HAS POTENTIAL GROWTH SLACKENED?

While GDP growth slowed between 2000 and 2001 from 3.5 to 1.2 per cent, the annual rate of inflation moved up from 1.4 to 2.7 per cent. The unexpected development adds to the uncertainty when forecasting inflation. One conceivable reason why a slackening of demand has been accompanied by a rising rate of price increases is that the Swedish economy's potential output grew more slowly in 2001. The output gap is a central item in the Riksbank's assessment of inflation. The basic notion is that if total demand for economic resources exceeds the available supply, the resultant upward pressure on prices may lead to inflation. Potential output is the level of production that is compatible with price stability. A problem with this approach, increasingly recognised by economists and central banks, is that the concept of potential output is not as clearly defined as aggregate demand. Work is in progress on the development of the analytic foundation for the former concept.

The various measurements of potential output and the output gap that the Riksbank uses in work on its inflation forecast are discussed here. In terms of potential output's trend over longer time horizons, the results of the different measurements are fairly similar. However, over shorter horizons, for example 1–2 years, the differences may be appreciable. In that the Riksbank's monetary policy assessments are primarily concerned with this shorter perspective, it is important to compare the methods.

POTENTIAL GROWTH

Factors that determine long-term potential output include technology, capital stocks, labour supply and the institutions and regulations that affect the workings of the economy. These factors also affect the development of demand. A gap between actual and potential output is liable to arise because, on account of, for example, rigidities in production factors and prices and market imperfections, it takes time for production and demand to adjust to a change.

Potential growth is not constant, neither does the level of production adhere to a simple long-term trend (Fig. B7). The economy is exposed to shocks of various kinds. Some are more transitory, for example a dry winter that leaves less water for hydroelectric power or a currency depreciation unconnected with economic fundamentals that increases demand for exports. Other

shocks are more permanent. For instance, new production technology can affect capital stocks and the industrial structure. Many of the shocks that occur affect both the supply and the demand side of the economy. A productivity shock, for example of the type that occurred in the United States in the late 1990s, besides affecting conditions for production, influences households' expectations of future income and wealth.

MEASURING POTENTIAL GROWTH

The Riksbank uses three different methods to estimate the output gap and these models also calculate potential growth. The measurements of potential growth should be seen as rough approximations, with a large element of uncertainty.[5] The Hodrick-Prescott (HP) method measures potential growth by smoothing actual output; the size of the fluctuations in potential growth then depends on the choice of filter. A weakness of the HP approach is that it does not include a connection between resource utilisation and the rate of price increases and does not say anything about which factors are driving the changes in potential output. The Unobservable Component (UC) method calculates potential growth from an estimation of the level of unemployment (the NAIRU level) that is compatible with unchanged inflation. This method accordingly uses both inflation and unemployment.

The third method, the production function or PF approach, uses a simple aggregated production function for the total economy, where output is determined by labour supply, total factor productivity (TFP) and the effective capital stock.[6] The transition from actual to potential output is achieved by smoothing the trends for mean working time and TFP and adjusting the extended labour force for some estimate of structural

5 Orhanides, A. & van Norden, S. (1999), The reliability of output gap estimates in real time, *Finance and Economics Discussion Series*, Federal Reserve Board 38.

6 Potential output is measured in the light of corporate sector value-added. As public goods and services do not have market prices, public sector output cannot be estimated in terms of value-added. Adding the public sector to value-added gives GDP (in the PF approach this is done by scaling up a factor that is determined by the relationship between value-added and GDP): $Y_t^{pot} = FV_t^{NL\text{-}pot} + FV_t^{off}$. The potential growth of corporate sector value-added is determined as $FV_t^{NL\text{-}pot} = TFP_t^{NL\text{-}HP} x (K_t^{NL\text{-}eff})^{0.39} x (L_t^{NL\text{-}utbud})^{1\text{-}0.39}$, where $TFP_t^{NL\text{-}HP}$ is H-P filtered TFP, $K_t^{NL\text{-}eff}$ is the effective capital stock and $L_t^{NL\text{-}utbud}$ is potential labour supply. The function assumes that the shares of value-added that accrue to capital and labour, respectively, are constant and that they sum to one, implying a constant return to scale. Empirical estimations do not confirm the assumption of a constant return to scale. The PF approach also assumes perfect competition and full capacity utilisation. The effective capital stock is calculated by Statistics Sweden.

unemployment (NAIRU).[7] A problem with the PF approach is the weak link between actual growth, potential output and price stability.

In the longer run these three approaches to the measurement of average potential growth yield comparatively similar results. The potential growth rate has been around 2 per cent in the past three decades and between 2 and 2.5 per cent in the past five years (Table B1).

Table B1. Estimates of potential growth.
Per cent

	UC	H-P	PF	GDP
1970-2000	2.0	1.9	1.9	1.9
1980-2000	1.9	1.9	1.9	1.9
1990-2000	1.9	1.8	1.8	1.6
1995-2000	1.9	2.4	2.3	3.0
1998-2000	2.0	2.7	2.3	3.7

Source: The Riksbank.

HAS RESOURCE UTILISATION RISEN IN RECENT YEARS?

Growth was high in the period 1998–2000; annual GDP growth averaged 3.7 per cent (Fig. B7). At the same time, potential growth seems to have picked up more slowly. Although there was some improvement in potential output, the increase was appreciably less than the acceleration of GDP growth. On average, the unutilised resources were reduced annually by one or two per cent of GDP.

An important question is to what extent resources were de-utilised during the slowdown in 2001, when GDP rose only 1.2 per cent. The UC method suggests that the slowing of GDP growth was accompanied by a largely equivalent decline in potential output, so that resource utilisation may still be broadly as high as at the end of 2000. As measured with the other methods, however, the fall in potential output is smaller (Fig. B7). This illustrates that over a relatively short period, the

7 Labour supply is given by the function $L_t^{NL\text{-}utbud} = N_t^{NL\text{-}utbud} \times L_t^{NLHP}$, where $N_t^{NL\text{-}utbud}$ is the extended NAIRU-adjusted labour force and L_t^{NLHP} the number of hours worked (mean working time smoothed with an H-P filter). The extended NAIRU-adjusted labour force is given by $N_t^{NL\text{-}utbud} = N_t^{NL\text{-}utvidgad} - N_t^{off} - N_t^{NAIRU}$. The extended labour force is given by $N_t^{NL\text{-}utvidgad} = (N_t^{psys} + N_t^{off}) + N_t^{Opp} + N_t^{Latent}$, where N_t^{off} is public sector employment, N_t^{psys} is private corporate sector employment, N_t^{Opp} is open unemployment, and N_t^{Latent} is the number who regard themselves as latent unemployed. NAIRU is given by $N_t^{NAIRU} = NAIRU_t^{UC} \times N_t^{NL\text{-}utvidgad}$. A time-varying NAIRU has been estimated in the UC model.

results from the different methods can differ appreciably. The UC method's results are difficult to interpret in economic terms because in this type of model the combination of low growth and high inflation may imply a slowing of potential growth but the model provides no indication of what this is caused by or the duration of the shock.

To arrive at a better picture of potential output there are grounds for also analysing this question with the PF approach, which is easier to interpret in economic terms. Certain components of the production function, such as mean working time and productivity growth, are smoothed with an H-P filter. Without this smoothing, the PF approach indicates that potential growth slowed from about 3 per cent at the beginning of 2000 to about 1 per cent at the end of 2001 (Fig. B8).

Potential growth can be decomposed into the contributions from its determinants (Table B2). In recent decades the contribution from the capital stock has been virtually constant. Neither did the path of the capital stock deviate during the latest business cycle.

Table B2. Contributions to potential growth.
Percentage points

	1970-2000	1980-2000	1990-2000	1998-2000	2001 2000
Capital stock	0.8	0.8	0.7	0.7	0.8
NAIRU-adjusted labour force	0.1	0.2	0.2	0.3	1.3
Mean working time	-0.3	0.0	0.0	-0.2	-1.3
TFP	1.4	1.2	1.5	2.0	0.6

Sources: Statistics Sweden and the Riksbank.

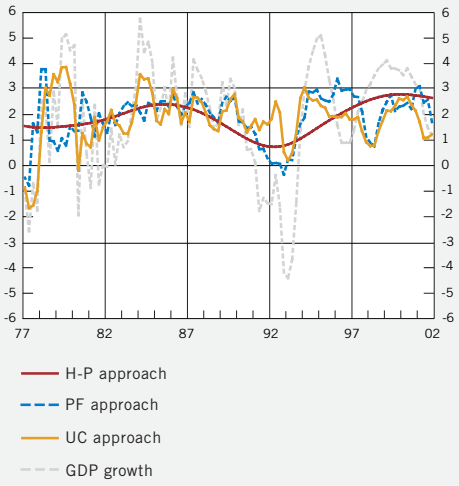
Except in the last few years, the trends for TFP and labour supply also seem to have been comparatively stable.

The extended labour force has expanded appreciably in recent years, above all as a result of increased employment in the corporate sector, particularly in services. This has been countered by a fall in mean working time.

The fall in mean working time is a result of several factors that are analysed in the box on pp. 32–37. A considerable part of the reduction is probably cyclical. But as structural factors also seem to have contributed (e.g. increased sick leave in connection with more generous replacement levels and negotiated working time reductions), it could be that the decrease in labour supply is partly more permanent.

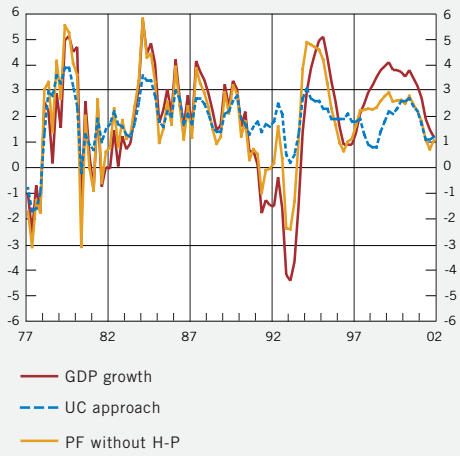
The slowing of productivity growth during 2001 is not remarkable. Compared with the downward cyclical

Figure B7. Estimations of time-dependent potential growth.
Percentage annual change



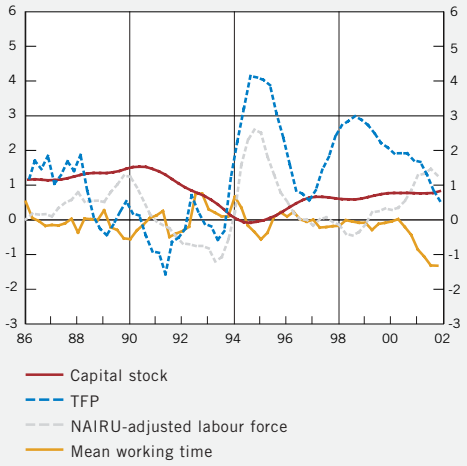
Source: The Riksbank.

Figure B8. Estimations of time-dependent potential growth.
Percentage annual change



Source: The Riksbank.

Figure B9. Factors of production. Percentage 12-month change



Source: The Riksbank.

Figure B10. Corporate sector total factor productivity (TFP) and labour productivity. Percentage annual change

Source: The Riksbank.

phases in 1977, 1980 and 1990, when productivity growth was negative for a number of quarters, the tendency in 2001 is limited. A similar picture emerges when productivity growth is measured as the change in labour productivity.

A difficulty in productivity assessments is that growth models tend not to provide explanations for technological improvements – TFP is obtained as a residual. In recent years theories have been put forward where the impact of technology is an endogenous variable (explained by the model instead of being taken as given); this has underscored the part played by, for example, the degree of openness, human capital and competitive pressure.[8] The favourable path that many of these factors seem to have followed in recent years supports the hypothesis that the slackening of productivity growth is not permanent. It may be the case that the positive effects generated by the deregulations in the late 1990s have now faded. But increased openness, a somewhat higher educational level in the 1990s and some improvements in competitive pressure may indicate that future productivity growth can also be somewhat higher than in the 1970s and 1980s.

An argument that productivity growth will not pick up again to the high rate in the 1990s is that this rate had to do with certain manufacturing sectors, for example the telecom industry. If productivity in these sectors were to become less favourable or if their relative importance becomes permanently smaller, this would suggest that productivity growth in the coming years may be somewhat lower.

The answer to the question posed by the box heading is by no means self-evident. There is much to suggest that a large part of the observed slowing of growth is cyclical. But there may be more permanent elements in two main respects. One is mean working time, which has fallen as a consequence of sick leave and other circumstances; the other is productivity, which may be weaker as a consequence of a diminishing economic role for the IT and telecom sectors.

8 See e.g. Aghion, P. & Howitt, P. (1998), *Endogenous Growth Theory*, MIT Press, and Stiroh, K., What drives productivity growth?, *FRBNY Economic Policy Review*, p. 37.