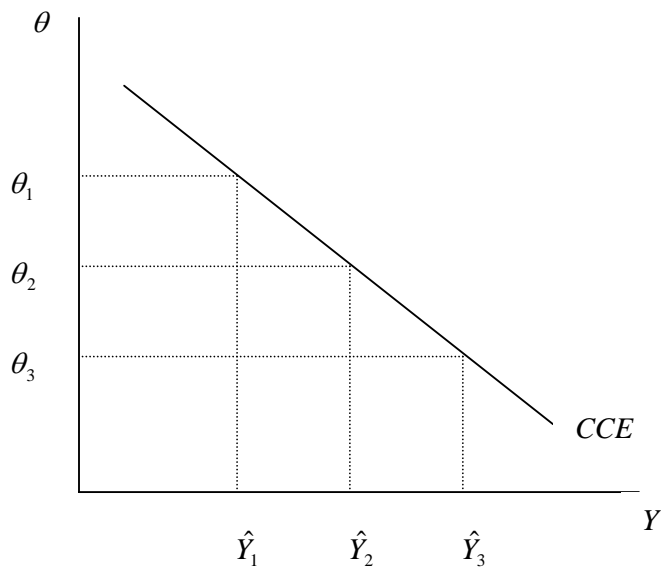
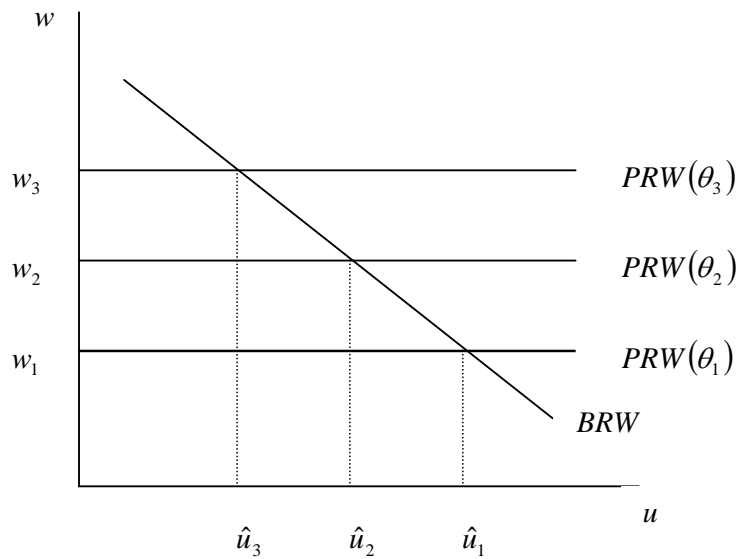


Chapter 13 review questions

1. How is the NAIRU determined in an open economy?

In an open economy the NAIRU is determined in the same way that it is determined in the closed economy. This is the level of unemployment where the bargained real wage and the price determined real wage are equal to each other. This is where the real wage aspirations of workers are consistent with the feasible real wage given firm productivity and mark-ups. At this point there is no pressure on wages or prices to change.



The main difference between the open and closed economies is that the overall price level is partly determined by the price of imported goods and services. Therefore, a different price determined real wage will result at different real exchange rates- so the NAIRU is no longer uniquely determined.

As the real exchange rate appreciates the cost of foreign goods becomes cheaper. This holds down the domestic price level, but given that productivity and mark-ups stay unchanged it increases the price determined real wage. Hence, a real appreciation lowers the NAIRU.

Long run aggregate supply is identified as the level of output consistent with the NAIRU. As the real exchange rate appreciates this level of output therefore rises. This relationship forms the competing claims equilibrium.

Algebraically:

Domestic prices are a mark up on domestic labour costs

$$P_D = (1 + \mu) \frac{W}{LP}$$

So, in a closed economy the price determined real wage can be calculated by re-arranging this price-setting rule and using $P_D = P$

$$PRW : w = \frac{W}{P} = \frac{LP}{(1 + \mu)}$$

In an open economy the price level is determined by a combination of domestically produced goods and imported goods:

$$P = \phi P_D + (1 - \phi) P_M$$

Where $P_M = EP^*$

Hence, the open economy PRW can be calculated in a number of stages:

$$P = \phi \left((1 + \mu) \frac{W}{LP} \right) + (1 - \phi) EP^*$$

First, divide both sides by P

$$1 = \phi \left((1 + \mu) \frac{W}{LP \times P} \right) + (1 - \phi) \frac{EP^*}{P}$$

Next, substitute in for the real exchange rate $\theta = \frac{EP^*}{P}$

$$1 = \phi \left(\frac{(1 + \mu) W}{LP} \frac{1}{P} \right) + (1 - \phi) \theta$$

$$1 - (1 - \phi) \theta = \phi \left(\frac{(1 + \mu)}{LP} \right) \left(\frac{W}{P} \right)$$

$$\frac{1 - (1 - \phi) \theta}{\phi} = \left(\frac{(1 + \mu)}{LP} \right) \left(\frac{W}{P} \right)$$

$$PRW : w = \frac{W}{P} = \frac{1 - (1 - \phi) \theta}{\phi} \left(\frac{LP}{(1 + \mu)} \right)$$

It is clear that $\frac{\Delta PRW}{\Delta \theta} < 0$, so real exchange rate appreciation increases the PRW.

The bargained real wage remains unchanged:

$$BRW : \frac{W}{P} = Z - \beta u$$

Hence the NAIRU (\hat{u}) is found where $BRW = PRW$.

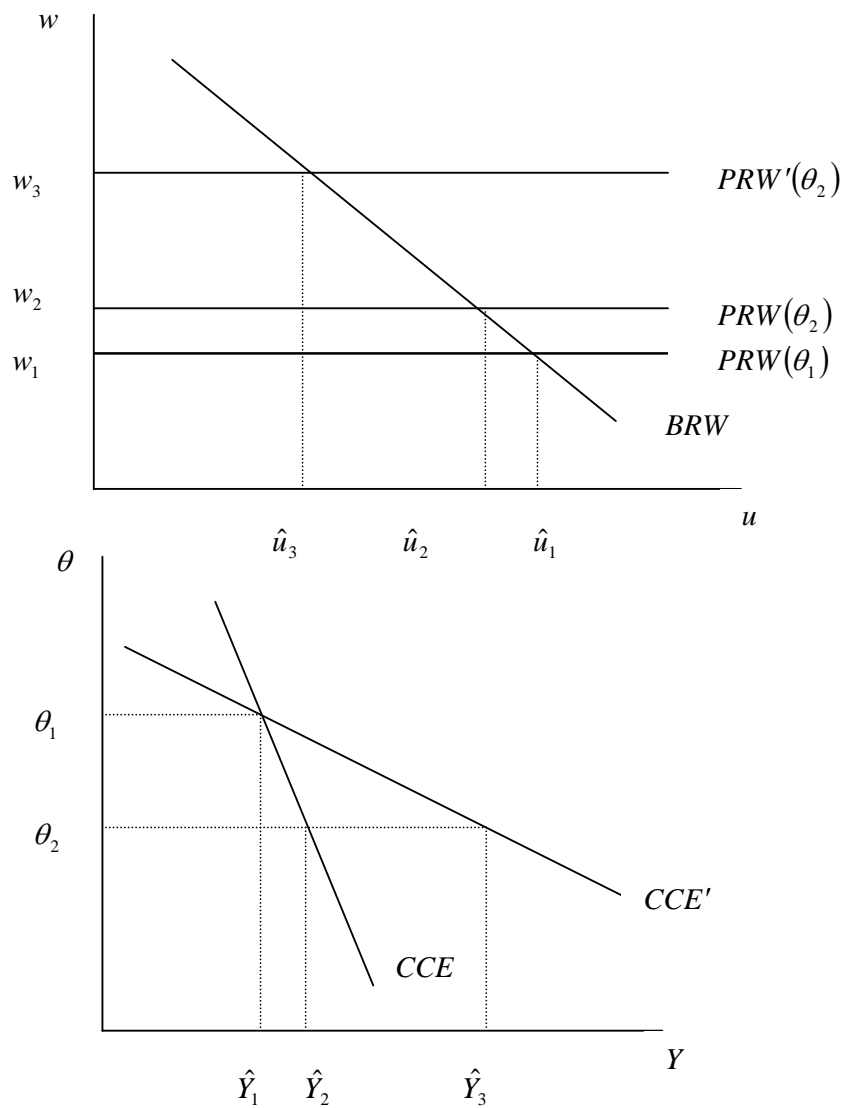
$$Z - \beta u = \frac{1 - (1 - \phi) \theta}{\phi} \left(\frac{LP}{(1 + \mu)} \right)$$

$$\hat{u} = \frac{1}{\beta} \left[Z - \left[\left(\frac{1 - (1 - \phi)\theta}{\phi} \right) \left(\frac{LP}{(1 + \mu)} \right) \right] \right]$$

This demonstrates that the NAIRU is influenced by all the same factors as in the closed economy, and also the real exchange rate θ such that $\Delta\hat{u}/\Delta\theta > 0$.

2. What factors determine the slope of the long run aggregate supply curve

The long run aggregate supply curve is the level of output consistent with the NAIRU. It can also be thought of as the level of output where the labour market is in equilibrium, so there is no pressure on the real wage to change.



The slope of the long run aggregate supply curve is determined by the proportion of imported goods in the total price level.

When this proportion is high, a real exchange rate appreciation significantly lowers the domestic price level, and hence there is a large upward shift in the price determined real wage. The fall in import prices is effectively acted as a price level subsidy, which enables unemployment to fall considerably whilst keeping the overall price level constant. Therefore the larger amount that the NAIRU fall, the higher the level of output consistent with stable prices. The long run aggregate supply (competing claims equilibrium) is flatter.

The change in the PRW following a movement in the real exchange rate can be found as:

$$PRW : w = \frac{W}{P} = \frac{1 - (1 - \phi)\theta}{\phi} \left(\frac{LP}{(1 + \mu)} \right)$$

$$\frac{\Delta PRW}{\Delta \theta} = -\frac{(1 - \phi)}{\phi} \left(\frac{LP}{(1 + \mu)} \right) < 0 \text{ as appreciation raises the PRW.}$$

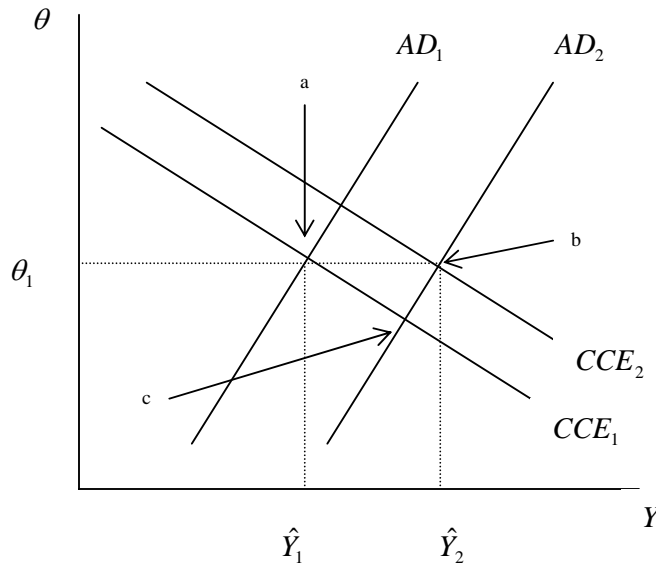
The extent depends on the parameter ϕ . If $\phi = 1$ then $\Delta PRW / \Delta \theta = 0$. This is the closed economy variant as there are no imported goods in the domestic price level. Here the long run aggregate supply curve will be vertical.

But as $\phi \rightarrow 0$ then $\Delta PRW / \Delta \theta \rightarrow \infty$. The larger the proportion of imported goods in the price level, the flatter the long run aggregate supply curve becomes relative to the real exchange rate.

3. Can shifts in the AD schedule permanently alter the NAIRU?

Hysteresis mechanisms are perfectly possible in the open economy.

Following an increase in demand output expands from \hat{Y}_1 to Y_2 (a to b). At point b the level of unemployment has risen above the NAIRU. Therefore domestic prices would be expected to increase, pushing the economy back to point c. However, if the NAIRU changes the economy's medium term equilibrium could stick at Y_2 .



From question 1 the open economy NAIRU is defined as follows:

$$\hat{u} = \frac{1}{\beta} \left[Z - \frac{1 - (1 - \phi)\theta}{\phi} \left(\frac{LP}{(1 + \mu)} \right) \right]$$

Hence the equilibrium level of output is

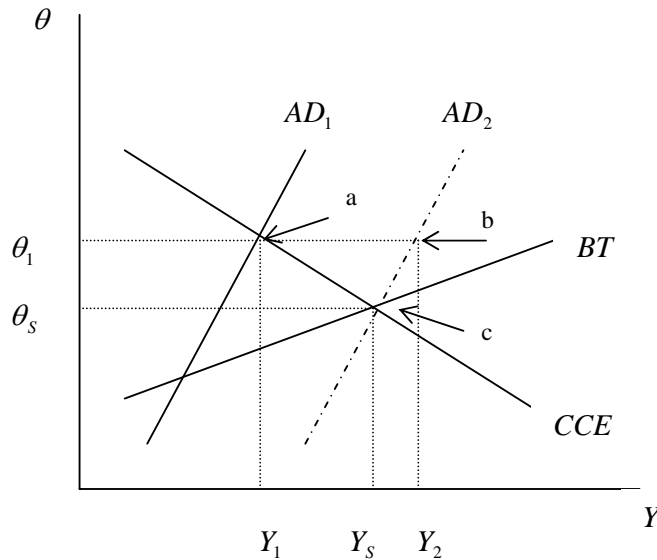
$\hat{Y} = F((1 - \hat{u})L)$ where L is the size of the labour force, so $(1 - \hat{u})$ is equilibrium employment.

There are various factors that could lower the NAIRU following a short run expansion in aggregate demand such as a rise in labour productivity LP , a fall in the number of long-term unemployed and higher search intensity β , or an increase in labour productivity.

4. An economy is currently in a position characterised by stable prices and a trade surplus.

a. Use the AD-CCE-BT model to represent this economy

If the economy exhibits stable prices, then it implies that aggregate demand equals aggregate supply and the economy is on the competing claims equilibrium schedule. However, a balance of trade surplus implies that the economy lies above the BT schedule. Therefore the economy could be identified as being at a point such as a .



b. What is the long run sustainable level of output in this economy? Explain how the economy might move to this level of output.

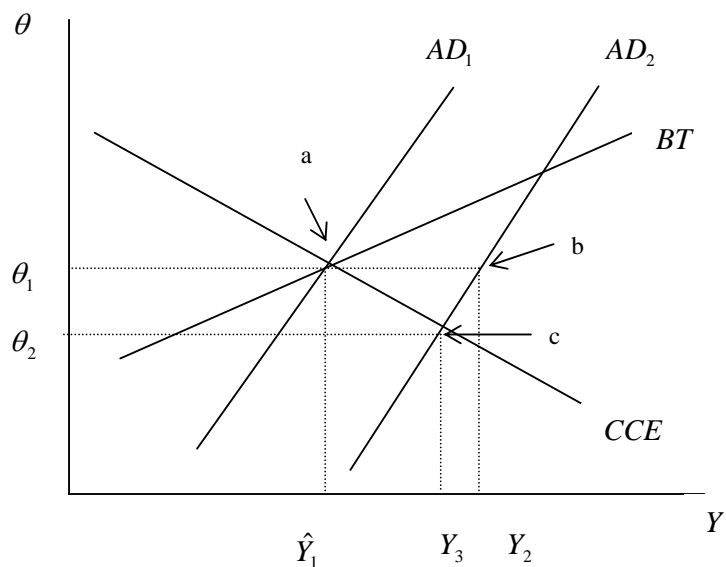
In the long run the economy will gravitate towards point *c* which we dub as the sustainable level of output. This point is consistent with internal equilibrium (the economy is at the NAIRU level of output) and external equilibrium (trade balance means the economy is accumulating neither foreign assets nor liabilities).

At point *b*, the medium run equilibrium the economy is running a trade surplus. Ultimately this requires a long run appreciation in the currency to correct- however this will put downward pressure on the price level and reduce the economy's NAIRU. Only at point *c* are the two consistent.

Equilibrium would also require an expansion in aggregate demand. This could be policy induced, by using an expansive monetary or fiscal policy when recognising that demand is below the NAIRU level of output in the long run. Alternatively it could arise automatically. Running balance of payments surpluses leads to an increase in foreign asset accumulation that builds up net-wealth and thus consumption. Alternatively, once surpluses are no longer directed towards purchasing foreign assets such as bonds, the funds can be re-directed towards domestic absorption.

5. Using the AD-CCE-BT model what would the short run and long run effects of the following:

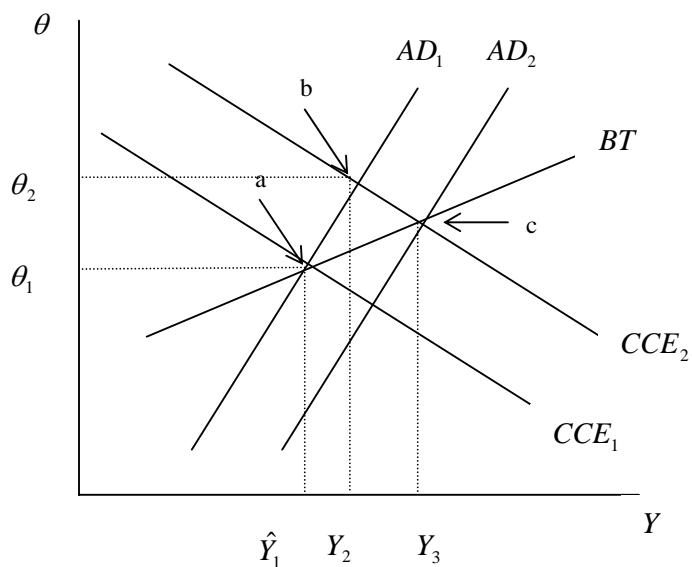
a. an increase in consumer confidence



In the short run an increase in aggregate demand sees the economy shift from a to b . Here, unemployment has fallen below the NAIRU which leads to an increase in the domestic price level, and the economy moves to point c .

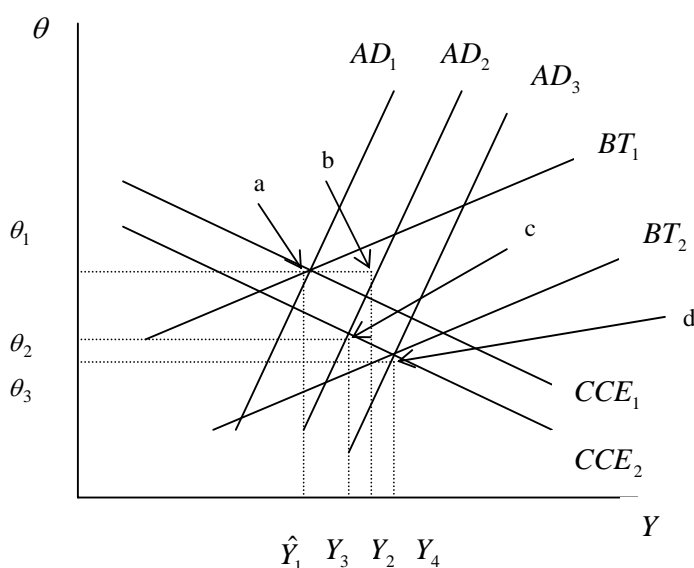
However, at point c , the economy operates a balance of payments deficit and hence starts to accumulate foreign liabilities. To correct the balance of trade a nominal (and real) exchange rate depreciation is required- but this will reduce the NAIRU level of output in the economy. The long run sustainable level of output is at point a .

b. A positive productivity shock



A positive probability shock would reduce the NAIRU and shift the CCE schedule outwards. At the existing level of output (point a) unemployment is above the NAIRU, so prices will fall and output expands to point b. As prices fall the real exchange rate depreciates moving the economy into surplus. In the long run, the real exchange rate will appreciate to its sustainable position at point c. The increase in productivity therefore allows the economy to move permanently to a higher level of output.

c. A tariff on all imports

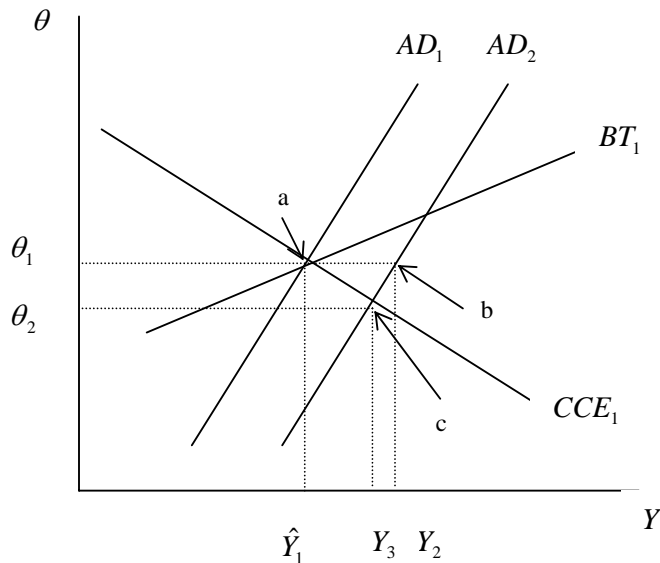


This is complicated because there is a justifiable argument that all the curves will shift. First, a tariff on imports would act to increase net-trade (providing no retaliation is carried out) so both the AD and BT schedules shift outwards. However, the tariff adds a wedge to the cost of imported goods, which should have the same impact as a rise in the overseas price level. As a result the NAIRU will fall and the CCE schedule downwards.

In the short run the economy will expand from Y_1 to Y_2 . However, in the medium term output will fall to Y_3 as prices rise. As the balance of trade is in surplus there will be a long run appreciation in the real exchange rate and output expands to Y_4 . Output is higher because the trade balance is in equilibrium at higher levels of output. Consequently the long run real exchange rate is appreciated which reduces the NAIRU.

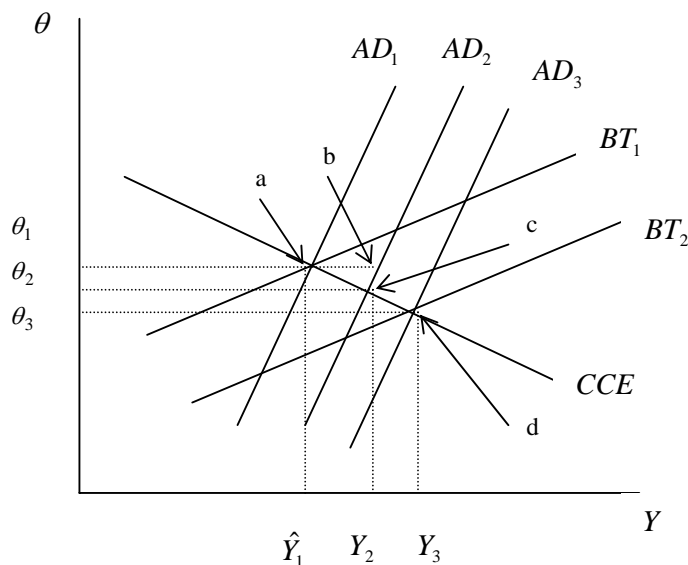
d. An increase in the money supply

An increase in the money supply will shift the AD schedule outwards but unemployment falls below the NAIRU and prices rise. In the medium term the economy moves from point a to point c.



At this point the balance of trade is in deficit so the economy is building up foreign liabilities. This requires a long run real depreciation in the currency, either through a nominal depreciation (when surpluses are no longer used to purchase foreign bonds) or through a fall in domestic prices (via a contraction in AD that increases unemployment above the NAIRU). The economy's long run sustainable position is back at point a.

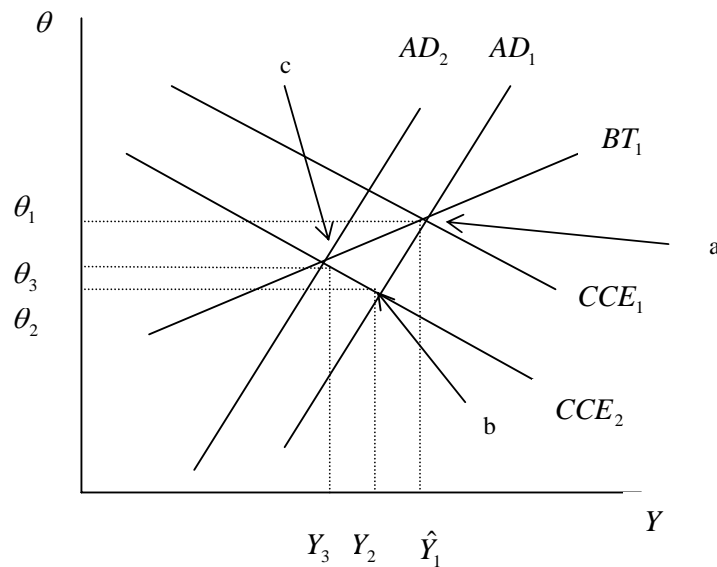
e. An increase in global demand



An increase in global demand increases exports- hence the BT and AD schedules both shift outwards. Therefore the AD and BT schedules will both shift outwards and the economy will move from point a to point b. Because unemployment is now below the NAIRU there will be upward pressure on domestic prices, and the economy will shift to point c. The balance of trade though remains in surplus. In the long run the real exchange rate will appreciate which enables the long run sustainable level of output to rise to Y_3 at point d.

f. A fall in the level of the workforce

A fall in the workforce will reduce the long run aggregate supply so the CCE schedule shifts downwards.



The current level of output is now above the long run aggregate supply level, hence prices rise and the economy moves towards point b. At this point the economy moves into a balance of trade deficit due to the real appreciation. In the long run the economy will move to point c. Output falls because the real exchange rate must depreciate in order to improve the trade balance.

6. Under what conditions will movements in the exchange rate have a large effect on the domestic price level?

In an open economy the domestic price level is determined by the prices of domestically produced and imported goods.

$$P = \phi \left((1 + \mu) \frac{W}{LP} \right) + (1 - \phi) EP^*$$

Domestic firms are modelled as setting prices as a mark up on marginal labour costs, and import prices are the prices of foreign produced goods converted into domestic currency terms using the nominal exchange rate.

This relationship suggests a direct pass through from the nominal exchange rate to the domestic price level.

$$\Delta P = (1 - \phi) \Delta E$$

A depreciation (appreciation) in the exchange rate will generate an increase (decrease) in the domestic price level.

The extent of the pass through though depends on a number of factors.

- The import content of the price level basket

The pass through will be larger when imports make up a larger proportion of the domestic price level, i.e. when ϕ is small.

These proportions though may not be independent of the exchange rate. An appreciation of the exchange rate will make domestic goods more price-competitive versus foreign goods- so may elicit substitution and a rise in ϕ . Therefore a more accurate description of the pass through will take account of the degree of substitution that arises:

$$\Delta P = (1 - \phi(E)) \Delta E \text{ where } \frac{\Delta \phi(E)}{\Delta E} > 0$$

- Pricing to market effects

In imperfect competition prices may be set for strategic reasons in order to preserve or gain market share. Therefore, firms may be prepared to adjust the margins in order to maintain the domestic price of the good or service at its target level.

If foreign firms also set prices as mark-up on marginal costs, $P^* = (1 + \mu^*)MC$, then adjustment in the mark up can reduce the impact of the exchange rate on the domestic price level.

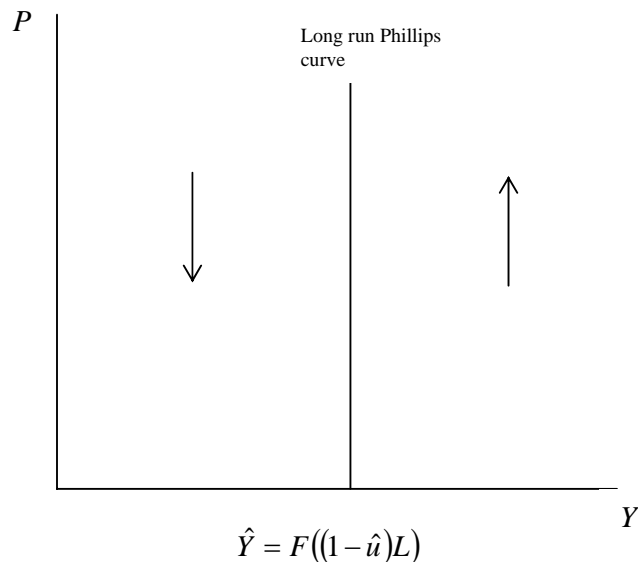
- Real wage resistance

Part of what happens to the price level is what happens to wages. Adjustment in wages could possibly amplify the effects of exchange rate pass through.

A depreciation in the exchange rate, via an increase in import prices, raises the domestic price level. This lowers the value of real wages, leading to workers to push for higher nominal wages to preserve the value of the real wage. This then feeds into the prices of domestically produced good and invokes a wage-price spiral. Alternatively, an appreciation, by lowering import prices and moderating nominal wage demands, could lead to a larger fall in the domestic price level.

More advanced questions

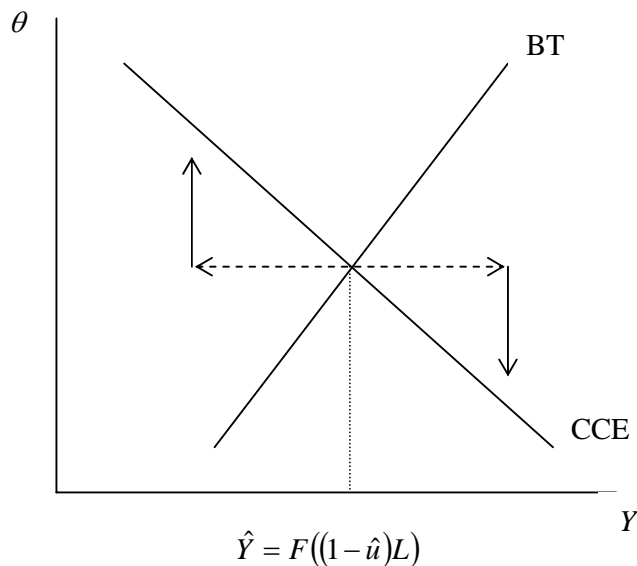
7. *Is there a three-way trade-off between unemployment, inflation and the trade balance?*



In the closed economy there is only a trade-off between inflation and unemployment. This can be seen from the long run aggregate supply curve. A position to the right of the long run aggregate supply curve indicates that unemployment is below the

NAIRU, and that prices are rising. A position to the left of the long run aggregate supply curve indicates that unemployment is above the NAIRU and that prices are falling. This bears a similar relationship to the Phillips curve.

In an open economy, there is a three way trade-off between unemployment, inflation and the trade balance.



The competing claims equilibrium (CCE) describes the level of output consistent with the NAIRU in an open economy. A position to the right of the CCE schedule again indicates that unemployment is below the NAIRU causing prices to rise (real exchange rate falls). If the economy moves to the left of the CCE schedule, then unemployment rises above the NAIRU and prices fall (real exchange rate appreciates).

In an open economy though there is added relationship. It is possible to reduce unemployment without increasing inflation if there is a fall in import prices (a real exchange rate appreciation) to offset the impact on the price level. Therefore, the NAIRU is not uniquely determined, and varies with the real exchange rate.

However- this introduces a further trade-off. A real appreciation enables unemployment to fall without increasing inflation, but moves the trade balance into deficit. An improvement in the trade deficit can be achieved from a depreciation of the real exchange rate, but this requires a rise in unemployment if the level of inflation is to be maintained.

Because import prices have a bearing on the domestic price level, in an open economy there is a three way trade-off between unemployment, inflation and the trade balance.

8. “Whether an economy is open or closed the gap between actual and equilibrium unemployment can be inferred from the change in inflation.” Discuss.

In a closed economy the NAIRU (\hat{u}_c) is uniquely determined where BRW = PRW.

$$\hat{u}_c = \frac{1}{\beta} \left[Z - \left(\frac{LP}{(1+\mu)} \right) \right]$$

Prices are a positive function of the deviation of unemployment from the NAIRU.

$$P_c = f(\hat{u}_c - u)$$

In an open economy the same relationship applies, the only difference is that domestic inflation is partly determined by import prices. As a result the open economy NAIRU (\hat{u}_o) is defined as:

$$\hat{u}_o = \frac{1}{\beta} \left[Z - \frac{1-(1-\phi)\theta}{\phi} \left(\frac{LP}{(1+\mu)} \right) \right]$$

Hence:

$$P_o = f(\hat{u}_o - u)$$

The difference between the open economy and closed economy NAIRUs can be expressed as follows:

$$\hat{u}_o = \hat{u}_c + \frac{(1-\phi)(1+\theta)}{\phi} \left(\frac{LP}{(1+\mu)} \right)$$

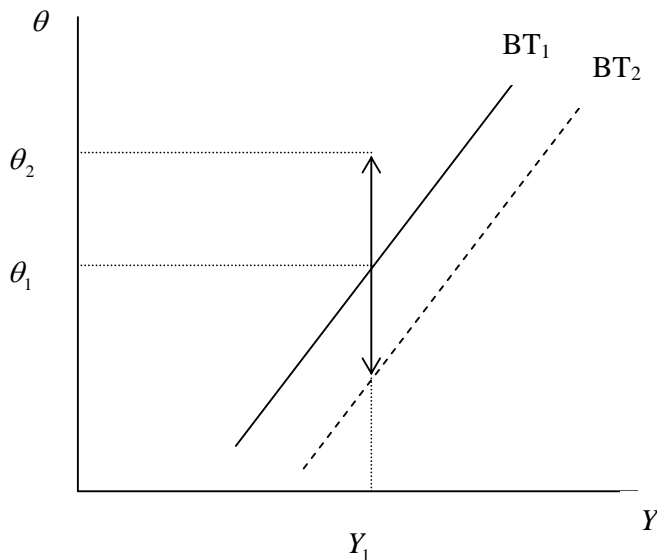
Clearly, when it's a closed economy $\phi = 1$ and $\hat{u}_o = \hat{u}_c$. Once the real exchange rate starts to appreciate ($\theta \downarrow$) $\hat{u}_o < \hat{u}_c$, and when the real exchange rate starts to depreciate ($\theta \uparrow$) $\hat{u}_o > \hat{u}_c$.

This suggests that inflation in an open economy can perhaps be expressed as follows

$$P_o = f(\hat{u}_c - u) + g(\theta)$$

This interpretation is interesting as it implies that open economy inflation can be decomposed into a labour market disequilibrium effect and also an international effect.

9. Explain how temporary movements in the real exchange rate might generate permanent effects on the trade balance? Using the AD-CCE-BT model explain what implications this effect will have on the sustainable level of output following a fiscal expansion.



At an income-real exchange rate combination (θ_1, Y_1) the trade balance is in equilibrium. A real depreciation improves the competitiveness of domestic goods relative to foreign goods and leads to an increase in net trade. Therefore at (θ_2, Y_1) the balance of trade moves into surplus.

If the real exchange rate were to depreciate back to θ_1 then it would be expected that net trades would fall and the surplus disappear. However, there may be a permanent effect on the trade balance, especially if there are sunk costs to entering and leaving markets. First, the temporary improvement in competitiveness may have allowed domestic producers to establish a beachhead in foreign markets. Having established a degree of brand awareness and loyalty, then exports may have permanently risen. Likewise, foreign producers may be forced out of domestic markets, and are unwilling to invest in re-establishing their brand when the exchange rate shifts back so imports permanently fall. This generates a permanent improvement in the BT schedule (shifting to BT_2), so even at (θ_1, Y_1) the trade balance is in surplus.

A fiscal expansion would be expected, in the medium term, to move the economy from point *a* to point *b*. Here, there is a deficit on the balance of trade, requiring long-run exchange rate depreciation. Therefore, the sustainable level of output is at point *a*.

However, in moving from point *a* to point *b* the economy has generated an increase in imports through a real appreciation and a rise in output. If this enables foreign producers to generate a degree of market power through the development of brand loyalty it is possible that import penetration has permanently risen. Therefore the BT schedule shift upwards and the long run sustainable level of output falls to Y_3 .

