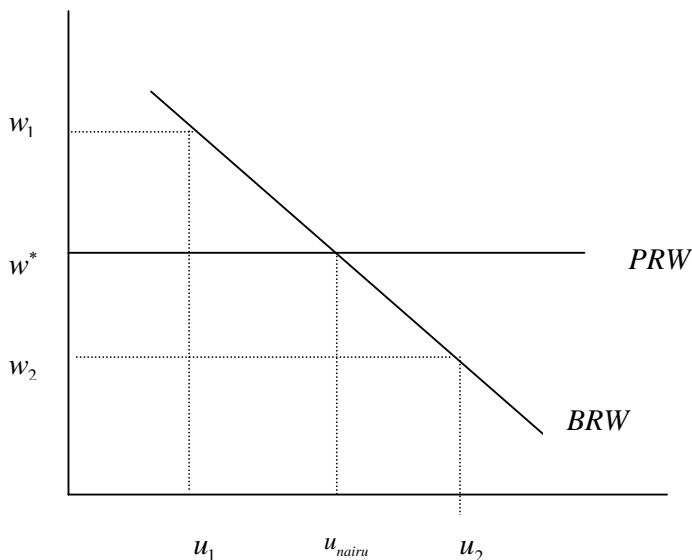


## Chapter 10 Review Questions

1. How can one account for a short-run trade-off between inflation and unemployment? What is the difference between the natural rate of unemployment and the NAIRU?

The NAIRU is determined as the equilibrium level of unemployment in the imperfect competition model. This represents a bargain over the level of real wages, where firms set prices and workers set nominal wages.



The wage setting relation is  $W = P^e (Z - \beta u)$  where  $P^e$  is the expected price level,  $Z$  a set of factors determining the bargaining power of labour, and  $u$  the rate of unemployment.

Prices are set as a mark-up over marginal costs,  $P = (1 + \mu) \frac{W}{LP}$ , where  $\mu$  is the mark-up,  $W$  the nominal wage and  $LP$  the level of labour productivity.

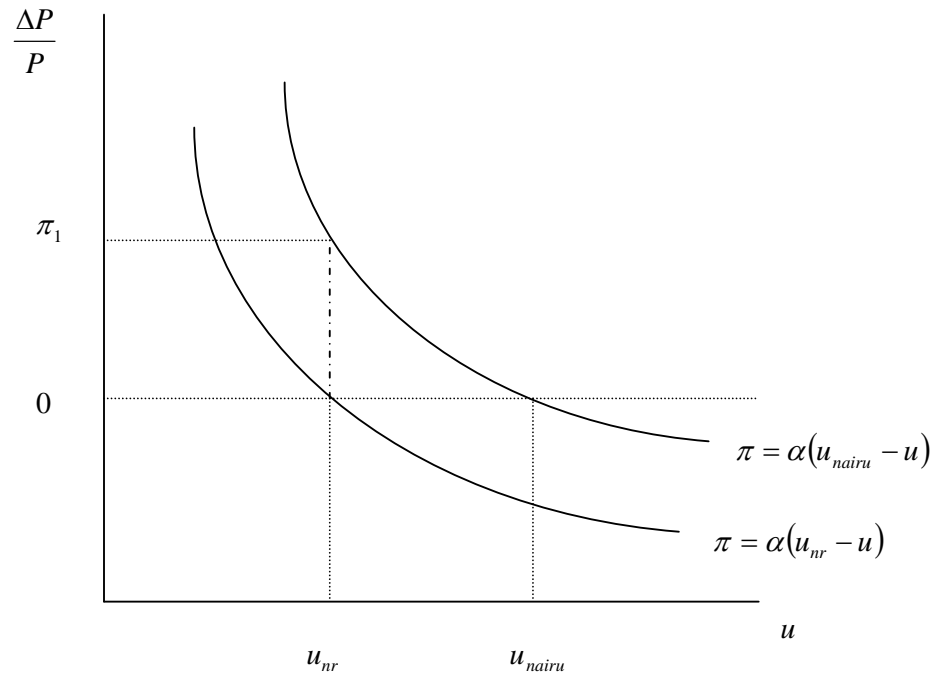
The NAIRU is defined as the point where the real wage demands of both sides of the bargain are consistent with each other. At this equilibrium position there is no pressure on either prices or wages to change.

If unemployment fell below the NAIRU, then workers will attempt to increase the real wage by bargaining for higher nominal wages. This however will then feed into the firm's price setting relationship, leading to an increase in prices if the mark-up and labour productivity remain unchanged. Likewise, if unemployment rose above the NAIRU, then workers will moderate real wage claims by reducing the nominal wage- which should then feed into prices through the price-setting relationship.

Hence, prices respond positively to the deviation of unemployment from the NAIRU.

$$\frac{\Delta P}{P} = \frac{\Delta W}{W} = f(u_{nairu} - u)$$

This gives rise to a trade-off between unemployment and inflation described by the Phillips curve.



The NAIRU and the natural rate of unemployment are often used interchangeably, although there is a subtle difference. The natural rate is the equilibrium unemployment rate in a competitive labour market, whereas the NAIRU refers to an imperfectly competitive one.

The natural rate of unemployment lies below the NAIRU. This is because in competitive markets the price level is equal to the marginal cost, where imperfect competition leads to a wedge between marginal costs and prices. Because of the higher price level, the feasible real wage that firms can afford at each level of unemployment is lower, hence equilibrium in the labour market requires a higher rate of unemployment,  $u_{nairu} > u_{nr}$ .

Imperfect competition leads to the presence of an inflation wedge in the Phillip curve. This is the level of inflation that would arise if a economy characterised by imperfect competition tries to assert the natural rate of unemployment.

$$\text{Inflation wedge} = \pi_1 = \alpha(u_{nairu} - u_{nr}).$$

2. The Phillips curve is written as:

$$\pi_t = \pi_{t-1} + 0.8(0.05 - u)$$

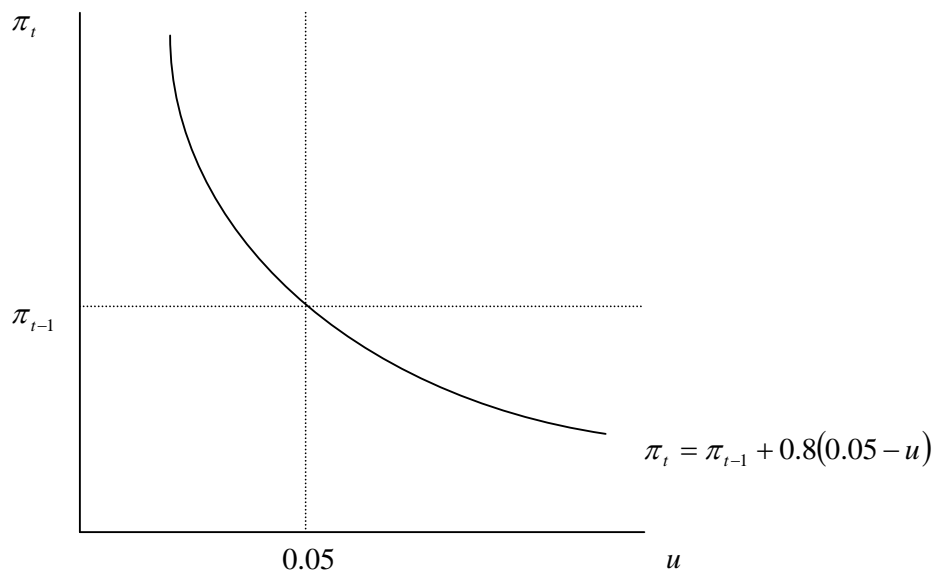
a. What is the natural rate of unemployment?

The natural rate of unemployment is where inflation is constant,  $\Delta\pi_t = \pi_t - \pi_{t-1} = 0$ .

$$\pi_t - \pi_{t-1} = 0.8(0.05 - u) = 0$$

$$u_{nr} = 0.05 \text{ or } 5\%.$$

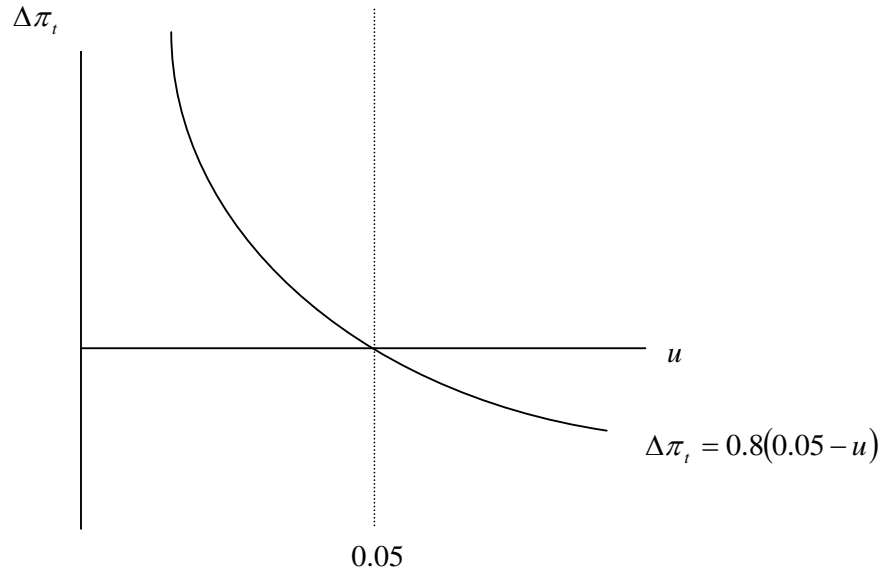
b. Graph the relationship between inflation and unemployment; graph the relationship between the acceleration in inflation and unemployment.



The Phillips curve, when unemployment is equal to the natural rate inflation remains unchanged at its previous level. The rate of inflation rises at any level of unemployment below 5%, and falls at any rate of unemployment below 5%.

The acceleration in inflation roughly corresponds to the change in inflation, which equals:

$$\Delta\pi_t = \pi_t - \pi_{t-1} = 0.8(0.05 - u)$$



The plot of the accelerationist Phillips curve highlights that the rate of inflation is only constant when unemployment is at its natural rate of 5%. If unemployment were to exceed this rate then inflation would decelerate, if unemployment were to fall below 5% inflation would accelerate.

*c. What level of unemployment is required to reduce inflation by 3%?*

From the accelerationist Phillips curve we require  $\Delta\pi_t = -0.03$ , hence

$$-0.03 = 0.8(0.05 - u)$$

$$-0.03 = 0.04 - 0.8u$$

$$0.8u = 0.07$$

$$u = \frac{0.07}{0.8} = 0.0875 \text{ or } 8.75\%.$$

To reduce inflation by 3% a temporary increase in unemployment to 8.75% is required.

*d. What policies can the government use to achieve a 3% fall in inflation?*

Unemployment can be raised by 3.75% through a demand contraction – either tightening monetary policy by increasing interest rates or limiting credit creation, or through fiscal policy by raising taxes or cutting government spending. This contraction is only required for one period, as once inflation has fallen to its required level it can be held there by moving unemployment back to the natural rate. If this doesn't happen inflation will continue to fall by this rate each period.

A short sharp contraction will therefore hit the inflation target. If though the government wished the inflation adjustment to be less severe it could have achieved the same target through a smaller but more protracted contraction. For example, if unemployment was raised to 6% then inflation would fall by 0.8% per year. This is deduced from the Philips curve:

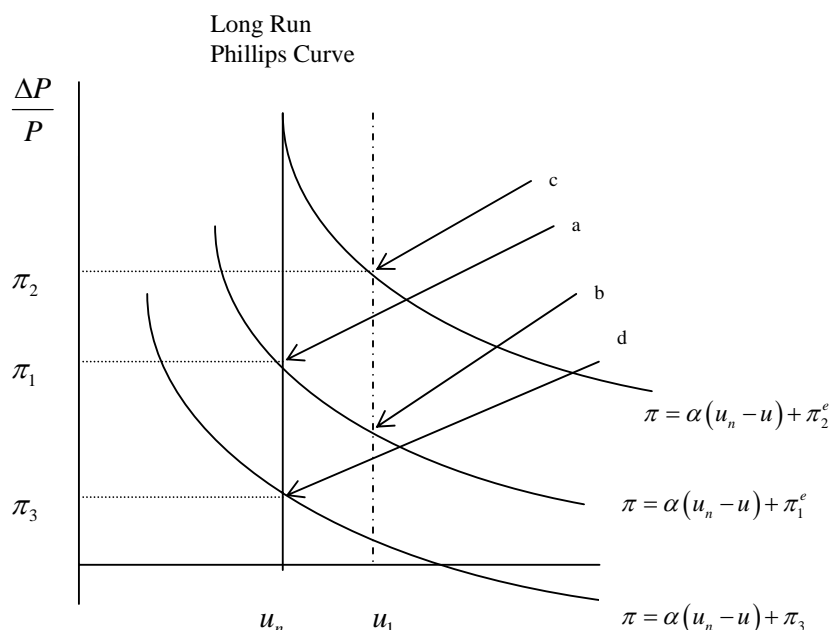
$$\Delta\pi_t = 0.8(0.05 - 0.06) = -0.008$$

Hence, at this rate inflation will have fallen by 3% within  $0.03/0.008 = 3.75$  periods.

Alternatively, inflation can be lowered by reducing the natural rate of unemployment by 3.75% to 1.25%. However, after one period the economy can be expanded to keep unemployment at this level otherwise inflation will continue to decelerate further. There are several supply-side policies that might be used to achieve this, but all are connected with either improving the productivity or efficiency of labour and capital, or by increasing the total supply through incentives to work or invest. Conventional wisdom though argues that supply-side (shifting the long run aggregate supply curve of the economy) is part of longer-term policy making.

*3. Suppose a government overestimates the NAIRU and attempts to prevent inflation from rising by contracting aggregate demand. Show the likely outcome of this policy in the short run and the long run.*

This describes a situation where the economy is at the NAIRU, but the government mistakenly believes that the NAIRU is in fact higher. The economy is actually at point *a*, but if the government perceives the NAIRU to be at  $u_1$  they believe the economy will move to a point such as *c*. Because current unemployment is below the perceived NAIRU, inflation would accelerate. In order to prevent this they may undertake a contractionary policy with the view of moving the economy to point *b*. Unemployment will return to the estimated NAIRU, but inflation will be prevented from accelerating.



If the government believes the NAIRU to be at  $u_1$ , then point b is a stable equilibrium in the economy. But because they are wrong in their estimates of the NAIRU, the economy was actually in a stable position at the original point a. The policy of increasing unemployment to prevent the acceleration of inflation just moves the economy into a recession with unemployment exceeding the NAIRU.

At point b, the rise in unemployment, via a reduction in nominal wage growth will lead to a reduction in inflation. As inflation expectations are updated this will lead to a further deceleration in wage and price inflation. The economy will return to the NAIRU, but with lower equilibrium inflation at point d. Unemployment falls because as long as the actual rate of unemployment exceeds the NAIRU, the real wage demanded by workers will fall below the feasible real wage afforded by firms given labour productivity and product market conditions.

#### 4. Under what circumstances is it possible to reduce inflation without increasing unemployment?

The Phillips curve posits a short run trade-off between inflation and unemployment, so inflation can only be reduced by increasing unemployment above the NAIRU ( $u_n$ ). However, the long run Phillips curve is vertical at the NAIRU and argues that there is no long-run trade-off between inflation and unemployment. Each point on the long run Phillips curve plots unemployment at the NAIRU, but the prevailing rate of inflation depends on inflation expectations.

A painless inflation, in terms of not increasing unemployment above the NAIRU, can be achieved if inflation expectations can be reduced. This simply leads to a downward shift in the short run Phillips curve, and the rate of inflation, whilst staying on the long run Phillips curve. No increase in unemployment is required.

An understanding of the importance of expectations can be seen from the interaction of the wage-setting and price-setting models

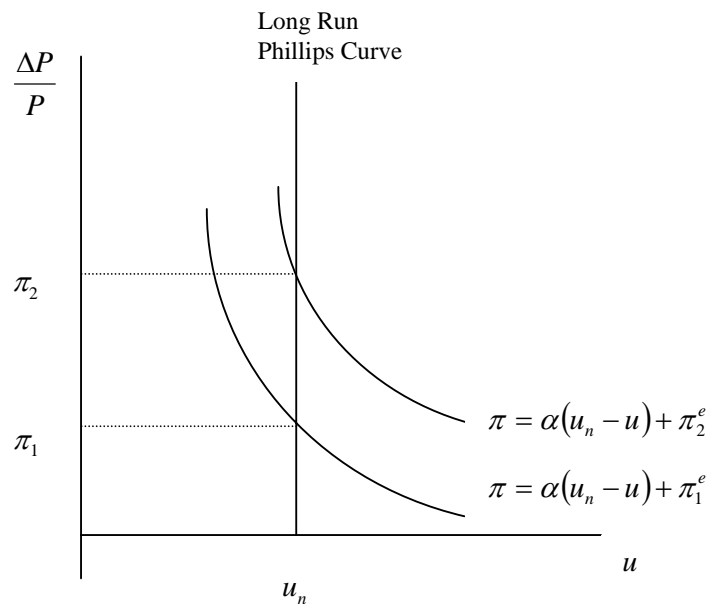
$$W = P^e (Z - \beta u)$$

An increase in price expectations leads to an increase in nominal wage demands.

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

An increase in nominal wage demands feeds directly into an increase in prices. Therefore there is a chain linking price expectations to actual prices in this bargaining framework.

$$\frac{\Delta P^e}{P^e} \rightarrow \frac{\Delta W}{W} \rightarrow \frac{\Delta P}{P}$$



A fall in inflation expectations  $\pi_2^e \rightarrow \pi_1^e$  simply acts to reduce actual inflation from  $\pi_2 \rightarrow \pi_1$  whilst unemployment remains at the NAIRU ( $u_n$ ). There is an intuitive

reason as to why the NAIRU remains unchanged. Because wages and prices are growing at the same rate, the real wage in the economy ( $w = W/P$ ) remains unchanged. Therefore, there is no change in or movement along either the PRW or the BRW schedules so the labour market remains in equilibrium.

This also accounts for how there can be a constant real wage at the NAIRU, but still a positive but stable rate of inflation. If wages and prices increase in the same proportions then the real wage will remain constant. If workers believe price inflation to have slowed, then maintaining the same real wage will require a smaller increase in the rate of growth of nominal wages- which then feed through into actual price inflation.

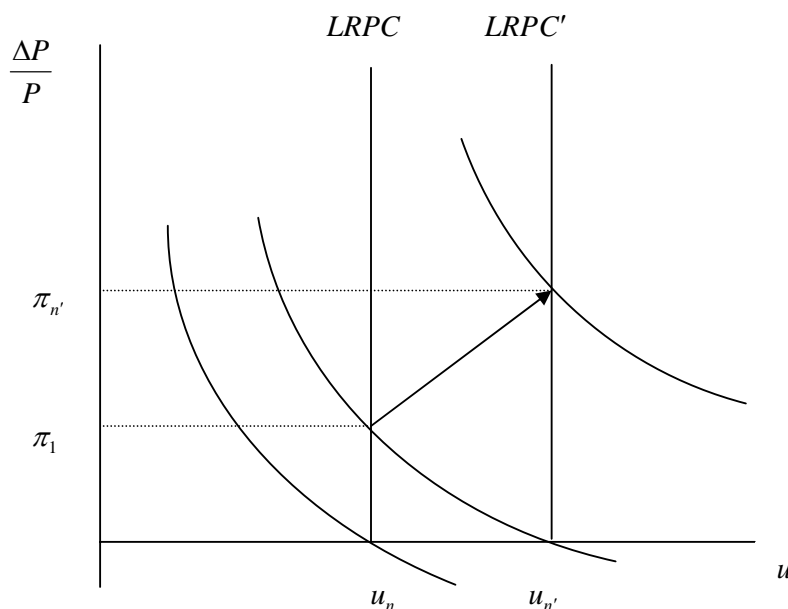
If this expectations route does not work, then policy-makers will have to influence nominal wage growth directly through unemployment. From the wage setting schedule, an increase in unemployment would lead to workers cutting nominal and real wages. Lower nominal wages will then feed through to price setting.

This process highlights two important factors concerning inflation expectations. First, if expectations are updated slowly in a backward-looking process it will be impossible to reduce inflation without increasing unemployment. Second, even if expectations adjust quickly the presence of nominal rigidities preventing the rapid adjustment of wages and prices might prevent inflation from falling.

### More advanced problems

5. What would be the effects on inflation and unemployment of:

a. A substantial rise in oil prices





If the bargained real wage is  $BRW = \frac{W}{P} = Z - \beta u$  and the price determined real wage

is  $PRW = \frac{W}{P} = \frac{LP}{(1+\mu)}$ , then the NAIRU can be found where  $BRW = PRW$ .

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

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

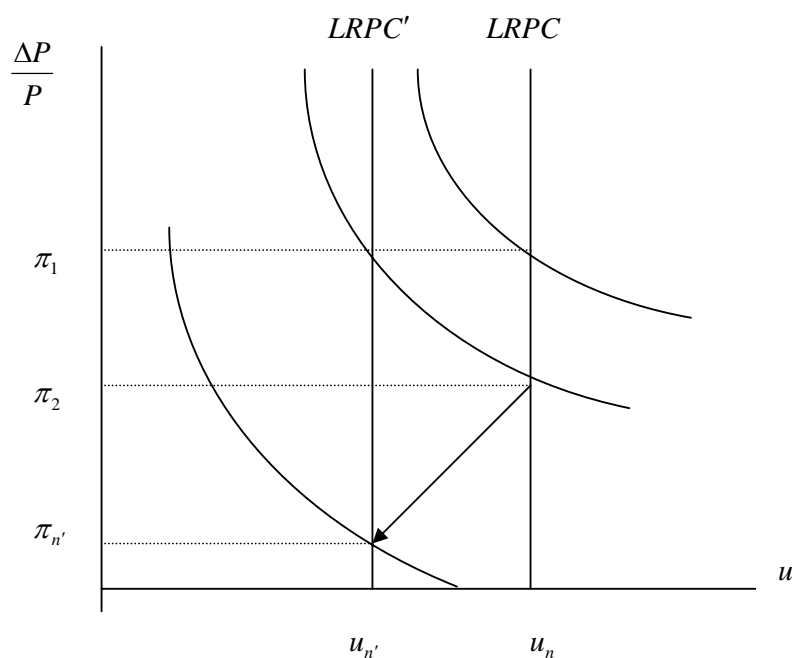
Therefore a fall in labour productivity induced by a rise in oil prices implies a rise in the NAIRU. This will shift the long run Phillips curve to the right so current unemployment now lies below the new NAIRU.

At the current level of inflation expectations, the rise in the NAIRU will induce accelerating inflation to the rate  $\pi_1$ . Inflation will continue to rise as long as the unemployment rate remains below the NAIRU, and that inflation expectations are adjusted upwards in line with actual inflation.

The new equilibrium position in the economy will be where unemployment equals the NAIRU, and inflation expectations are consistent with actual inflation at the rate  $\pi_{n'}$ .

*b. a major improvement in productivity*

This would have entirely the opposite impact as that described in part a.



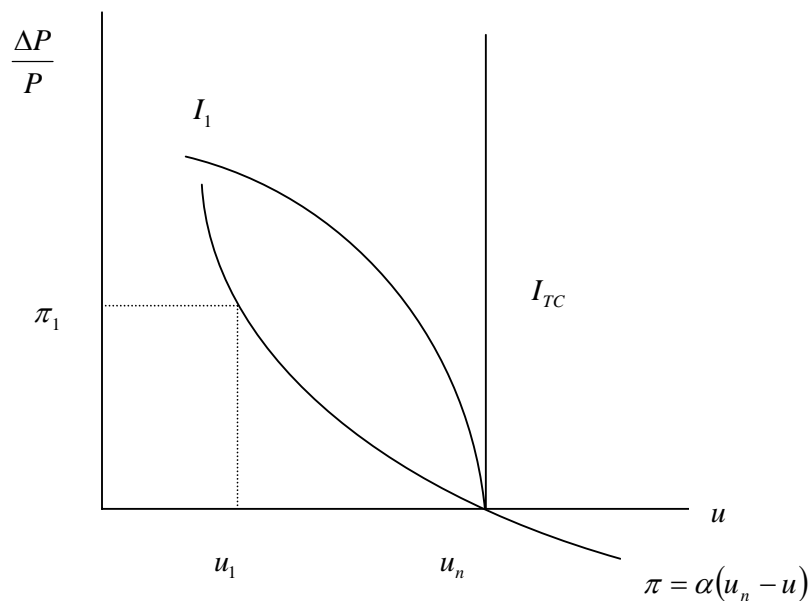
An improvement in productivity will reduce the NAIRU. Therefore, at the current rate of inflation expectations there would be a fall in the rate of inflation, reflecting the fact that unemployment is above its new NAIRU. Inflation will continue to decelerate as long as inflation expectations are adjusted downwards, and that unemployment remains above the new NAIRU. The new equilibrium position will exhibit both lower unemployment and inflation.

*c. A reform of labour market institutions*

This would be expected to have the same consequences as a rise in labour productivity. By reducing the bargaining strength of labour, directly through regulation on trade unions power etc. or indirectly through attempts to increase competition, the bargained real wage will fall at all levels of unemployment. Hence the long run NAIRU will also fall.

Given that workers now target lower real wages at each level of unemployment, firms can afford to hire more labour given the levels of the mark-up and productivity. Price inflation will fall because workers will push for a lower rate of nominal wage growth in order to reduce the real wage, and also because inflation expectations will fall.

*6. The government can do nothing about the NAIRU, so should just target inflation and let unemployment settle at the lowest rate possible?*



The government has preferences over inflation and unemployment that can be represented by a suite of indifference curves ( $I$ ). Because inflation and unemployment both give disutility, these are concave to the origin and welfare is enhanced by moving onto lower curves.

The NAIRU determines the level of unemployment where the rate of inflation is constant. Any position away from this level can only be held temporally, and adjustment back to the NAIRU will lead to a permanent change in the level of inflation. This determines the position of the long run Phillips curve. Therefore, in the long run it is likely that the government should maximise utility subject to this constraint. This will invariably lead to an outcome of trying to move the economy to a point towards the bottom of the long run Phillips curve.

In the short run a preferred position can be achieved by exploiting the short-run Phillips curve trade-off. This enables unemployment to be traded off for higher inflation, but only in the short run. Reducing unemployment below the NAIRU will induce an acceleration in inflation that would lead to a worse long run position, i.e. higher up the long run Phillips curve. For this reason, the government may be best advised to allow unemployment to settle at the NAIRU and then just target a low rate of inflation.

However, in the long run the government can permanently move to a lower indifference curve by shifting the long run Phillips curve to the left. This however would require policies to reduce the NAIRU through supply side policies.

From question 5, the NAIRU is defined as:

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

Hence a reduction in the NAIRU can be achieved by:

Increasing  $\beta$ : This raises the sensitivity of real wage aspirations to the level of unemployment. Therefore the bargained real wage curve will pivot downwards and the NAIRU will fall. This could be achieved through policies to increase the job search intensity of unemployed workers. The long-term unemployed are specifically prone to lose motivation and suffer alienation. Attempt to increase labour mobility may also act to curb insider power in labour markets, meaning that unemployed workers can compete more effectively with existing employed workers.

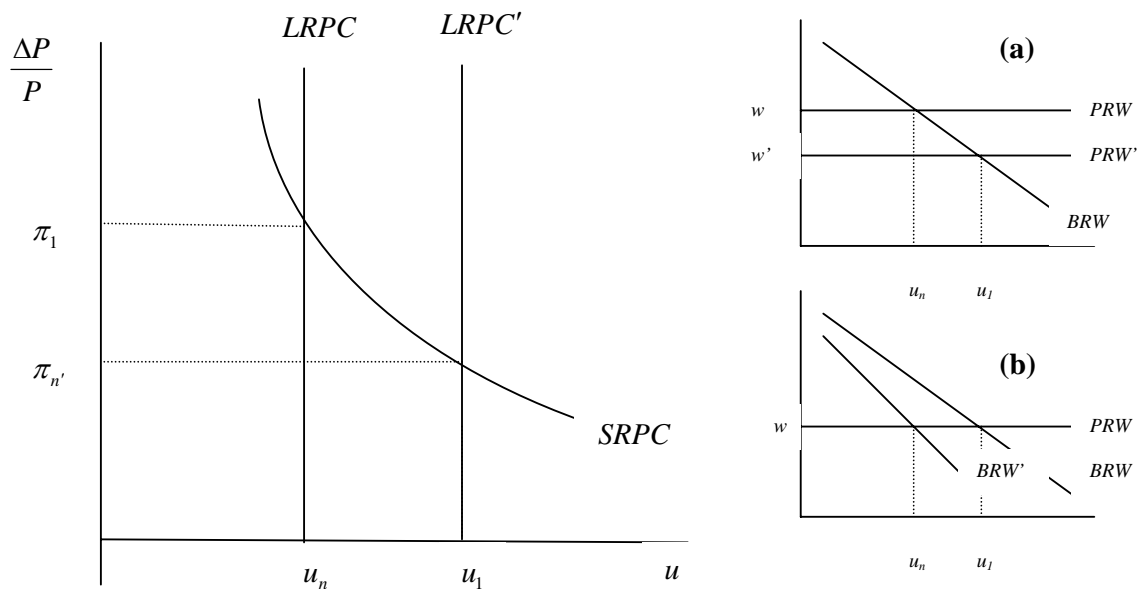
Reducing  $\mu$ : A lower mark-up enables a higher price determined real wage and a fall in the NAIRU. This could be achieved by increasing competition in product markets, perhaps through competition policy.

Increase LP: Higher labour productivity also increases the price determined real wage schedule, enabling a higher level of real wages to be paid in the economy. Therefore more workers can be hired without placing upward pressure on prices. Typical policies to improve productivity may consist of encouraging investment in skills and innovation.

Reduce Z: This is a catch-all variable that picks up factors affecting the bargaining power of labour. A lower Z reduces real wage aspirations, and therefore employment can expand without inducing inflation. Policies that might achieve could include direct controls on labour power such as trade union reform; reductions in the alternative wage which is affected by the generosity of unemployment benefits, redundancy payments and lower minimum wages; and by making the labour market more competitive- both domestically and internationally.

### 7. Explain how a recession might raise the NAIRU.

Hysteresis refers to the case where temporary or short run movements in the NAIRU can be propagated into medium or long term effects. As a result, changes in unemployment that arise in the short run can become very persistent or even permanent.



For example, the economy starts off at the NAIRU, but following a recession unemployment rises to  $u_1$ . If the usual dynamics play out, the economy will return to the NAIRU but inflation will decelerate. This is because at high unemployment real wage aspirations of workers fall, which both prices them back into employment but also through a wage-price spiral lowers the expected and actual rate of inflation prevailing in the economy.

This mechanism though will be shut off if the NAIRU also increases to  $u_1$ . Because bargained and price determined real wages are now consistent at this level of unemployment, there will be no further pressure on either unemployment or inflation to fall.

A hysteresis mechanism is anything that leads to a temporary change in unemployment becoming permanent. This would arise through something influencing the components of the wage bargaining process.

For example, (see panel (a)) a rise in unemployment may act to reduce labour productivity and shift the price determined real wage upwards. This could be the result of skill degradation from unemployment, or lower capital investment due to a depressed economy.

Alternatively, the bargained real wage may shift or pivot upwards (see panel (b)). There are numerous effects which may cause this to happen. An increase in unemployment may raise the level of long-term unemployed and reduce the search intensity of unemployed workers, so real wages become less sensitive to unemployment. If powerful insider-outsider effects occur a similar situation would arise if the higher unemployment displaces previous insiders into the pool of outsiders- who have little power to influence the wage bargain.

*8. What are the costs of inflation? Does the control of inflation deserve its pre-eminent position in policy circles?*

If inflation is unanticipated, then it may generate redistribution effects if contracts are not sufficiently flexible. An unexpected rise in inflation will most significantly redistribute from savers/lenders to borrower. This is because the real interest rate on debt is reduced, but also higher inflation erodes the value of nominal liabilities. It also benefits price-setters (firms) over wage-setters (wages) by reducing the real wage.

Fiscal drag occurs when nominal wages are updated for inflation, but income tax thresholds remain unchanged. This has the tendency to drag households into higher tax brackets- therefore generating redistribution from tax payers to government. Also, those on fixed incomes, which are predominately those that live on social security payments, may see the real value of this income decline.

Almost all of these re-distributive effects could be countered by specifying contracts that take account of inflation. If these variables were indexed, so adjust automatically to inflation, then the real value of these variables could be maintained even if inflation was unexpected.

When inflation is anticipated it can still produce menu and shoe leather costs. These are the real resources that are consumed in dealing with changes in prices. Menu costs refer to the costs of reprinting menus- but could apply to any record of sales prices such as brochures etc. If prices rise, then more money is required to undertake the

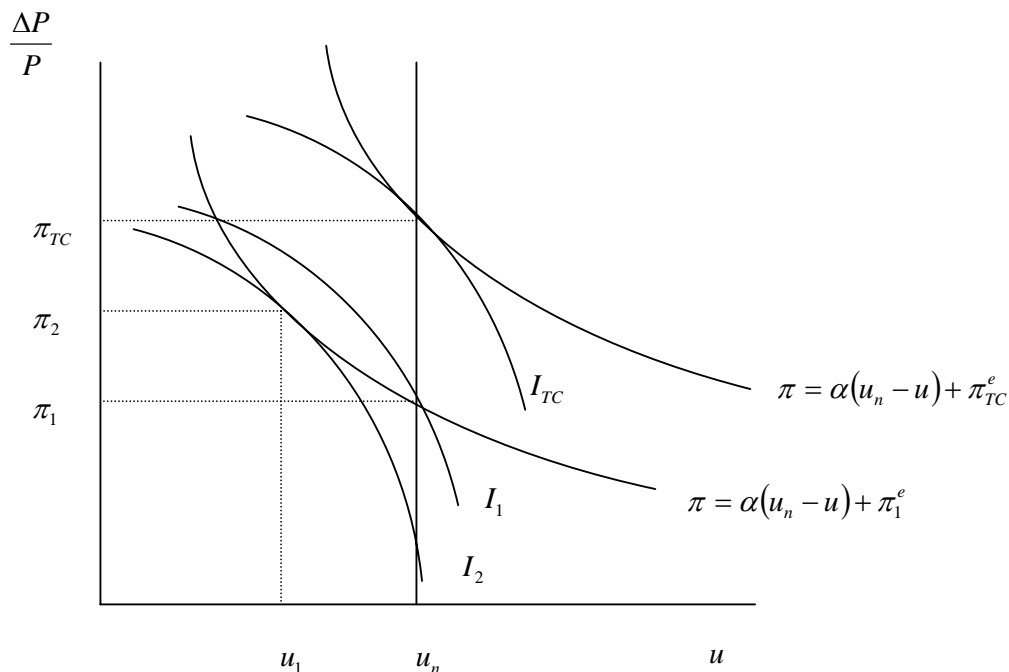
same transactions. the cost of dealing with this is known as shoe-leather costs, because it is symbolised with people having to make more trips to the bank.

Since the 1970s economic policy-making has shifted away from the target of full employment towards maintaining price stability, or low and stable inflation. This change in ethos partly reflects the poor performance of demand-management programs designed to maintain full employment- but largely responsible for stop-go cycles in the economy. Also, prior to the 1970s high and persistent inflation was not a feature of developed countries, and therefore the control of inflation wasn't a major macroeconomic policy objective.

The rise of inflation was deemed to create instabilities in the economy that might be detrimental to its long term growth prospects. Sharp fluctuations in prices make it difficult for firms to evaluate the real value of future cash flows. Price stability is also likely to be transmitted into nominal and real interest rate instability. Therefore, in an era of inflation, policy-makers saw their responsibility as creating a stable macroeconomic environment characterised by low inflation and predictable interest rates.

This change in emphasis has led to monetary policy rising in significance to fiscal policy. In terms of maintaining inflation targets fiscal policy is hampered by a lack of flexibility (it can only be adjusted from time to time), and is also affected by Lucas critique issues, as well as having the added complication of affecting the composition as well as the level of output.

9. 'Policymakers would better attain their macroeconomic objectives if they had their discretion taken away from them.' Discuss



Policy-makers face difficulties because low inflation announcements are ‘time-inconsistent’. Suppose inflation was at its time consistent level,  $\pi_{TC}$ , yet the government wished to reduce inflation to a target of  $\pi_1$ . On announcement, if this target was credible the private sector would reduce their inflation expectations to this level and the economy would experience a painless disinflation.

However, this policy is unlikely to work. If the private sector sets inflation expectations equal to  $\pi_1$  the government faces an incentive to unleash an inflation surprise, and trade-off higher inflation for lower unemployment. This is because the government can move onto a lower indifference curve as a result. In fact, the lowest level of inflation where this incentive does not exist is  $\pi_{TC}$  - this would be a time consistent inflation announcement.

The difficulty, in terms of credibility, arises because the government has preferences for both low inflation and unemployment and might be prepared to exploit a short run Phillips curve trade-off. If monetary policy is delegated to a body that has no preference for unemployment, then the time inconsistency problem disappears.

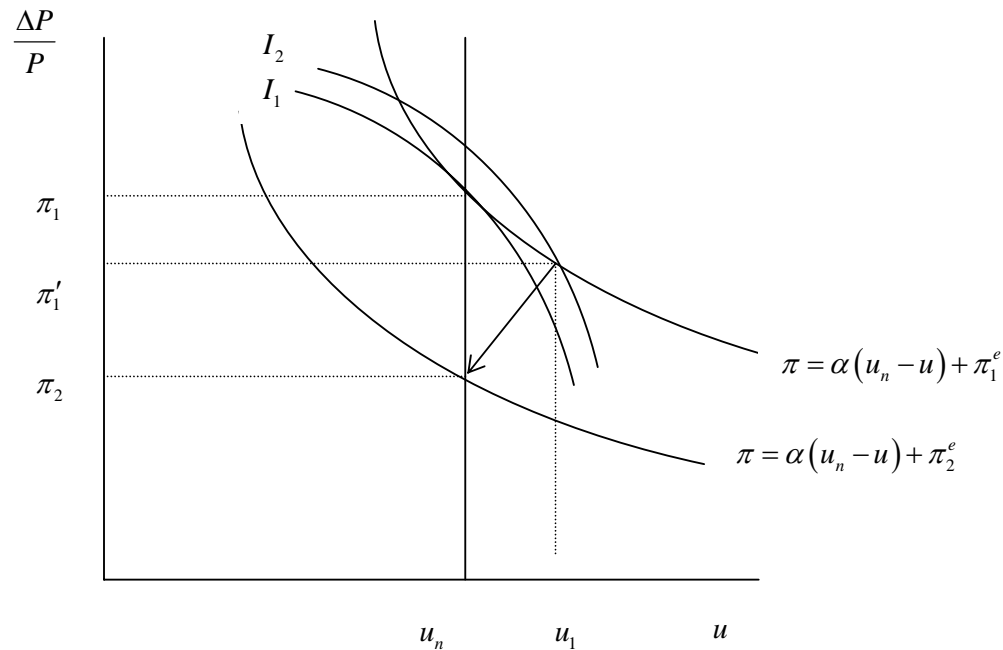
There are however some costs to delegating monetary policy to a body such as an independent central bank. First, the government loses control of a lever it could otherwise use to control the economy, so delegation may involve stabilisation costs for output. Secondly, if monetary and fiscal policies have competing objectives, then a lack of coordination could ensure that pushes the economy towards an inferior equilibrium position.

#### *10. Would a decrease in the central bank's inflation target affect the level of unemployment?*

If monetary policy is credible, then low inflation announcements would lead directly to a reduction in inflation expectations. These will then feed through the price-setting process into actual inflation. As a result there is a painless disinflation to the new target.

For policy to be credible, the private sector has to believe that the central bank would be prepared to raise interest rates and push unemployment above the NAIRU to force inflation down to target- if necessary. Therefore, the private sector would not see fit to try and call the bluff of the central bankers.

If central bankers were concerned about inflation, then a rise in unemployment would lead to a shift on a higher indifference curve. Under these conditions the resolve of the central bankers to actually take the painful policy action if required may be weak. Therefore, the private sector may be prepared to question whether the new inflation target will be enforced.



Credibility over inflation announcements therefore arises from the single-mindedness of central bankers to target inflation and ignore other possible macroeconomic objectives. There are various ways in which credibility can be achieved:

- delegation of policy to an independent central banker with a strong reputation for being inflation adverse.
- designing contracts to encourage central bankers to behave in a particular way
- allowing the central bank to build a reputation for being tough on inflation over time.

*11. During World War II, both Germany and Britain printed large amounts of the others currency. Why might dropping this on an enemy city cause more damage than high explosives?*

The basic rationale is related to the quantity theory of money. A dramatic increase in the money supply would generate high levels of inflation, which may undermine the domestic currency as a medium of exchange. This could then lead to economic and political disruption. If the currency becomes worthless then agents may have no other choice but to barter.



*12. Explain the roles of monetary and fiscal policy in ending hyperinflation.*

A period of hyperinflation often arises when a government runs a large debt which it pays for by printing money. It can do this by selling bonds to the central banks which print money to pay for them- the government then spends the proceeds. Seignorage, or the inflation tax, represents the real resources accrued to the government by generating inflation. However, raising a given amount of seignorage revenue would require higher and higher inflation which could lead to hyperinflation.

One way to end the period of hyperinflation is to replace the inflation tax with other taxes, or through a reduction in government spending. This will stabilise the level of debt and therefore the need to monetise it.

In terms of monetary policy, the government needs to make a credible commitment not to finance deficit spending by printing money. There are a number of ways in which this credibility might be achieved. The central bank could be prevented from buying government bonds. The nominal exchange rate could be pegged to a low inflation currency- an attempt to anchor expectations and import disinflation. Alternatively, the government could dollarise- therefore any seignorage revenues would pertain to the US so there is no incentive to monetise fiscal deficits.