

QUESTION 1: SHORT VERSUS MEDIUM RUN. 30 points

Consider an economy that fits the AS-AD model. The labor market equilibrium is given by the AS curve. The equilibrium in the goods market is given by the IS curve. The equilibrium in the money market is given by the LM curve. The combination of equilibrium in both the goods market and the money market is given by the AD curve.

1. Assume the economy is at a point such that the unemployment rate is equal to the natural rate of unemployment.
What does it imply for the expected level of prices? Explain.

Solution: *If the economy is at the natural rate of unemployment, it implies that expected prices are equal to actual prices.*

This is actually one of the definitions of the natural rate of unemployment. Formally, the natural rate of unemployment is defined by the wage-setting/price-setting relationships. If workers do not make any "mistake" about the price level ($P=P^e$), and if firms can charge a mark-up \mathbf{m} then equilibrium in the job market implies:

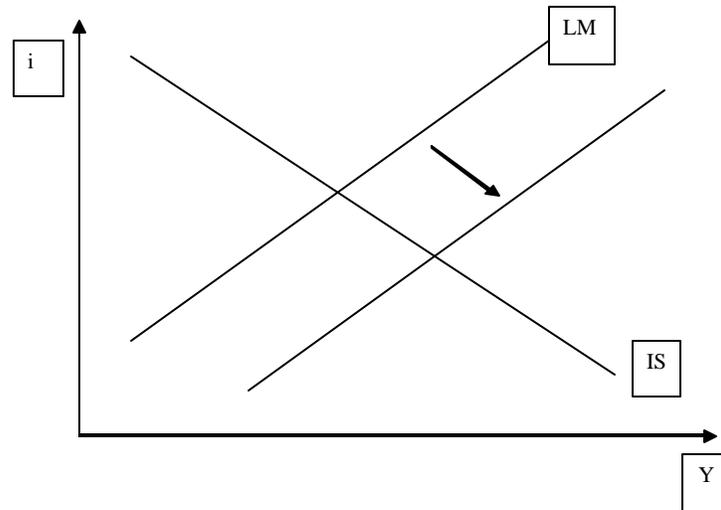
$$P/P^e = 1 = (1 + \mathbf{m})F(u_n, z)$$

The only way to temporarily decrease unemployment below (resp. above) the natural rate of unemployment is to have workers mistaken about the level of prices and expecting lower prices than those actually set (resp. higher). Workers are either mistaken about prices, or they could be aware of the increase in prices, but unable to renegotiate their wages immediately because of some rigidities in the labor market. If expected prices are equal to actual prices, then unemployment is equal to the natural rate of unemployment, which depends on the technological and institutional state of the economy (\mathbf{m} the F function and z).

Assume now that the Central Bank decides to run an expansionary monetary policy: it increases the supply of money. For the next two sub-questions, we look at the impact of this policy in the short run.

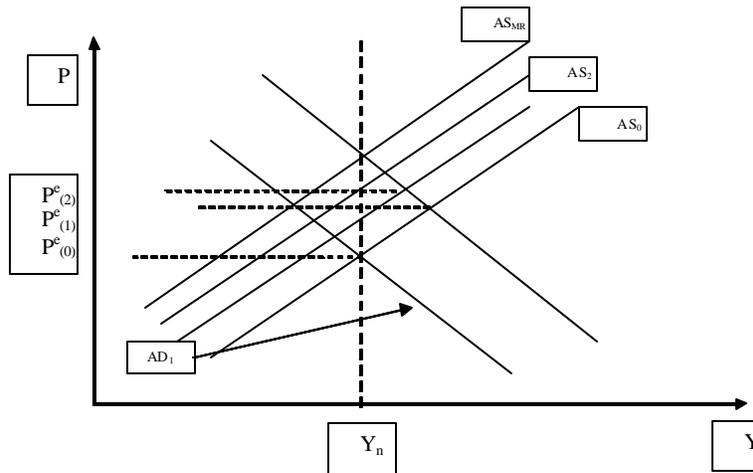
1. Describe the impact of such a policy on the equilibrium in the money market, in the goods market and in the labor market. Draw the shift in the IS and/or the LM curves in the (i, Y) space, and the shift in the AS and/or the AD curve in the (P, Y) space.

Solution: when the Central Bank increases the money supply, it pushes down the interest rate. This increases investment, and therefore output. The LM curve shifts to the right, and therefore equilibrium output goes up and interest rates go down. For any level of prices, the output is higher. This implies that the whole AD curve shifts to the right. Output increases. This reduces unemployment, and therefore increases wages. Firms respond by setting higher prices in order to maintain a constant mark-up. This increase in prices will lead to a shift in the LM curve: the contraction of real money supply due to increased prices will push interest rates up and partially reduce output (this consequent shift in the LM is not represented graphically; you got full points if you did represent it or not).

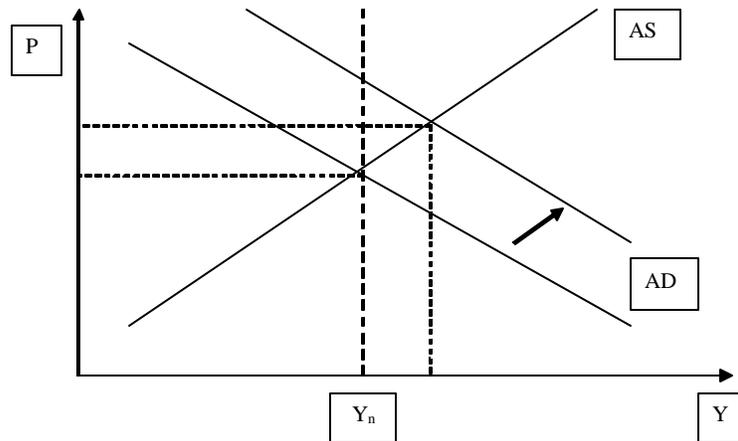


We now study the evolution of this economy over the medium run. We will assume that expectations are adaptive, meaning $P^e(t) = P(t-1)$.

1. Show graphically how the AS and/or the AD curves move over the medium run. Give an economic interpretation of the shifts in the curves.



Solution: After the initial shock, expectations about prices gradually adjust until eventually the economy comes back to the natural level of output. After the initial shock, we have seen that prices have gone up while expectations were not updated. In the beginning of the next period, workers set their expectations for the prices in the coming period at $P^e(1) = P(0)$. This shifts the AD curve to the left from AD_0 to AD_1 . When workers anticipate a higher price level, they will want to get higher wages (for a given level of output), which will force firms to increase prices in order to maintain their mark-up. Those higher prices shrink the real money supply, which increases interest rates and depresses investment. Prices have gone up, and output has gone down, following this updating of price expectations. In the next stage, workers once again realize they have been mistaken by prices (which have gone up more than they expected). They update their expectations about prices which increases nominal wages, increases prices, forces interest rates up, depresses investment and therefore output. These cycles (increase in prices, reduction in output, updating of expectations) go on until equality is restored between actual and expected prices. It takes some time for this to happen. But once actual and expected prices are equalized, output is back to its natural level.



1. How do output and prices respond to the monetary shock in the short run? You are only asked to state whether a variable goes up, down, stays unchanged, or whether the change is ambiguous. You ought to give a brief explanation of why such a change occurs.

Solutions: Prices and output go up in the short run following the monetary expansion.

The mechanism is the following: monetary expansion eases up the money market and pushes the interest rate down. This stimulates investment and increases output. This increase in output can only come from a lower unemployment rate (more workers). This decrease in unemployment generates inflation: when unemployment decreases, workers can bargain a higher nominal wage; firms to restore their mark-up increase prices. This increase in prices tightens the money market and dampens a bit the original increase in the interest rate and in output.

This is all short run dynamics meaning that workers have not updated their expectations about prices yet.

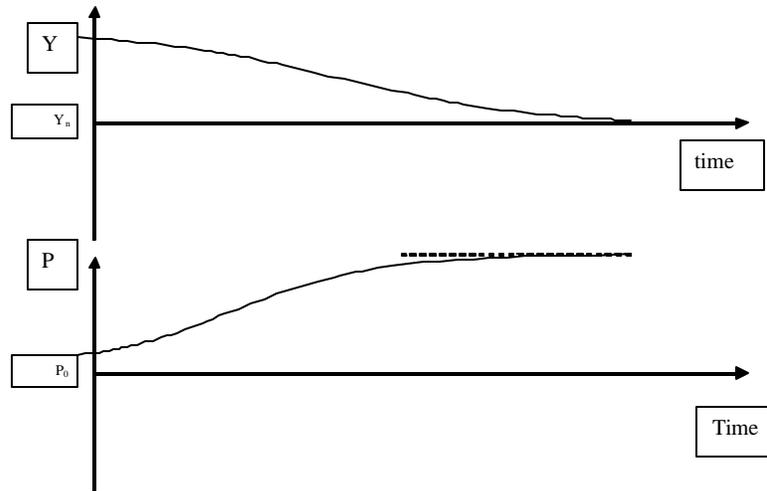
1. If the Central Bank has increased the money supply by 5%, what will be the percentage change in the level of prices in the Medium Run? Describe the forces driving the change in the level of prices.

Solution: *In the medium run, expectations about prices adjust until they are equal to actual prices. This brings back output to its natural level. Since the IS curve has not moved, or in other words, the demand for goods still follows the same structure (same consumption function, same investment function, same government spending), it must then be that interest rates are the same as before the Central Bank intervention. If output and interest rate are the same as before, the demand for real money balances is the same. To have equilibrium in the money market, it must be that the real money supply is unchanged.*

Over the medium run, M^e/P is constant, which implies that $\Delta M/M = \Delta P/P$. If the nominal money supply has increased by 5%, the prices must increase by the same percentage change, prices must increase by 5%.

This is what we called the neutrality of money over the medium run: monetary policy can only have a short run impact on the real economy. This impact is allowed by rigidities in the prices (here in the updating of expectations by wage setters). Over the medium run, prices adjust and real variable return to their original level.

1. Draw the path that output and prices will follow over the medium run. Give a brief explanation for each graph.



At the impact, output and prices jump following the monetary intervention. This is due to the mechanism described in sub-question 3: the money market is loosened, interest rates go down, this increases investment which in turn increases output. In order to increase output, unemployment goes down. This allows workers to ask for a higher wage. Firms in response set a higher price to restore their mark-up. Then over the medium run, expectations about prices are updated. As wage setters get more and more aware of the increase in prices, their expectation about prices increases, this depresses real wages and therefore increases unemployment. At the same time, prices keep going up (at a slower pace than expected prices) until expected prices and actual prices are equalized again.

Over the medium run, monetary policy has no effect on output (neutrality of money), and prices increase to nullify the increase in money supply.

QUESTION 2: The MUNDELL – FLEMING MODEL. 70 points

Consider the following equations describing the Goods market:

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

$$G = \bar{G}; T = \bar{T}$$

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

$$NX = X(Y^*, \epsilon) - \epsilon IM(Y, \epsilon)$$

where C is consumption, Y domestic output, T taxes, G , public expenditure, I investment, i the domestic interest rate, X are exports, IM imports and e the real exchange rate (the price of one unit of foreign goods in terms of domestic goods). Foreign variables are denoted by a star. As usual, assume the Marshall-Lerner conditions hold: this means that net exports increase when domestic currency depreciates.

1. Complete the previous equations by indicating what should be the sign of each question mark (?). Be sure to provide the economic reasoning behind your answer.

$$NX = X(Y^*, \epsilon) - \epsilon IM(Y, \epsilon)$$

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When foreign income increases, demand for domestic goods by foreigners increases and therefore exports increase. When the exchange rate depreciates, domestic goods become relatively cheaper and exports increase and imports decrease. When domestic income increases, domestic demand for foreign goods increases and imports increase.

Now, the financial markets can be described by the money market and the uncovered interest parity (UIP).

$$\frac{M^d}{P} = YL(i)$$

$$M^s = M$$

$$i = i^* + \frac{E^* - E}{E}$$

$$\epsilon = E \frac{P^*}{P}$$

Assume the price levels are equal $P^* = P$ and constant, the exchange rate E is flexible and the foreign interest rate is i^* .

1. Describe and draw the equilibrium in the Goods market and in the Financial markets using the IS-LM open-economy model. Is the open economy IS the same as the closed economy IS? Is the open economy LM the same as the closed economy LM?

The open economy IS differs because it includes NX. See p.423 for a discussion.

The LM is identical.

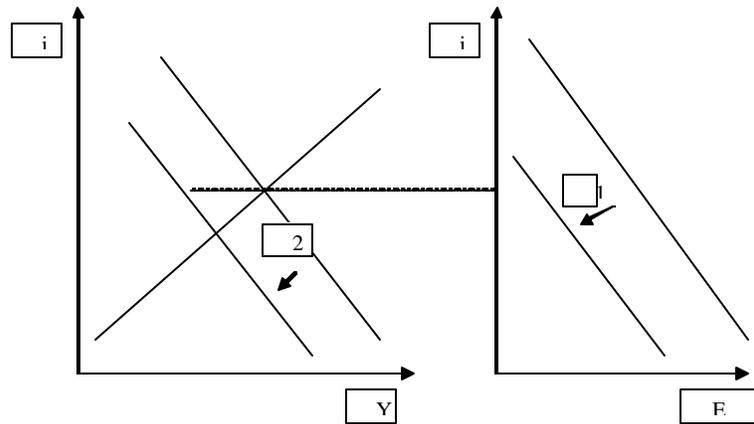
Graph in p.423

2. Describe the different effects of a fiscal expansion (an increase in G) and a monetary expansion (an increase in M^s) on the equilibrium output, interest rate and exchange rate.

See p.424-425

3. Assume that financial investors think that the domestic currency is undervalued and expect an appreciation of the currency. Describe and draw the consequences on the equilibrium output, the interest rate and the exchange rate.

Financial investors think that the exchange rate will appreciate which means that E^e decreases. This implies a inward shift of the UIP schedule 1. At the same interest rate the exchange rate appreciates, and the expectations are self-fulfilled. The appreciated exchange rate reduces exports, which implies an inward shift of the IS 2.



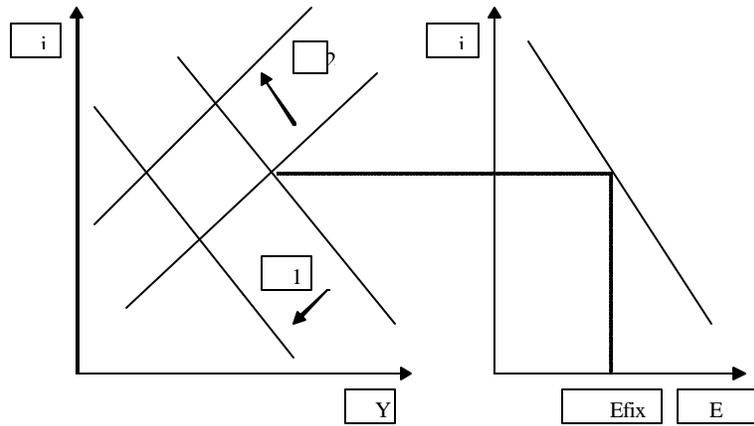
The domestic country decides to shift to a fixed exchange rate regime and set $E = E_{\text{fixed}}$.

1. Assume financial investors expect the exchange rate to remain unchanged at E_{fixed} . Describe the implications for the UIP and for the conduct of domestic monetary policy

A fixed exchange rate implies $i = \hat{i}$ if the exchange rate level is credible. The domestic monetary policy becomes endogenous to maintain the fixed E .

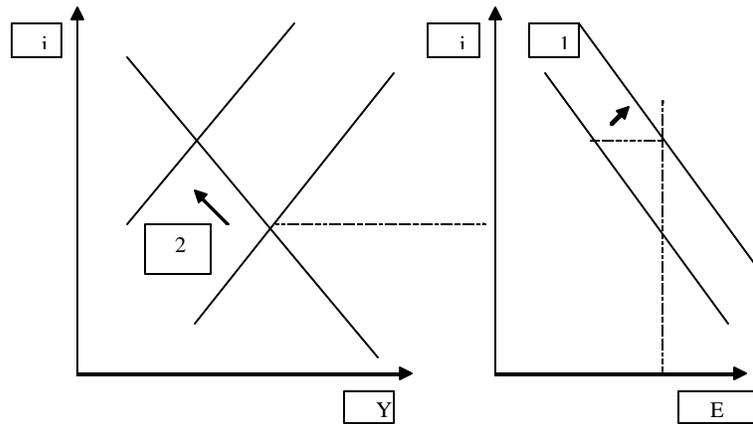
2. Using your answer in point 6, describe and draw the effects of a fiscal contraction (G decreases).

A fiscal contraction shifts the IS inwards 1, and decreases the interest rate. Given the exchange rate cannot depreciate the monetary authority has to decrease M to bring back the interest rate at its starting level 2. This decreases further output.



1. Assume financial investors think the level of fixed exchange rate is not anymore sustainable and has to devalue. The authority of the domestic country decides to fight and maintain the parity. Describe and draw the sequence of events triggered by the expected devaluation.

The increase in E^e implies a outward shift in the UIP 1. To maintain the fixed E the monetary authority has to decrease M 2.



Assume the country is forced to go back to a flexible exchange rate regime. However domestic residents now believe that trade and capital flows are detrimental to their economy.

1. Assume the domestic country starts a campaign “buy domestic”: they convince residents to buy proportionally more domestic goods. What will be the consequences of such a policy for equilibrium output, the interest rate, the exchange rate and the Trade balance?

You can interpret it as a decrease in the marginal propensity to import. Which flattens the IS.

2. Describe the implications of “buy domestic” on the effectiveness of monetary policy.

Given the IS is flatter MP will have a greater effect (other answers were possible with different interpretation in 8)