The relationship between the business cycle and the labour market in Sweden

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Over the last year, it appears that the relationship between the business cycle and the labour market in Sweden has weakened. GDP fell heavily in 2009 without unemployment increasing as expected. In this commentary, the relationship between the business cycle and unemployment is estimated on the basis of Swedish data using Okun's law. The estimate shows that the relationship varies over time and that a higher level of economic growth is needed today to change the level of unemployment compared to the average historical relationship. It also now takes longer before the full impact of a change in growth on unemployment becomes apparent.

Normally, there is a relatively strong relationship between fluctuations in GDP and activity on the labour market. This relationship has long been of interest to economists.[2] Economic downturns have a negative impact on the labour market, employment falls and unemployment increases, while upturns have a positive effect. **However, during the latest downturn, which followed in the wake of the global financial crisis in the autumn of 2008, it appears that the relationship between the business cycle and the labour market has weakened.** GDP fell by almost 5 per cent without unemployment increasing as expected, given the historical relationship. This commentary aims to analyse the relationship between the business cycle and the labour market and to study the nature of this relationship over time.

Time lags are normal

When production changes, activity on the labour market also changes. This normally takes place with a certain time lag. This pattern is common in Sweden as well as in other countries. Many companies have to adjust their production when the total level of demand in the economy changes. Adjusting the size of the workforce entails certain costs for the companies. **When demand varies, it is therefore rational for the companies, in the short term, to instead vary how much they utilise the existing workforce.** In a typical process in connection with changes in the business cycle companies adjust production first, then the number of hours worked in production and, finally, the size of the workforce at the company.

Three phases in upturns and downturns

In the initial phase of an economic *downturn* it is common to reduce production without a corresponding adjustment in the number of hours worked. This means that the companies' existing resources are utilised less efficiently and that productivity growth declines. The companies do not immediately adjust the number of hours work to the lower level of production. **There may be several reasons why this takes time.** Companies may initially perceive the fall in demand as temporary. It also takes time for companies to plan how to utilise their existing personnel in the new situation.

It is not until the next phase of a downturn that the number of hours worked is adjusted. In this phase, companies may, for example, choose to alter the number of shifts, stop or reduce new recruitment or train their existing personnel. This means that the number of hours worked is adjusted without adjusting the number of employees, that is average working hours are reduced. In Sweden, the time lag between GDP and the number of hours worked has averaged one quarter since 1981.[3]

2 See for example Okun (1962), Kydland and Prescott (1982), Christiano and Eichenbaum (1992), Kydland (1995) and Millard et al. (1997).
3   One quarter is the time lag that gives the highest Correlation between the variables in the period 1981:1-2009:4.

In the third phase, companies also adapt the number of employees to the lower level of demand. There are several reasons for this time lag. Staff turnover is costly for the companies. Swedish labour legislation is probably a significant factor in this context.[4] Laying off personnel takes time and during such a process the productivity of the employees may be lower. The companies may also envisage that it will be difficult to find skilled and correctly-trained personnel when demand recovers.[5] The time lag between GDP and employment in Sweden has averaged two quarters since 1981, which is one quarter more than the time lag between GDP and hours worked. Figure 1 shows how GDP and employment evolved in Sweden in the period 1981-2009.

Only the phases in an economic downturn are described in this section. The opposite applies in an upturn, that is first production growth *increases* without the corresponding change in hours worked and so on.

"Labour hoarding" and "jobless growth"

It is thus rational and normal that companies do not immediately adjust their existing workforces when demand changes. **This also means that the development of employ**ment is more stable than that of production and hours worked. **The fact that com**panies may choose to "ride out the storm" with their existing personnel in periods of declining demand is often referred to by economists as *labour hoarding*. Such a phase may be followed by a period of economic growth without an increase in employment, a phenomenon often referred to as *jobless growth*. A company's decision to wait to recruit new staff may be explained by the fact that it has unutilised resources that it can use when demand increases again.[6] A certain degree of labour hoarding and jobless growth is thus normal over a business cycle. However, when periods of labour hoarding and jobless growth become unusually long, questions arise about how the relationship between the business cycle and activity on the labour market has changed over time.

The supply of labour and the business cycle

The supply of labour also varies over the business cycle. The likelihood of finding a job decreases in a downturn, which leads to more people leaving the labour force (this dampens the increase in unemployment). Some people choose to begin studying, for example. During an upturn, on the other hand, the chances of finding a job increase, which instead increases the supply of labour as more people enter the labour market (this slows down the decrease in unemployment). The time lag between GDP and unemployment has averaged two quarters since 1981, that is the same as for the time lag between GDP and employment. Figure 2 shows how GDP and unemployment evolved in Sweden in the period 1981-2009.

Okun's law – an estimated relationship between the business cycle and unemployment

Unemployment thus normally co-varies with the business cycle. **Economists usually re**fer to this relationship as *the Okun relationship* or *Okun's law*.[7] Okun (1962) presented two empirical relationships, the difference version and the gap version, between the business cycle and unemployment. The difference version of Okun's law captures the relationship between GDP growth and the change in unemployment, while the gap version shows the relationship in the form of deviations from a more long-term trend.[8] Okun's law states the level of GDP growth required for the level of unemploy-

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4 The Act on Security of Employment stipulates, for example, that an employee is entitled to a period of notice between 1 to 6 months and that the companies must issue a redundancy notice 2 to 6 months before the period of notice begins.
5 There are also a number of other factors that influence a company's decisions about the size of its workforce that are perhaps less dependent on the current cyclical situation. The fact that employees are about to retire, are absent due to illness or on various forms of statutory leave, such as parental leave or leave of absence, may affect a company's decisions with regard to the number of hours to be worked by the existing personnel or the size of the workforce.
6 Other conceivable explanations of how GDP can grow without an increase in employment are, for example, capital injections, innovations (technology shocks) and the structural transformation of the economy.
7 In the early 1960s, Arthur Okun formulated the negative relationship between GDP growth and changes in unemployment that has become known as Okun's lag. This is one of the best known empirical relationships in macroeconomics and is often used as a rule of thumb in forecasting contexts. James Tobin (1983) described Okun's law as "one of the most reliable empirical regularities of macroeconomics."
8 The gap version of Okun's law is difficult to use in practice as the potential levels of unemployment and GDP are not observable and must therefore be estimated.

ment to remain unchanged. The law itself states that if actual GDP growth is below this level then unemployment will increase, and vice versa.[9]

Estimating the difference version of Okun's law on the basis of Swedish data reveals a relatively strong contemporaneous relationship between unemployment and GDP growth (see Figure 3). Over the last year, however, it appears that this relationship has weakened (see also Figure 2). GDP fell heavily in 2009 without unemployment increasing as expected, given the historical relationship. GDP fell by almost 5 per cent. According to Okun's law, as illustrated in Figure 3, unemployment should have increased by approximately 3 percentage points. **The outcome was almost one percentage point lower.**

However, as the business cycle affects unemployment with a certain time lag it is not only the contemporaneous relationship that is of interest. **The change in unemployment is also affected by GDP growth in earlier periods and possibly by the change in unemployment in earlier periods. A dynamic version of Okun's law is therefore estimated.** The model includes both contemporaneous GDP growth and GDP growth in the two preceding periods, as well as the change in unemployment in the immediately preceding period, in accordance with the following equation:[10]

(1) $\quad$ *Change in unemployment$_t$ = a + b$_0$*(BNP growth)$_t$ + b$_1$*(BNP growth)$_{t-1}$ + b$_2$*(BNP growth)$_{t-2}$*
$\quad\quad\quad\quad$ *+ q*(Change in unemployment)$_{t-1}$ +ε$_t$*

The ratio *-a/∑b* measures how quickly the economy needs to grow for the level of unemployment to remain unchanged. The Okun coefficient, which measures the effect that the rate of GDP growth has on unemployment, is expected to be negative. This means that a higher rate of GDP growth is associated with a lower level of unemployment, and vice versa. The Okun coefficient from the dynamic version of Okun's law is calculated as *(∑b/(1-q)).*

Has the relationship changed?

Okun's law is an empirical relationship that can change over time. **As the relationship between GDP and unemployment is dependent on factors such as technological development, politics, legislation, preferences, social norms and demographics there is also reason to believe that the Okun coefficient changes over time.** In periods when the relationship between the business cycle and activity on the labour market is weaker, for example when the degree of labour hoarding is higher than the historical norm, one may expect the Okun coefficient to decrease, and vice versa.[11]

In order to analyse how the Okun relationship has varied over time, equation (1) is estimated using so-called rolling regressions.[12] The Okun coefficients are estimated on the basis of quarterly data, expressed in terms of the annual percentage change, from the first quarter of 1977 to the fourth quarter of 2009. Each rolling regression is estimated on the basis of 40 quarters, that is 10 years. This means that the first rolling regression estimates the value of the coefficients from equation (1) on the basis of the data from the first quarter of 1977 to the fourth quarter of 1986. The sample is then moved one quarter ahead at a time and the regression is estimated once again. The procedure is repeated until the final sample is reached, which comprises the first quarter of 2000 to the fourth quarter 2009. This method means that older data will not affect the more recent relationships; for example, changes that occurred in the 1990s will not affect the estimates for the 2000s.

9 For the USA, Okun (1962) found that GDP growth must be at least 3 per cent to prevent unemployment rising.
10 Time displaced observations are included in the model to capture the persistency of the data and to obtain the best fit possible to actual data. By including the lagged dependent variable in the equation one can also remove the serial correlation in the error term (ε$_t$). It should also be mentioned in this context that the results in the study are sensitive to the choice of model specification.
11 Previous studies have shown that the Okun coefficient varies strongly depending on the country and period studied. The coefficient is lower in countries where employees enjoy a high degree of labour-market protection, for example Japan where there are lifetime contracts on the labour market. At the same time, the relationship is more unstable in countries with less flexible labour markets. See for example Moosa (1997), Sögner and Stiassny (2002), Altig et al. (2002) and Knotek (2007).
12 The use of rolling regressions means that a specific relationship is estimated for several different periods. Each individual regression produces a number of estimated coefficients. If the relationship is stable over time, the values of the estimated coefficients will not differ very much from each other.

The relationship between the business cycle and unemployment varies over time

Figure 4 shows how both the estimated Okun coefficient and the rate of GDP growth that is compatible with unchanged unemployment have varied over time. Throughout the sample, the Okun coefficient has varied between -0.4 and -1.5. The coefficient was in the region of -0.5 until the early 1990s. It then increased to remain relatively stable at around -0.9 for a period of ten years. The coefficient increased further in 2004 and averaged -1.2 up to the end of 2008. This indicates that unemployment in the period 2004-2008 was more sensitive to changes in GDP. However, the final rolling regression, which is based on the last 10-year period and also includes 2009, indicates that unemployment has once again become less sensitive to growth in the economy. The relationship between GDP and unemployment is now approximately -0.7, which is close to the historical average since 1977. This means that if GDP growth is one percentage point above "normal" (the growth that is compatible with unchanged unemployment), then unemployment will fall by approximately 0.7 percentage points.

It can also be seen in Figure 4 that, at present, higher GDP growth is required to reduce unemployment, compared to an estimate for the entire sample. Viewed over the entire period, GDP would have needed to grow by more than 2.3 per cent in order to reduce unemployment. This relationship, like the Okun coefficient, has also varied. In the early 2000s, the level of GDP growth compatible with unchanged unemployment began to rise and has now reached 2.8 per cent.

The analysis also shows that it now takes longer for a change in GDP to have a full impact on unemployment. Figure 5 shows the accumulated effects on unemployment if GDP in period 1 (the first quarter) grows by one percentage point more than is required for unemployment to remain unchanged. The various lines in the figure show how the effects of GDP growth on unemployment differ in the different periods. For the estimate relating to the period 2000-2009, only 40 per cent of the total impact on employment has occurred after four quarters. Prior to this, in both the 1980s and 1990s, the impact in the first four quarters is approximately twice as large, that is 80 percent.

Conclusions

The relationship between variations in GDP and activity on the labour market is fairly strong. **It is also normal that there is a certain time lag between changes in production** and activity on the labour market. **However, business cycles may be very different** in character. The reasons why crises arise vary, and the factors that determine the strength and duration of a business cycle are seldom identical. Alongside cyclical variations, structural changes also take place in the economy. All-in-all, this means that the relationship between GDP growth and activity on the labour market changes over time. One sign that the relationship has changed over the last year is that the dramatic fall in GDP in 2009 did not result in a increase in unemployment as expected given the previous historical relationship.

Okun's law is an estimated relationship between the business cycle, in terms of GDP growth, and activity on the labour market, in terms of unemployment. Estimates made on the basis of Swedish data show that the relationship between GDP and unemployment has varied in different periods. Over time, there has been a tendency for GDP growth to have an increasing impact on unemployment. However, when the last year are included in the estimates, the relationship weakens once again and is in line with the historical average since 1977. At the same time, a higher level of economic growth is now required to change the level of unemployment compared to the average historical relationship. The results also show that it now takes longer for a change in GDP growth to have its full impact on unemployment.
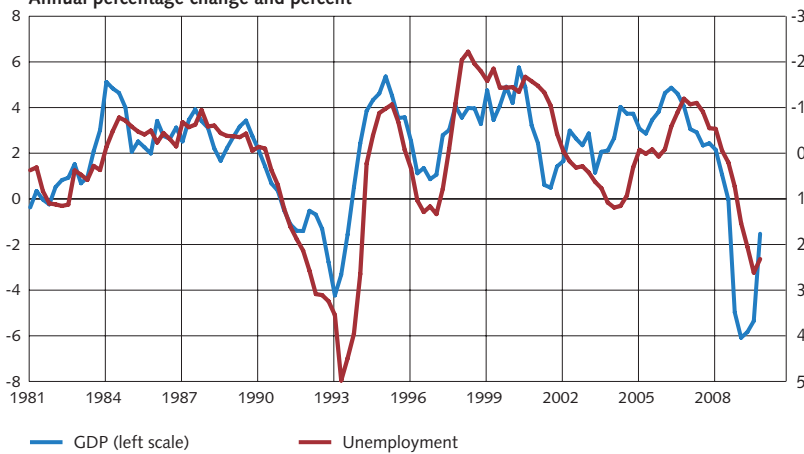
Figures

Figure 1. GDP and employment (15-74 age group), seasonally-adjusted data.
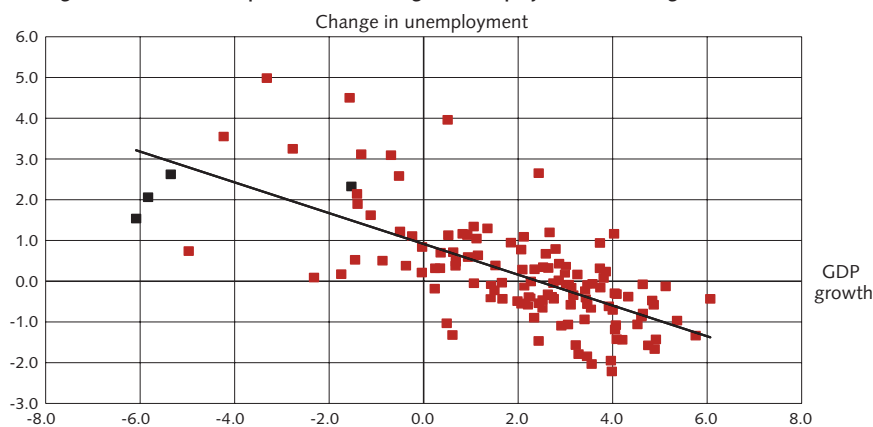**Annual percentage change**

GDP   Employment

Note. Data for employment before 2001 has been spliced by the Riksbank.
Sources: Statistics Sweden and the Riksbank.

Figure 2. GDP and unemployment (percentage of labour force, 15-74 age group), seasonally-adjusted data.
Annual percentage change and percent


GDP (left scale)   Unemployment

Note. Note the inverted scale on the right axis. Data for unemployment before 2001 has been spliced by the Riksbank.
Sources: Statistics Sweden and the Riksbank.

**Figure 3. The relationship between the change in unemployment and GDP growth**

Note. The regression line is given by the following equation: Change in unemployment$_t$ = 0.91 − 0.38*(GDP growth)$_t$.The equation is estimated on the basis of quarterly data, expressed in terms of the annual percentage change, from the first quarter of 1977 to the fourth quarter of 2009. The data for 2009 are marked as black boxes.
Source: The Riksbank

Figure 4. Estimated rate of growth that retains the level of unemployment and the sensitivity of unemployment in relation to the growth of the economy.
Per cent and estimated coefficients

— GDP growth compatible with unchanged unemployment (left scale)
— Dynamic Okun coefficient
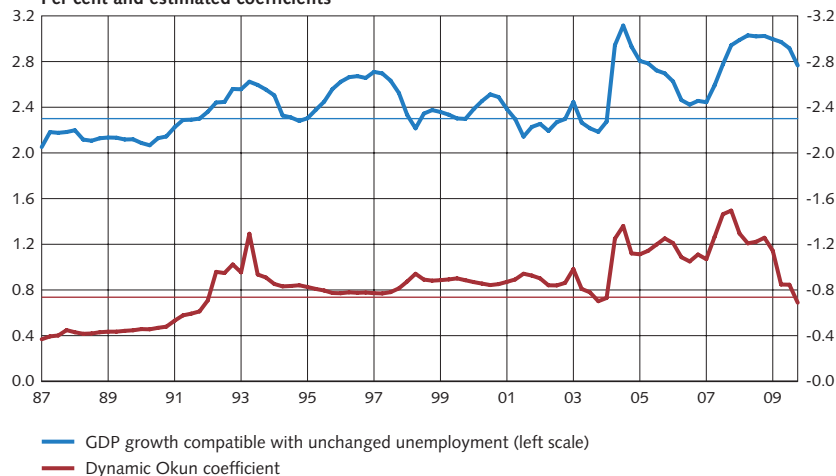
Note. Note the inverted scale on the right axis. Thin unbroken lines show estimates for the entire sample (1977:1 – 2009:4)
Source: The Riksbank

Figure 5. Accumulated impact on unemployment of a change in GDP growth, various periods.
Percentage points

Periods

— 1989:4   — 1999:4   — 2009:4   − − 1976–2009
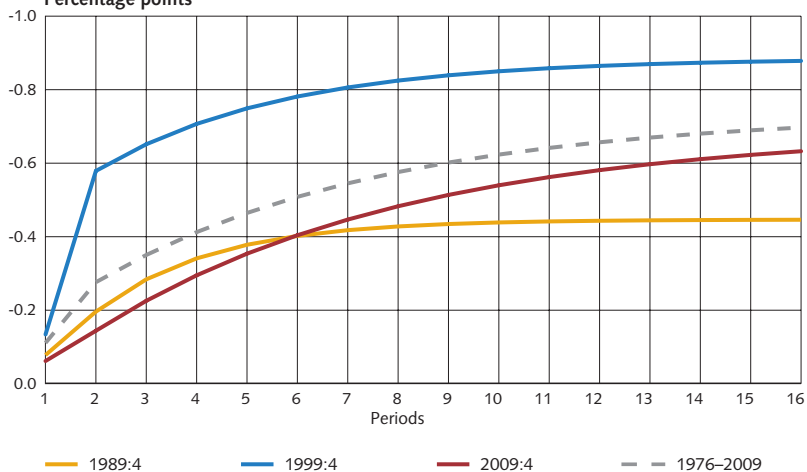
Note. The dating relates to the final quarter in the sample for the estimation of the coefficient. Each regression is estimated on the basis of 40 quarters (i.e. 10 years). The grey broken line represents an estimate of the entire sample.
Source: The Riksbank

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