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An indicator of resource utilisation

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Our view of resource utilisation plays a central role in the analysis of how monetary policy should be formulated. However, measuring resource utilisation is difficult in several ways. It cannot be observed directly in the data and there is no established method for measuring it. This makes it important to study a number of different measures. This commentary presents a method of summarising the information in survey data and labour market data. The indicator so produced – designated the RU indicator – captures economic developments well. The advantages of the RU indicator are that it is not revised particularly extensively when new information is received and it can be updated rapidly. The RU indicator could thus form a good complement to other measures of resource utilisation, although it should be pointed out that it does not show the Riksbank's collected assessment.

The Riksbank's monetary policy is focused on maintaining price stability while simultaneously supporting general economic development with the aim of attaining sustainable growth and high employment. The Riksbank does this by striving to stabilise inflation around the inflation target and production and employment around sustainable long-term levels – that is to say, a normal level of resource utilisation.[2]

In the Riksbank's analysis of the manner in which monetary policy should be formulated, the view of resource utilisation in the economy thus plays a central role. As there are many ways of measuring resource utilisation, the Riksbank studies a large number of measures, such as survey data, unemployment, the employment rate, deviations of production and employment from long-term trends, model-based estimates and so on. However, measuring resource utilisation is very difficult. One problem is that long-term sustainable levels cannot be observed. Another is that different measures of resource utilisation do not necessarily provide a uniform view of the economic situation. Furthermore, the outcomes of production and employment are revised continually, a circumstance which may change the picture of resource utilisation.

This economic commentary describes a statistical method for calculating a comprehensive measure of the information present in survey data and labour market data. This measure is designated the RU indicator. This indicator can also be used to calculate a measure of the trend development of GDP, and thus a measure of the deviation of GDP from its trend.

The RU indicator summarises the economic situation

One method of assessing resource utilisation is by studying survey data. Information of this nature, which can provide a reliable indication of the state of resource utilisation in companies can be found in the Business Tendency Survey from the National Institute of Economic Research. Companies state, for example, whether they have a shortage of labour and describe the main factor limiting their production. Capacity utilisation according to Statistics Sweden, together with labour market data from Statistics Sweden's labour force surveys and the Employment Service, also provide information on resource utilisation. It may thus be worthwhile to attempt to compile this information into one measure – the RU indicator. The variables included in the RU indicator have been selected for the information they contain concerning the utilisation of labour and capital, as well as the state of demand. Furthermore, they should describe the state of the economy, that is the level of activity at a specific point in time, rather than primarily focusing on change over time (growth). The Business Tendency Survey includes information on four industries – manufacturing, construction, the retail trade and private services. See Appendix for an account of the variables included.

There is a good reason for using information from aggregate labour market data in combination with survey data in the RU indicator. Unemployment and the employment rate provide an accurate view of the situation across the entire labour market. Furthermore, the responses to the Business Tendency Survey provide a supplementary

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2 Sveriges Riksbank (2010)

view of resource utilisation, as they reflect the degree to which the labour force and capital are actually utilised in companies. For example, in an economic slowdown, it is not unusual for companies initially to retain their labour forces, even if these are too large in relation to production, which suggests that resource utilisation in companies is declining.[3] As companies do not start laying off personnel as soon as the economy weakens, unemployment may continue to be low for a period, giving the impression that resource utilisation in the economy as a whole continues to be high. With the aid of companies' survey responses, it thus becomes possible to discern changes in resource utilisation before these become visible in other statistics.

Large amounts of data in a comprehensive view

In order to summarise the information from survey data and labour market data in the RU indicator, the Riksbank uses what is known as a principal component analysis.[4] Put simply, this method entails weighting the different variables together to form an index in a manner that explains as much of the total variation of the variables as possible. The index, which is the actual RU indicator, can thus be seen as a weighted average of the variables included.[5]

The variables used in the calculation of the RU indicator are measured in different units (for example, net figures and proportion of unemployed) and must therefore first be standardised in some manner. The standard method of doing this is to allocate the average values of zero to the variables and one to the standard deviation, as has been carried out for the period 1996 to 2010.[6] The final RU indicator has also been standardised in this manner.

This standardisation is not entirely insignificant when the RU indicator is used as a measure of resource utilisation. Even if the RU indicator has the mean value of zero for a given period, it is not certain that resource utilisation, on average, has been normal for this period. For example, this may apply if the economy has been impacted by an unusually severe disruption, such as, for instance, the major decline in GDP occurring in 2008–2009. One method of assessing the significance of standardisation is to study the mean value of the RU indicator during individual economic cycles. Most analysts more or less agree that the economic cycle between the peaks of 2000 and 2007 was relatively normal. This signifies that resource utilisation, on average, should be approximately normal for this period. The mean value for the RU indicator during this period was close to zero (+0.1), which can be interpreted as indicating that the extremely weak economic development of 2008–2009 has not affected the estimates to an unreasonable degree.

The RU indicator captures economic developments

The RU indicator seems to capture the cyclical variations of the economy well. During 2008, when the world economy, including Sweden, was affected by an economic crisis, the RU indicator fell steeply to a low point in the second quarter of 2009, after which it showed a relatively rapid upturn (see Figure 1). The RU indicator has a greater co-variation with different measures of GDP's deviation from trend than it does with equivalent measures for the labour market. Changes in the economic climate normally affect GDP before they affect the labour market (one reason is that it takes time for companies to lay off personnel). The RU indicator seems to react quickly to changes in the economic climate. This may be connected with the fact that, apart from labour market variables such as employment and unemployment, the RU indicator also includes indicators concerning the utilisation of labour and capital by companies. Variations in resource utilisation probably become noticeable sooner in companies than in aggregate data for the entire labour market (see discussion in earlier section).

3 See, for example, Aranki, Friberg and Sjödin (2010).
4 Principal component analysis is an effective way of summarising the data for forecasting and economic analysis. See, for example, Bernanke and Boivin (2003), Stock and Watson (2002 and 2006).
5 Principal component analysis involves the calculation of what are known as latent variables (principal components), which explain as much as possible of the total variation of the original variables. The first principal component captures the greatest share of the variation in the data material, while the second principal component, which is independent of the first, explains the second greatest share of the variation and so on. The RU indicator is the same as the first principal component. The RU indicator explains approximately 47 per cent of the variation in the data. For a more detailed description of principal component analysis, see (for example) Johnson and Wichtern (1992).
6 Previously to 1996, data for the retail trade and the private service sector was unavailable, and, consequently, the RU indicator has been calculated on the basis of quarterly data from 1996.

One example of the co-variation of the RU indicator with GDP's deviation from trend is illustrated in Figure 1, where this deviation is estimated in relation to what is called a Hodrick-Prescott (HP) trend.[7] The percentage deviation of GDP from trend is usually designated the output gap. Similarly to GDP's deviation from a HP trend, the RU indicator reveals a cyclical pattern. It should thus be possible to employ it to separate a measure of the GDP trend and to estimate an output gap. The information in the RU indicator becomes easier to interpret when it is expressed in terms of the percentage deviation of GDP from trend, as opposed to in terms of standard deviations.

In order to illustrate the manner in which the RU indicator can be utilised to estimate a production gap, a simple model is presented here. This can be made significantly more sophisticated, but here the intention is only to indicate the manner in which the RU indicator may be used. The method can briefly be described as follows: GDP is assumed to consist of a cyclical component and a trend component. The cyclical component can be identified with the aid of the RU indicator and a modelled, non-observable trend. Growth in the trend is assumed to vary, with the mean value being assumed to be approximately the same as the mean value of the observed GDP growth over the estimation period. Using these assumptions, the non-observable trend can be separated from GDP.[8]

The advantage of this method, compared with the HP filter, is that no assumptions need to be made regarding the variability of the trend and that other information (in this case the RU indicator) is used to identify the trend.[9] Another advantage is that the method provides more stable results at the end of the estimation period – which is frequently the most interesting moment – unlike the HP filter, which tends to place the trend too close to the actual GDP series.[10] At the same time, naturally, there are also elements of assessment during the estimation of output gap with the aid of the RU indicator, in so far as the model being used as a basis in the separation of the trend must be specified.

Figure 2 shows the level of GDP together with HP filtered GDP and a GDP trend estimated with the aid of the RU indicator (known as the RU trend). During the crisis, GDP fell by approximately 7 per cent, in addition to which the RU trend fell steeply. The trend adjustment indicates that the GDP level may have declined permanently as a result of the crisis.[11] However, according to the RU trend, growth in the trend has not declined after the crisis. On the other hand, the outcome of the HP trend is much more even, flattening out in 2007. The HP trend has a fairly strong resemblance to a moving average and will thus be impacted for a long period of time by the large decrease in GDP, both before and after this took place.

The deviation of GDP from each trend, estimated using both methods, is illustrated together with the RU indicator in Figure 3. Both gap measures result in approximately the same picture of economic developments, i.e. the peaks and lowest points of the economy approximately coincide. However, according to the HP gap, resource utilisation was somewhat higher before the most recent crisis, and resource utilisation during the crisis was not as low as suggested by the RU gap.

How stable are different measures when new information is received?

Current resource utilisation is of great significance for monetary policy. Consequently, methods that provide stable results which do not need to be revised too much are advantageous. It is also an advantage if current estimates of resource utilisation can be made without excessive time lags.[12]

7 HP filtering is a statistical method that can be used to separate the cyclical variations in a data series. See Hodrick and Prescott (1997)
8 More specifically, this can be performed by setting up a model of what is known as state space-form, and applying a Kalman filter (for a detailed description of the method, see, for example, Harvey (1993).
9 During HP filtering, the actual user selects the variability of the trend by determining what is known as the lambda parameter. In the state space model, equivalent parameters are estimated using statistical criteria.
10 This is known as the HP filter's terminal point problem.
11 The decrease in the trend looks rather large, which is probably connected with the fact that statistical methods function poorly under very unusual circumstances. There is thus a risk that the extremely large and rapid decline in GDP may be interpreted, to an excessive degree, as a decrease in the trend, rather than a cyclical phenomenon.
12 Giannone, Reichlin and Small (2005) suggest that information used for forecasts in real time should preferably have two characteristics to be considered relevant: **publication with a minimum time lag and high forecast capacity. However, the data with the best forecast capac**ity (hard data) is usually published with a great time lag, while survey data (soft data) has a lower level of forecast capacity, but is published with a short time lag. It has been demonstrated that it is valuable to use survey data in the analysis as this is published with a short time lag and is not revised either.

In order to investigate the manner in which the RU indicator is revised when it is updated with new information, estimations have been carried out for different periods. The data material has successively been extended by a quarter, starting from 2006. Estimates indicate that the indicator has been revised to a fairly limited extent in recent years, as new information has been received (see Figure 4). The indicator captured the extensive decline in GDP at an early stage, and has constantly indicated that resource utilisation was high (measured in this manner) in the years prior to 2008.[13]

On the other hand, an HP filter has difficulty in capturing events at the end of a period and is affected strongly by new information. Figure 5 shows how a GDP gap calculated with the HP filter is heavily revised over recent years as new data is received. As current resource utilisation is frequently the subject of interest, this method is difficult to use in real time.

When the RU indicator is used to separate the GDP trend, revisions are still significant (see Figure 6), but, even so, less important than is the case with the HP gap and more evenly spread over the entire period. However, the estimates are relatively stable until the third quarter of 2008. After this, the estimates are affected by the major drop in GDP in 2008–2009, and the trend is also revised historically. This indicates how difficult it is for most methods to interpret developments in recent years, and that there is a need for continued development work in this area.

Conclusions

This economic commentary has described a method of summarising large amounts of data which provide information on resource utilisation in one measure – the RU indicator. The RU indicator captures the cyclical variation in the economy relatively well and can thus contribute towards the analysis of resource utilisation. Furthermore, it has the advantage of not needing to be revised particularly extensively upon being updated with new information, and it can be updated relatively rapidly. However, it should be borne in mind that the RU indicator will probably encounter problems in fully capturing events connected with the most recent economic crisis – just like many other methods.

It should also be pointed out that, even if the RU indicator balances information from various sources with statistical methods, it should not be regarded as the Riksbank's collected measure of resource utilisation. When the Riksbank makes an overall assessment of resource utilisation, other information and measures are also utilised.

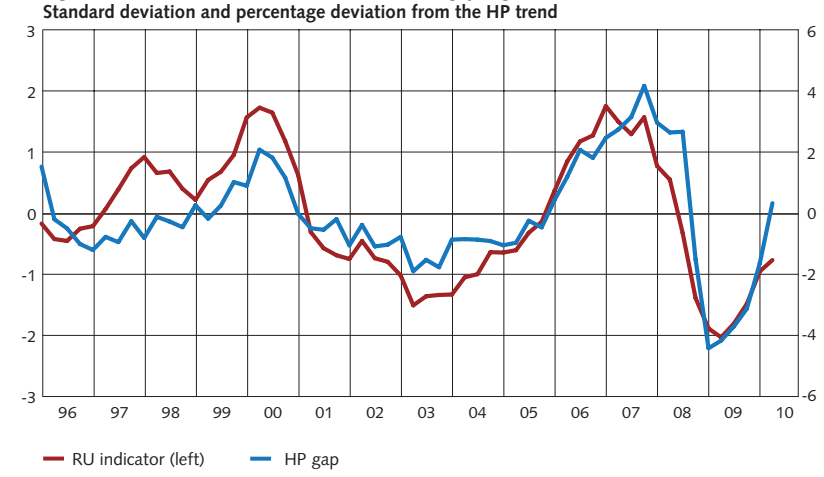
For example, at present, the RU indicator probably gives an excessively optimistic view of resource utilisation in the economy as a whole. Unemployment is still relatively high, which indicates that resource utilisation on the labour market is lower than the view presented by the RU indicator. Consequently, in order to obtain an overall view of resource utilisation, different measures should be studied. The RU indicator may be one of these.

It is also worth pointing out that such an overall assessment is difficult to capture in a single figure, but is more suited to being described qualitatively, for example by a statement of whether resource utilisation is slightly lower or higher than normal, or much lower or higher than normal.

13 In contrast, the RU indicator was revised at the start of the period. The data included in the RU indicator is not normally revised – instead, the revisions in the indicator derive partly from standardisation (mean value zero and standard deviation one) and partly from estimates of the common factor, the principal component. The longer the time series used, the more stable the indicator becomes. Mean value adjustment plays a lesser role when several business cycles are covered and estimates of the common factor become more stable.

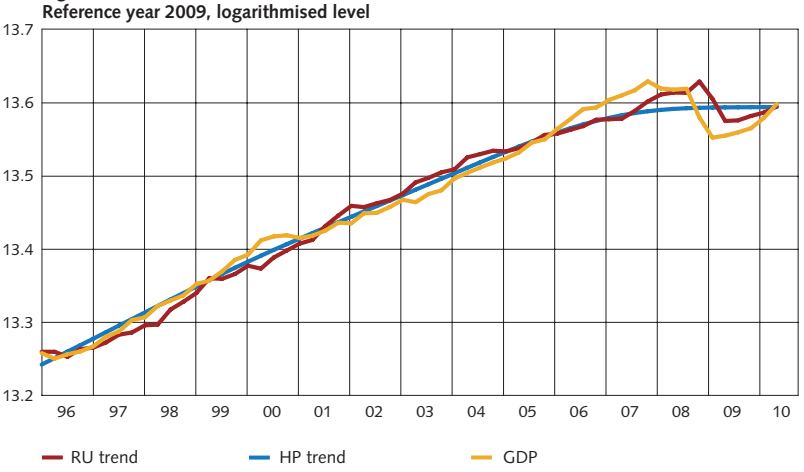
Figure

Figure 1. The RU indicator (left scale) and the HP gap (right scale)
Standard deviation and percentage deviation from the HP trend



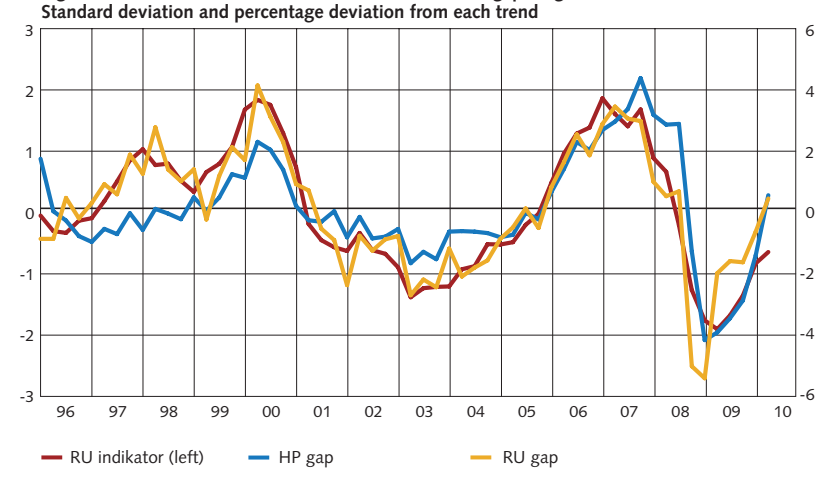
Sources: Employment Service, National Institute of Economic Research, Statistics Sweden and the Riksbank.

Figure 2. GDP and different measures of its trend
Reference year 2009, logarithmised level



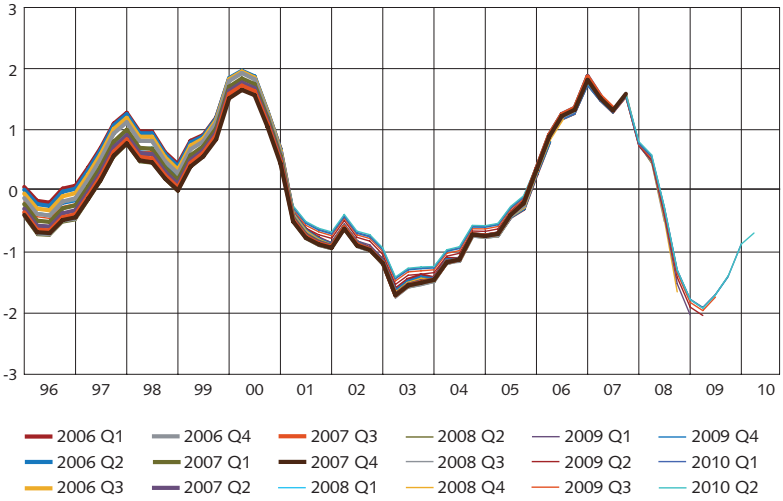
Sources: Employment Service, National Institute of Economic Research, Statistics Sweden and the Riksbank.

Figure 3. The RU indicator (left scale) and various GDP gaps (right scale)
Standard deviation and percentage deviation from each trend



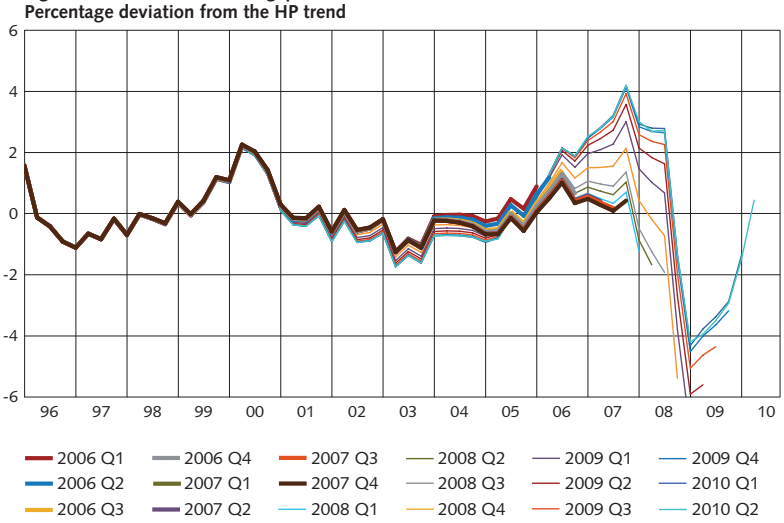
Sources: Employment Service, National Institute of Economic Research, Statistics Sweden and the Riksbank.

Figure 4. Revisions of the RU indicator when the time horizon is extended
Standard deviation



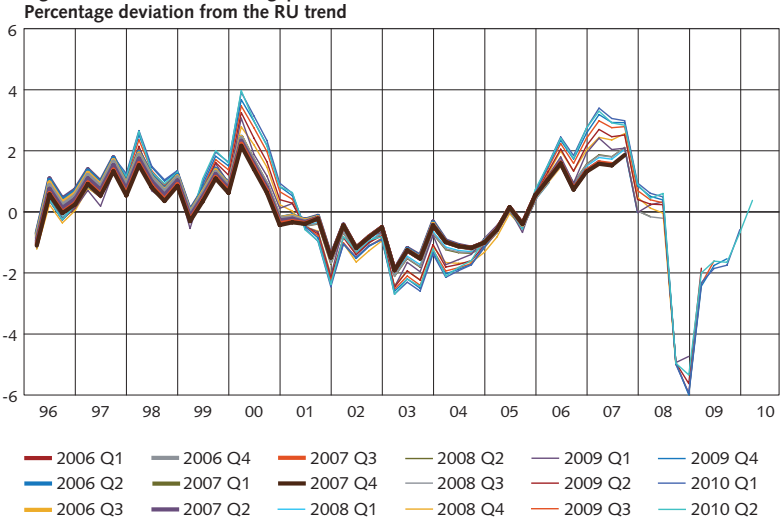
Sources: Employment Service, National Institute of Economic Research, Statistics Sweden and the Riksbank.

Figure 5. Revisions of the HP gap when the time horizon is extended
Percentage deviation from the HP trend



Sources: Statistics Sweden and the Riksbank

Figure 6. Revisions of the RU gap when the time horizon is extended
Percentage deviation from the RU trend



Sources: Employment Service, National Institute of Economic Research, Statistics Sweden and the Riksbank.

APPENDIX

The following variables are included in the RU indicator: Survey data from the Business Tendency Survey, National Institute of Economic Research

Private service industries

Computer consultants and software producers etc., legal and economic consultants, employment offices, recruitment and staffing companies, office and other business services and haulage firms (questions 105–111)

Question	
103	Volume of assignments/orders on hand, current assessment (comparatively large, sufficient, too small)
105	Profitability, current assessment (good, satisfactory, poor)
107	Personnel shortage, current assessment (yes, no)
108	Full utilisation of companies' resources, current assessment (yes, no)
111	Primary hindrance to company's operations, shortage of labour (yes, no)

Retail sector

Question	
102	Current sales, current assessment (strong, satisfactory, weak)
104	Inventories, current assessment (too large, satisfactory, too small)
106	Personnel shortage, current assessment (yes, no)
108	Profitability, current assessment (good, satisfactory, poor)

Construction industry

Question	
104	Order stock, current assessment (comparatively large, satisfactory, too small)
1074	Primary hindrance to company's construction operations, shortage of labour (yes, no)

Manufacturing industry

Question	
103	Production capacity, current assessment (more than sufficient, satisfactory, insufficient)
104	Current capacity utilisation (percentage)
109	Total order stock, current assessment (comparatively large, satisfactory, too small)
115	Profitability, current assessment (good, satisfactory, poor)
117-119	Labour shortage, different occupational categories, current assessment (yes, no)
126	Primary hindrance to company's production, shortage of labour (yes, no)
125	Primary hindrance to company's production, shortage of machinery and plant capacity (yes, no)

Other data

Capacity utilisation in the manufacturing sector according to Statistics Sweden

Employment rate 16–64 according to labour force survey (AKU)

Unemployment according to AKU

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