Macroeconomics 1 (A European Perspective)

Week 3

Utrecht School of Economics
2022–2023

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Recap

Main readings

Blanchard, O., Amighini, A., Giavazzi, F. (2021). *Macroeconomics: A European Perspective*, 4th edition. Pearson: New York.

Khan Academy on IS-LM: IS-LM Model.

Pages 1–4 of Lecture Notes of Whelan: Introducing the IS-MP-PC Model.

Getting to the IS relation

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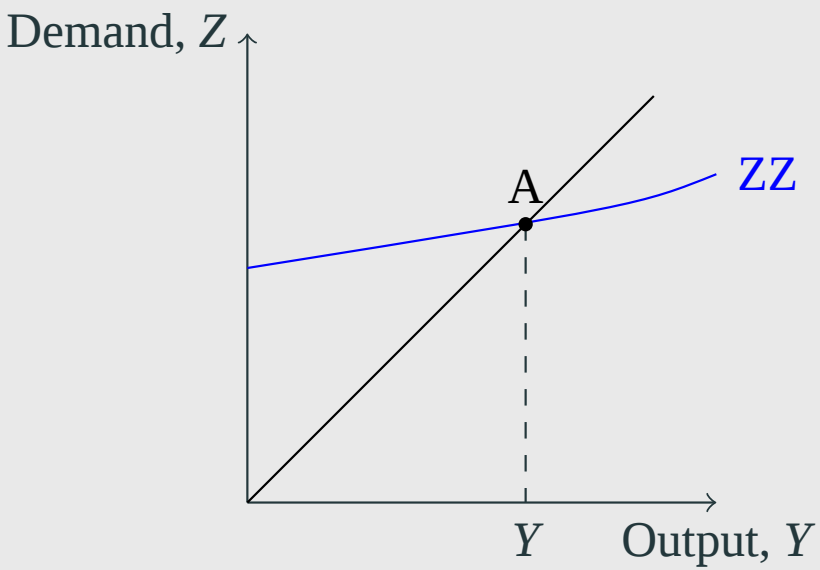
- A positive growth in sales stimulates firms to produce more and therefore to invest in new capital (business expansion).
- An increase in the interest rate hinders firms in business expansion as the cost of borrowing becomes more expensive.
- Put algebraically, the investment relation is written as

$$I = I(Y, i)$$
$$(+, -)$$

Getting to the IS relation



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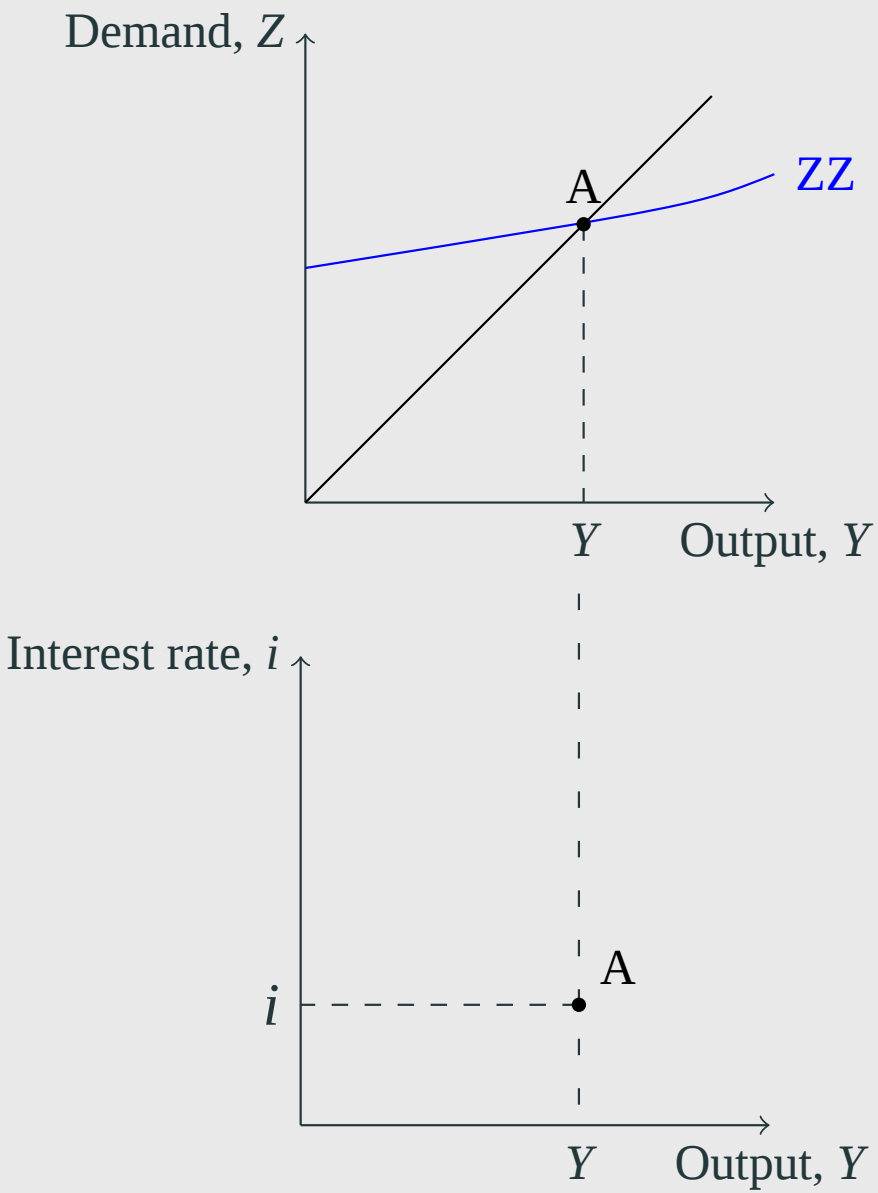

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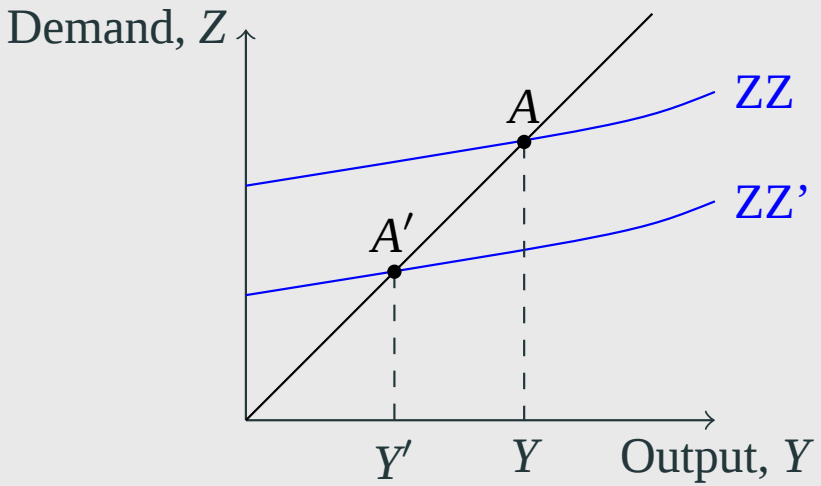

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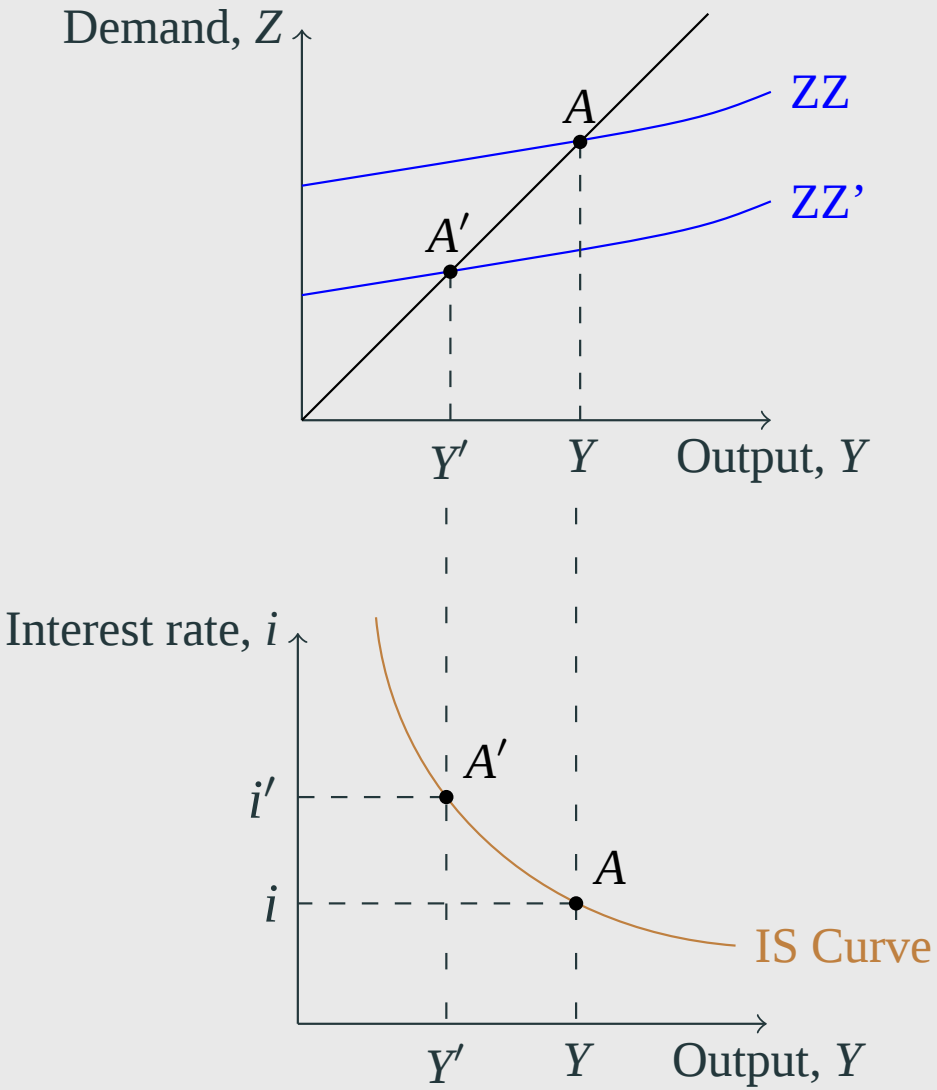

Getting to the IS relation

- The IS curve depicts the relation between interest rate and output. In other words, we need more interest rates to construct *the* curve.
- For a given interest rate, any factor that *decreases* the equilibrium level of output cases the IS curve to shift *leftward*.
- Symmetrically, for a given interest rate, any factor that *increases* the equilibrium level of output, e.g. a decrease in taxes, an increase in gov't spending, causes the IS curve to shift *rightward*.

Getting to the LM relation

- Previously, the interest rate is determined by the equality of the supply of and the demand for money:

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- We need a *real* relation! (Why and how?)
- More convenient as the ‘inflation component’ is ruled out and easier for macroeconomic modelling (empirical research).

Getting to the LM relation

- Recall that Real GDP = nominal GDP / GDP deflator!
- Dividing Eq. (1) by P (price level) on both sides gives

$$\frac{M}{P} = YL(i), \tag{2}$$

  restated as the *real money supply* (money stock in terms of goods, *not* euros) be equal to the *real money demand*, which depends on real income (Y) and the interest rate (i).

- Eq. (2) is referred to as the *LM relation*.
- In the past, central banks thought of the money supply as the monetary policy variable, but now the focus on the interest rate. In other words, they *choose* an interest rate $\bar{i}$.

Getting to the LM relation

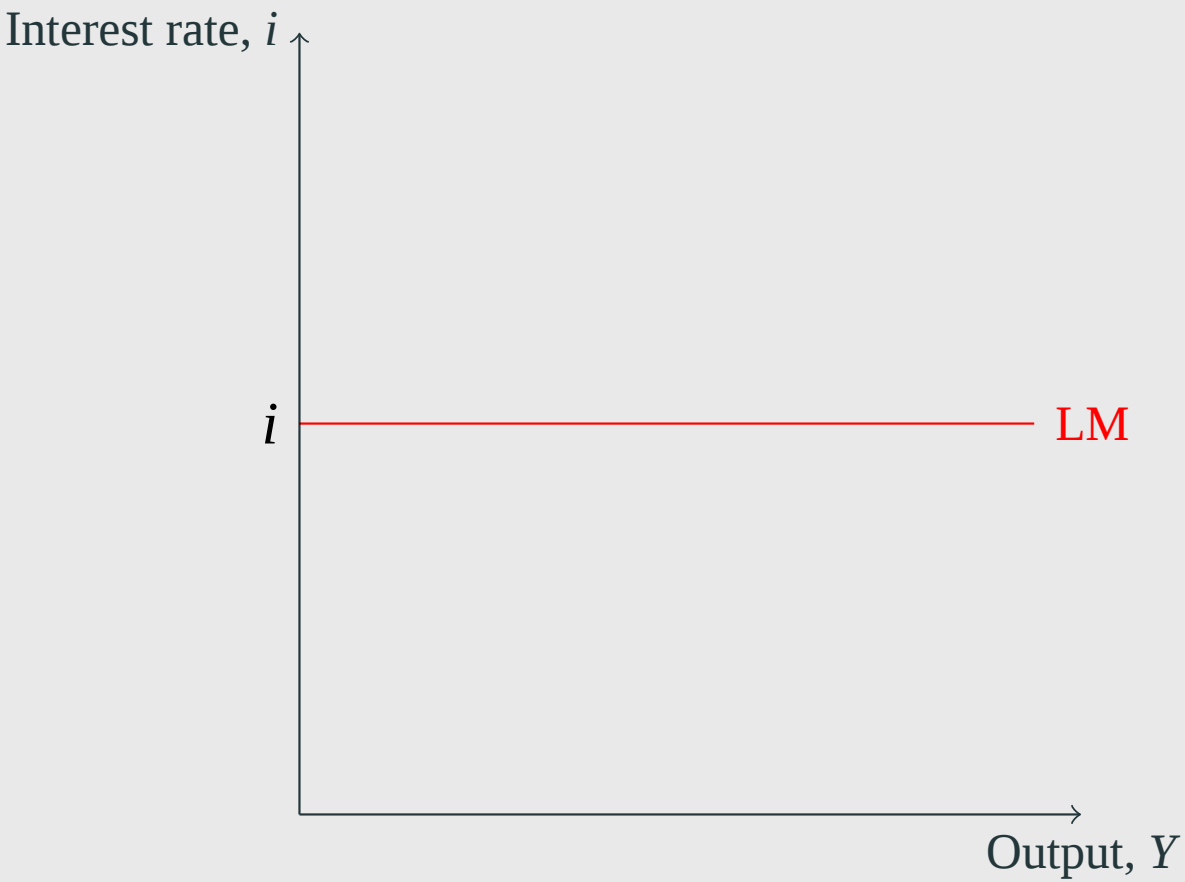

Figure 3: LM curve: the central bank chooses *the* interest rate and in turn adjusts the money supply so as to achieve it.

IS-LM

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- *Any points* on the downward-sloping IS curve corresponds to equilibrium in the goods market.
- *Any points* on the horizontal LM curve corresponds to equilibrium in financial markets.
- Note however that it is more appropriate to refer to the model as MP, stemming from monetary policy rule. Hence, it should be IS-MP model. More details can be found here.

IS-LM

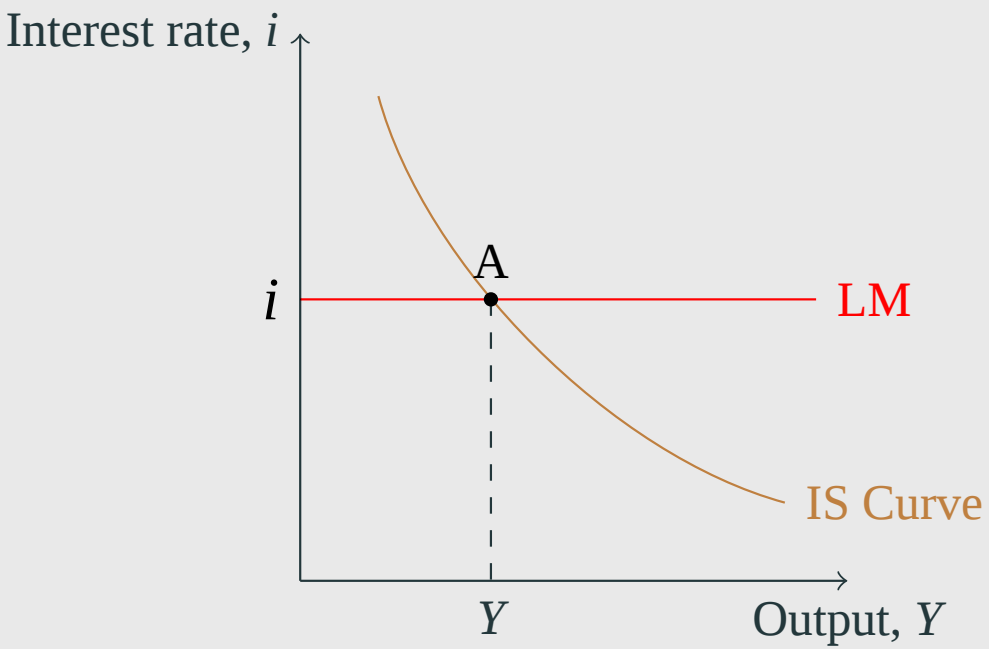

Figure 4: Equilibrium in the goods market (IS) implies that an increase in the interest rate leads to a decrease in output. LM is the equilibrium in financial markets. Together, they make both goods and financial markets in equilibrium.

IS-LM: Fiscal policy

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Nominal and real interest rates

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- However, the expected inflation rate is $\pi^e_{t+1} = 5\%$. This implies that the expected price of the piece of cake next year is $P^e_{t+1} = (1 + 5\%)€2.00 = €2.10$.

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- The real interest rate (r_t) is then

$$\frac{(1 + i_t)P_t}{P^e_{t+1}} = \frac{2.06}{2.10} = 0.98;$$

$0.98 - 1.00 = -0.02 = -2\%$.

Nominal and real interest rates

Case II

- Suppose you want to buy a piece of carrot cake today at $P_t = €2.00$, but you don't have money :(
- You decide to borrow money of €2.00 from Best Friend Bank (BFB) at the rate of $i_t = \mathbf{5\%}$ p.a. This means you need to repay to BFB $(1 + 5\%)€2.00 = €2.10$ next year.
- However, the expected inflation rate is $\pi^e_{t+1} = \mathbf{2.5\%}$. This implies that the expected price of the piece of cake next year is $P^e_{t+1} = (1 + 2.5\%)€2.00 = €2.05$.

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Case II

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- However, the expected inflation rate is $\pi^e_{t+1} = \mathbf{2.5\%}$. This implies that the expected price of the piece of cake next year is $P^e_{t+1} = (1 + 2.5\%)€2.00 = €2.05$.
- The real interest rate is (r_t) then

$$\frac{(1 + i_t)P_t}{P^e_{t+1}} = \frac{2.10}{2.05} = 1.024;$$

$1.024 - 1.00 = 0.024 = 2.4\%$.

Nominal and real interest rates

Lessons learnt from the two cases

- The value '1' in $(1 + r_t)$ is just to compute the inflation rate in percentage term. Take a look at the last step/line of the computation and verify the equations in Blanchard!
- In Case I, the nominal interest rate $(i_t = 3\%)$ is lower than the expected inflation rate $(\pi^e_{t+1} = 5\%)$. This results in the **negative** real interest rate $(r_t = -2\% < 0)$.
- In Case II, the nominal interest rate $(i_t = 5\%)$ is higher than the expected inflation rate $(\pi^e_{t+1} = 2.5\%)$. This results in the **positive** real interest rate $(r_t = 2.4\% > 0)$.
- The terms $\frac{P_t}{P^e_{t+1}}$ can be rewritten as $\frac{1}{(1+\pi^e_{t+1})}$. (Verify!)

Nominal and real interest rates

Lessons learnt from the two cases

- We could simply calculate r_t without the price!

$$(1+r_t) = \frac{(1+i_t)\cancel{P_t}}{(1+\pi^e_{t+1})\cancel{P_t}}$$

$$(1+r_t)(1+\pi^e_{t+1}) = (1+i_t)$$

$$1 + r_t + \pi^e_{t+1} + (r_t)(\pi^e_{t+1}) = 1 + i_t$$

$$(r_t) + \pi^e_{t+1} + (r_t)(\pi^e_{t+1}) = i_t$$

$$(r_t) + (r_t)(\pi^e_{t+1}) = i_t - \pi^e_{t+1}$$

$$(r_t)(1+\pi^e_{t+1}) = i_t - \pi^e_{t+1}$$

$$r_t = \frac{(i_t - \pi^e_{t+1})}{(1+\pi^e_{t+1})};$$

If the rates in the nominator are small, say less than 10%, we could use the rough rule-of-thumb:

$$r_t \approx i_t - \pi^e_{t+1}.$$

Self-recap

Make sure you review and understand, but not limited to, the following terms

- Risk premium and the determinants, risk aversion, bonds rating, rating systems.
- Capital ratio, profit per unit of capital, insolvency, fire sale prices, bank runs, liquidity. Make sure you know the difference between (il)liquidity and (in)solvency!
- The different interest rates in IS and LM equations, policy rate, borrowing rate, financial shocks.
- Subprime mortgages, NINJA loans, leverage, wholesale funding, international spillovers.

Problem Set

Problem set

1. Question 5, page 111. Consider the following numerical example of the IS-LM model:

$$C = 200 + 0.25Y_D$$
$$I = 150 + 0.25Y - 1000i$$
$$G = 250$$
$$T = 200$$
$$\bar{i} = 0.05$$

   (a) Derive the IS relation. (Hint: you want an equation with Y on the left side and everything else on the right.)

   (b) The central bank sets an interest rate of 5%. How is that decision represented in the equations?

   (c) What is the level of real money supply when the interest rate is 5%? Use the expression:

$$\frac{M}{P} = 2Y - 8000i$$

Problem set

(d) Solve for the equilibrium values of C and I, and verify the value you obtained for Y by adding C, I, and G.

(e) Now suppose that the central bank cuts the interest rate to 3%. How does this change the LM curve? Solve for Y, I, and C; and describe in words the effects of an expansionary monetary policy. What is the new equilibrium value of M/P supply?

(f) Return to the initial situation in which the interest rate set by the central bank is 5%. Now suppose that the government spending increases to $G = 400$. Summarise the effects of an expansionary fiscal policy on the real money supply?

Problem set

(g) Starting from an interest rate equal to 5% and government spending equal to 250 units, increase government spending to 400 units while fixing the real money supply at 1600 units. (Hint: the money market must be in equilibrium so $1600 = 2Y - 8000i$ (part c) and the goods market must be in equilibrium so $Y = C + I + G$ at the same values of Y and i.) Compare the effect of the increase in government spending on Y, I, and C to the same increase in G in (f) and explain the difference.

Problem set

2. Q 7, page 112. The Bush-Greenspan policy mix. In 2001, the Fed pursued an expansionary monetary policy and reduced interest rates. At the same time, President George W. Bush pushed through the legislation that lowered income taxes.
   (a) Illustrate the effect of such a policy mix on output.
   (b) How does this policy mix differ from the Clinton-Greenspan mix?
   (c) What happened to output in 2001? How do you reconcile the fact that both fiscal and monetary policies were expansionary with the fact that growth was so low in 2002? (Hint: what else happened?)

Problem set

3. Q 8, page 112. What mix of monetary and fiscal policy is needed to meet the following objectives?
   (a) Increase Y while keeping the interest rate constant. Would investment (I) change?
   (b) Decrease a fiscal deficit while keeping Y constant. Why must $\bar{i}$ also change?

Problem set

4. Q 9, page 112. The (less paradoxical) paradox of saving. A chapter problem at the end of Chapter 3 considered the effect of a drop in consumer confidence on private saving and investment, when investment depended on output but not on the interest rate. Here, we consider the same experiment in the context of the IS-LM framework, in which investment depends on the interest rate and output but the central bank moves interest rates to keep output constant.
   (a) Suppose consumer confidence falls, so households save a higher proportion of their income. In an IS-LM diagram where the central bank moves interest rates to keep output constant, show the effect of the fall in consumer confidence on the equilibrium in the economy.
   (b) How will the fall in consumer confidence affect consumption, investment, and private saving? Will the attempt to save more necessarily lead to more saving? Will this attempt necessarily lead to less saving?

Problem set

5. Q 4, page 137. Modern bank runs. Consider a simple bank that has assets of 100, capital of 20 and checking deposits of 80. Recall from Chapter 4 that checking deposits are liabilities of a bank.
   (a) Set up the bank's balance sheet.
   (b) Now suppose that the perceived value of the bank's assets falls by 10. What is the new value of the bank's capital? What is the bank's leverage ratio?
   (c) Suppose the deposits are insured by the government. Despite the decline in the value of the bank capital, is there any immediate reason for depositors to withdraw their funds from the bank? Would your answer change if the perceived value of the bank's assets fell by 15? 20? 25? Explain.

Problem set

6. Q 5, page 137. The IS-LM view of the world with more complex financial markets. Consider an economy described by Figure 6.6 in the text.
   (a) What are the units on the vertical axis of Figure 6.6?
   (b) If the nominal policy interest rate is 5% and the expected rate of inflation is 3%, what is the value for the vertical intercept of the LM curve?
   (c) Suppose the nominal policy interest rate is 5%. If expected inflation decreases from 3% to 2%, in order to keep the LM curve from shifting in Figure 6.6, what must the central bank do to the nominal policy rate of interest?
   (d) If the expected rate of inflation were to decrease from 3% to 2%, with the nominal policy rate unchanged, does the IS curve shift?
   (e) If the expected rate of inflation were to decrease from 3% to 2%, does the LM curve shift?
   (f) If the risk premium on risky bonds increase from 5% to 6%, does the LM curve shift?

Problem set

(g) If the risk premium on risky bonds increase from 5% to 6%, does the IS curve shift?

(h) What are the fiscal policy options that prevent an increase in the risk premium on risky bonds from decreasing the level of output?

(i) What are the monetary policy options that prevent an increase in the risk premium on risky bonds from decreasing the level of output?

Problem set

7. Q 8, page 138. **Calculating the risk premium on bonds**.

$$(1+i) = (1-p)(1+i+x) + p(0),$$

where p is the probability that the bond does not pay at all (the bond issuer is bankrupt) and has a zero return, i is the nominal policy interest rate, and x is the risk premium.

   (a) If the probability of bankruptcy is zero, what is the rate of interest on the risky bond?

   (b) Calculate the probability of bankruptcy when the nominal interest rate for a risky borrower is 8% and the nominal policy rate is 3%.

   (c) Calculate the probability of bankruptcy when the nominal interest rate for a risky borrower is 1% and the nominal policy rate is 4%.

   (d) Calculate the probability of bankruptcy when the nominal interest rate for a risky borrower is 5% and the nominal policy rate is 4%.

   (e) The formula assumes that payment upon default is zero. In fact, it is often positive. How would you change the formula in this case?

Problem set

8. Q 9, page 138. **Unconventional monetary policy: financial policy and QE**.
   IS relation: $Y = C(Y - T) + I(Y, r + x) + G$
   LM relation: $r = r$
   Assumptions: (i) the rate at which firms can borrow is much higher than the Fed rate, and equivalently (ii) the premium x in the IS is high.
   (a) Aim: increasing solvency. Suppose the gov't is successful, what is likely to happen to the premium? What will happen to the IS-LM diagram? Can we consider financial policy as a kind of macroeconomic policy?
   (b) Condition: zero nominal interest rate. The Fed purchases securities (QE). If QE is successful, what is likely to happen to the premium? What effect will this have on the IS-LM diagram? If QE has some effect, is it true that the Fed has no policy options to stimulate the economy when the Fed funds rate is zero?
   (c) One argument for QE is that it increases expected inflation. Suppose it does happen. How does that affect the LM curve?

Problem set

9. Last week we focused on the ECB conventional monetary policy through open market operations and standing facilities. Now let's have a look at the main unconventional monetary: the APP.
   https://www.ecb.europa.eu/mopo/implement/app/html/index.en.html
   (a) What is the meaning of the APP, and how does it relate to the monetary policies presented in CORE and the clips?
   (b) What are the main assets in the APP?
   (c) What is the current cumulative value of the APP?
   (d) What is the consequence of this large value?

Questions?