SPEECH

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GDP growth and resource utilisation

It's a pleasure to be back here in Saltsjöbaden again. It has now been ten years since I was involved in starting these annual conferences as the head of Statistics Sweden. In those days, this was a matter of improving economic statistics. What several of the proposals we discussed had in common was that they were important for our efforts to elucidate and understand productivity growth. These proposals included a better price index in the private service sector, better capital stock calculations, better input-output statistics and better IT statistics. I also considered that Statistics Sweden should do more to describe and analyse productivity growth. I am therefore very pleased to see that the conferences have come to focus on the important area of productivity growth and its causes.

My speech today can be summed up in the following three points:

- Resource utilisation can be measured in several different ways, among others as actual GDP in relation to potential GDP (the GDP gap).
- The financial crisis has lowered the growth rate of potential GDP.
- Resource utilisation is thus largely normal, even though GDP is only slightly higher than before the crisis.

I will start by describing GDP growth over the longer term. Then, I will address resource utilisation's significance for monetary policy, give an account of the Riksbank's calculations of potential GDP, discuss the impact of the financial crisis on potential GDP, give an account of different measures of resource utilisation and what they say about resource utilisation at present, and conclude by addressing the need for continued analyses.

GDP grows over time, but the rate of growth varies

GDP growth since 1950 is illustrated in Figures 1 and 2. What is known as an HP trend is also included in the figures. I will return to these HP trends later. Seen over the entire period from 1950 to 2010, GDP has increased by an average of 2.7 per cent per year. Growth was significantly stronger in the 1950s and 1960s compared with the 1970s and 1980s. There then followed a ten-year

period from the mid-1990s with relatively rapid GDP growth and associated relatively rapid productivity growth.

In earlier seminars, we have discussed the reasons for the strong productivity growth during this later period. I myself have pointed out a number of possible explanations.[1] Globalisation through the expansion of the EU, the opening up of the economies of eastern Europe and China's rapidly-growing international trade have increased competition, which has been particularly significant for Sweden, with our substantial foreign trade and high proportion of international companies. Furthermore, a number of product markets were deregulated in the 1990s (taxis, domestic flights, postal services, telecommunications, electricity etc.). Sweden also has high proportions of IT production and IT use in production. Last year, we also discussed the significance of education, work organisation and intangible investments.

In conjunction with the financial crisis, GDP then fell by over five per cent in 2009, before rising again by over five per cent in 2010. Productivity in the economy as a whole, measured as GDP per hour worked, decreased for two consecutive years by a total of over four per cent. I will later address the possible reasons for this and the possible consequences. But I will start with the significance of resource utilisation for monetary policy.

Resource utilisation is of great significance to monetary policy

According to the Sveriges Riksbank Act, the objective for monetary policy is to maintain price stability. At the Riksbank, we have interpreted this to mean that we should strive to hold inflation, measured in terms of the consumer price index, at two per cent per year. We have been clear about the CPI being the target variable. But we also follow a number of other inflation measures to analyse and better understand the development of inflation: the CPI with a fixed interest rate (CPIF), CPIF excluding energy, the EU-harmonised measure HICP and several measures of underlying inflation.[2]

There are two reasons for the Riksbank to care about resource utilisation, in addition to price stability. The first is that we are striving to attain high GDP, high employment and low unemployment, and resource utilisation is related to these targets. But we should only do this when it is compatible with the inflation target. The inflation target takes precedence. This differs from the United States, where the central bank has the double target of achieving price stability and maximum employment. In addition, the preparatory works for the Sveriges Riksbank Act only refer to "high" employment (as compared with the United States' "maximum" employment) and not to any particular level of unemployment.[3]

The other reason to care about resource utilisation is that it serves as an indicator of future inflation. The positive relationship between resource

[1] Svante Öberg, "Productivity and monetary policy", 7 June 2007 and Svante Öberg, "Monetary policy and productivity", 29 January 2008.
[2] Sveriges Riksbank, *Monetary Policy in Sweden*, June 2010.
[3] My colleague Lars Svensson has a different interpretation of our task, namely that, during the forecast period, we should strive to hold inflation measured in terms of the CPIF (the CPI with a fixed interest rate) as close to two per cent as possible and resource utilisation measured in terms of unemployment as close to an estimate of the long-term sustainable level of unemployment as possible. See, for example Lars E.O. Svensson, "For a better monetary policy: Focus on inflation and unemployment", 8 March 2011.

utilisation and inflation is illustrated in Figure 3, which shows the correlation between three different measures of resource utilisation and CPIF inflation 1-12 quarters ahead.[4] The connection is fairly strong 3–8 quarters ahead. The connection is stronger and faster for the hours gap than for the GDP gap and the RU indicator. This may be because the development of the labour market usually follows behind output and because it is very important for the development of prices and wages. Of course, it is difficult to draw any conclusions from the covariation of two variables, but the same type of relationship also exists in more developed empirically-estimated models.

Considering this, we wrote, in Monetary Policy in Sweden, that the Riksbank, in addition to achieving low and stable inflation, should also strive to stabilise output and employment around long-term sustainable paths.[5] This means that we also strive to hold resource utilisation at a normal level. We usually say that the Riksbank is thereby conducting a flexible inflation-targeting policy. We have also chosen to take a broad approach when it comes to interpreting resource utilisation, instead for only looking at a single measure of resource utilisation.

The Riksbank's calculations of potential GDP

Resource utilisation can be measured in several different ways. Here, I will demonstrate how we, at the Riksbank, calculate measurements of resource utilisation based on GDP and potential GDP, as well as hours worked and potential hours worked. Potential GDP refers to the level of GDP that is consistent with a use of the available resources that is sustainable in the long term and that does not push up inflation. If GDP exceeds the potential level, then resource utilisation is high – and vice versa. We call the difference between actual and potential GDP the GDP gap.[6] When resource utilisation is normal, GDP is equal to potential BNP, and the GDP gap is equal to zero. Consequently, potential GDP does *not* refer to the highest level GDP may reach over the short term.

In Figure 1, the trend development of GDP is represented by a Hodrick-Prescott trend (HP trend). An HP trend is something between a linear trend and the actual development of GDP. The HP trend is a common and often fairly good measure of the underlying long-term development in GDP during normal cyclical fluctuations. But the HP trend is not good at estimating the underlying development of GDP at the end of a time series and it gives no guidance as to why output deviates from its trend level.

The production function approach

On the other hand, our ability to analyse why output deviates from its long-term level can be improved if a production function (PF) approach is used. This is a common technique used by international organisations such as the IMF

[4] The figure is based on the ten-year period 1997–2006. This period is not extended further than 2006 so as not to be affected too much by the period after the outbreak of the financial crisis in the autumn of 2008. However, the differences do not become so great even if the years 2007 and 2008 are included.
[5] Sveriges Riksbank, *Monetary Policy in Sweden*, June 2010.
[6] In the original Taylor rule, the policy rate is determined by inflation and the GDP gap. See Taylor, J.B., "Discretion versus policy rules in practice", Carnegie-Rochester Conference Series on Public Policy, North-Holland, 1993.

and the OECD. The Riksbank has used such an approach since 2010.[7] A production function shows how output depends on production factors and technological level. In the most common case, we may consider that output (Y) depends on the number of hours worked (H), the capital stock (K) and total factor productivity (TFP).

The level of TFP determines how much output is derived from a given amount of hours and capital.[8] TFP can thus be seen as a measure of the level of technology. By specifying a form for the production function, the following breakdown is obtained: [9]

$$Y = TFP + \alpha K + (1 - \alpha)H$$

The wage share in the economy is usually about two-thirds, which is why hours are considered to stand for two-thirds of the production factors ($1 - \alpha = 2/3$) and capital for the remaining third ($\alpha = 1/3$). The contribution of each factor to output can then be calculated. Output increases through more capital weighted by a third, more hours worked weighted by two thirds and improved TFP.

But, in practice, it is difficult to measure TFP. Instead, it must normally be estimated as a residual, often called a Solow residual after Nobel Prize winner Robert Solow. The output that does not depend on the input factors of capital and labour is assigned to TFP.

In accordance with the production function, the potential level of production can also be divided up into potential total factor productivity, potential capital stock and potential hours. Deviations from the potential level can be estimated for each of the three factors affecting output – capital, hours worked and TFP. These deviations can then be weighted together to give a total output gap.

Calculations of potential GDP

This section describes the calculations forming the basis for the GDP and hours gap published in the most recent Monetary Policy Update.[10]

Figure 4 shows an estimate of actual and potential TFP. Actual TFP is estimated with the Solow residual. The TFP estimate thus captures all change in output that cannot be explained by the development of capital and hours. Potential TFP is estimated with an HP trend based on the Solow residual. The idea is that the TFP estimate will describe technical developments. But, among other factors, it is also affected by the fact that the production factors' degree of utilisation varies over time. Estimating TFP is thus the most uncertain part of applying the PF approach. The assessment made was that actual TFP at present was largely the same as potential TFP.

Figure 5 shows the development of the capital stock or, more precisely, the flow of services from the capital stock. In this connection, it is assumed that the

[7] See the article "The driving forces behind trends in the economy can be analysed using a production function" in the Monetary Policy Report of October 2010.
[8] It is important to make a distinction between labour productivity, which is defined as output per hour, and total factor productivity.
[9] This is the logarithm of what is known as a Cobb-Douglas function: $Y = TFP \times K^{\alpha} \times H^{(1-\alpha)}$. Consequently, the relationship in the text applies to the logarithms of Y, K, H and TFP.
[10] Sveriges Riksbank, Monetary Policy Update, September 2011.

- actual capital stock corresponds with the potential capital stock. The development of the capital stock in the period ahead has been based on the Riksbank's investment forecast.

Figure 6 shows the development of the number of hours worked and the potential level of these. The development of potential hours in the future is determined by demographic developments, the assumption that there will be a trend increase in labour force participation among older people and an assessment of the effects of economic policy. These assessments have led to the potential number of hours worked presently exceeding the indications of the HP trend.

Figure 7 shows GDP and two measures of potential GDP: the HP trend and the PF approach. The difference between potential GDP calculated with the HP trend and with the PF approach is not so large. The most important difference between the measures is the potential development of hours. In the PF approach, the development of potential hours is based on assessments with no HP trend element.

Figures 8 and 9 show the measures of resource utilisation based on GDP and potential GDP, in addition to hours worked and potential hours worked, that were the result of these calculations. They indicate that resource utilisation is largely normal this year. The GDP gap based on the HP filter is slightly higher than normal, while the GDP gap based on the PF approach is slightly lower than normal. The reason for the difference lies in the assessment of the potential number of hours worked. The hours gap based on the HP filter is slightly higher than normal, while the hours gap used in the PF approach is slightly lower than normal.

Difficulties in calculations, but reasonable view of present situation

There are several problems with the method of calculating potential GDP I have just described. Among others, these include the calculations of potential labour, capital stock and TFP. The difficulty of assessing potential GDP is also illustrated by the way that assessments of the GDP gap have changed over time. Attention has been drawn to this, not least by Orphanides.[11] Among other observations, he shows that the estimates of the GDP gap for the United States for a certain year, made by the International Monetary Fund (IMF), have changed radically between the various dates of calculation, and draws the conclusion that GDP growth should be focused on as the basis for monetary policy, rather than the GDP gap.

Figure 10 presents estimates of the GDP gap in real time and in accordance with the most recent calculation from September 2011. The estimates in real time show what we believed the current GDP gap to be at the various previous forecasting occasions. The figure indicates that resource utilisation was higher in the years preceding the crisis than we believed at the time. However, there are also problems with estimating resource utilisation in retrospect, which mean that such calculations may perhaps overestimate how high resource utilisation was before the crisis. I will come back to this.

[11] See, for example Orphanides, A. (2010), "Monetary Policy Lessons from the Crisis", Central Bank of Cyprus.

Despite these difficulties, my assessment is that the Riksbank's calculations of the GDP gap largely give a reasonable view of *current* resource utilisation. The decisive factor for this assessment is that the GDP gap currently corresponds with other ways of measuring resource utilisation that are based on other economic statistics. These other measures also show that resource utilisation is largely normal. I will review a number of such measures at a later point.

In contrast, I do not think that the GDP gap provides a reasonable view of the development of resource utilisation over the course of recent years. I shall return to this shortly. First, however, I would like to address the effects of the financial crisis on potential GDP, as this plays an important role in the assessment of the GDP gap.

The financial crisis has had a negative effect on potential GDP

The financial crisis has probably lowered the potential growth rate.[12] There may be several reasons for this. The capital stock has been negatively affected by the financial crisis through the decrease of the investment level. Growth in the capital stock has come to a halt. Even though we expect investments to recover quite strongly in the period ahead, the capital stock will not reach the pre-crisis trend level.

The labour force has probably also been affected negatively due to exclusion from the labour market, with competence among the labour force being undermined by long periods of unemployment. However, this reduction of the labour supply due to the crisis has been more than counteracted by an economic policy focused on increasing labour force participation. The number of people in the labour force has increased in recent years due to this.

The most important factor, which is also the most difficult to explain, is that total factor productivity also fell during the most recent crisis. It is, of course, normal for productivity to develop less strongly at the start of a recession. But the heavy fall of just over six per cent that occurred between the third quarter of 2008 and the first quarter of 2009 was abnormally large. This was probably partially due to a decrease of the degree of utilisation of capital and labour.

According to Figure 8, actual GDP and potential GDP were largely the same in 1995 and 2005. As the estimate of potential GDP was not seriously affected by terminal point problems or deep recessions in these years, it probably provides a reasonable view of potential GDP. This is also supported by data on economic activity that shows that resource utilisation was largely normal in these years. The average rate of growth in GDP between 1995 and 2005 was 3.1 per cent per year. Consequently, this is also the average rate of growth of potential GDP during this period.

According to Figure 8, actual GDP and potential GDP were also roughly the same in 2011. Between 2005 and 2011, both GDP and potential GDP have thus increased by an average of 2.0 per cent per year. A projection of GDP from 2005 according to the earlier trend of three per cent per year would have given a GDP level about six per cent higher than actual GDP in 2011. Even if this is only a mathematical example and the potential growth, if there had been no

[12] Experiences of earlier financial crises are described in detail in Reinhart, C.M. and Rogoff, K.S., "This time is different: eight centuries of financial folly", Princeton University Press, 2009.

financial crisis, is assumed to be significantly lower than three per cent per year, it still shows that the financial crisis put a dent in the long-term upwards development of potential GDP.[13]

The lowered rate of growth of potential GDP after the financial crisis corresponds with international experiences. In conjunction with financial crises, it is normal for GDP growth to be lower in the ten years following the crisis than in the ten years before the crisis.[14]

But the financial crisis primarily affected Sweden through reduced exports, not through problems in the banking sector. It is thus not self-evident that the rate of growth of potential GDP should necessarily be lower in Sweden. One explanation may be that the rate of growth of potential GDP does not only decrease in conjunction with financial crises, but also in conjunction with deep recessions. We have seen in earlier crises, in the late 1970s and early 1980s, as well as in the early 1990s, that a deep recession can have this effect. On these occasions, GDP did not reach the pre-crisis trend level for the next ten years.[15] Another explanation may be that Sweden, with its high international dependence, cannot isolate itself too much from developments abroad. There are also rigidities in the economy that mean that it will take time before a sharp fall in exports can be replaced by an increase of exports or by an increase of domestic demand that fully compensates for this decline.

I actually think it is more reasonable to concentrate the negative effect on potential GDP to the period immediately after the start of the financial crisis, rather than to spread it out over a larger number of years before and after the financial crisis in the way that both the HP trend and the PF approach do. This would mean that the GDP gap would not appear so high in 2008 and perhaps not so low in 2009 either. But this is unimportant for the assessment of resource utilisation this year.

Resource utilisation is largely normal

My assessment is thus that resource utilisation is largely normal. The measures of resource utilisation that I showed earlier in Figures 8 and 9 indicated this. But it is also supported by other measures of resource utilisation, based on questions to individuals and companies. An additional advantage of measures of this type is that they can be seen directly in the statistics, thus avoiding the problems associated with HP trends and PF approaches.

Figure 11 shows such a measure, capacity utilisation in the manufacturing sector from Statistics Sweden (SCB). It is now more or less on the average level for the period 1996–2008. Another measure of this type is the employment rate from the labour force surveys (AKU), which shows the proportion of the population of working age that is in employment. Figure 12 shows that the employment rate this year is close to the average for the years 2000–2008.

[13] The assumed long-term GDP growth in Figure 7 after the end of the forecast period in 2013 is 2.3 per cent per year.
[14] Reinhart, C. M. and Reinhart, V. R. (2010), "After the Fall", National Bureau of Economic Research Working Paper 16334.
[15] Svante Öberg, "Potential GDP, resource utilisation and monetary policy", 7 October 2010.

The Riksbank's indicator of resource utilisation (the RU indicator) summarises about thirty such economic variables regarding levels.[16] The RU indicator includes survey data from the National Institute of Economic Research's Economic Tendency Survey for private services, the retail trade and the construction and manufacturing industries. In addition, capacity utilisation in the manufacturing sector from Statistics Sweden, the employment rate and unemployment from the labour market surveys, and unfilled vacancies from the Swedish Public Employment Service are also included. According to the RU indicator, resource utilisation is slightly higher than normal (see Figure 13).

Figure 14 shows unemployment together with an average for the period 2000–2008 and an assessment of long-term unemployment.[17] Seasonally-adjusted unemployment is presently higher than this long-term level. But assessments of long-term unemployment are fraught with great difficulties. It is possible that the financial crisis will lead to an increase of long-term unemployment. At the same time, it is possible that the measures adopted in recent years will lead to a reduction of long-term unemployment. The net outcome of these two opposing forces will eventually become clear. [18]

At the same time as the unemployment gap is positive (see Figure 15), there is a shortage of labour in many sectors and in the business sector as a whole (see Figure 16). This indicates that matching on the labour market has deteriorated. This is also supported by the fact that the Beveridge curve, which shows the connection between the number of persons unemployed and the number of unfilled vacancies, has shifted outwards (see Figure 17). The composition of the category unemployed has also changed. For example, the proportion of unemployed people with brief and incomplete educations has increased. All in all, for my part, I interpret this to mean that resource utilisation with regard to labour is also largely normal.

The most recent Monetary Policy Update included the assessment that resource utilisation was somewhat lower than normal, but that it would be largely normal towards the end of the forecast period. My overall assessment at the monetary policy meeting was instead that resource utilisation was already normal, and I have taken the opportunity to explain my judgement in a little more depth in this speech. The different measures of resource utilisation that I have addressed today are summarised in Table 1.

We need more knowledge of productivity growth

Today, I have given you an account of how the Riksbank tries, in various ways, to assess how large resource utilisation is. One of the measures of resource utilisation that we use compares actual GDP with an estimate of potential GDP. The financial crisis has probably lowered the growth rate of potential GDP. Actual GDP is thus roughly equal to potential GDP at present, even though GDP is only slightly higher than it was before the crisis. My assessment is also that resource utilisation is largely normal. This assessment is also supported by

[16] See "An indicator of resource utilisation", Economic Commentary no. 4, 2010, Sveriges Riksbank.
[17] See the article "The driving forces behind trends in the economy can be analysed using a production function" in the Monetary Policy Report of October 2010.
[18] See also the article "Low unemployment – a challenge" in the Monetary Policy Report of July 2011.

- other measures of resource utilisation that are not associated with such large problems in calculation.

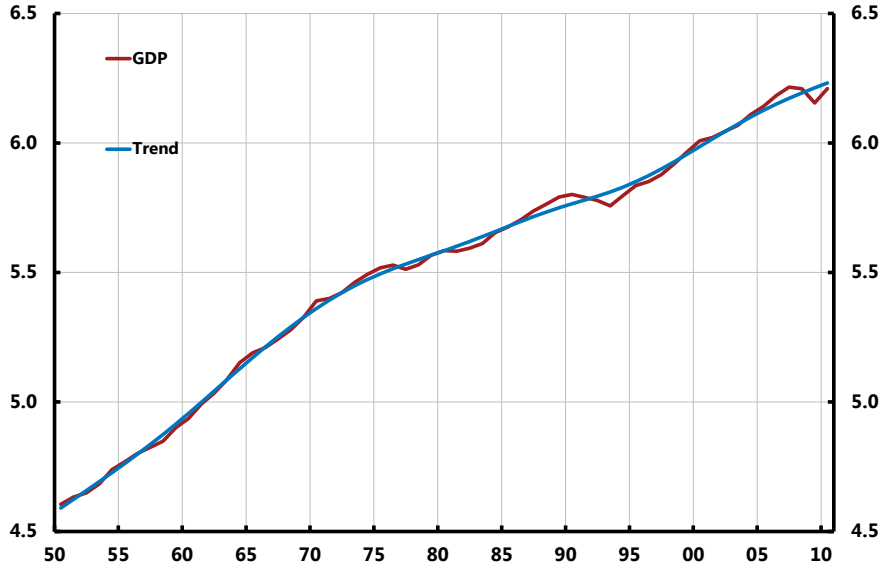
Resource utilisation has a positive relationship with future inflation. Resource utilisation is thus also an indicator of future inflation. It is therefore important to be able to reliably estimate the level of resource utilisation. But the financial crisis and the associated deep recession have greatly increased uncertainty in estimates of resource utilisation. Different assessments of the level of resource utilisation can lead to different views of how monetary policy ought to be conducted.

It is therefore essential that more analyses are conducted to better understand what it is that determines the development of output and potential GDP in conjunction with financial crises and deep recessions. One important factor behind the development of potential GDP seems to be total factor productivity (TFP). This is particularly troublesome as TFP itself is often counted as an unexplained residual. One possible way forward could be to combine the production function approach with economic short-term statistics to analyse how TFP behaves in normal cyclical fluctuations and in deep recessions. The almost unique opportunities for Sweden to conduct analyses based on micro data for individuals and companies should be a major asset in this regard.

Figures and tables

1. Actual and trend GDP

Logarithmed levels

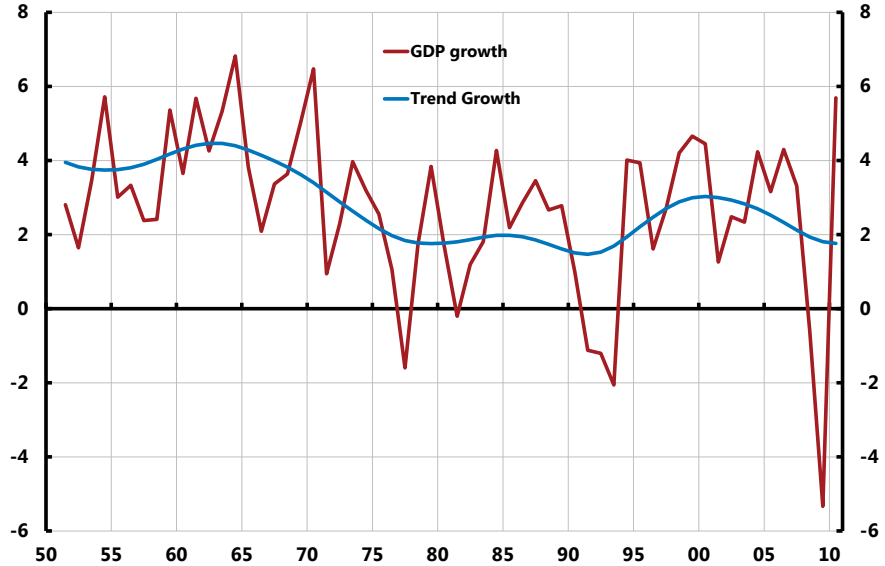


Note. HP trend derived solely from annual data 1950-2010.

Sources: Statistics Sweden and the Riksbank

2. Actual and trend growth

Annual percentage change

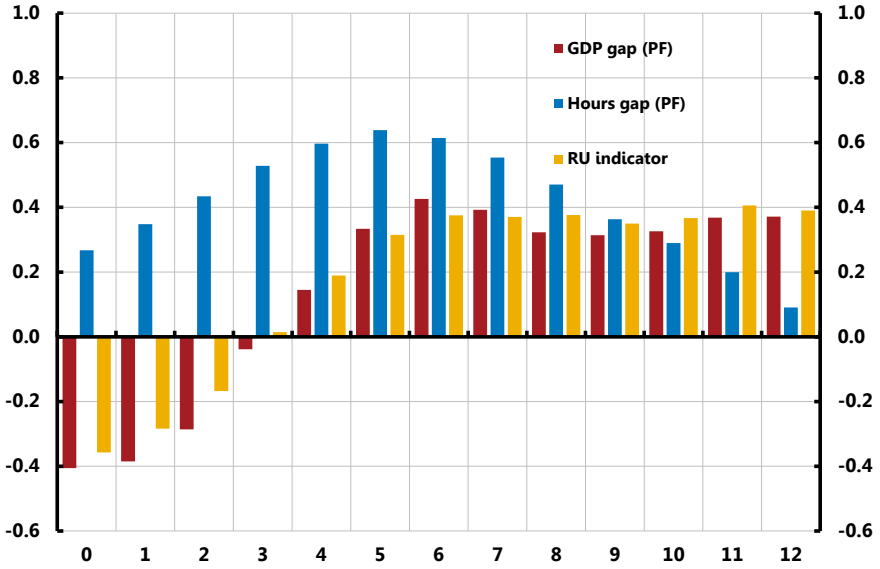


Note. HP trend derived solely from annual data 1950-2010.

Sources: Statistics Sweden and the Riksbank

3. Resource utilisation and inflation

Correlation betwen different measures of resource utilisation and CPIF inflation, 0-12 quarters ahead

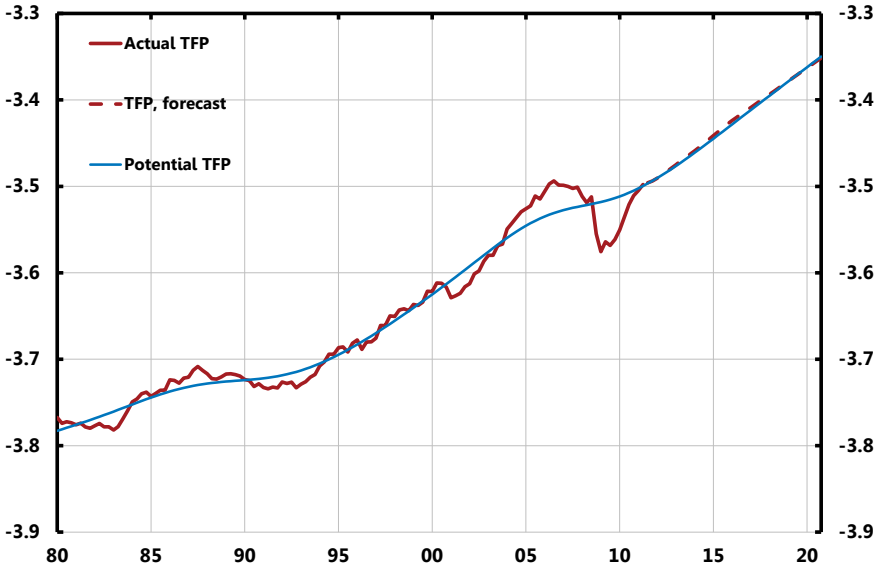


Note. Estimation period is 1997-2006.

Sources: Statistics Sweden and the Riksbank

4. Total factor productivity

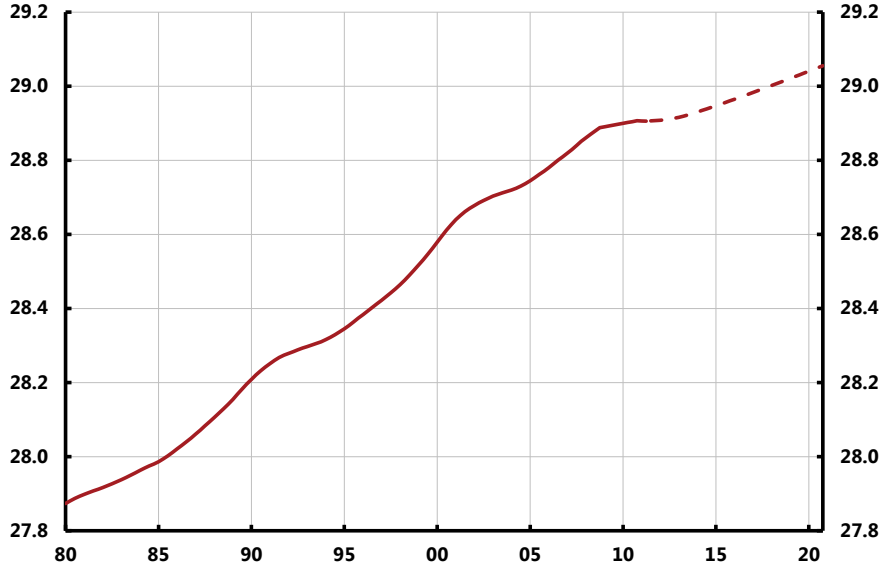
Logarithmed levels



Source: The Riksbank

5. Capital stock

Logarithmed level

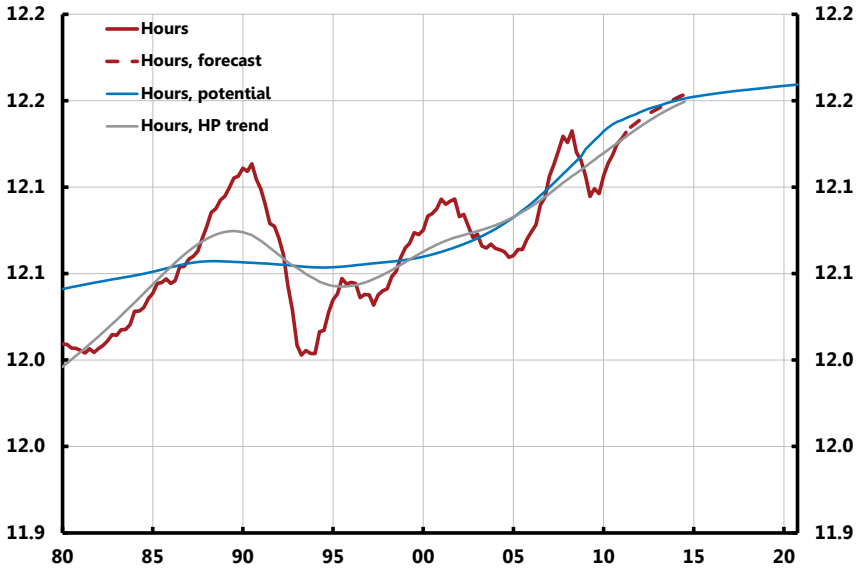


Note. Capital services

Sources: The OECD and the Riksbank

6. Number of hours worked

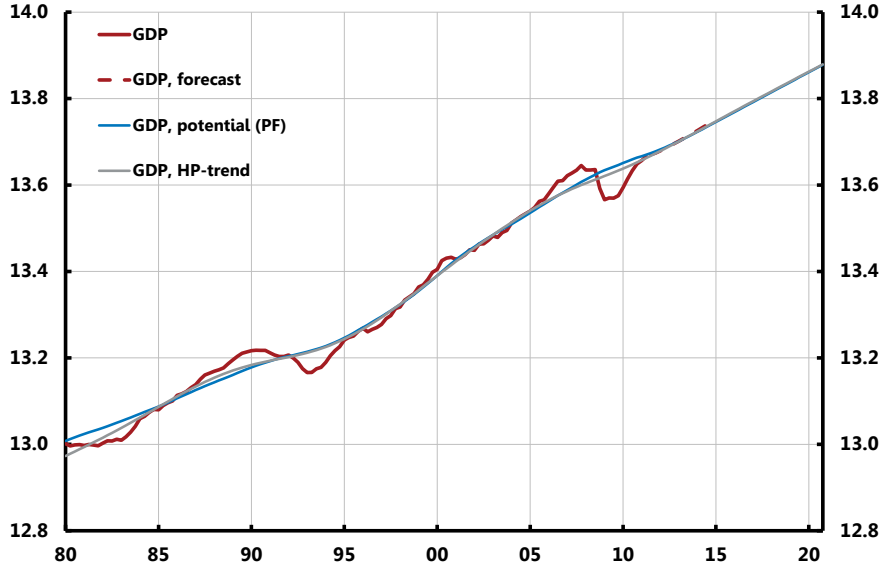
Logarithmed levels



Sources: Statistics Sweden and the Riksbank

7. Actual and potential GDP

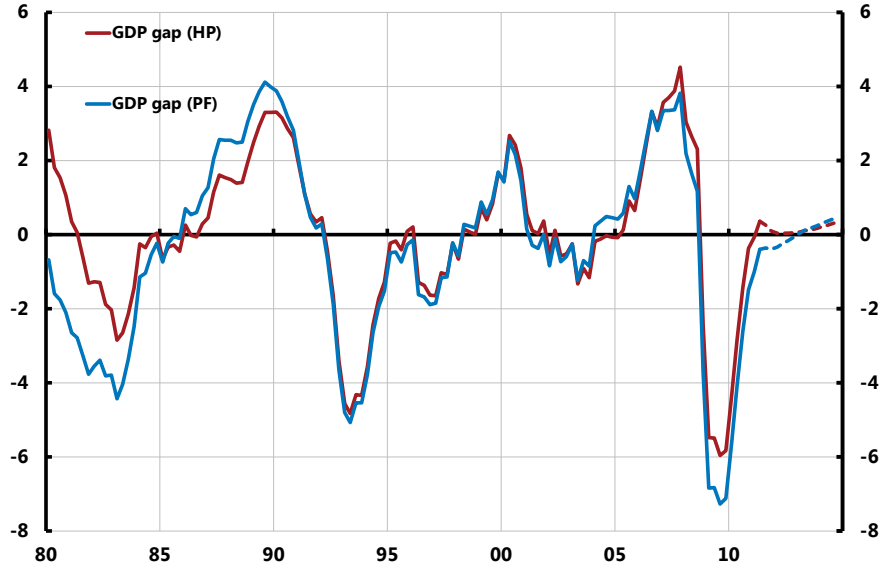
Logarithmed levels



Sources: Statistics Sweden and the Riksbank

8. GDP gap

Per cent

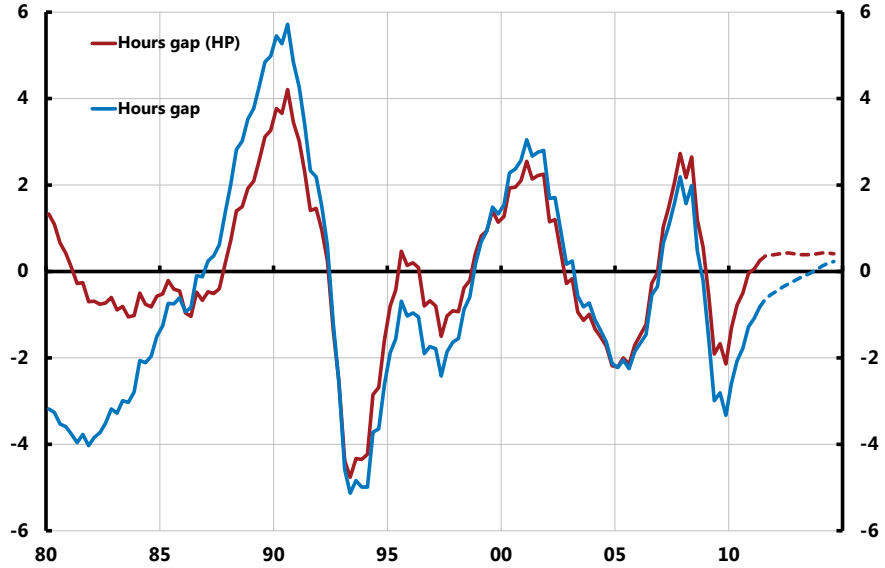


Note. GDP gap (HP) refers to GDP's deviation from trend calculated with a HP-filter. GDP gap (PF) refers to GDP's deviation from trend calculated with a production function.

Sources: Statistics Sweden and the Riksbank

9. Hours gap

Per cent

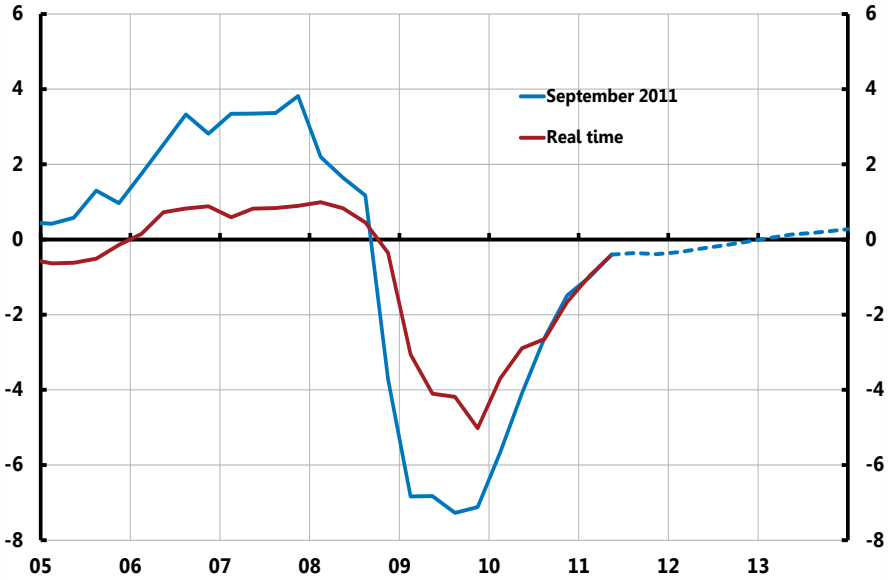


Note. Hours gap (HP) refers to the deviation of hours worked from trend calculated with a Hodrick Prescott filter. Hours gap refers to the deviation of hours worked from the Riksbank's assessed trend for hours worked.

Sources: Statistics Sweden and the Riksbank

10. GDP gap, September and in real time

Per cent

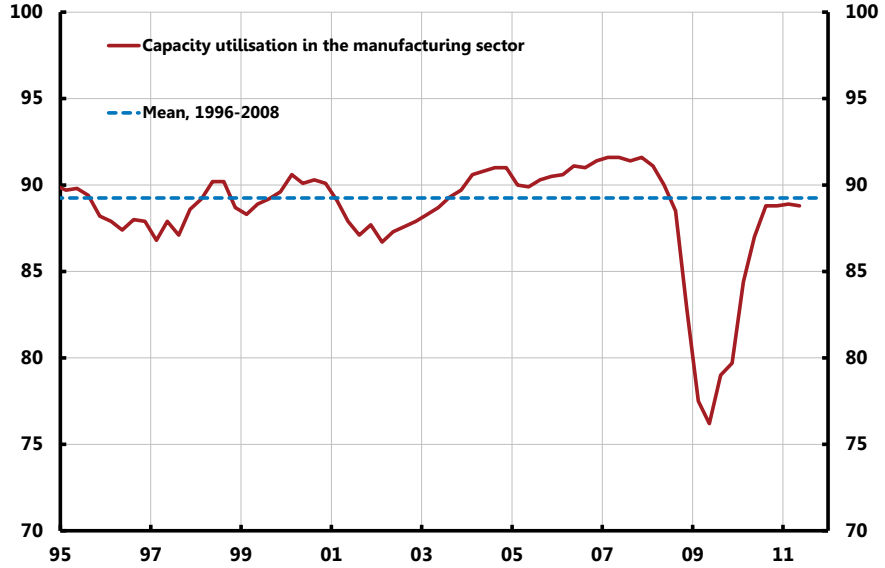


Note. September 2011 refers to the PF gap. Real time refers to the HP gap except from October 2010 and onwards when the PF gap is used.

Sources: Statistics Sweden and the Riksbank

11. Capacity utilisation

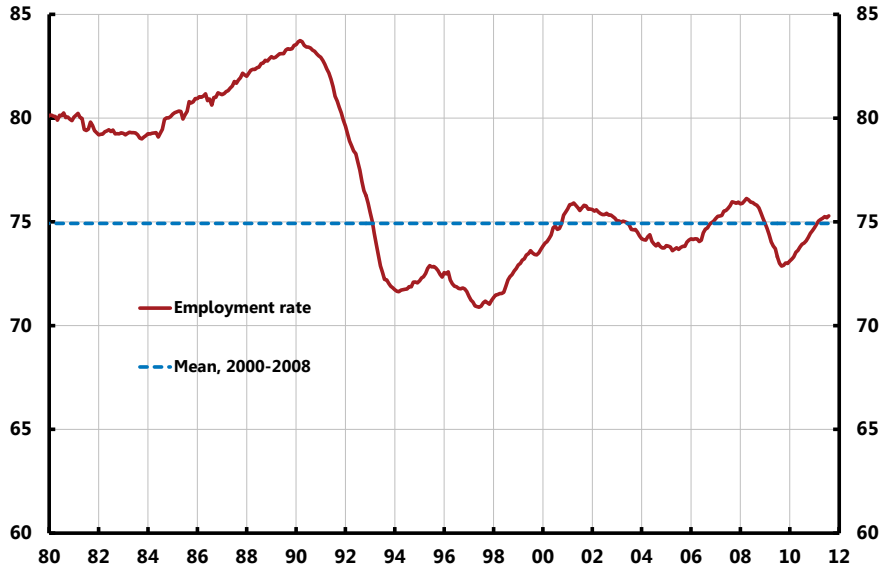
Per cent, seasonally-adjusted data



Source: Statistics Sweden

12. Employment rate

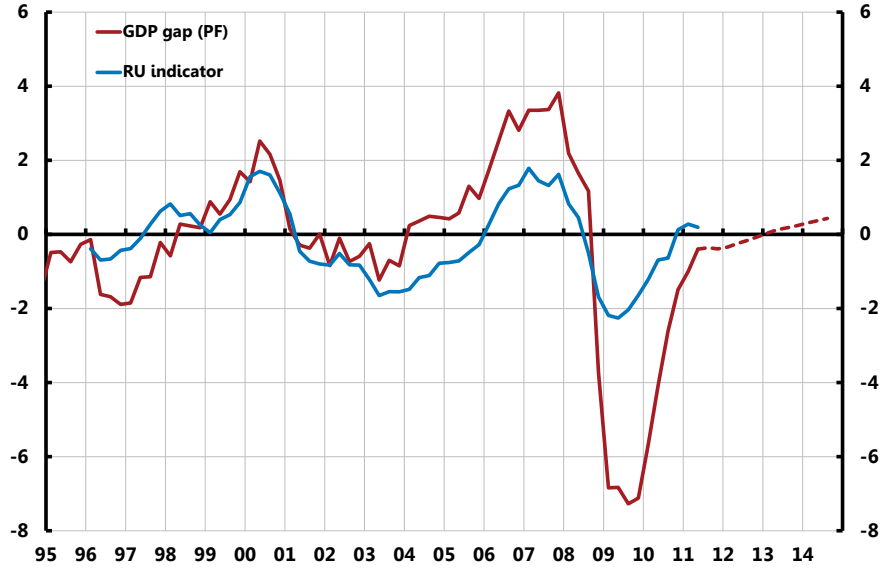
Percentage of population aged 16-64



Source: Statistics Sweden

13. RU indicator and GDP gap

Standard deviation and percentage

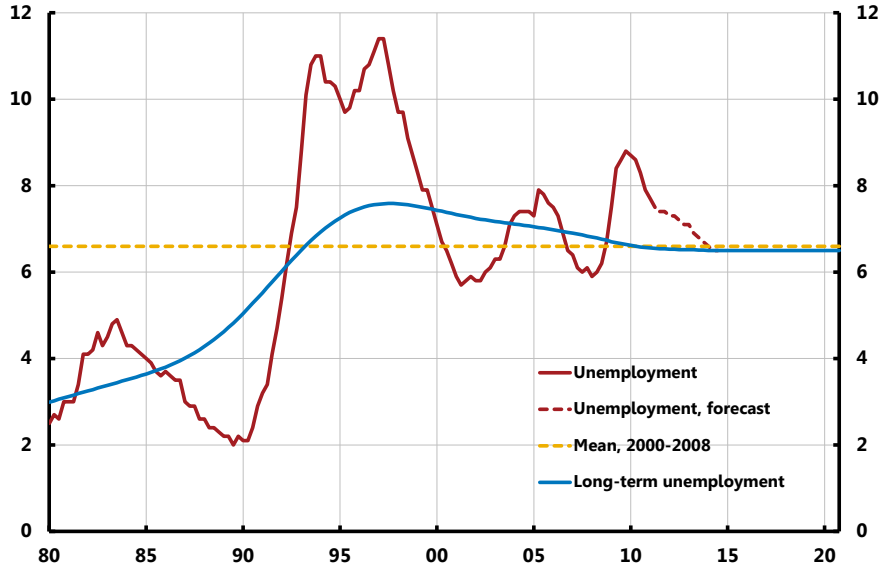


Note. The RU indicator has been normalised so that the mean value is 0 and the standard deviation is 1. The reference period is 1996-2008. GDP gap according to production function (PF) approach.

Sources: Statistics Sweden and the Riksbank

14. Actual and long-term unemployment

Per cent of labour force aged 16-64

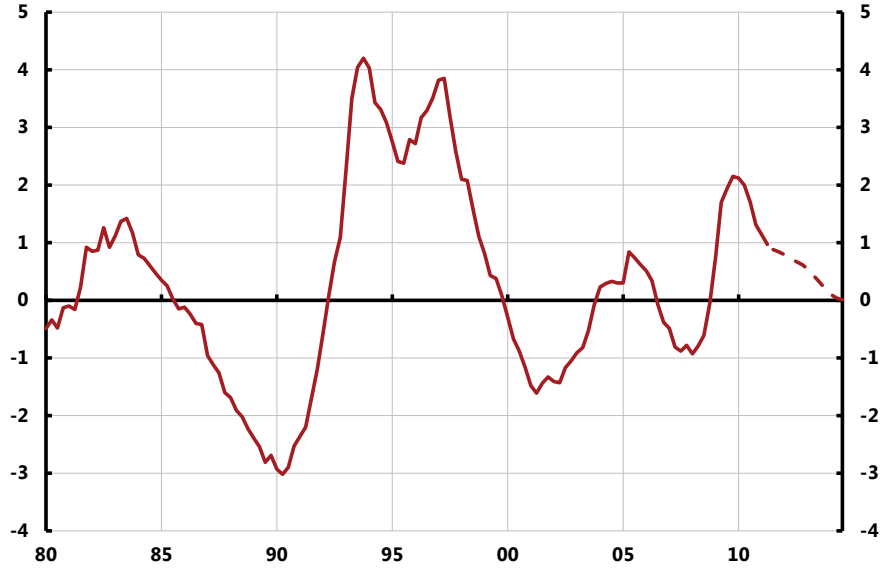


Note. Forecast refers to ages 15-74

Sources: Statistics Sweden and the Riksbank

15. Unemployment gap

Per cent

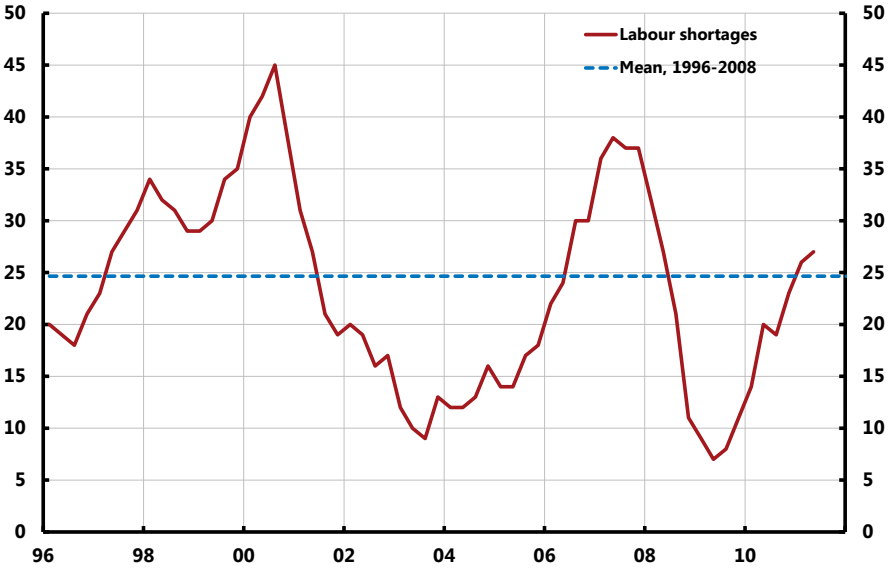


Note. Unemployment gap refers to the deviation between actual and long-term unemployment in Figure 14.

Sources: Statistics Sweden and the Riksbank

16. Labour shortages

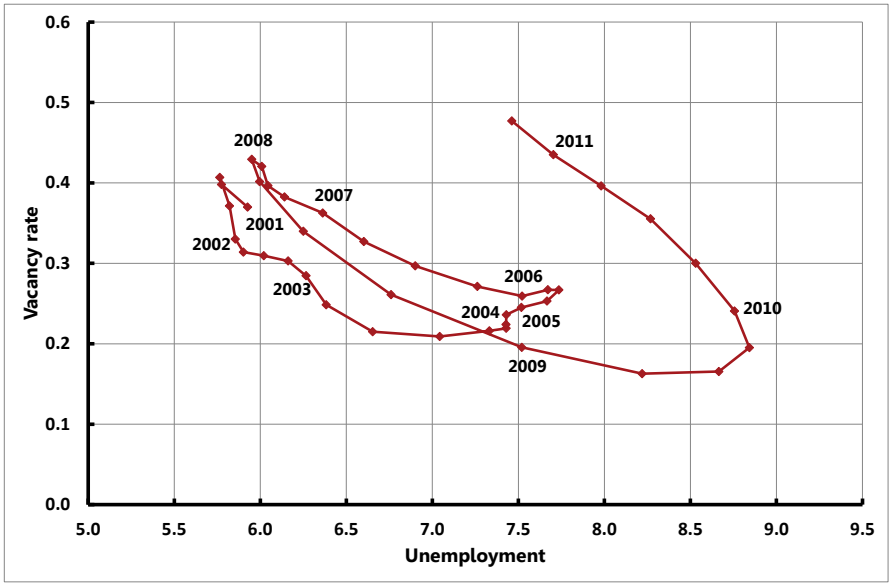
Percentage of companies, seasonally-adjusted data



Source: National Institute of Economic Research

17. Beveridge curve

Per cent



Note. Years indicate the first quarter of each year.

Sources: Statistics Sweden and the Riksbank

Table 1. Resource utilisation, second quarter 2011

Gap as percentage and RU indicator in standard deviation

GDP gap, HP	0.4
GDP gap, PF	-0.4
Hours gap, HP	0.3
Hours gap, PF	-0.8
Capacity utilisation[1]	-0.3
Employment rate[2]	0.3
RU indicator	0.2
Unemployment gap[3]	-1.0
Labour shortage[1]	2.3

[1]Deviation from mean value, percentage points, 1996-2008

[2]Deviation from mean value, percentage points, 2000-2008

[3]Percentage points, reverse sign