Economic Commentaries

Lower labour shortage could partly explain low wage growth

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Nominal wage increases in Sweden have been unusually low in recent years, despite a strong outcome for the Swedish labour market. Several indicators point to demand for labour having exceeded supply, which according to the textbook should have led to higher wage growth. In this Commentary I show how survey-based indicators can have exaggerated the demand for labour in recent years, and thus exaggerated wage pressures. The analysis shows that Swedish companies raise salaries when they perceive it is difficult to obtain staff and that they raise salaries more the higher the shortage of labour. A new supplementary indicator shows that the shortage of labour may be lower than other measures are showing, and that this could partly explain why wage growth has been more subdued in recent years. However, the analysis does not fully explain why wage growth has been so low. It is therefore probable that other changes on the labour market have contributed to slowing down wage growth in recent years.

The labour market in Sweden has developed very strongly in recent years. Unemployment has shown a falling trend since the end of 2012, although there are signs of an upturn over the past year, and many analysts agree that the demand for labour has been higher than the supply. According to the textbook, a strong labour market, all else being equal, should lead to faster wage growth.[2]

Several indicators used to assess the demand for labour are based on surveys. **Surveys have many advantages:** they are directly accessible after the reference period, they are not revised and they give an idea of the variables that cannot be measured in register-based statistics.

Figure 1 shows one of the most common questionnaires used, the National Institute of Economic Research, NIER's, indicators of labour shortages in the business sector, to follow the demand for labour over time, and total nominal wage increases in the business sector in Sweden. Prior to the crisis, the correlation between the indicator and nominal wage increases was relatively strong, with some time lag. But since then, the correlation appears to have weakened.[3] Despite the percentage of companies reporting a labour shortage increasing from just under 13 per cent in the middle of 2013 to 47 per cent during the third quarter of 2018, wage growth was stable at around 2.5 per cent.

Survey data also has disadvantages In the NIER's survey, for instance, companies respond to how they perceive production, employment or profitability. The view of what is "normal" or entails "an increase" can in these surveys represents different levels or quantities at different points in time, which can make it difficult to interpret the results.[4] For instance, the normal situation in the NIER's Economic Sentiment Indicator (a value of 100) now seem to correspond to a lower GDP growth than was the case prior to the crisis.[5] There could be several reasons for this. But one explanation is that longer periods of weak economic activity cause the respondents to review what they consider as normal. In other words, "normal" now means a lower growth than before. In contrast to the

[2] Other important factors for wage development are, for instance, inflation expectations and productivity growth.
[3] Among others, Borio (2017) and the Swedish Association of Industrial Employers (2018) claim that digitalisation and globalisation may have contributed to weakening the relationship between labour shortages and wage developments. But the fact that the overall correlation between developments in wages and measures of resource utilisation as well as unemployment change over time, does not necessarily mean that the behaviour of the employees or employers has changed. It can instead be an effect of other so-called exogenous changes influencing the relationship during a period of time. Jonsson and Theobald (2019) illustrate with the aid of a macroeconomic model how such changes can affect the relationship on an overall level.
[4] There are central banks that try to obtain an idea of how intensive the labour shortage is. For instance, the Bank of Canada asks questions both about whether the shortage of labour makes it difficult to meet demand and whether the shortage has become more or less intensive. See Bank of Canada (2019).
[5] See DG-ECFIN (2017) and the National Institute of Economic Research (2018a). The Economic Sentiment Indicator serves the purpose of measuring the current sentiment in the Swedish economy by using the information from all of the National Institute of Economic Research's surveys.

Economic Sentiment Indicator, which is often related to GDP growth, the shortages in the NIER's survey do not have any equivalent in register-based statistics, which means it is not possible to make similar analyses to the ones the NIER makes for the Economic Sentiment Indicator.

There are, of course, other measures than survey data that show demand in the economy, such as the employment gap, the hours worked gap or the GDP gap.[6] However, the calculations are often uncertain in real time, which is because data is revised but also because the estimated trends (or equilibrium levels) change over time.[7] Other measures of the situation on the labour market include data on vacancies and job openings produced by Statistics Sweden (SCB), but unfortunately these statistics are also uncertain.[8]

Figure 1. Correlation between labour shortages and wage developments
Left scale: percentage of companies reporting a labour shortage, per cent. Right scale: annual percentage change.
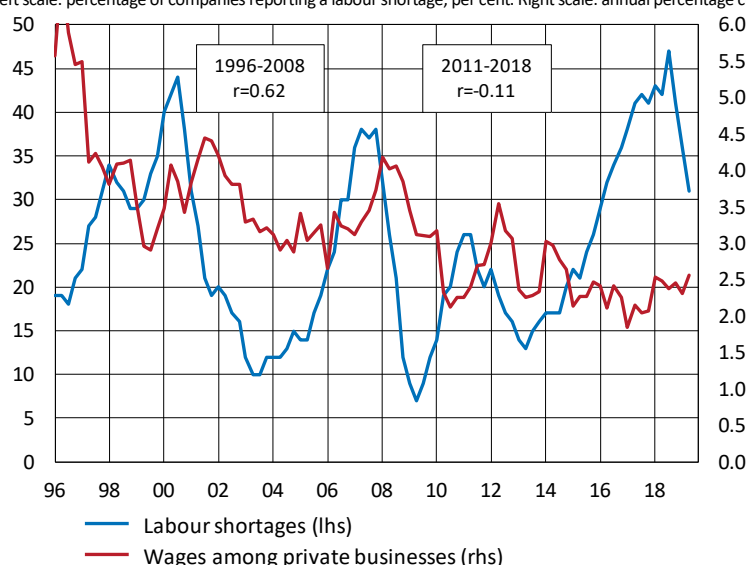
Sources: National Mediation Office and National Institute of Economic Research.
Note. The correlation coefficient r has been calculated as an average with a labour shortage moved forward five or six quarters. The period 2009-2010 is excluded.

A relatively uncharted source is the Swedish Public Employment Service's interview survey including employers throughout Sweden, which is carried out twice a year. Unique to this survey is that it gathers detailed information on the companies' labour shortages and the average wage development per employee at each workplace.[9] On the whole, these data are very similar to those on shortages produced by the NIER, and to wage developments in the short-term wage statistics compiled by the National Mediation Office, see Annex 1.

The data is collected by staff at the Swedish Public Employment Service, through personal visits to employers, or by telephone interviews. The survey is the largest corporate survey of its type in Sweden and covers around 11,000 interviews with companies every six months.

Microdata from this survey is used in this Economic Commentary to analyse an alternative measure of relative labour shortages and how they are linked to wage developments in individual companies. In total, the material used in this commentary covers 240,000 responses from 2007 up to the first half of 2018 (2018h1). Using firm-level data makes it possible to investigate, for instance, labour shortages and wage developments in

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[6] Using unemployment as a measure of resource utilisation is complicated by the fact that the composition of the labour force changes over time, and that different groups become established on the labour market with varying ease.
[7] See, for instance, Orphanides and van Norden (2002). Newer studies use other methods of calculating the trends that are less sensitive to these problems. See, for instance, Stock and Watson (2019).
[8] See Statistics Sweden (2019).
[9] For the remainder of this Economic Commentary, the concepts of company and workplace will be used synonymously.

different groups of companies. It also enables modulation of the picture of how labour shortages have developed and how wages have been affected since the crisis years.

The first part contains a general presentation of the survey and then I investigate how the companies manage labour shortages. In the second part, I create an alternative measure of relative labour shortages that takes into account how many shortages the companies report and investigates how the measure is linked to the companies' wage growth. The final part compares the usual survey-based indicator of labour shortages with the new one.

The Swedish Public Employment Service's interview survey (AFU)

The Swedish Public Employment Service's interview survey (AFU) is based on a representative selection of workplaces in terms of branches (SNI 2007), regions and sizes based on the number of employees. The workplaces have been taken from Statistics Sweden's company register and all workplaces with more than 100 employees are included in the survey. Participation is voluntary, but in general the response frequency is much higher than for other surveys, often above 80 per cent.[10] According to the Swedish Public Employment Service, this is because the questions are asked during a personal meeting or by telephone, often with a manager at the company, and because the Employment Service staff and the employers have a history of contacts.[11]

The number of workplaces interviewed is very large for a sample survey, and this means that the reliability is assessed as good.[12] Surveys normally ask very simple and brief questions to enable respondents to reply quickly.[13] **As the Swedish Public Employment Service carries out the interviews**, either at personal visits or by telephone, **they also ask more detailed questions than normal surveys.** Annex 1 shows the questions in the AFU used in this Economic Commentary.

How companies manage labour shortages

**Companies that have a shortage of labour do not necessarily increase wages to recruit.** Figure 2 shows how the companies respond to the question about managing labour shortages. Seen across the whole period 2007-2018, the normal situation is that the shortage means it takes longer to recruit than before and that the companies need to lower their requirements regarding experience, education or social competence. It is also common that the recruitments are broken off completely. Other measures are also used. This could be that the company uses external recruiters, recruits to a different region, uses subcontractors or a staffing agency. Raising salaries comes in fifth place, seen across the entire time period. **But it has become more common to raise salaries during the period 2016-2018 than it was in 2013-2015.** It has also become somewhat more common for companies to lower their competence requirements or offer other benefits, while it has become less common for companies to break off the recruitment or take other measures.

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[10] For instance, the weighted response frequency is 70 per cent for the manufacturing industry and construction and plant industry, and around 60 per cent in the trade and commerce sector in the NIER's Economic Tendency Survey.

[11] This is similar to the experience form the Riksbank's Business Survey which is mainly carried out with the largest companies in Sweden.

[12] Other authors have also investigated how the companies' responses to the surveys are linked to actual outcomes. They find that they often coincide. See Müller (2009) and Liu et al (2011).

[13] Surveys often used so-called Likert Scales (Increase, Unchanged, Decrease) as response alternatives to various statements and questions. One problem with these scales is that the intensity of weight of a particular response alternative is not included in the calculations. Some political surveys instead use quadratic voting methods, which means that each respondent has a pot of "points" to distributed between different response alternatives in a survey. This means that respondents are forced to think about how much weight they want to give a particular alternative, and the method has proved to give different results than the Likert Scales. See, for example, Cavaille et al (2018).

Figure 2. Companies have several ways of managing labour shortages
Percentage of responses
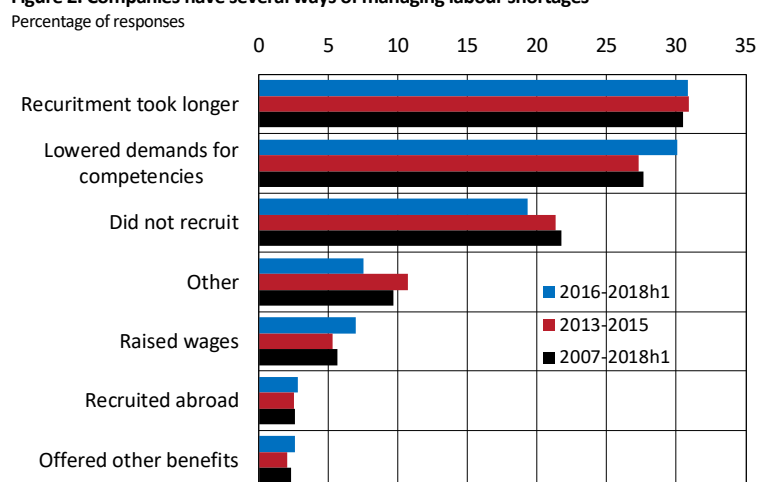
Source: Swedish Public Employment Service.
Note. Competence requirements sums up the responses for the alternatives experience, education and social competence. Black columns are an average across the whole period 2007-2018h1. Blue columns are an average from 2013-2015 and red columns refer to 2016-2018h1. From 2013, the percentages are calculated to the level that would have been attained if all companies in the population had been asked. Prior to 2013, the development in the similarly weighted responses is used to link the time series. But the development is in principle the same if the entire time series is equally weighted over the entire time period.

Do wage increases differ for companies with shortages and those without?

One way of examining how the labour shortage in the AFU figures is related to wage developments is to calculate the average wage increases for groups of companies without labour shortages, companies that do have labour shortages and companies with shortages who respond that they are increasing wages because of the labour shortage.[14] But the way the labour market functions has changed over the years and the globalisation and digitalisation of the past decades could mean that the transmission between labour shortages and wages has been dampened.[15] In addition, other changes in the Swedish labour market since the crisis years may have contributed to weakening the relationship.[16]

Figure 3 therefore divides companies' wage increases into three periods: prior to the crisis 2007-2008, during and immediately after the crisis 2009-2012 and the period with low wage increases 2013-2018h1. This shows that companies without labour shortages had a rate of wage growth of 3.6 per cent during 2007-2008, 2.9 per cent during 2009-2012, and 2.6 per cent in 2013-2018h1. The wage growth rate was 0.2 percentage points higher for companies with labour shortages (red columns) during 2007-2008 and 2009-2012, but only 0.1 percentage points higher during 2013-2018h1. For companies with labour shortages that also raised wages to manage the shortages (blue columns), the difference was around 0.8 percentage points during 2007-2008, 0.7 during 2009-2012, and 0.6 percentage points during 2013-2018h1.

The fact that the difference in wage increases has declined between companies with and without labour shortages indicates that the shortage now has less effect on wage increases than prior to the crisis.[17] **One explanation may be that the degree of labour shortages is varying between the periods.** For instance, the companies responding to the Riksbank's

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[14] These types of analysis cannot be made using, for instance, the National Institute of Economic Research's data, as they do not gather information on wage growth in these companies.
[15] See Borio (2017).
[16] See National Institute of Economic Research (2018b) and Jonsson and Theobald (2019).
[17] This agrees with several studies showing that the transmission between different measures of resource utilisation and wages has weakened. See, for instance, Sveriges Riksbank (2018b).

Business Survey state that they do not experience any major general shortage of labour.[18] On the other hand, they often experience shortages of special competences and there the wage increases have been larger, but have not yet had an impact on the total wage growth in the companies. It is therefore important to also examine whether the labour shortages refer to individual recruitments or is more general.

Figure 3. Wage growth is higher in companies with labour shortages
Annual percentage change in wages.
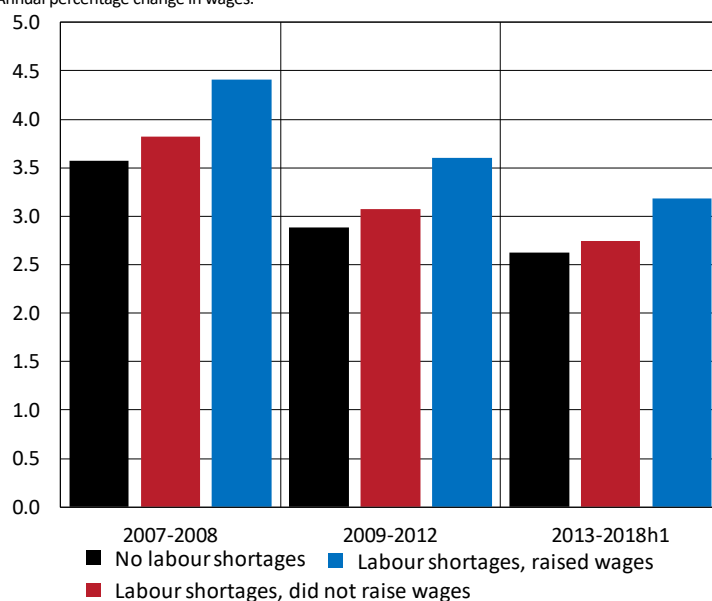
Source: Swedish Public Employment Service.
Note. The figures show the average rate of wage growth among companies without labour shortages (black columns), companies with labour shortages but responding that they do not raise wages (red columns), and the companies with labour shortages who say that they raise wages when they experience labour shortages (blue columns). The average for 2007-2008 is based on 25,965 observations regarding companies without shortages, 10,580 for companies with labour shortages but that do not raise wages, and 1,315 for companies that experienced shortages and raised wages. For 2009-2012, the same figures are 60,623, 13,884 and 1,125. For 2013-2018h1 the figures are 68,731, 31,338 and 4,065.

A new company-specific measure of relative labour shortages

To obtain a measure of relative labour shortages at company level, the number of labour shortages in the AFU figures is related to the number of employees per workplace, see (1).[19]

$$BK_{it} = B_{it}/S_{it} \tag{1}$$

BK_{it} is thus the ratio between the number of labour shortages and the number of employed. B_{it} is the number of labour shortages in a company i during the time period t and S_{it} is the number of employed. If the shortage increases, but employment remains constant, the ratio rises and indicates that the labour shortage is increasing. On the other hand, if the shortage remains unchanged at the same time as the number of employees in the company increases, the ratio falls.[20] One weakness is that the measure does not take into account how labour shortages vary with regard to different competences and professional roles. It may be the

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[18] The Riksbank's Business Survey in November 2018.

[19] This is done because a shortage of an employee can push wages upwards in a company with 10 employees, while it probably has less significance in a company with 100 employees.

[20]As the number of posts where the companies are experiencing a labour shortage and the number of employees in the survey at times contain extreme values, the mean values calculated in the data will be affected. The fact that there are extreme values is in some cases due to incorrect reporting. To manage extreme values one can use various methods. The simplest is quite simply to exclude them from the data. Another method is to apply so-called winsorization, which is the method used in this Economic Commentary. It means that extreme values are replaced by a specific value instead of entirely excluding the observation. In this case, the ratio of labour shortages and the number of employed is winsorized to the 99th percentile. This means that deviating observations carry less weight when calculating mean value. For instance, there is an observation in the data where the ratio of unfilled posts to the number of employed amounts to more than 142,720%, which appears unreasonable.

case that a company has a major shortage of IT engineers, for instance, at the same time as they employ more production workers, so that the number of employed rises more than the labour shortages. In this case, the measure at company level would imply that the relative labour shortage was falling on the whole, despite it remaining unchanged for special competences. For more detailed analyses of how labour shortages in various professions have changed, this is a weakness, but it should be less significant in analyses at a more general level.

Figure 4 shows how the relative labour shortage has developed, measured by the mean and median values of the ratio over time.[21] The measure was much higher in 2007 than during the period 2013-2018h1. During the crisis year 2009, the relative labour shortage was also higher than during the previous years. This may appear strange, as 2009 was a year with a large fall in demand and probably a rather small labour shortage in general.

One explanation for this is that employment fell relatively more than the shortage of labour in these years, and that a substantially smaller percentage of companies actually reported a labour shortage. For instance, there were only around 1,500 companies responding "Yes" to the question of whether they had a labour shortage in 2009, which can be compared with on average 3,370 companies in 2007-2008, or an average of 3,280 companies in 2013-2018h1. When fewer companies respond that they have a shortage, the spread in the measure of relative labour shortage increases and it becomes more uncertain at total level.

Figure 4. Relative labour shortages was lower 2013-2018 h1 than under 2007-2008
Per cent
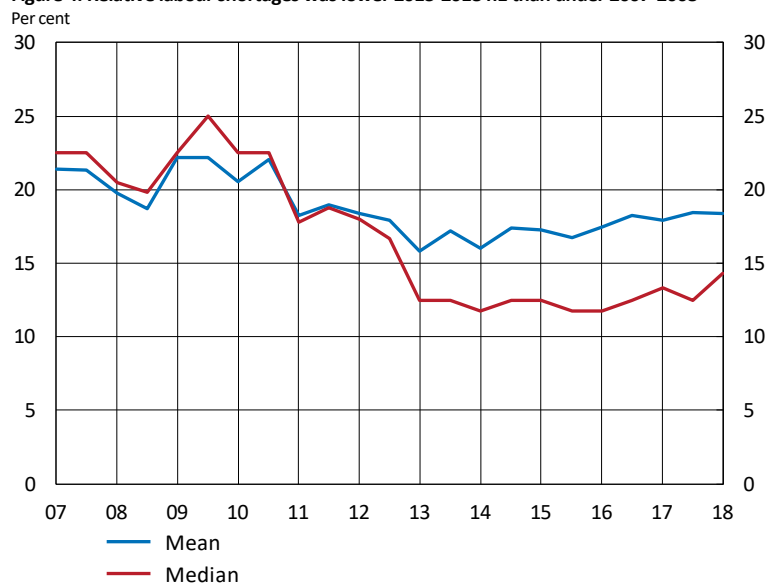
Source: Swedish Public Employment Service.
Note. The ratio for the labour shortage is calculated as the number of unfilled posts/number of employees at the company. The average and mean value have been calculated for all companies every sixth months. From 2013, the percentages are calculated to the level that would have been attained if all companies in the population had been asked. Prior to 2013, the development in the similarly weighted responses is used to link the time series. But the development is basically the same even when the whole series is equally weighted over the entire time period.

The respondents who nevertheless reported a shortage in the survey were in general smaller companies and at branch level, for instance, an unusually large number of recruitment agencies responded that they had difficulty finding labour in 2009.[22] One

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[21] When the average and the mean value differ, this is because the distribution of values is biased in some way. When the average is higher than the mean value in a sample, it means that there are a few observations with very high values and a large number of observations with lower values.
[22] Other branches responding that the shortage was higher than normal compared with other periods included scientific research, architecture and software producers.

possible explanation for recruitment agencies in particular experiencing difficulty finding employees in 2009 could be that they began to predict the need for a flexible labour force within the manufacturing industry after the financial crisis. Although employment fell more quickly in staffing companies in 2009, it also rose much faster than in other branches in the following years, which indicates that they had staff available to meet the increased demand.[23]

As the measure is affected by the number of companies that actually have a shortage of labour, it is appropriate to supplement it with other measures to obtain a picture of the shortage at an overall level. **The measure should thus be regarded as a complement to other survey data, statistics and analyses.** One method of using the information to gain an overall picture of the labour shortage is presented at the end of this Economic Commentary.

Larger relative labour shortages linked to higher wage growth

With the new measure it is possible to analyse how the relative shortage of labour is linked to average wage growth. This is done by dividing up all of the companies into groups according to the size of their relative shortage. In the first decile group there is the tenth of the companies that has the lowest relative labour shortage seen over the total time period (2007-2018h1), while the decile group ten is the tenth of the companies with the highest shortage. **Figure 5 shows that the average wage growth increases with each group: the larger the relative labour shortage, the higher the wage growth.**

Figure 5. Companies' wage growth increases in line with relative labour shortage
Annual percentage change

■ Labour shortages, did not raise wages
■ Labour shortages, raised wages

Source: Swedish Public Employment Service.
Note. The figure shows the average wage increases for each decile of relative labour shortage seen over the whole time period 2007-2018h1. For companies with relative labour shortages but not raising wages, the calculation is based on 53,728 observations and for companies that raise wages, it is based on 6,269 observations. The average relative labour shortage in the respective decile is: 1: 0.64 per cent, 2: 1.65 per cent, 3: 2.97 per cent, 4: 4.55 per cent, 5: 6.60 per cent, 6: 9.14 per cent, 7: 11.99 per cent, 8: 15.93 per cent, 9: 23.02 per cent and 10: 51.44 per cent.

Wage growth is just over 2.7 per cent among the companies with labour shortages that do not raise wages in decile one, and it rises to just over 3.1 per cent in the decile ten group. For companies with a shortage that also respond that they are raising wages, the same figures are 2.9 and 4.2 per cent. **On the whole, this shows that wage growth tends to rise when the relative labour shortage increases.**

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[23] See, for instance, Almega (2014) which describes how staffing companies testify that after the crisis there was a change in direction for industrial companies because of the uncertainty being perceived as greater. This led to the percentage of temporary staff increasing and the development was also clear in white collar professions.

An overall indicator of labour shortages

Figure 6A shows an indexed series for the proportion of companies answering "Yes" to the question of whether they have experienced labour shortages in their recruitment over the past six months (black line). The figure also shows two indicators that consider the relative labour shortages from Figure 4.[24] **This measure shows lower labour shortages during 2018H1 than the normal survey-based indicator, which only shows the proportion of companies that are experiencing labour shortages, and is either on or below the level that prevailed in 2007.** It therefore differs from the normal survey-based measure, which has been above the 2007 level since the end of 2016. This is also the picture obtained from the National Institute of Economic Research's shortage figures, although they have fallen below the 2007 level in the latest quarters of 2019.

Figure 6. Labour shortages can be lower than those shown by normal survey-based shortage figures
Index: 2007H1=100.

(A) Shortages — Labour shortages — Mean — Median

(B) Shortages and increase wages — Labour shortages — Mean — Median
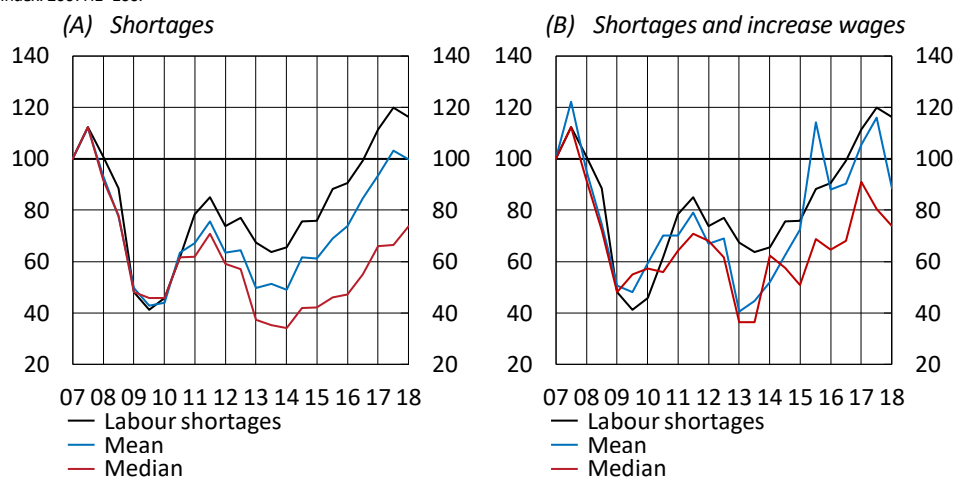
Source: Swedish Public Employment Service.
Note. The number of companies reporting labour shortages in (A) from 2013 and onwards is 2,900 on average. For companies in (B), the same figure is 375 on average. From 2013, the percentages are calculated to the level that would have been attained if all companies in the population had been asked. Prior to 2013, the development in the similarly weighted responses is used to link the time series. But the development is basically the same even when the whole series is equally weighted over the entire time period.

The measures are also estimated for the companies answering that the shortages lead to them increasing wages, see Figure 6B. Here, the sample is much smaller and the indicators therefore become more volatile, but provide approximately the same picture as before. This suggests that the labour shortages have been slightly lower than what is shown by other surveys, which can help to explain why wage increases have been slightly lower during the period 2013-2018H1.

But even this measure has risen since 2013-2014 without any significant change in wage increases. This suggests that other factors have also contributed to holding back wage development.

Other factors also affect wage development

In the article "Strong economic activity but subdued wage increases" in the Monetary Policy Report in July 2017, the Riksbank estimated several different empirical models for wage development in Sweden where, in addition to resource utilisation in Sweden, productivity development and inflation expectations, resource utilisation in the euro area was also

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[24] Relative labour shortages multiplied by the mean and median value of labour shortages. If the proportion of companies with labour shortages rises and relative labour shortages are unchanged, the indicator still increases. In the same way, it increases if the proportion is unchanged but relative labour shortages rise.

included.[25] Despite the inclusion of these additional variables in the estimations, the models generated significantly higher wage growth than was indicated by subsequent outcomes.

Increasing globalisation and digitalisation could explain this. For example, wage earners may become less willing to demand wage increases when the scope for companies to recruit from abroad increases or when production can be moved to another country. Digitalisation can make it easier to replace working tasks with technical solutions. But how these types of structural changes affect wages in Sweden is not obvious and different studies provide different results.[26] In addition, Swedish foreign trade as a share of GDP has been more or less unchanged since the great recession of 2008-2009 and indicators for Sweden's participation in global value chains suggest a decline since the crisis.[27] It can certainly be the case that companies and employees are slow to change and that the increasing globalisation in the decades before 2009 are still affecting behaviour on the labour market. How digitalisation has developed over time is difficult to measure, but available indicators suggest it has become more widespread since the crisis.[28]

Other possible factors that may explain the low wage growth in recent years are changes on the Swedish labour market. Jonsson and Theobald (2019) study how poorer matching efficiency on the labour market, weaker bargaining power among employees and lower compensation rates in unemployment insurance may have reduced the correlation between labour shortages and wages since the crisis. The composition of employees may also have reduced aggregate wage growth to a certain extent.[29]

Reduced labour shortages may partly explain the low wage increases

According to several analysts, the labour market in Sweden has been strong in recent years and demand for labour seems to have exceeded supply, which, according to the textbook, should have led to rising wage growth. But despite this, wage growth has remained subdued at around 2.5 per cent.

The analysis in this economic commentary, which is based on the firm-level data from the Swedish Public Employment Service's survey, shows that Swedish companies increase wages when they are experiencing difficulty in finding staff and that wages rise more when the shortage of labour increases. **A new indicator shows that the shortage of staff may be lower than other measures are showing, which could partly explain why wage growth has been more subdued in recent years.** It is thereby a complement to other types of survey, statistics and analysis.

But even the alternative measure points to labour shortages having gradually increased since 2013-2014, which should have led to slightly higher wage growth. The fact that wage development has still been subdued in recent years may therefore have to do with other factors.

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[25] See Sveriges Riksbank (2017) and Sveriges Riksbank (2018b).

[26] See Westermark (2019) for a review of how structural changes have affected wages and inflation.

[27] Se OECD (2019), Trade in goods and services (indicator). doi: 10.1787/0fe445d9-en (Accessed on 28 June 2019) and OECD (2019), Import content of exports (indicator). doi: 10.1787/5834f58a-en (Accessed on 28 June 2019).

[28] For example, e-Commerce as a share of total trade in Sweden has risen from 3 per cent in 2007 to 9 per cent in 2018. See Skingsley (2019).

[29] See National Institute of Economic Research (2018b).

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Appendix 1

The first question used in the this economic commentary relates to how many employees the company had one year ago, has at present, and will have one year and two years ahead, see Table A1. The second question is whether the company has experienced labour shortages when recruiting staff over the last six months. The wording of the question differs slightly from the National Institute of Economic Research's business survey, where respondents are asked to respond to the short statement "Labour shortages at present?" with a simple "Yes" or "No". [30]

Table A1: A selection of questions from the Swedish Public Employment Service's interview survey

1: Number of employees at the workplace (excl, staffing agency personnel): Estimate the number and make an assessment about the future.
12 months ago: Current situation: In a year: Two years ahead:
2: Have you experienced any labour shortage when recruiting over the last 6 months?
Yes   No   No need   State no. of places where you have experienced a shortage:
3: How is recruitment at the workplace affected by the labour shortage?
We did not manage to recruit, It took longer than normal to recruit, We lowered our demands regarding: education, professional experience or social skills, We recruited from abroad, We offered higher wages, We offered other benefits, Other measures.
4: Quantify how much the average wage (per employee) has risen at the workplace over the last year.
Less than 1 %,   1-2 %,   2-3 %,   3-4 %,   4-5 %,   5-6 %,   6-7 %,   More than 7%.

Another important difference between the two surveys is that the Swedish Public Employment Service, as a supplementary question, ask companies to state how large the labour shortage is, calculated in terms of work positions. This is an important supplement, as a "Yes" can mean several hundred work positions at one point in time and only a few positions at another. **Several companies having a shortage of *few* competencies probably has less of a bearing on total wage development than several companies having a more general shortage of *several* competencies.**

In the AFU, more supplementary questions are also asked about how recruitment is affected by the labour shortage. Respondents have various options to choose from and can answer that they did not manage to recruit, that it took longer, that they lowered their demands, recruited from abroad, offered higher wages, offered other benefits or took other measures.

The reliability of the responses collected in the AFU is high. This can be checked by looking at how the answers to the questions about wages and labour shortage in the survey correspond to other data. Figure A1A shows wage growth in the AFU, calculated as an average for all companies for each time period and wage growth in the business sector according to the National Mediation Office. For wage growth in the AFU, the mid-point for each response category in Table 1 has been used. This means that the average wage increase will be 0.5 per cent if the company answers less than 1 per cent, 1.5 per cent if they answer 1-2 per cent and 7.5 per cent if they answer more than 7 per cent.[31] The shortage figures in Figure A1B are the share of companies answering that they experience labour shortage in the AFU and in NIER's Economic Tendency Survey. **Despite the method differences, wage**
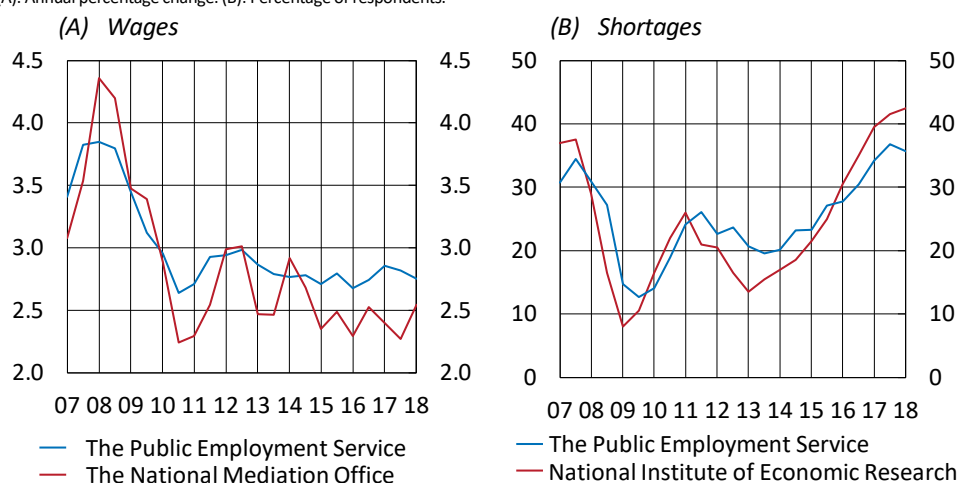
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[30] The National Institute of Economic Research's survey captures to a large extent the company's need to increase its number of employees, i.e. resource utilisation within the company. In the Economic Tendency Survey, a company can say that it has a shortage, but this does not necessarily mean that it is difficult to recruit staff. The questions are also worded slightly differently for different industries. See National Institute of Economic Research (2017).

[31] It is also the method used by the Swedish Public Employment Service when they pool together the responses in the LFS. It can of course be the case that a company that answers less than 1.0 per cent actually has wage growth that is lower or higher than 0.5 per cent. But the mid-points on the scales seem to work well to describe the total development, probably because wage development in Sweden is relatively compressed.

growth and indicators of labour shortage from the AFU tend to go in the same direction and provide the same qualitative picture as this other data.

Figure A1: Data from the AFU tallies with other statistics
(A): Annual percentage change. (B): Percentage of respondents.

(A) Wages	*(B) Shortages*
—— The Public Employment Service	—— The Public Employment Service
—— The National Mediation Office	—— National Institute of Economic Research

Sources: Swedish Public Employment Service and National Mediation Office
Note. Wage growth from the National Mediation Office and the shortage figures from NIER is calculated as an average for two quarters every half-year to match the half-year data from the LFS. From 2013, the time series are calculated to the level that would have been attained if all companies in the population had been asked. Prior to 2013, the development in the similarly weighted responses is used to link the time series. But the development is in principle the same if the entire time series is equally weighted over the entire time period.

Table A2: Number of establishments in total, establishments with a shortage and number of companies with shortages – whole survey.

	Number	Per cent
Total establishments	243,335	
Establishments with shortages	68,782	28.3
Establishments with shortages that are also raising their wages	7,101	2.9
Relative labour shortage	66,002	27.1
Relative labour shortage that are also increasing their wages	6,863	2.8

Note. The table shows the number of establishments included in the survey, number of establishments reporting a labour shortage and those reporting both a labour shortage and answering that they are increasing wages. It also shows the number of establishments where the measure of relative labour shortage can be calculated and those establishments that are also increasing their wages.