

Introduction to Macroeconomics · M5 · 2015-16

Problem set 3

1. Interest rate. (i) May the nominal interest rate of an economy be persistently negative? What would that mean? (ii) And zero? (iii) Can people be considered more patient when $i = 0$ than when $i > 0$?

2. Rate of return. (i) Compute the rate of return of a €120 loan when only €80 are repaid. (ii) What if €80 are loaned and €120 repaid? (iii) Find in each case the corresponding discount factor.

3. Present value. Calculate the present discounted value in period 1 of €100: (i) from period 2 when the interest rate is 5%; (ii) from period 3 when the interest rate is 5% in period 1 and in period 2; (iii) from period 3 when the interest rate is 5% in period 1 and 10% in period 2; (iv) from period 3 when the interest rate is 10% in period 1 and 5% in period 2; (v) from period 3 when the interest rate is 10% in periods 1 and 2.

4. Interest rate, discount factor. (i) Can the discount factor rise while the interest rate is also rising? (ii) €50 from period 1 are worth €60 in period 2. Find the corresponding interest rate and discount factor.

5. T-bills. (i) Compute the rate of return of a T-bill with face value $V = 210$ and price $P = 200$. (ii) Find the interest rate i under which the rate of return of the T-bill agrees with i . (iii) Find the face value of T-bills priced 200 if the interest rate is 5%.

6. T-bills. (i) Find the price (that prevents arbitrage) of a T-bill with face value 1,200 if the real interest rate is 5% and the inflation rate is 15%. (ii) The nominal interest rate is 10% and the price of a T-bill is 200. Calculate the face value of the T-bill.

7. Equilibrium interest rate. (i) Identify three events, different from those in Exercise 10, that may cause an increase in the equilibrium interest rate and another three that may cause a fall in the equilibrium amount of liquidity. (ii) Identify two events that may cause, simultaneously, a fall in the equilibrium interest rate and a fall in the equilibrium amount of liquidity.

8. Price and rate of return. Explain why a fall in the price of T-bills is likely to be accompanied by an increase in the rate of return of T-bills.

9. Discount factor. (i) The discount factor is 0.6 and the price of a T-bill is 200. Given the relationship between the interest rate and the price of T-bills, find the face value of the T-bill. (ii) Calculate the present value of 200 if the (per one) interest rate is $2/3$.

10. Liquidity market model. Consider the liquidity market model with increasing supply of liquidity function and decreasing demand for liquidity function. Ascertain the likely effect on the equilibrium interest rate and the amount of liquidity of each of the following events.

- (1) The arrival of a large number of immigrants
- (2) A significant number of factories close
- (3) There is an increase in the proportion of income saved by households
- (4) To finance important investment projects the main firms of the economy issue corporate bonds
- (5) The central bank executes an expansionary open market operation
- (6) More foreigners purchase domestic financial assets
- (7) The population of the economy grows old
- (8) The banks refuse to lend to persons younger than 40-year old
- (9) Foreign banks enter the economy and settle new offices
- (10) Unemployment doubles
- (11) The inflation rate doubles
- (12) It is expected that the inflation rate will double
- (13) The central bank increases the reserve ratio and sells T-bills to banks
- (14) The central bank increases the reserve ratio and purchases T-bills from banks
- (15) The government budget goes from surplus to deficit
- (16) The stock market crashes
- (17) Unquestionable evidence that the afterlife exists is made public
- (18) The economy goes into a recession (GDP falls)
- (19) Spain leaves the eurozone
- (20) (1) and (2) occur simultaneously
- (21) The first ten events occur simultaneously
- (22) A bank run takes place

11. Money multiplier process, loan market, monetary policy. Banks have voluntarily decided to increase their reserves substantially. (i) Explain the effect that this decision is likely to produce on the money multiplier process. (ii) By means of a graphical representation of the liquidity market, show the impact of that decision on the equilibrium interest rate. (iii) Suggest a measure by the central bank that could offset that impact and explain what would make the measure effective.

12. Real interest rate. Find the real interest rate in a certain period if the nominal interest rate is 5%, the CPI at the beginning of the period is 200, and the GDP deflator at the end of the period is 220.

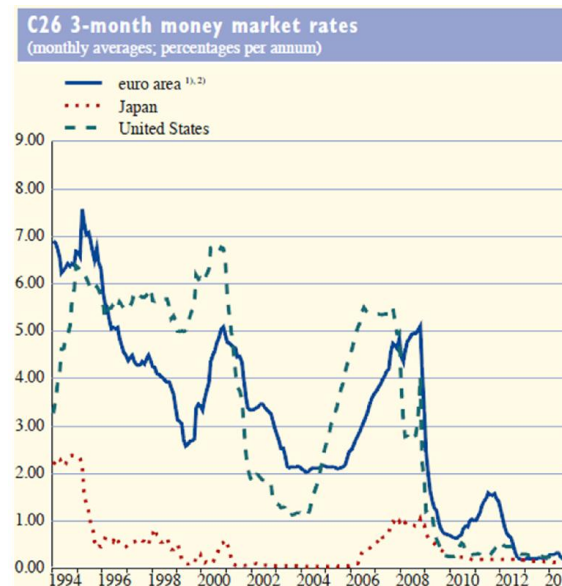
13. Liquidity market model. (i) Find out the effect on the loan market equilibrium of: (a) a reduction in the government deficit; (b) a reduction in the government deficit that takes place at the same time as a reduction in the number of banks. (ii) Suggest an open market operation capable of neutralizing the effect on the interest rate established in (b) and illustrate your answer graphically.

14. Equilibrium interest rate. (i) Which is the effect on the interest rate of an increase in the reserve ratio that occurs at the same time as a sale of T-bills by the central bank? (ii) What if the sale were a purchase?

15. Fisher effect. Explain if having a negative real interest rate for five years is consistent with the Fisher effect.

16. Real interest rate. Find the real interest rate: (i) if the nominal interest rate is 5% and the CPI is 200; (ii) if the real interest rate is constant and the inflation rate is 5%.

17. Liquidity market model. (i) With the help of a graphical representation of the liquidity market model, determine and explain the effect on the equilibrium interest rate of an increase in the number of people that purchase financial assets. (ii) Suggest two measures by the central bank that could neutralize that effect and indicate in a graphical representation of the market how these measures achieve the desired goal.

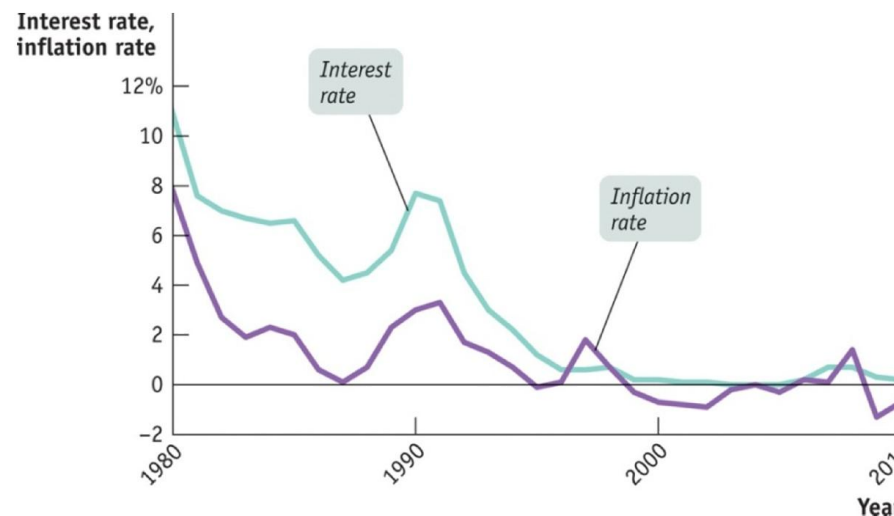


18. Liquidity market model. (i) Over the two decades represented in the chart on the left, can monetary policy be considered, in all three economies, rather expansionary or rather contractionary?

ECB Monthly Bulletin, December 2014
<http://www.ecb.europa.eu/pub/pdf/mobu/mb201412en.pdf> (S43)

19. Expansionary monetary policy. Explain four ways by means of which a central bank can increase liquidity.

20. Real interest rate, Japan. (i) Does the chart below provide information concerning the real interest rate? (ii) If so, identify a period in which it is positive and another one in which it is negative. (iii) Can a period be identified during which it rises? And another one during which it falls?



http://bcs.worthpublishers.com/krugmanwellsmacro3/default.asp#t_768077 (Chapter 16 → Student PowerPoint Slides)

21. MROs by the ECB. The European Central Bank (ECB) decides to provide liquidity (€500 million) to the market by means of a main refinancing operation (MRO) executed through a variable rate tender procedure. (i) Calculate, in the following table, the allotment to each bank. (ii) Determine the marginal interest rate of the tender. (iii) [Optional] Answer the same question if the ECB decides to provide €300 million.

<i>i</i>	<i>bids by the banks</i>				<i>allotment by the ECB</i>			
	B1	B2	B3	B4	B1	B2	B3	B4
5.5%	30	25	10	15				
5.4%	40	30	25	20				
5.3%	50	35	30	40				
5.2%	70	50	50	60				
5.1%	100	80	90	80				
5.0%	120	100	100	100				

22. MROs by the ECB. The ECB provides €500 million of liquidity by means of an MRO executed as a fixed rate tender procedure. Find, in each table, how the ECB allots the €500 million to the banks.

<i>bids by the banks</i>				<i>allotment by the ECB</i>			
B1	B2	B3	B4	B1	B2	B3	B4
200	100	50	400				

<i>bids by the banks</i>				<i>allotment by the ECB</i>			
B1	B2	B3	B4	B1	B2	B3	B4
100	50	50	150				

<i>bids by the banks</i>				<i>allotment by the ECB</i>			
B1	B2	B3	B4	B1	B2	B3	B4
150	80	70	200				

23. Monetary policy. A speculative bubble (market bubble or speculative mania) occurs when the price of a good or financial asset is systematically inflated with respect to what may be called its intrinsic or fundamental value. In this case, most of the trade in the market is carried out under the expectation that the price of the good or the financial asset will rise, so buyers typically buy expecting to be able to sell later at a higher price. A speculative bubble bursts when the price of the good or financial asset suddenly plummets (crashes). Explain why central banks generally respond to a stock market crash by conducting expansionary open market operations.

24. Interest rate. (i) Why a rise in the interest rate tends to cause a fall in the price of financial assets? (ii) Is it true that the interest rate tends to go down when the central bank sells financial assets?

25. Liquidity market model. (i) By means of a graphical representation of the liquidity market model (with an upward sloping market supply function), determine and explain (separately) the effect on the interest rate of:

(a) placing a 10% tax on bank loans that has to be paid by borrowers (those who obtain the loan);

(b) the prohibition of obtaining loans from other countries with the same currency (for instance, the Spanish government does not allow Spanish firms and citizens to borrow from French banks).

(ii) Suggest two measures by the central bank that could neutralize the effect on the interest rate in case (a) and show in a graphical representation how any of these measures achieves the goal.

26. Face value of T-bills. Assuming that the relationship between the economy's interest rate and the price of T-bills holds, determine the face value of T-bills if the discount factor is $5/6$ and the price of T-bills when issued is 600.

27. Fisher equation. Economies **A** and **B** have the same real interest rate. The inflation rate in **A** is five percentage points higher than in **B**. According to the Fisher equation, which economy has the higher nominal interest rate and by how many percentage points? Justify your answer in detail.

28. Similarities and differences. For each of the following pairs of concepts, indicate something that the two concepts have in common and something that differentiates them.

- (1) Nominal interest rate and discount factor
- (2) Nominal interest rate and real interest rate
- (3) Nominal interest rate and inflation rate
- (4) Nominal interest rate and **M1**
- (5) Open market operation and price of a T-bill
- (6) Open market operation and discount factor
- (7) Arbitrage and nominal interest rate
- (8) Eurosystem and European System of Central Banks
- (9) Marginal lending facility and Euribor
- (10) Fisher equation and interest rates set by the central bank
- (11) Fisher effect and Fisher hypothesis
- (12) Reserve requirement and open market operation
- (13) Discount factor and real GDP

29. Liquidity market model. Consider the variation on the liquidity market model in which the supply of loans function is increasing up to a certain point (i', L') and, for each interest rate $i > i'$, the supply function becomes vertical at the value $L = L'$.

(i) Draw this function. Draw also a standard demand for liquidity function such that the equilibrium interest rate i^* is higher than i' .

(ii) Suppose that, for any shift to the right or to left of the supply of liquidity function, the resulting function remains vertical at L' , so the supply of liquidity cannot be higher than L' . Taking as initial situation the market equilibrium drawn in (i), analyze graphically the effect on the interest rate when an expansionary open market operation is conducted and indicate which functions are affected by the open market operation.

30. Robin Hood tax. (i) Analyze graphically the effect on the equilibrium interest rate of establishing a tax on the sales of existing financial assets. It is the sellers who must pay the tax. The central bank and the government are both tax-exempt. (ii) Suggest a monetary policy measure by the central bank that could neutralize the change in the volume of liquidity found in (i).

31. T-bills. One million T-bills are issued in period t . Each one is sold at a price equal to €1,000 and promises to pay € V in $t + 1$. The interest rate from t to $t + 1$ is 50%. Find the value of V consistent with the absence of arbitrage opportunities.

32. Fisher equation. Using the Fisher equation, find the value of the nominal interest rate if real GDP is 100 and the GDP deflator inflation rate is 10%.

33. Liquidity market model. Find all the equilibria interest rate if the demand for liquidity function is

$$L^d = \begin{cases} 8 - i & \text{if } 0 \leq i \leq 8 \\ 0 & \text{if } i > 8 \end{cases}$$

and the supply of liquidity is given by the expressions $i = 14 + 2 \cdot L^s$ if $L^s > 0$ and $L^s = 0$ if $0 \leq i \leq 14$.

34. T-bills. Assuming that the relationship between the economy's interest rate i and the price of T-bills holds, find the price of T-bills (when issued) if their face value is 1,000 and the discount factor (based on i) is $1/2$.

35. Central bank. (i) Explain why the central bank cannot simultaneously control the interest rate i and the money stock **M1**. (ii) List three functions of a central bank.

36. Real interest rate. The price level today is 100; tomorrow, 200. By lending €1,000 today, you get €1,200 tomorrow. Calculate the corresponding exact real interest rate.

37. Interest rate. A government announces a debt default: interest payments corresponding to the government's public debt will not be honoured for the next ten years. Explain and analyze graphically the effect of this announcement on the domestic interest rate.

38. Discount factor. Assuming valid the equation linking the price of T-bills and the interest rate of the economy, calculate the economy's discount factor if the price of T-bills, when issued, is 500 and their face value is 1,000.

39. T-bills. T-bills with face value V are about to be issued in period t . They mature in period $t + 1$. The interest rate between t and $t + 1$ is negative. What can be said about the relationship between V and the price P at which the T-bills are initially sold?

40. Liquidity market model. In the first week of May 2015 the Danish government announced that it was planning to allow gas stations, clothing stores, and restaurants the option to stop taking cash payments. Explain how this measure would affect the money multiplier process and the money multiplier itself.

<http://qz.com/399531/denmark-hopes-to-boost-its-economy-by-eliminating-cash/>

41. Open market operation. Explain what an open market operation is, pick two macroeconomic variables affected by this kind of operation, and indicate how they are affected.

42. Real interest rate. Calculate the real interest rate between period $t = 0$ and period $t = 1$ if the CPI in $t = 0$ is 100, the CPI in $t = 1$ is 105, and the nominal interest rate between $t = 0$ and $t = 1$ is 3%.

43. Bank runs. There are many instances of bank runs in the US economic history: 1819, 1837, 1857, 1873, 1893, 1907... (i) Explain, with the help of the liquidity market model, the effect of a bank run on the interest rate, stating clearly which function or functions shift and why. (ii) Suggest two monetary policy measures that could offset the effect of the bank run on the interest rate and indicate the function or functions that each measure modifies.

44. OMOs. Explain the meaning of the expression “contractionary open market operation”.

45. Fisher effect. Indicate two variables having to do with the Fisher effect and another two completely unrelated to the Fisher effect.

46. ECB. (i) Name two of the decision-making bodies of the European Central Bank. (ii) Find the ECB web page where two bodies are described. (iii) Has the European Central Bank ever set a negative (nominal) interest rate? If so, indicate which one.

47. T-bills. Assuming the formula that relates the face value of a T-bill, its price, and the interest rate calculate the face value: (i) if the discount factor is 1 and the price is 100; (ii) if the interest rate is 100% and the price is 100.

48. Real interest rate. Compute the real interest rate if the nominal interest rate equals the inflation rate.

49. Liquidity market model. Initial situation: purchasers of financial assets have to pay a tax when purchasing financial assets, whereas the sale of financial assets is tax-free. (a) Using the liquidity market model, explain and analyze graphically the effect on the equilibrium interest rate of each of the following events: (i) the government removes the tax on purchasers of financial assets; (ii) the government imposes a tax on the sellers of financial assets when selling financial assets. (b) Indicate a monetary policy measure that could offset the effect on the interest rate when both (i) and (ii) occur.

50. Interest rate. The (exact) real interest rate between t and $t + 1$ is 10%. According to the CPI, the purchasing power in t of €1,000 is 5 baskets of goods. The CPI in $t + 1$ is 300. Find, if possible, the CPI inflation rate between t and $t + 1$ and the nominal interest rate between t and $t + 1$.

51. Liquidity market model. Indicate how the following events are likely to modify the market functions (“→” = shift to the right, “←” = shift to the left) and the equilibrium interest rate i^* (“↑” = goes up, “↓” = goes down, “=” = unaltered, “?” = ambiguous or uncertain change), where **S** = supply of liquidity function and **D** = demand for liquidity function.

	S	D	i^*
The central bank conducts an expansionary OMO			
Households reduce the amount of financial assets bought			
The government issues T-bills			
Banks refuse to lend to firms and, to finance their activities, firms sell financial assets that they have previously bought			
The central bank reduces the legal reserves ratio			
Banks expect an immediate rise in the inflation rate but firms and the public in general ignore the rise			
Firms and households suddenly refuse to buy financial assets anymore			