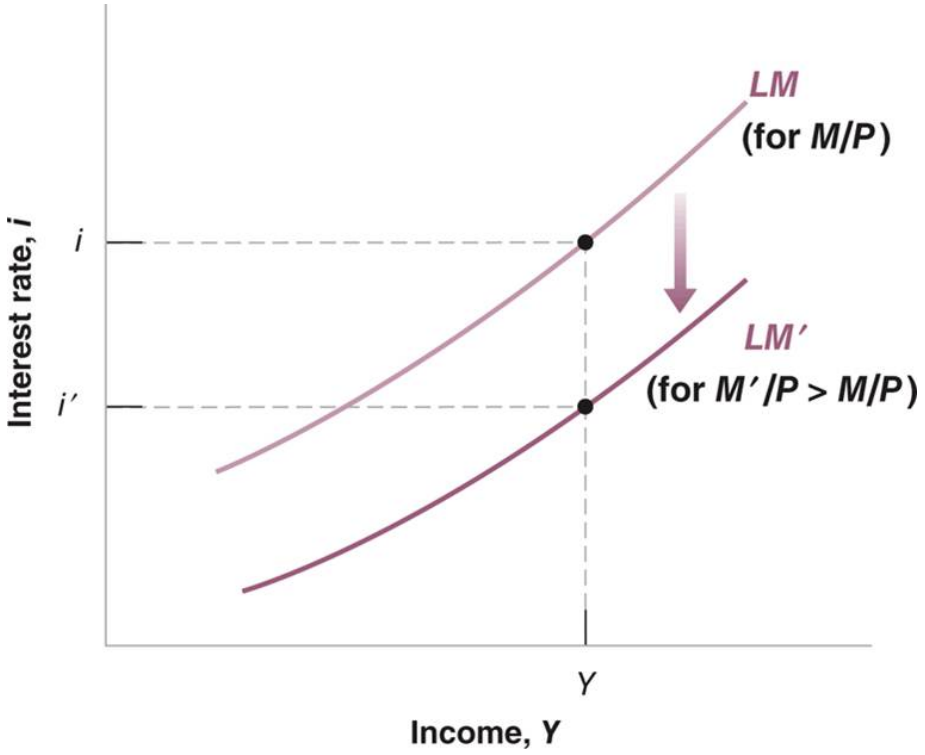

Figure 5. Shifts of the LM curve

3 PUTTING THE IS AND LM RELATIONS TOGETHER

So far we have thought of the goods market as determining Y given i (IS relation (1.2)) and financial markets as determining i given Y (LM relation (2.1)). Now we can put them

together to determine both equilibrium output and interest rate. See Figure 6 below.

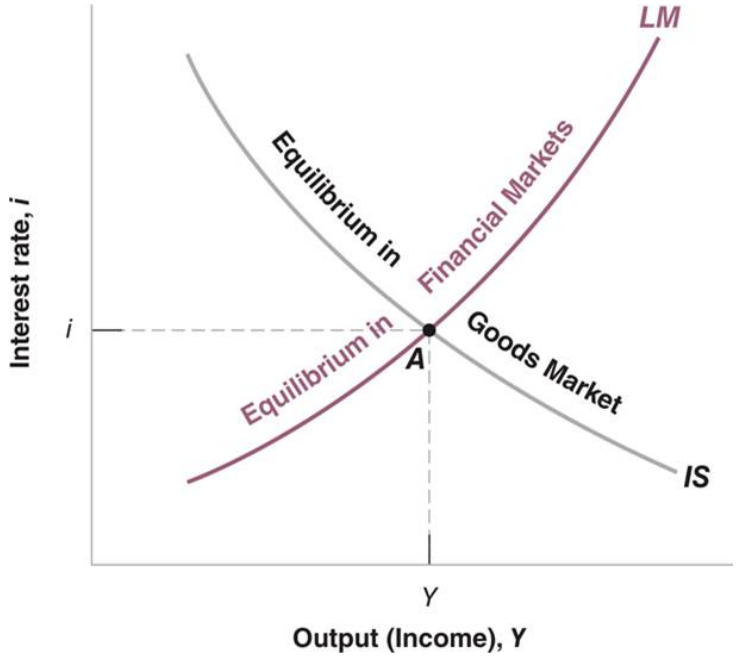

Figure 6. The IS-LM Model

Note that any point on the IS curve corresponds to an equilibrium in the goods market. Any point on the LM curve corresponds to an equilibrium in financial market. Only at the intersection point of the IS and LM curves are both equilibrium conditions satisfied.

Fiscal policy, activity, and the interest rate. We consider the effects of a **fiscal contraction**, or **fiscal consolidation**—a decrease in government budget deficit $G - T$, e.g. increasing taxes while keeping government spending unchanged—on the equilibrium output and interest rate.[2] There are four steps to follow:

- The IS curve shifts to the left. This is because an increase in taxes reduces people's disposable income, which in turn decreases consumption. The decrease in consumption, through the multiplier effect, decreases output at any given interest rate.
- The LM curve remains unchanged because taxes do not apprear in the LM relation and thus do not affect the equilibrium condition.
- In equilibrium, both output and interest rate decrease. See Figure 7 below.
- Story-telling: higher taxes lead to lower disposable income, which causes people to decrease their consumption. This decreases demand and hence output and income, which in turn reduces the demand for money, leading to a decrease in the interest rate.

[2] An increase in the government budge deficit is called **fiscal expansion**.

However, the decline in interest rate reduces but does not completely offset the effect of higher taxes on the demand for goods.[3]

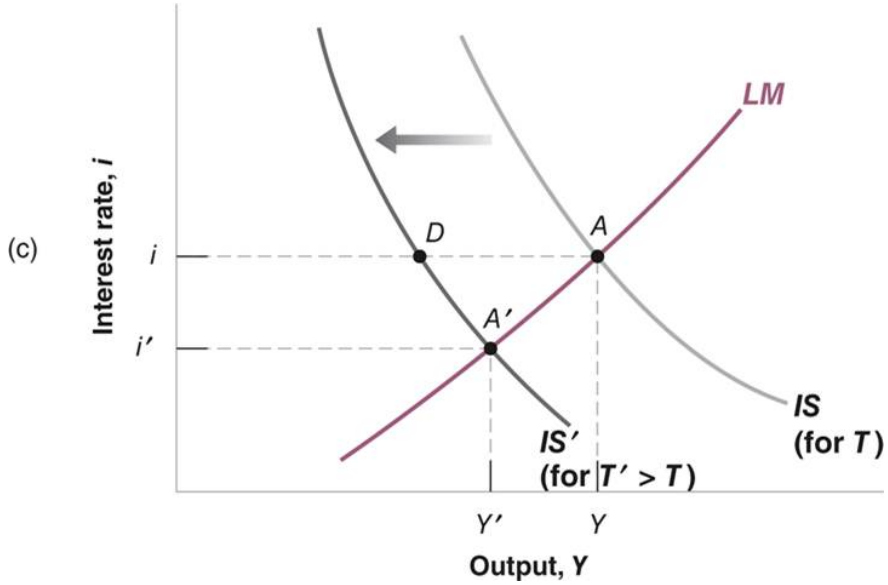

Figure 7. The effects of a fiscal contraction

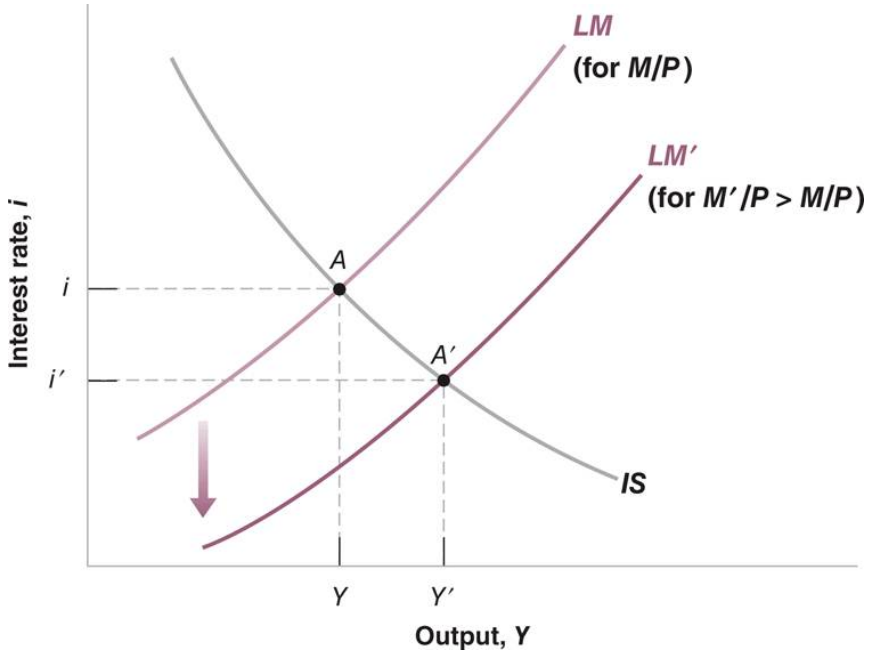

Figure 8. The effects of a monetary expansion

Monetary policy, activity, and the interest rate. We consider the effects of a **monetary expansion**—an increase in the nominal money supply M through, e.g. open market operation—on the

[3]Since investment depends on both sales and interest rate, and lower output means lower sales and investment whereas lower interest rate leads to higher investment, a deficit reduction may or may not decrease investment in the short run.

equilibrium output and interest rate.[4] There are again four steps to follow:

- The IS curve remains unchanged because money supply does not apprear in the IS relation and thus do not affect the equilibrium condition.
- The LM curve shifts down. This is because an increase in the money supply leads to a decrease in the interest rate as we have shown earlier.
- In equilibrium, output increases and interest rate decreases. See Figure 8 above.
- Story-telling: higher money leads to lower interest rate, which in turn leads to an increase in investment and thus, an increase in demand and output.[5]

4 USING A POLICY MIX

In practice, both monetary and fiscal policies are used together and such combination is known as **monetary-fiscal policy mix**. Sometimes, the right mix is to use both policies in the same direction, e.g., the recession of 2001 in the U.S., where both monetary and fiscal policies were used to fight the recession. Sometimes, the right mix is to use them in opposite directions, e.g., the early 1990s in the U.S., where a fiscal contraction was used to reduce the budget deficit and a monetary expansion was used to make sure that demand and output remained high.

[4] A decrease in the money supply is called **monetary contraction** or **monetary tightening**.

[5] Since sales are higher and interest rate is lower, investment unambiguously goes up, which is in sharp contrast to a fiscal expansion.