

Exercises
(Advanced) Macroeconomics
in WS25/26

I Introduction and the short-run

1. Define these variables and solving the questions below:

- (a) Define GDP.
- (b) Given this example of two firms, one produces flour and one produces bread. To produce bread, the bakery needs to buy flour from the flour company. Both firms have to also pay their employees.

	Flour company (Firm 1)	Bakery (Firm 2)
Revenues from sales	100	200
Expenses	80	170
Wages	80	70
Flour purchase	0	100
Profit	20	30

What is the GDP in this case?

- (c) Define nominal and real GDP.
 - (d) Define inflation rate.
 - (e) Define interest rate, real interest rate and nominal interest rate.
2. The demand as a function of income is as follows:

$$Z = (c_0 + \bar{I} + G - c_1T) + c_1Y \tag{1}$$

in which: Z is the total demand for goods, \bar{I} is investment, G is government spending, T is tax and Y is income.

- (a) Draw the equilibrium of the goods market
- (b) According to figure 3.3 (p. 2-20) in the lecture, we learned that if the demand curve shifts upward after an exogenous demand factor, regardless of income, then firms will respond to the excess demand by expanding output so that supply rises

to its initial value in the demand curve. The expansion of productions will also lead to an increase of income. However, higher income can lead to higher demand, which again adjust the supply to a higher value. And so on.

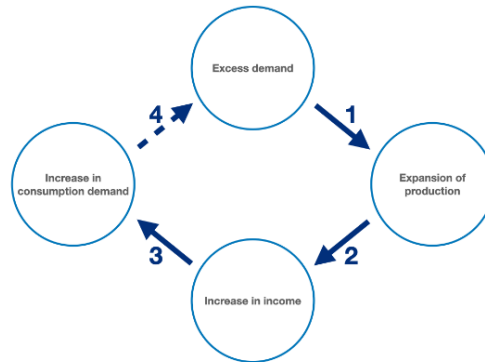


Figure 1: Conceptual representation of the adjustment process

So does the adjustment process never stop?

- (c) Suppose that demand decreases by a certain amount. Draw a graph describing the adjustment process from the old equilibrium to the new equilibrium.
- (d) In this part, we assume that the adjustment from firms (production) to demand and the adjustment of consumption to income are instantaneous. Is that plausible in reality?
3. (a) What are financial assets? What are bonds?
- (b) What are central banks and what do they do?
Why do we need central banks? * **[6 Points]**
- (c) What is the primary goal of the European Central Bank (ECB)?
- (d) These days, transparency is also a goal for central banks. They're trying to share all the relevant info about their policy decisions with a wide range of audiences, including firms, households, and investors. For instance, the ECB publishes its monetary policy decisions every six weeks. As an audience, do you think being in the know about these decisions would be helpful for your life, and why?
4. (a) Let's look at monetary policy in Europe around 2018: The ECB was buying bonds on the open financial markets. What happened to Money supply and demand? What happened to the interest rates?

- (b) Supposed that the ECB would be selling bonds from its inventory. What effect would that have on Money supply and interest rates? * **[6 Points]**
5. (a) Assume that you can secure a risk-free 3% interest rate via your bank. Inflation is also at 3%. What is the real interest rate that you are receiving?
- (b) What is the difference between nominal and real exchange rates? Which of the two is more important?
- (c) Is inflation bad?
6. (a) What is the IS relation and what does the IS curve depend on?
- (b) What are the assumptions for consumption, investment spending and government spending in the IS relation?
- (c) What happens to the output when the interest rate increases/decreases?
- (d) If the interest rate is inelastic (ineffective), how does the IS curve look like?
- (e) In reality, in which situation that the interest rate is ineffective?
- (f) How does the IS curve look like in relation with the real and nominal interest rates?
7. (a) What is the monetary-fiscal policy mix?
- (b) Using the knowledge of monetary-fiscal policy mix, fill out this table and explain the reason for your answer.

	Shift of IS	Shift of LM	Movement of Output	Movement of Interest Rate
Increase in taxes	left	?	down	?
Decrease in taxes	?	?	up	?
Increase in spending	?	?	?	?
Decrease in spending	?	?	?	?
Increase in money	?	?	?	?
Decrease in money	?	?	?	?

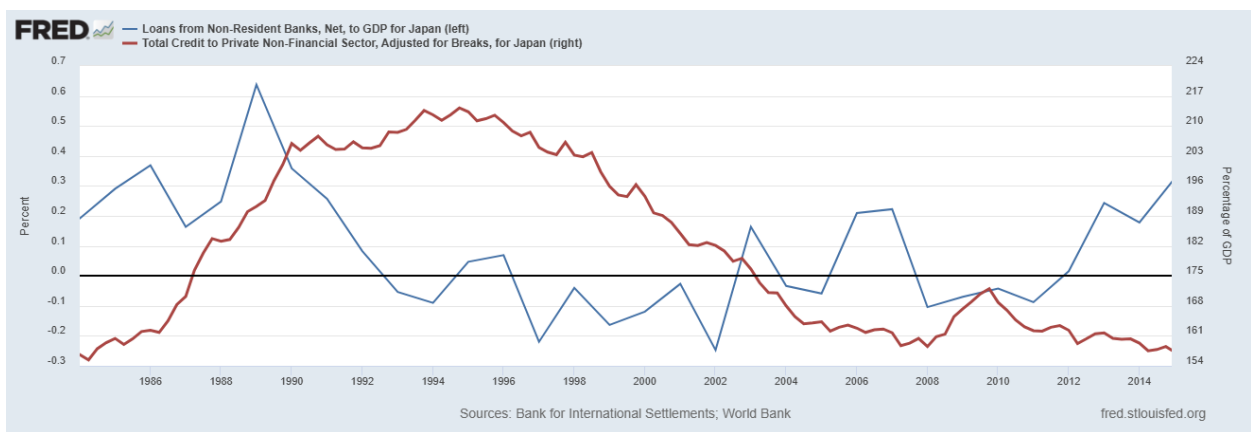
8. What is risk premium and how do they affect the effectiveness of monetary policy in the IS-LM relation?

II The medium-run

9. (a) What is the current unemployment rate in Germany?

- (b) What is the current *natural* unemployment rate in Germany?
- (c) Generally, what is the effect of higher unemployment benefits on the (natural) rate of unemployment?
- (d) Assume that a free-trade agreement has been established. This increases demand for products in both countries in the medium-run. How would a free-trade agreement affect the labor market?
- (e) Let's look at how unemployment is linked to inflation: Look at how inflation and unemployment have moved together. Is there a *relation* between unemployment and inflation?
10. (a) What is the accelerationist Phillips Curve? What is the difference between the Phillips Curve and the *accelerationist* Phillips Curve?
- (b) Assume that the natural rate of unemployment and the actual rate of unemployment are both 6%. Expected inflation is at the $\pi_e = 2\%$ target of the central bank. What do you expect future inflation to be?
- (c) Now the rate of unemployment drops to 4%. What do you expect future inflation to be?
- (d) How would inflation have evolved if the unemployment rate risen to 8% ?
- (e) Assume that energy prices suddenly and permanently decrease. What is the effect on the natural rate of unemployment? What is the effect on inflation, if inflation expectations are stable?
- (f) Imagine that the microprocessor industry restructured so that there is only one large company that makes chips. What is the effect on the natural rate of unemployment? What is the effect on inflation, if inflation expectations are stable? *
- [6 Points]**
11. (a) Define bargaining power. Which factors does the bargaining power depend on?
- (b) Draw a graph describing the relationship between Real wage (y-Axis) and Employment rate (x-Axis) including the price-setting relation.
- (c) Still using the graph drawn from the question above, how does the wage-setting relation change when the unemployment rate increases?
- (d) What are the assumptions for the natural rate of unemployment and the output in the medium run? How do they differ from the short run?

12. The three figures below describe some aspects of the economy in Japan from 1984 to 2014.



(a) Describe each of the figures i.e. how does each aspect change over time? Is there any noticeable pattern between them?

- (b) Look for periods when two or more lines seem to be moving in a similar or opposite direction. Explain why these changes could be connected to each other.
- (c) Based on these figures, discuss any possible issues Japan might have faced during this period.
- 13.** (a) Suppose that workers at a firm negotiate a higher nominal wage, which the firm agrees to implement. From the firm's perspective, what strategies could it adopt to maintain profit levels given the increased labor costs?
- (b) If workers expect future inflation to rise after wage negotiations, how would this influence wage-setting behavior? What macroeconomic consequences might arise if this pattern continues over time, suppose that the central bank's policy is unchanged?
- (c) When both wages and inflation increase simultaneously, how might the central bank respond (in the medium run), and what tools would it use to stabilize the economy?*

[4 Points]

- 14.** Okun's Law is written as

$$u - u(-1) = -0.4(g_Y - 3\%)$$

- (a) What is the sign of $u - u(-1)$ in a recession? What is the sign of $u - u(-1)$ in a recovery?
- (b) Explain where 3% comes from?
- (c) Explain why the coefficient on the term $(g_Y - 3\%)$ is -0.4 and not -1 .
- (d) Suppose the number of immigrants per year allowed entering in one country is sharply decreased. How would Okun's Law change?
- 15.** (a) What is output gap? What does an output gap depend on?
- (b) When an economy experiences a large positive output gap, how will the inflation rate and unemployment rate change, suppose that the monetary policy is unchanged?
- (c) What will happen to the output gap in the medium run, if the tax increases?
- 16.** (a) Draw 2 graphs describing the IS-LM-PC model, suppose that the economy is operating at potential output.

- (b) Suppose that the economy experiences a supply shock which leads to an increase in energy prices. Assume that the IS curve does not shift and the monetary policy is unchanged. How would potential output and actual output change? How would the graphs change?
- (c) The increase in energy price now becomes permanent. How would the central bank react and how would the central bank's decision affect the IS-LM-PC model (in graphs)?

III The long run

17. (a) What is economic growth?
- (b) Why are there such large differences between growth rates in countries and why is it that the fastest growing countries might not be the most developed and industrialised countries?
18. (a) What is the Relationship between the aggregated output, capital and labor in the long run? How much does the output increase if both capital and labor is increased by 1%?
- (b) What should we expect to happen if only one of the two inputs in the economy (i.e capital or labor) is increased?
- (c) Think of the capital stock as being measured at the beginning of each year, so K_t refers to the capital stock at the beginning of year t , K_{t+1} to the capital stock at the beginning of year $t + 1$, and so on.
How does the capital stock per worker change overtime in relation with saving per worker and depreciation?
- (d) Draw a graph describing the output per worker, the investment per worker and the depreciation. In the graph, mark where the output per worker, the investment per worker and the depreciation are, suppose that capital per worker is K_0/N .
- (e) What is the effect of a higher savings rate on output per person?
- (f) What is the effect of increasing the savings rate on consumption per capita? * [4 Points]
19. Using the Cobb-Douglas Production function and the Steady State, compare two countries with different saving rates. Assume the following:

- Country A: saving rate 0.2, depreciation rate 0.07
 - Country B: saving rate 0.3, same depreciation rate
 - The output elasticity of capital in both countries is $1/3$
- (a) Calculate the steady-state output per worker. Which Country has larger steady-state output per worker? What is the reason for that?
- (b) If Country A decides to increase the saving rate to 0.5, would that help their economy grow faster than country B? And for how long?
- (c) Which tool can the government use to increase/ decrease the saving rate? Briefly explain.* **[3 Points]**
- (d) Calculate the Steady-state consumption per worker.
- 20.** (a) What is the relationship between output per worker, capital per worker and human capital per worker?
- (b) Would increasing both physical and human capital per worker lead to permanent increase in growth rate?
- (c) What is effective labor? What is the effect of effective labor on output?
- (d) At steady state level, how much does the output per effective worker grow and why?
- 21.** Suppose that the economy's production function is:

$$Y = \sqrt{K}\sqrt{AN}$$

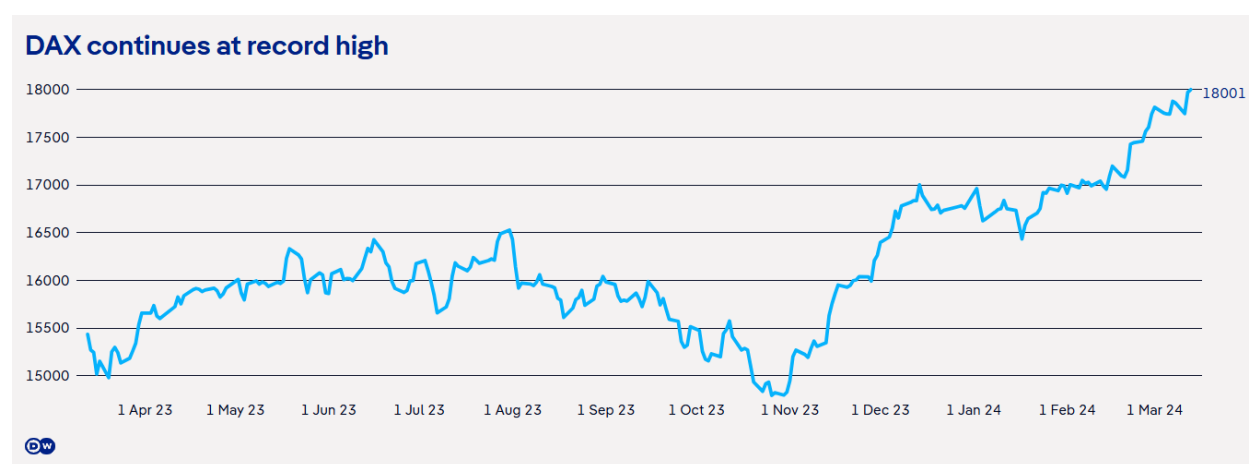
The saving rate is 16%, the rate of depreciation is 10%. The number of workers grows at 2% per year and the rate of technological progress is 4% per year.

Calculate the steady-state values of:

- (a) The capital stock per effective worker
 - (b) Output per effective worker
 - (c) The growth rate of output per effective worker
 - (d) The growth rate of output per worker
 - (e) The growth rate of output
- 22.** What are the difference(s) between the short-run, medium-run and long-run models?

IV Expectations

23. (a) When observing the stock market, it is not unusual for the index to go up or down by 15% within a year. Daily movements of 2% or more are also not unusual. What causes the movements?
- (b) How is inflation related to economic growth and stock indices?
- (c) Early 2024, the DAX stock index increased sharply to a new record high despite low economic growth. Inflation was about 5.9%. Research institutes (ifo Institute, IWH, etc.) expected inflation would fall to 2.2 to 3% in 2024 and even further in 2025.



Why is the DAX going up if inflation was still relatively high? Why did the analysts expect inflation to go down in 2024?

24. Define these variables:
- Present discounted factor and expected discounted factor.
 - Yield and yield curve.
 - Fundamental value of stock.
 - Dividends.
25. Using the information in this chapter, label each of the following statements true, false, or uncertain. Explain briefly.

Please submit the answers through this link (anonymously):

<https://forms.gle/4Pi8rhMgYTuDDvfy9>

- (a) The present discounted value of a stream of returns can be calculated in real or nominal terms.
 - (b) The higher the one-year interest rate, the lower the present discounted value of a payment next year.
 - (c) One-year interest rates are normally expected to be constant over time.
 - (d) Bonds are a claim to a sequence of constant payments over a number of years.
 - (e) Stocks are a claim to a sequence of dividend payments over a number of years.
 - (f) House prices are a claim to a sequence of expected future rents over a number of years.
 - (g) The yield curve normally slopes up.
 - (h) All assets held for one year should have the same expected rate of return.
 - (i) In a bubble, the value of the asset is the expected present value of its future returns.
 - (j) The overall real value of the stock market does not fluctuate very much over a year.
 - (k) Indexed bonds protect the holder against unexpected inflation.
- 26.** Assume the short term real policy rate, current and expected, had been 2% until now. Suppose the Fed decides to tighten monetary policy and increase the short-term policy rate from 2% to 3%.
- (a) What happens to real stock prices if the change in short-term policy rate is expected to be temporary, that is, last for only one period? Assume that expected real dividends do not change.
 - (b) What happens to stock prices if the change in short-term policy rate is expected to be permanent, that is, is expected to persist? Assume that expected real dividends do not change.
 - (c) What happens to stock prices today if the increase in the real interest rate, current and expected, reflects an increase in expected future output and expected future dividends?
- 27.** Houses can be thought of as assets with a fundamental value equal to the expected present discounted value of their future real rents.

- (a) Would you prefer to use real payments and real interest rates to value a house or nominal payments and nominal interest rates?
- (b) The rent on a house, whether you live in the house yourself and thus save paying the rent to an owner, or whether you own the house and rent it, is like the dividend on a stock. Write an equation for a house's real price.
- (c) Why would low interest rates help explain an increase in the price-to-rent ratio?
- (d) If housing is perceived as a safer investment, what will happen to the price-to-rent ratio?

28. (Optional - Would be discussed in the last exercise)

The paper "Asset price bubble in Japan" by Shigenori Shiratsuka discusses the case of the housing price bubble in Japan in 1980s and lessons learned for financial and macroeconomic stability. Please read and answer these questions:

- (a) What is the main reason of the high growth rate in Japan during 1955-1973? Explain using macroeconomics theory.
- (b) How about inflation at that time? Was it increased or decreased?
- (c) What is the "bubble period" mentioned in the paper about? Why is it called a "bubble"?
- (d) Define the "intensified bullish expectations" mentioned in the paper.
- (e) How did the change in land price affect the real economic activities? What were the consequences of the burst in housing price bubble at that time?
- (f) What is the adverse effect on the financial stability mentioned in this case?
- (g) what are the differences between a bank-based financial system and market-based financial system? Which category does Japan belong to?
- (h) What difficulties did the banking system in Japan have during that time?
- (i) Did the central bank in Japan (Bank of Japan) do anything in order to help stabilize the economy? If yes, were the program efficient?

29. A firm is considering an investment in new machinery. The rental cost of the capital is 5% of its value, and the shadow cost (opportunity cost plus depreciation) is estimated at 4%.

- (a) Define shadow cost and explain how it differs from the rental cost of capital.

- (b) If expected future profitability increases by 10%, how might this affect the firm's decision to invest?
- (c) If the shadow cost of labor (wage plus benefits and training costs) rises by 10% due to a change in regulation, what impact does this have on the firm's decision to hire more workers?
- (d) What role does uncertainty in future returns play in investment decisions?
- (e) Beside the shadow cost and rental cost, is there any other way for the firm to decide whether or not to invest in a new machine?
- 30.** (a) A firm experiences an increase in cash flow due to improved sales. How would this affect its investment decisions?
- (b) Does a higher profitability lead to higher investment in the short run?
- (c) A firm must decide between investing in a new factory or retaining cash for potential market uncertainties. Discuss the factors that might influence this decision, including market volatility, interest rates, and future growth opportunities.
- (d) A firm with low profitability is still heavily investing in R&D and infrastructure. Discuss why this might be rational, referencing industries like technology or pharmaceuticals.
- 31.** Suppose that a consumer is born with zero financial wealth and lives for three periods — youth (30 years), middle age (40 years), and old age (10 years). Consumers work in the first two periods and retire in the last one. Their income is €100,000 (in total) in the first period, €350,000 in the second, and €0 in the last one. Inflation and expected inflation are equal to zero, and so is the real interest rate.
- (a) What is the present discounted value of labor income at the beginning of the first period of life? What is the highest sustainable level of consumption such that consumption is equal in all three periods?
- (b) For each age group, what is the amount of saving that allows consumers to maintain the constant level of consumption you found in part (a)? (Hint: Saving can be a negative number if the consumer needs to borrow to maintain a certain level of consumption.)
- (c) Suppose now that there are certain borrowing constraints for consumers in their youth. Given that sum of income and total financial wealth is cash in hand, the

borrowing constraints mean that consumers cannot consume more than their cash in hand.

Calculate consumption in each of the three periods—youth, middle age, and old age. Compare this answer to your answer to part (a) of Problem 5, and explain the differences.

- (d) Consider the following statement: “Financial liberalization may be good for individual consumers, but it is bad for overall capital accumulation.” Discuss.
- (e) How does uncertainty about future labor income affect the saving (or borrowing) of consumers in their youth?

32. Define these programs and make clear how they differ from each other:

- (a) Fiscal consolidation
- (b) Fiscal austerity
- (c) Deficit program

33. A new president, who promised during the campaign that she would cut taxes, has just been elected. People trust that she will keep her promise, but expect that the tax cuts will be implemented only in the future. Determine the impact of the election victory on current output, the current interest rate, and current private spending under each of the assumptions in parts a through c. In each case, indicate what you think will happen to Y^e , r^e , and T^e in the IS relation, and then how these changes in expectations affect output today.

- (a) The Fed will not change its current policy rate, but does not make a commitment as to the direction of rates in the future.
- (b) The Fed will act to prevent any change in current and future output.
- (c) The Fed will not change either the current real policy interest rate or the future real policy interest rate.

V The open economy

34. Each of the governments of Brazil and Turkey has issued bonds in Brazilian real (BRL) and Turkish lira (TRY), respectively. Assume that both government securities are one-year bonds, i.e., paying the face value of the bond one year from now.

Suppose that the exchange rate, E , stands at 1 Brazilian real per 0.79 Turkish lira.

The following table gives face values and prices of both bonds:

	Face value	Price
Brazil	BRL 10,000	BRL 9,630
Turkey	TRY 10,000	TRY 9,450

- (a) Compute the nominal interest rate on each of the bonds.
 - (b) Compute the expected exchange rate next year consistent with uncovered interest parity.
 - (c) If you expect the real to depreciate relative to the lira, which bond should you buy?
 - (d) Assume that you are a Brazilian investor. You exchange the reals for liras and purchase the Turkish bond. One year from now, it turns out that the exchange rate, E , is 0.75, i.e., 0.75 liras buy one real. What is your realized rate of return in reals compared to the realized rate of return you would have made had you held the Brazilian bond?
 - (e) Are the differences in rates of return in part d consistent with the uncovered interest parity condition? Explain your answer.
- 35.** Suppose the domestic currency depreciates (i.e., E falls). Assume that P and P^* remain constant.
- (a) Define nominal and real exchange rates.
 - (b) How does the nominal depreciation affect the relative price of domestic goods (i.e., the real exchange rate)? Given your answer, what effect would a nominal depreciation likely have on (world) demand for domestic goods? on the domestic unemployment rate?
 - (c) Given the foreign price level, P^* , what is the price of foreign goods in terms of domestic currency? How does a nominal depreciation affect the price of foreign goods in terms of domestic currency? How does a nominal depreciation affect the domestic consumer price index? (Hint: Remember that domestic consumers buy foreign goods (imports) as well as domestic goods.)
 - (d) If the nominal wage remains constant, how does a nominal depreciation affect the real wage?

36. Compare the IS relation in the short run in a closed economy and in an open economy graphically and in words.
37. Using the definition of the real exchange rate (and Appendix 2 in chapter 20), you can show that:

$$\frac{(\varepsilon_t - \varepsilon_{t-1})}{\varepsilon_t} = \frac{(E_t - E_{t-1})}{E_t} + \pi_t - \pi_t^*$$

In words, the percentage real appreciation equals the percentage nominal appreciation plus the difference between domestic and foreign inflation.

- (a) If domestic inflation is higher than foreign inflation, and the domestic country has a fixed exchange rate, what happens to the real exchange rate over time? Assume that the Marshall-Lerner condition holds. What happens to the trade balance over time? Explain in words.
- (b) Suppose the real exchange rate is currently at the level required to have the trade balance equal to zero. In this case, if domestic inflation is higher than foreign inflation, what must happen over time to maintain a trade balance of zero?
38. Consider an open economy characterized by the following equations:

$$C = c_0 + c_1(Y - T)$$

$$I = d_0 + d_1Y$$

$$IM = m_1Y$$

$$X = x_1Y^*$$

The parameters m_1 and x_1 are the propensities to import and export. Assume that the real exchange rate is fixed at a value of 1 and treat foreign income, Y^* , as fixed. Also assume that taxes are fixed and that government purchases are exogenous (i.e., decided by the government). We explore the effectiveness of changes in G under alternative assumptions about the propensity to import.

- (a) Write the equilibrium condition in the market for domestic goods and solve for Y .
- (b) Suppose government purchases increase by one unit. What is the effect on output? (Assume that $0 < m_1 < c_1 + d_1 < 1$. Explain why.)
- (c) How do net exports change when government purchases increase by one unit?

(d) + (e) + (f)

Now consider two economies, one with $m_1 = 0.5$ and the other with $m_1 = 0.1$. Each economy is characterized by $(c_1 + d_1) = 0.6$.

Suppose one of the economies is much larger than the other. Which economy do you expect to have the larger value of m_1 ? Explain.

(e) Calculate your answers to parts b and c for each economy by substituting the appropriate parameter values.

(f) In which economy will fiscal policy have a larger effect on output? In which economy will fiscal policy have a larger effect on net exports?

39. (a) In an IS-LM–UIP diagram, such as Figure 19-2 (in the lecture slides), show the effect of the increase in foreign output, Y^* , on domestic output Y and the exchange rate E , when the domestic central bank leaves the policy interest rate unchanged. Explain in words.
- (b) In an IS-LM–UIP diagram, show the effect of an increase in the foreign interest rate, i^* on the domestic output Y .
40. (a) What are the disadvantages of flexible and fixed exchange rates? Which one does the central bank prefer?
- (b) Consider a fixed exchange rate system, in which a group of countries (called follower countries) peg their currencies to the currency of one country (called the leader country). Design a fiscal policy mix that leaves consumption and domestic output unchanged when the leader country increases interest rates. What component of output is changed?
- (c) Suppose that a country is under fixed exchange rate regime. How does the exchange rate affect output in the short run and medium run?

41. Consider a country operating under fixed exchange rates. The IS curve is given by equation:

$$Y = Y\left(\frac{\bar{E}P}{P^*}, G, T, i^* - \pi^e, Y^*\right)$$

The Phillips curves for the domestic and the foreign economy:

$$\text{Domestic Phillips curve: } \pi - \bar{\pi} = (\alpha/L)(Y - Y_n)$$

$$\text{Foreign Phillips curve: } \pi - \bar{\pi}^e = (\alpha^*/L^*)(Y^* - Y_n^*)$$

- (a) Explain the term $(i^* - \pi^e)$. Why does the foreign nominal interest rate appear in the relation?
 - (b) Explain why when π^e increases, the IS curve shifts left.
 - (c) We assume that the foreign economy is always in medium-run equilibrium. What are the implications of that assumption for foreign output and foreign inflation?
 - (d) We assume that the domestic and foreign economies share the same anchored value for the level of expected inflation denoted so that $\bar{\pi} = \bar{\pi}^e$. What is the implication of that assumption once both the domestic and foreign economies are both in medium-run equilibrium?
- 42.** Assume that an economy is under fixed exchange rate regime. However, the investors doubt that the country can maintain its fixed exchange rate and start selling the domestic currency.
- (a) What might be the reasons investors expect a devaluation?
 - (b) What would happen after this regarding capital inflows and domestic interest rate?
 - (c) What action/policy options does the central bank have to defend the peg?
 - (d) Discuss the conditions under which the central bank might abandon the peg and adopt a floating exchange rate.