

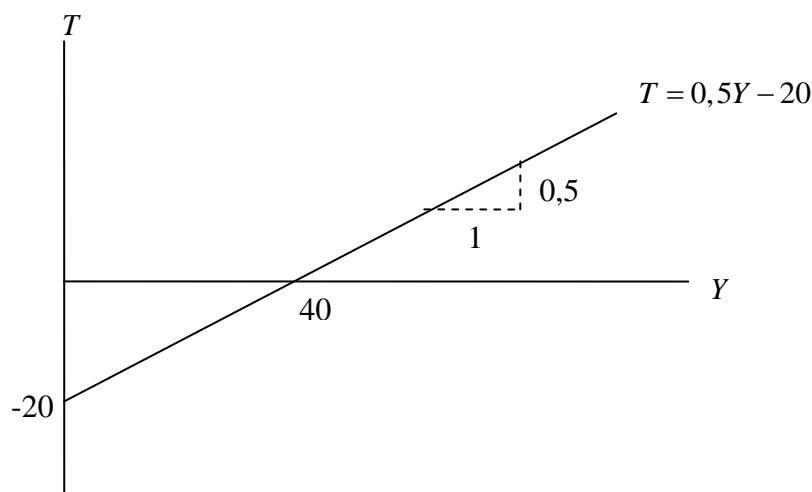
14 THE OPEN ECONOMY IN THE SHORT RUN

1.

- a) The marginal tax shows how large fraction of an increase in income that is paid in tax. We get it by taking the derivative of the tax function with respect to income:

$$\text{i. } \frac{dT(Y)}{dY} = 0,5$$

If $Y = 0$ we get $T = T(Y) = 0,5 \cdot 0 - 20 = -20$ so this is the intercept, and the marginal tax determines the slope.



- b) The import function is $C^f(Y, \varepsilon) = \varepsilon \cdot 0,25Y$

The price elasticity of imports is

$$\frac{dC^f}{d\varepsilon} \frac{\varepsilon}{C^f} = 0,25Y \frac{\varepsilon}{C^f} = 0,25Y \frac{\varepsilon}{\varepsilon \cdot 0,25Y} = 1$$

- c) The export function is $X(Y^*, \varepsilon) = (0,9 - 0,6\varepsilon)Y^* = 0,9Y^* - 0,6\varepsilon Y^*$

The price elasticity of exports is

$$\frac{dX}{d\varepsilon} \frac{\varepsilon}{X} = -0,6Y^* \frac{\varepsilon}{(0,9 - 0,6\varepsilon)Y^*} = -\frac{0,6\varepsilon}{0,9 - 0,6\varepsilon}$$

When $\varepsilon = 1$ we get: $\frac{dX}{d\varepsilon} \frac{\varepsilon}{X} = -\frac{0,6}{0,9 - 0,6} = -2$

- d) Netto exports are

$$NX(\varepsilon, Y^*, Y) \equiv X(Y^*, \varepsilon) - C^f(Y, \varepsilon) / \varepsilon = (0,9 - 0,6\varepsilon)Y^* - 0,25Y$$

And we get

$$\frac{dNX}{dY} = -0,25 < 0 \quad \frac{dNX}{dY^*} = 0,9 - 0,6\varepsilon > 0 \quad \frac{dNX}{d\varepsilon} = -0,6Y^* < 0$$

e) $Y = C + I + G + X - C^f / \varepsilon$

$$Y = 3 + 0,60(Y - 0,5Y + 20) + I + G + (0,9 - 0,6\varepsilon)Y^* - 0,25Y$$

$$Y = 3 + 0,60Y - 0,30Y + 12 + I + G + 0,9Y^* - 0,6\varepsilon Y^* - 0,25Y$$

$$Y = 15 + 0,05Y + I + G + 0,9Y^* - 0,6\varepsilon Y^*$$

$$Y - 0,05Y = 15 + I + G + 0,9Y^* - 0,6\varepsilon Y^*$$

$$0,95Y = 15 + I + G + 0,9Y^* - 0,6\varepsilon Y^*$$

$$Y = \frac{1}{0,95}(15 + I + G + 0,9Y^* - 0,6\varepsilon Y^*).$$

f) $\frac{\Delta Y}{\Delta I} = \frac{1}{0,95} \Rightarrow \Delta Y = \frac{1}{0,95} \Delta I \approx 1,05 \Delta I$

The multiplier is small because the marginal tax is high and a large part of demand is directed towards foreign goods.

g) Substitution $I = 20$, $G = 30$, $\varepsilon = 1$ and $Y^* = 100$ we get

$$Y = \frac{1}{0,95}(15 + 20 + 30 + 0,9 \cdot 100 - 0,6 \cdot 1 \cdot 100) = \frac{95}{0,95} = 100$$

h) $Y = \frac{1}{0,95}(15 + 16 + 30 + 0,9 \cdot 100 - 0,6 \cdot 1 \cdot 100) = Y = \frac{91}{0,95} = 95,8$

Production decreases somewhat more (4.2 units) than the decrease in investment (4 units) because the multiplier is somewhat larger than unity.

i) From the beginning we had $G - T = 30 - (0,5 \cdot 100 - 20) = 30 - (50 - 20) = 0$.
After the decrease in production we have

$$G - T = 30 - (0,5 \cdot 95,8 - 20) \approx 30 - (48 - 20) = 2.$$

In percent of GDP the deficit is now $\frac{G-T}{Y} = \frac{2}{96} \approx 2,1\%$ so the deficit is still below the 3 percent level.

j) With a fixed exchange rate, the interest rate cannot be adjusted. For net exports to increase, wages must fall so domestic goods become cheaper.

$$k) Y^n = Y = \frac{1}{0,95} (15 + I + G + 0,9Y^* - 0,6\epsilon Y^*)$$

$$100 = \frac{1}{0,95} (15 + 16 + 30 + 90 - 60\epsilon)$$

$$95 = 15 + 16 + 30 + 90 - 60\epsilon$$

$$60\epsilon = 15 + 16 + 30 + 90 - 95 = 56 \Rightarrow \epsilon = 56 / 60 \approx 0.93$$

Thus we need a real depreciation of about 7 percent.

Explanation: Exports were 30 initially. Aggregate demand has decreased by 4 units which corresponds to about 13 percent of exports (4/30). Since the price elasticity of exports is about 2, a price decrease of about 7 percent is needed in order to achieve this increase in exports. Thus we need a substantial price change.

2.

a) If you invest one unit of the foreign currency in in the foreign currency you get $1+i^*$ in foreign currency. If you instead invest in the currency of the small open economy you get $1/e$ units of the currency of the small open economy and after one period you get $(1+i)/e$ units. When you exchange it back to foreign currency to get $(1+i)e_{+1}/e$. These two investments should give the same *expected* return.

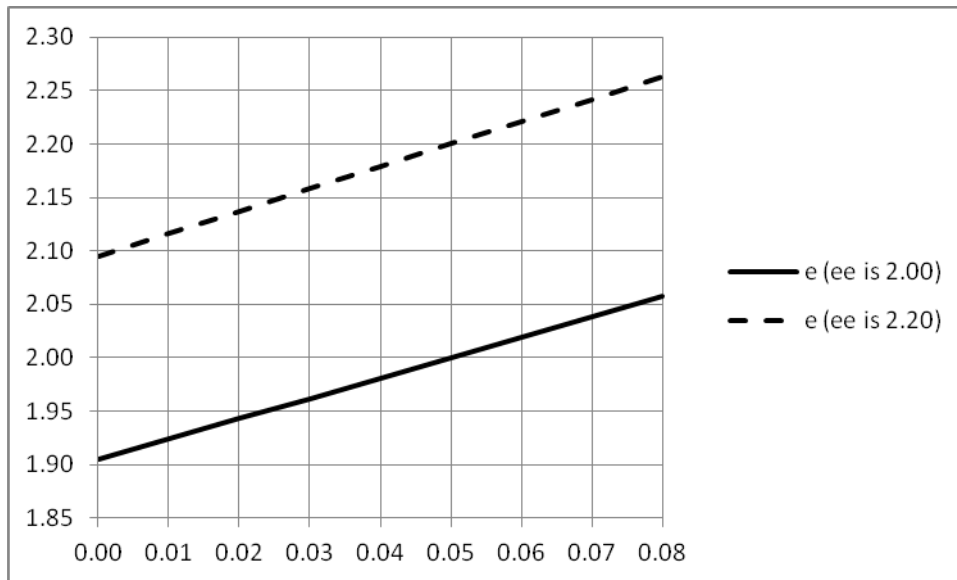
$$b) e = \frac{1+i}{1+i^*} e_{+1}^e .$$

If the domestic interest rate increases, the currency will increase in value (appreciate). A higher interest rate increases the return on loans in the currency of the small open economy. Therefore, the currency of the small open economy will increase in value until the expected return is the same as the return on loans in foreign currency.

c) With $i^* = 0,05$ we can calculate the exchange rate:

	$e_{+1}^e = 2.00$	$e_{+1}^e = 2.20$
$i = 0,04$	$e = \frac{1+i}{1+i^*} e_{+1}^e = \frac{1,04}{1,05} \cdot 2.00 \approx 1.98$	$e = \frac{1+i}{1+i^*} e_{+1}^e = \frac{1,04}{1,05} \cdot 2.20 \approx 2.18$

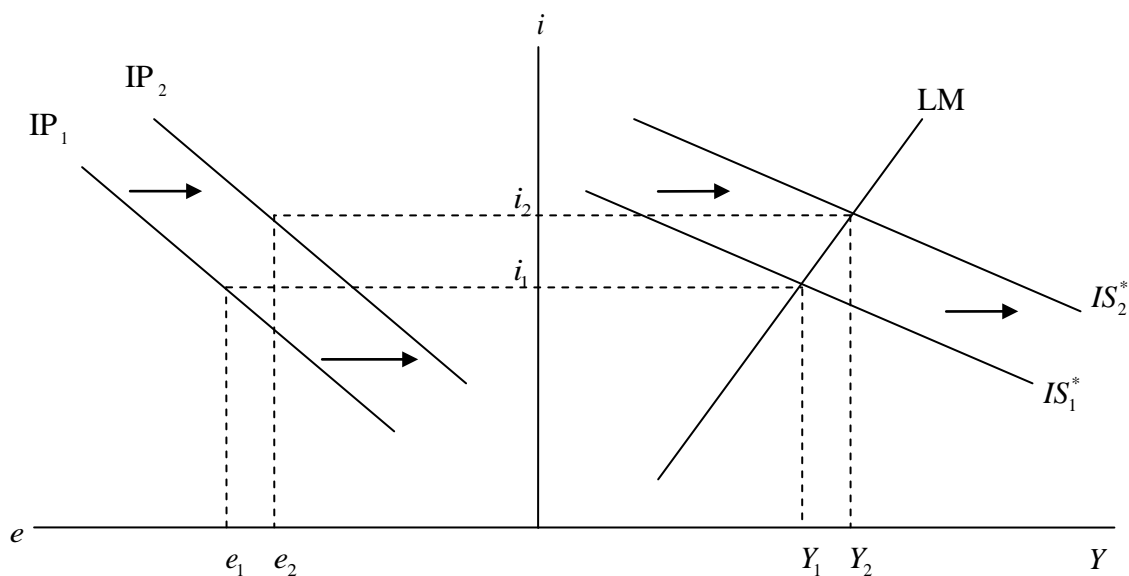
$i = 0,05$	$e = \frac{1+i}{1+i^*} e_{+1}^e = \frac{1,05}{1,05} \cdot 2,00 \approx 2,00$	$e = \frac{1+i}{1+i^*} e_{+1}^e = \frac{1,05}{1,05} \cdot 2,20 \approx 2,20$
$i = 0,06$	$e = \frac{1+i}{1+i^*} e_{+1}^e = \frac{1,06}{1,05} \cdot 2,00 \approx 2,02$	$e = \frac{1+i}{1+i^*} e_{+1}^e = \frac{1,06}{1,05} \cdot 2,20 \approx 2,22$



- d) If the expected future exchange rate increases the line shifts down so for a given interest rate, the currency appreciates (e increases) already today.
- e) If the foreign interest rate increases the line shifts up so e decreases; the currency depreciates.

3.

a)



The foreign interest rate enters the equations for the IS^* - and IP curves. It does not affect the LM curve. The IP curve shifts inwards: for each interest rate, the currency depreciates. The IS^* curve shifts outwards as the currency depreciates and this has a positive effect on aggregate demand.

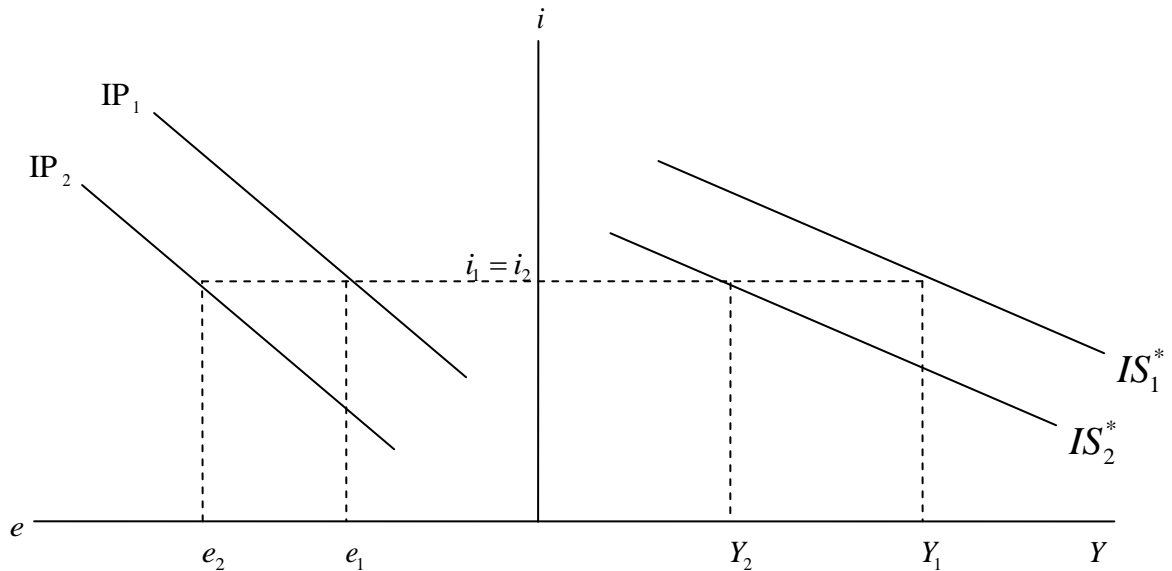
- b) Production increases, the interest rate increases, and the currency depreciates.
- c) As it is more attractive to lend in foreign currency, the investors want to buy foreign currency and the domestic currency depreciates. This increases exports and aggregate demand. As production increases there is increased demand for money and the interest rate increases. This has a negative effect on investment which counteracts the increase in production.
- d) Higher income should increase consumption but this effect is counteracted by a higher interest rate. Investment will decrease because of a higher interest rate. Net exports increase as the currency depreciates.
- e) If the central bank keeps the interest rate constant, the currency will depreciate more and there will be a larger increase in exports and production.
- f) In order to avoid overheating and higher inflation, the central bank should raise the interest rate.
- g) It is more likely that the bank of Norway will raise its interest rate.

4.

- a) The variables that are affected by the news are e^e and π^e . The expected future value of the currency increases and expected inflation falls

- b) These enter the IP- and IS* equations. For a given interest rate, the currency will appreciate so the IP curve will shift to the left.

A stronger currency means lower exports and demand so the IS* curve shifts to the left. Also, a higher expected real interest rate has a negative effect on investment.



- c) The currency appreciates and production falls.
- d) A higher expected value of the currency means that it increases in value today and this has a negative effect on exports and aggregate demand. Also, lower expected inflation means that the expected real interest rate increases and investment falls. All this leads to lower aggregate demand and production.
- e) The central bank should decrease the interest rate in order to counteract the decrease in production.
5. Higher expected future income will increase consumption and there a need for increased investment. Thus there is an increase in aggregate demand and at an unchanged interest rate there will be higher employment and inflation.
- a) An increase in taxes reduces consumption and helps to prevent overheating provided that there is not full Ricardian equivalence.
- b) A reduction in government expenditure has a similar effect.
- c) An increase in the interest rate counteracts the increase in consumption and investment. Also, the currency appreciates so there is a reduction in net exports.

Either policy would help to prevent overheating of the economy and inflation, but since the country is richer now it makes little sense to reduce private or government consumption. Higher investment is needed in order to exploit the natural resource. From this point of view it makes more sense to let much of the adjustment happen via net exports. A higher interest rate will lead to an appreciated exchange rate. Demand for domestically produced goods today has increased so it makes sense that the inter-temporal and the international relative prices of domestically produced goods both increase.