Wage formation in Sweden

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The development of wages in an economy can have an impact on inflation and as it is the objective of the Riksbank to keep inflation at a low and stable level we have to regularly analyse and produce forecasts for wage development. Historically, wages and prices in Sweden have covaried fairly well. However, instability in price and wage formation, for example in the form of upward or downward price-wage spirals, can occur in an economy for various reasons.

The aim of this article is to provide a greater understanding of how instability in price and wage formation can arise, but also of how the Swedish wage-formation model works. The article analyses wage formation in Sweden from the historical, institutional and international perspectives. It also presents an econometric model for wage formation that makes it possible to analyse how a number of factors affect wage formation in the Swedish economy. This model shows that the situation on the labour market and the collective agreements between the central employee and employer organisations are of great significance for wage formation in the short term.

Why do central banks produce forecasts of wage development?

Safeguarding price stability is an overall objective for most central banks today. The main tool that the central banks use to keep inflation low and stable is the policy rate. As the interest rate decisions affect inflation with a certain time lag, the central banks must base their decisions on forecasts of future inflation and the factors that may affect it. One such factor may be wage development in the economy. Many central banks thus attempt to forecast the development of wages. Wage development can, however, be measured in different ways and the measure or measures used vary

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from country to country.[1] It may also be the case that the development of labour costs, that is wages including employer's social contributions [2], or unit labour costs, which are also dependent on productivity, are more relevant when attempting to explain fluctuations in inflation.

Another reason for forecasting the development of wages is the attempt to predict price-wage spirals or wage-wage spirals. A central bank that has stable inflation as one of its objectives aims to prevent the occurrence of such spirals in the economy. For example, rising inflation can lead to higher inflation expectations among the social partners. Higher expectations of the future level of inflation may then influence the level of wage increases. A higher rate of wage increases may lead the rate of inflation to increase further, which in turn may lead to even higher inflation expectations – in other words, a price-wage spiral has begun. So-called wage-wage spirals can also arise in the economy. One example is when the social partners in one area of the labour market negotiate a wage agreement that entails wage increases of a certain level. The partners in other areas are influenced by the level in this agreement and conclude agreements that provide the same or somewhat higher wage increases than in the first agreement – in other words a wage-wage spiral has arisen.[3]

What can prevent or hinder the occurrence of price-wage spirals?

The probability of a price-wage spiral arising in the economy is affected by both cyclical and institutional factors. One important cyclical factor is the situation on the labour market. On a weak labour market, for example, an individual employee will be in a weaker bargaining position in relation to the employer. A falling rate of inflation in such a situation may increase the risk of a downward price-wage spiral. Similarly, a rising rate of infla-

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1 Most OECD countries use the level of the wage sums in relation to the number of people in employment according to their national accounts as a measure of national wage development. In Sweden, we often use the level of the wage sums in relation to the number of hours worked according to the national accounts, which provides a measure of the average hourly wage in the economy. Statistics Sweden also publishes short-term wage statistics and structural wage statistics, which means that more measures of wage development are available in Sweden than in many of the other OECD countries.

2 Employers' social contributions charges includes statutory employers' contributions and premiums for collective insurance schemes. The statutory employers' contributions consist of charges for old-age pensions, survivor's pensions, health insurance, occupational injury insurance and parental insurance, as well as a labour market contribution and a general wage charge. The general wage charge is essentially a tax on labour. The companies that are affiliated to the Confederation of Swedish Enterprise pay premiums to a range of collective health, occupational injury, life and supplementary pension schemes. Premiums for similar collective schemes for employees in the State sector are paid by the Swedish Agency for Government Employers and for employees in the local government sector by municipalities and county councils affiliated to the Swedish Association of Local Authorities and Regions.

3 During the 1970s and 1980s, a number of articles on economic theories relating to price-wage spirals and wage-wage spirals were published. A review of early economic theories regarding these phenomena is provided by Wood (1978). In more recent economic theory, terms such as price inflation persistence and wage inflation persistence are used to a greater extent to describe phenomena of this type.

tion when the labour market is strong increases the risk of an upward price-wage spiral.

The probability of a price-wage spiral arising in an economy is also affected by a number of institutional factors in wage formation. One such factor is how the social partners conclude wage agreements. In Sweden, wages are primarily negotiated between organisations on the labour market. The results of this collective bargaining process are shown in the collective agreements that these organisations enter into. Apart from collaboration at the sector level, there is also collaboration at a more central level. Since 1998, the central organisations on the employees' side have, to varying degrees, coordinated their demands ahead of the various rounds of collective bargaining. The employers have also coordinated their efforts to a varying extent. Local wage formation at the workplaces also occurs to a greater or lesser degree within the various sectors. The degree of centralisation in the collective bargaining process may be of importance with regard to preventing or hindering the occurrence of price-wage spirals. It is, for example, conceivable that a high degree of centralisation in wage negotiations will make it more difficult for such spirals to arise. According to a hypothesis presented in Calmfors and Driffill (1988), the most favourable macroeconomic outcome, that is an outcome that entails relatively lower levels of unemployment and inflation, is achieved in central and local wage negotiations. The least favourable macroeconomic outcome, according to this hypothesis, arises from wage negotiations that are not co-ordinated and conducted sector by sector.

Long agreement periods provide more stability

The Swedish wage formation model with collective agreements also makes the duration of the agreements an important factor that can affect the probability of price-wage spirals arising in the economy. Long agreement periods reduce the risk of price-wage spirals as the pay increases are partly or wholly stipulated in agreements during the period concerned. Since 1995, three-year agreements have been signed in several sectors of the Swedish labour market. According to the National Mediation Office (2008), approximately 99 per cent of the employees whose wage agreements were signed in 2007 have an agreement period of 31-42 months. In 2007, again according to the National Mediation Office, 572 wage agreements were signed between confederations/central organisations on the Swedish labour market and a total of approximately 3.4 million employees were covered by these agreements. A large number of companies also signed so-called application agreements that covered over 260 000 employees. The wage agreements that were signed in 2007 therefore cover

more than ¾ of the total labour force. This means that the probability of a price-wage spiral arising in the current situation should be fairly small.

Price and wage clauses in the agreements previously represented a strong breeding ground for price-wage spirals

However, the risk of price-wage spirals arising also depends on the structure of the individual wage agreements In the 1980s, wage agreements with price and wage clauses were common. Price clauses (price indexation clauses) in a collective agreement mean that the agreed wages are adjusted upwards if a given inflation index, usually the CPI, exceeds a certain predetermined level. Wage clauses (wage adjustment clauses) in a collective agreement mean that the agreed wages are adjusted upwards to the same level as other, as yet unknown, agreed wage increases within one or several other sectors. The use of price and wage clauses in collective agreements, which previously represented a strong breeding ground for price-wage spirals and wage-wage spirals, was dropped in connection with the so-called Rehnberg Agreement of 1991–1992. Agreements with such clauses have been very unusual on the Swedish labour market since then.

How large a part of the wage scope is determined by the central organisations on the labour market can also affect the probability of price-wage spirals arising in the economy. Agreements in which the entire wage scope is determined by the outcome of negotiations between the central organisations within the sector concerned should hinder the occurrence of price-wage spirals as the level of the wage increase is firmly stipulated in an agreement. Agreements in which wage increases are determined entirely or partly in a local wage formation process may, on the other hand, increase the risk of a price-wage spiral arising. According to the National Mediation Office (2008), approximately 24 per cent of the employees on the Swedish labour market covered by agreements signed in 2007 have agreements in which wage increases are wholly or partly determined locally.

Agreements with or without termination clauses may also affect the probability of price-wage spirals. Termination clauses in wage agreements may, for example, help to increase the probability of a price-wage spiral arising. According to the National Mediation Office (2008), the premature termination of wage agreements is possible in the case of more than 30 per cent of the employees in the private sector covered by the agreements signed in 2007. In the manufacturing industry, all of the agreements include clauses on premature termination. There are also termination clauses in some agreements in the local government sector, but there are no such clauses in the wage agreements in the State sector.

Temporary framework agreements increase wage flexibility but can contribute to instability

It is also possible for the central organisations on the labour market to temporarily circumvent wage agreements that have already been entered into. One example of this is the temporary framework agreement, the so-called "Framework agreement on temporary lay-offs and training", entered into between the trade union IF Metall and three employer organisations in the engineering, manufacturing, chemical and metal-working industries in early March 2009. A three-year wage agreement was signed in these sectors in March 2007 with the proviso that the final year could be terminated (the agreement could be terminated on 30 September 2008 at the latest). Under the framework agreement, wages may be reduced to a limit of 80 per cent, while there is no lower limit for the reduction of working hours.[4] The framework agreement applies until 31 March 2010 at the latest.

At the same time as agreements of this type increase wage flexibility, that is the adaptation of wages to the prevailing situation on the labour market, they may also entail a certain risk that a downward price-wage spiral will arise. According to a survey conducted by Teknikföretagen, an employers' organisation in the engineering industry, almost 400 of the organisation's affiliated companies have signed local agreements within the framework of the central framework agreement. These local agreements cover approximately 50 000 employees in this sector. Similar agreements have been entered into in other industrial sectors. It is estimated that a total of 100 000 employees in industry are covered by local agreements on reductions in wages and working hours.

Varying degrees of centralisation in wage negotiations during the 1980s

The Swedish wage formation model has changed somewhat over the years. Throughout the 1980s and early 1990s, the degree of centralisation in collective bargaining varied in the different rounds (see Table 1). Up to and including 1983, wage negotiations were conducted at three levels: at the central level between central bargaining organisations such as SAF, LO

[4] This framework agreement makes it possible to circumvent the regulations on lay-offs/redundancies in the Act on Security of Employment. This Act contains a discretionary regulation that employees should be paid in full in the event of lay-offs. Under the framework agreement, the employers can reduce their labour costs more quickly than in the case of the normal procedure for lay-offs.

Table 1. Wage agreements and agreement outcomes in Sweden 1980–2009

Agreement period	Bargaining level etc.	Collectively-agreed wage increase	Nominal wage increase	Real wage increase
1980	1-year central agreement	7.5	9.1	–4.8
1981–1982	2-year central agreement	5.6	7.3	–3.0
1983	1-year central agreement The Swedish Metalworkers' Union and the Swedish Metal Trades Employers' Association sign a separate agreement.	5.1	6.5	–2.4
1984	1-year agreement at sector level. The Swedish Metalworkers' Union and the Employers' Association of the Swedish Mining Industry are the first to sign an agreement.	5.7	8.1	0.0
1985	1-year central agreement	4.5	6.6	–0.8
1986–1987	2-year central agreement	5.2	7.2	3.0
1988	1-year agreement at sector level. The Swedish Factory Workers' Union and the General Industrial Group of the Swedish Employers' Confederation are the first to sign an agreement.	3.5	7.0	1.2
1989–1990	2-year central agreement The trade unions in the engineering industry sign a separate agreement.	6.5	10.3	1.9
1991–1992	Rehnberg Agreement (2-year central agreement). The Rehnberg group, i.e. Bertil Rehnberg and the chief negotiators of SAF, LO, TCO and SACO propose a stability agreement. Almost all of the trade unions accept the proposal with no or only slight deviations from the proposal.	2.5	4.9	–1.0
1993–1994	2-year agreement at sector level. The Commercial Employees Union and the Commercial Employers' Association are the first to sign an agreement.	1.4	2.5	–0.9
1995–1997	3-year agreement at sector level. The Swedish Paper Workers' Union and the Swedish Forest Industries' Association are the first to sign an agreement.	3.5	4.6	3.4
1998–2000	3-year agreement at sector level. Collective bargaining is coordinated at the central level, including LO's coordination. Wage negotiations in the manufacturing industry are conducted within the framework of the Cooperation Agreement. The Swedish Metal Workers' Union and the Swedish Metal Trades Employers' Association are the first to sign an agreement.	2.7	3.6	3.3
2001–2003	3-year agreement at sector level. Collective bargaining is coordinated at the central level. Other agreements on bargaining procedures are in place, in addition to the Cooperation Agreement. New legislation on mediation is adopted and the National Mediation Office is established in 2000. The Industrial Workers' Union and the Swedish Industrial and Chemical Employers' Association are the first to sign an agreement	2.5	4.0	1.8
2004–2006	3-year agreement at sector level. Collective bargaining is coordinated at the central level. The Swedish Association of Health Professionals, SKTF (employees in the local government sector), the Swedish Medical Association, the Swedish Association of Graduate Engineers and the Employers' Alliance are the first to sign an agreement.	2.0	3.2	2.4
2007–2009	3-year agreement at sector level. Collective bargaining is coordinated at the central level. IF Metall and the Swedish Industrial Association are the first to sign an agreement.	2.9	3.7*	1.9*

Note. The average of annual percentage changes for the total economy during the agreement period (calculated per calendar year) is shown in the table.
* = forecast for 2009.
Sources: Friberg (2004), the National Institute of Economic Research, the National Mediation Office, the Confederation of Swedish Enterprise, Statistics Sweden and the Riksbank.

and PTK[5], at the sector level between trade unions and employer confederations and at the local level between employees and companies. A typical central wage agreement contained three components: a nominal wage increase, usually specified as a cash amount, a wage drift guarantee and a special kitty for the low paid. The typical wage agreement also included price and wage clauses.

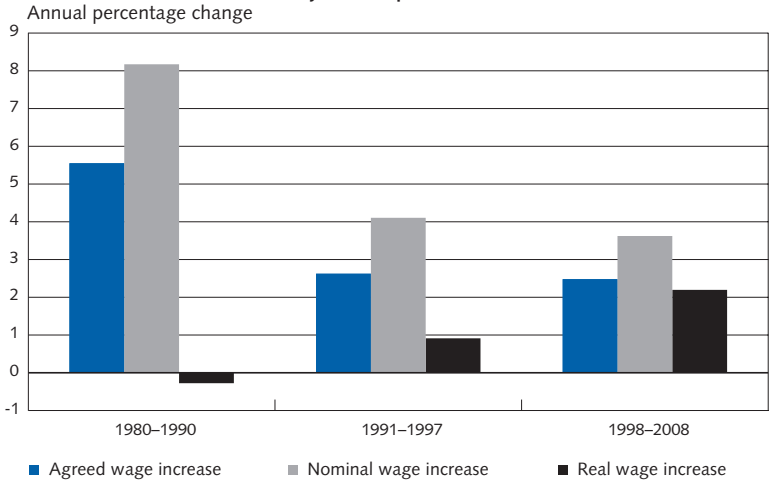
In 1983, the Swedish Metalworkers' Union did not participate in the central negotiations but signed a separate agreement with the Swedish Metal Trades Employers' Association. This affected the other parties on the labour market such that the negotiations for the 1984 wage agreement were conducted at only two levels: the sector level and the local level. For several years following 1984, the number of levels in the rounds of collective bargaining varied between two and three, that is central agreements were entered into in some years but not in others. During this period, the average duration of the agreement periods was also relatively short, i.e. 1 to 2 years. The nominal wage outcomes were high, averaging increases of 8.2 per cent per year, while the real wage outcome was negative, averaging -0.3 per cent, in the period 1980–1990 (see Figure 1). In the early 1980s, the real wage outcome was extremely negative, averaging -3.3 per cent during the period 1980-1983.

Stabilisation agreements and new preconditions for stabilisation policy during the 1990s

In the period 1990-1991, the situation on the Swedish labour market deteriorated dramatically. In an attempt to counteract this deterioration, a proposal for a stabilisation agreement for 1991-1992 was presented by the so-called Rehnberg group, which consisted of a mediator appointed by the government, Bertil Rehnberg, and the chief negotiators of SAF, LO, TCO and SACO. Practically all of the organisations on the labour market signed wage agreements that were largely in line with the proposed stabilisation agreement. The proposal entailed low agreed wage levels and the removal of the price and wage clauses. The wage agreements entered into in the period 1991-1992 are often referred to under the collective name "The Rehnberg Agreement". In 1991–1992, the collectively-agreed wage increases in the Swedish economy averaged 2.7 per cent per year, as compared to the average level of wage increases in the period 1980–1990 of 5.6 per cent per year.

[5] SAF (Swedish Employers' Confederation), LO (Swedish Trade Union Confederation) and PTK (Federation of Salaried Employees in Industry and Services) were central organisations for various areas in the Swedish private sector. PTK was a central bargaining organisation for white-collar workers in the private sector affiliated to TCO (Swedish Confederation for Professional Employees), SACO (Swedish Confederation of Professional Associations) and SALF (Swedish Association of Supervisors and Managers).

Figure 1. Average agreed wage increases, nominal wage increases and real wage increases in the Swedish economy in three periods.
Annual percentage change



Sources: The National Institute of Economic Research, the National Mediation Office, Statistics Sweden and the Riksbank.

Since 1993, wage negotiations have been conducted under the new preconditions for stabilisation policy. One such important precondition for stabilisation is the price stability target that the Riksbank introduced in 1993, which is that inflation measured in terms of changes in the CPI should be 2 per cent with a tolerance interval of +/- 1 percentage point. Ahead of the round of collective bargaining in 1995, inflation expectations were, however, still relatively high and it appeared that the new monetary policy regime had not yet achieved full credibility among the social partners. Attempts to coordinate the bargaining demands of the trade unions affiliated to LO also failed. The Swedish Paper Workers Union and the Swedish Forest Industries Association were the first organisations to conclude an agreement with relatively high wage increases. This wage agreement then acted as a guide for the level of agreed wage increases in other sectors for a large part of the labour market. The collectively-agreed wage increases averaged 3.5 per cent per year in the period 1995–1997. The agreements entered into in 1995 also entailed a lengthening of the average duration of the agreement periods to approximately 3 years.

Local wage formation has also increased in extent since the early 1990s. An agreement model in which the central organisations do not specify the scope for wage increases for those in management positions has been applied in large parts of the labour market since 1992/1993. The structure of these agreements inspired several other sectors ahead of the round of collective bargaining in 1995. Agreements that did not specify particular figures were signed in a number of sectors, primarily

for white-collar workers in the private sector but also for some groups of academics in the public sector. Under this type of agreement, new salaries are set in connection with pay reviews either by the local parties or in discussions between managers and employees, so-called salary-setting discussions. The number of employees covered by agreements that do not specify any centrally-determined scope for wage increases increased steadily up to the mid-2000s.

Increased coordination among the parties since 1997

In 1997, the trade unions in the manufacturing industry entered into an agreement on collective bargaining demands and rules on bargaining procedures, the so-called Industrial Cooperation Agreement or Industrial Agreement. In the collective bargaining round of 1998, all of the trade unions affiliated to LO also agreed on a recommendation regarding joint demands. LO has also been successful in coordinating demands ahead of the various rounds of collective bargaining since 1998. Other central employee organisations have also to a greater or lesser extent coordinated their demands since then, as have organisations on the employers' side.

Coordination and cooperation among the central organisations on the labour market have probably contributed to the fact that wage increases in agreements have averaged approximately 2.5 per cent per year in the period 1998–2009, which on average is around 3.3 per cent lower than in the agreements entered into in the period 1980–1991 and approximately 1 per cent lower than during the agreement period 1995–1997. However, in the period 1998–2008 real wages increased by an average of approximately 2.1 per cent per year. It is also expected that employees in Sweden will receive real wage increases in 2009. An interesting observation is that average real wage increases were so much higher in the period 1998-2008 than in the period 1991-1997 despite the fact that the collectively-agreed wage increases were on average marginally lower during the later period (see Figure 1). This indicates that less costly collective agreements for the companies can still provide higher real wage outcomes for the employees.

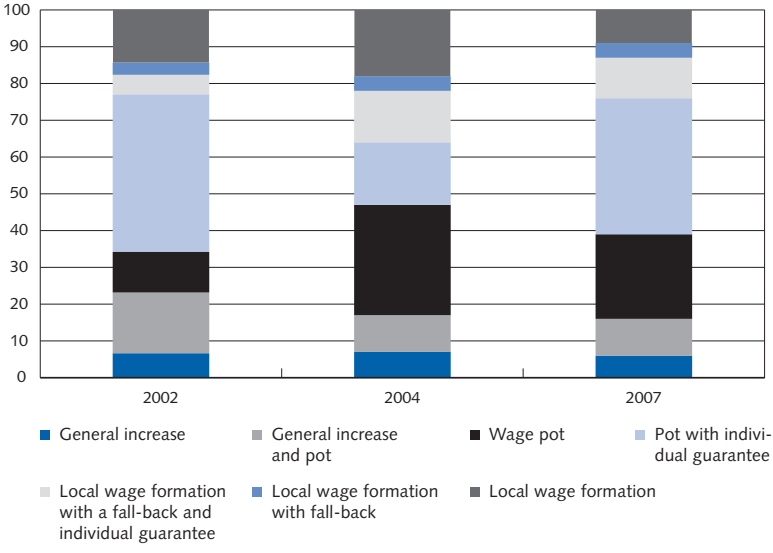
An increase in the coordination of collective bargaining that leads to lower outcomes is thus in line with the Calmfors-Driffill hypothesis. However, the weaker situation on the labour since the crisis of the 1990s and the delayed recovery due to the costly wage agreements for the companies in the period 1995–1997 have probably also contributed to the lower wage negotiation outcomes since 1998. It is also probable that the increasing credibility of the Riksbank's inflation target in the eyes of the social partners has helped to keep down the level of collectively-agreed

wage increases since then. The establishment of the National Mediation Office in 2000 as a mediation service for the social partners may also have had an impact on the level of the agreed wage increases. It is uncertain, however, whether this is the case, although the National Mediation Office has probably helped to reduce both the number and duration of industrial conflicts.

Less local wage formation in the agreements of 2007

In recent years, a typical wage agreement comprises a wage pot specified as a percentage with some form of individual guarantee (see Figure 2). Around 37 per cent of the employees were covered by this type of wage agreement in 2007. Agreements with a wage pot but without individual guarantees are also common (23 per cent of the employees in 2007). In these two types of agreement, the size of the pot and the individual guarantee is mainly determined in trade union negotiations at the sector level. Between 2004 and 2007, the percentage of employees in the entire economy covered wholly or partly by local wage formation fell from 36 per cent to 24 per cent. A certain degree of centralisation in wage forma-

Figure 2. Distribution of different forms of agreement throughout the economy.
Percentage of employees.



The National Mediation Office only has statistics reaching back to 2002 for the entire economy.

Brief wordlist: General increase = Wage increases in trade union agreements that are paid to all. Individual guarantee = Guaranteed minimum wage increase for the individual employee. Wage pot = Wage increase that is determined in trade union negotiations and then distributed by the employers and local trade union organisations. Fall-back clause = A compulsory default regulation in trade union agreements that comes into force if the local parties can not agree.

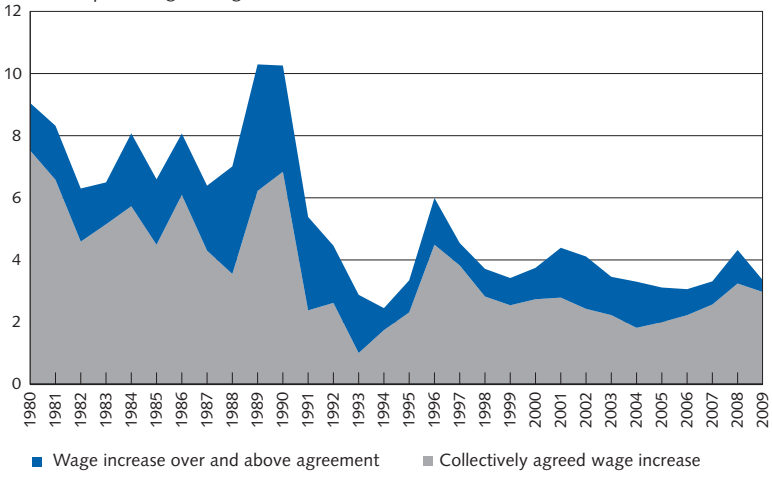
Source: The National Mediation Office.

tion thus took place in the agreements signed in 2007 compared with the agreements signed in 2004.

The Swedish wage formation model enables a division of total wage increases into two components: collectively-agreed wage increases and wage increases over and above the collective agreement (often referred to as residual wages or wage drift). Figure 3 presents such a division. The series for the collectively-agreed wage increases contains centrally and/or sectorally-determined wage increases. The series for wage increases over and above those determined in collective agreements contains locally-agreed wage increases, wage drif in the more traditional sense – that is wage increases over and above the agreement – and structural effects in the wage statistics.[6]

The percentage of wage increases over and above those in collective agreements in relation to total wage increases has varied over time. Up to and including the early 1990s, there was an increasing trend to around 45 per cent but this level then declined. In the period 1998-2008, the percentage was approximately 31 per cent, while for 2009 it is estimated that the percentage of wage increases over and above those in collective agreements will be very low due to the situation on the labour market.

Figure 3. Collectively-agreed wage increases and wage increases over and above those in central agreements (wage drift) in the total economy 1980–2009.
Annual percentage change



Note. For the period 1980–1991, a number of sectors are missing in the weighted series for agreed wage increases. Forecast for wage drift in 2009.

Sources: The National Institute of Economic Research, the National Mediation Office, Statistics Sweden and the Riksbank.

[6] One such structural effect may be that changes in the composition of the labour force lead to changes in the average wage level. If cyclical wage statistics are used to calculate wage increases over and above central agreements, changes in, for example, the sample or in the division into industrial sectors may lead to structural effects in the wage statistics.

Wage formation in Sweden has similarities with that in other industrialised countries

Swedish wage formation has a lot of similarities with wage formation in other industrialised countries. There are, however, some differences. In Du Caju et al. (2008) institutional factors in wage formation in 23 European countries, the USA and Japan are compared. Their results are based on the responses to a written questionnaire that was sent to economists at the central banks of the various countries in 2007.

In most of the countries, wage formation takes place at several different levels: the national/central level, the regional level, the inter-sector level, the sector level, the occupational level and the company/local level. The most common wage formation level in the countries studied is the sector level. This level predominates in, for example, Germany, Spain, France, Italy, the Netherlands, Portugal, Japan and Sweden. In some countries, the national/central level predominates, for example in Ireland, while the company level predominates in the USA, the UK and several of the countries in eastern Europe.

According to the Calmfors-Driffill hypothesis, the non-coordinated sector level is the level that provides the least favourable macroeconomic outcomes. However, Du Caju et al. (2008) show that in several of the countries wage formation also takes place at the central and local levels, that is bargaining levels that according to the hypothesis provide more favourable macroeconomic outcomes. In Sweden, for example, we have both coordinated wage formation between different central organisations on the labour market, wage formation at the sector level and local wage formation.

Relatively limited political intervention in wage formation in Sweden

Direct political intervention in wage formation in Sweden is, according to the compilation by Du Caju et al., relatively limited. In Sweden, for example, there is no legislation on wage indexation[7] like that in Belgium, Luxembourg and Cyprus. Sweden also has no national legislation on the level of the minimum wage of the type that exists in most other countries. In Sweden, minimum wage levels are instead specified in the collective agreements, as in Austria and Finland. On the other hand, Sweden and several of the other industrialised countries have relatively strict legislation on security of employment which may affect wage formation indirectly.

[7] Wage indexation is a formal and automatic indexation of nominal wages in line with an official price index.

Strict legislation on security of employment can give the trade unions a better negotiating position in relation to the employers and thus affect the outcome of negotiations. Sweden is also one of the countries where the State offers specific mediation services to companies and other organisations (through the National Mediation Office). Other countries, for example the USA, the UK, France and Finland, have similar bodies that offer similar services.

Sectoral wage leadership is common in Sweden

In Sweden, sectoral wage leadership has also been common according to the compilation and the manufacturing industry has been the wage leader.[8] Similar forms of wage leadership are also common in Germany and Austria. In recent years, Sweden, Denmark and Ireland have had the longest agreement periods, approximately 3 years, among the countries in the compilation. In Sweden, as in most of the other countries, collective bargaining is not conducted during a specific month of the year but usually begins 1 to 2 months before the current agreement expires and the expiry date can vary from sector to sector. During the last three rounds of collective bargaining, however, most of the agreements expired on 31 March.

In the study, the economists were also asked to specify the factors that they thought were of the greatest importance for the outcomes of wage negotiations in the respective countries. The development of inflation or inflation expectations was regarded as being the most important factor. The development of labour productivity was the factor mentioned most often after this. Factors such as the average wage increases in other countries (particularly neighbouring countries), announced or assumed changes in taxes and employers' contributions and the profits and competitive situation of the companies were also regarded by the economists as being important for the outcomes of wage negotiations in the countries studied.[9]

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[8] The research results vary regarding the wage leadership of the manufacturing industry on the Swedish labour market in an historical perspective. Tägtström's (2000) findings support the claim that the manufacturing industry has played a wage leadership role in relation to the central and local-government sectors and the rest of the private sector, while Friberg (2007) does not find the same clear support. It is likely that, periodically at least, the manufacturing industry has been the wage leading sector on the Swedish labour market. The findings of Holmlund and Ohlsson (1992), and Jacobson and Ohlsson (1994) support the belief that the private sector has played a wage leadership role in relation to the central and local-government sectors.

[9] It should be mentioned that the results should be interpreted with caution as the design of the questionnaire in this type of study may have affected the responses received.

Central banks try to forecast the future development of wages …

The fact that different measures of the development of wages have, historically speaking, covaried relatively well with inflation and that monetary policy works with a certain time lag means that many central banks attempt to predict the future development of wages. The Riksbank, for example, uses a number of econometric models to forecast the development of wages and other factors. These include VAR-models, Bayesian VAR (BVAR) models, DSGE models and partial OLS models.[10]

Forecasts from econometric models are an important complement to mere assessments of the development of different economic variables. This is because econometric models make it possible, on the basis of published statistics for economic variables, to identify historical relations between these variables. These relations change of course over time, but they can nevertheless provide valuable information on the possible level of future outcomes given the historical links. The ongoing use of econometric methods also provides information on gradual changes in the relations between different economic variables. It is then up to the forecaster to evaluate the information and see whether any structural changes have taken place, for example in wage formation, such that the historical relations have changed.

In the econometric models, it is also possible to use published information that applies to the future to forecast economic variables. One example of such information is the statistics published by the National Mediation Office on collectively-agreed wage levels which, in the case of three-year agreement periods for instance, can affect wages three years ahead.

…but depicting wage formation in an econometric model can be difficult

It is important in this context, however, to be aware of the difficulties involved in depicting economic relations such as the determinants of wage formation in an econometric model. In the first place, wage formation in Sweden has varied between different contractual and industrial sectors. The structure and duration of the agreements, the degree of influence of the central organisations and the bargaining strengths of the respective parties differ, for example, from sector to sector. There may, however, be strong wage spread effects between different sectors. Friberg (2004), for example, demonstrates a strong correspondence/influence in wage for-

[10] For a more general description of VAR models and Bayesian VAR models see, for example, Andersson and Löf (2007). For more information on the Bayesian VAR model used by the Riksbank, see Andersson et al. (2008). For more information on the DSGE model used by the Riksbank, see Andersson et al. (2007).

mation between different sectors. This correspondence indicates, however, that it is equally effective to analyse wage formation at an aggregated level as at the sector level.

In the second place, there have been a number of shifts or shocks in the Swedish wage formation process that may be difficult to capture in an econometric model. Friberg and Uddén Sonnegård (2001) identify two such regime shifts in the Swedish wage formation model since 1980. The first occurred in 1982–1983 when the Swedish Metalworkers' Union chose not to participate in the central negotiations. The traditional central wage formation model was abandoned and was followed by a period of more decentralised wage formation.

The second regime shift is the Rehnberg Agreement of 1991–1992 and the change in monetary policy around 1992/1993. Since the Rehnberg Agreement, the wage agreements no longer contain any price and wage clauses, which has probably led to greater stability in the formation of prices and wages. The Rehnberg Agreement also entailed a downward shift in the level of collectively-agreed wages. The change in monetary policy meant that the social partners needed to take more account of the fact that wage formation should not drive inflation. In reality, however, it took several years before the new monetary policy regime achieved full credibility among the social partners. High inflation expectations among the social partners ahead of the round of collective bargaining in 1995 contributed to the collectively-agreed wage increases reaching an average of 4.2 per cent during the period 1996–1997. All in all, however, there has been a downward shift in both the collectively-agreed wage increases and the nominal wage increases since the beginning of the 1990s, which can be seen as a regime shift in wage formation.

It may also be possible to add a third regime shift in the Swedish wage formation model. This is the coordination of the bargaining demands that has taken place for a large part of the labour market from and including the round of collective bargaining in 1998. On the employers' side too, coordination has taken place ahead of the rounds of collective bargaining to a varying degree since 1998. These regime shifts thus make it difficult to depict wage formation in an econometric model.

An econometric model of wage formation

In the economic literature, prices, inflation expectations, productivity and various measures of the situation on the labour market are often used as variables in wage formation models. Politically-determined factors such as the tax wedge, the benefit ratio in the unemployment insurance scheme and the number of people involved in active labour-market policy meas-

ures are also commonly used to explain wage formation. A variable such as collectively-agreed wages can be used to depict the Swedish collective agreement model with collective bargaining between the central organisations on the labour market. The percentage of trade union members and the profits of the companies can, for example, be used as measures of the bargaining strength of the social partners.

There is thus a range of possible explanatory factors to choose from when one wants to create an econometric model for wage formation in Sweden. With this in mind, a Bayesian VAR model of wage formation in Sweden has been estimated. Seasonally-adjusted quarterly data for the period 1980:1-2008:4 are used in the model. Data on wages throughout the economy according to short-term wage statistics, productivity (measured as GDP at fixed prices divided by the number of hours worked), the CPI, the percentage of unemployed according to the ILO-definition and collective agreement levels are used in the model.[11] The model contains a shift dummy for the period 1991:1-2009:1 that is assumed to capture the permanent structural shift in wage and price formation that arose in connection with the Rehnberg Agreement 1991-1992 and the regime shift in monetary policy in 1993. The model also contains a shift dummy for the period 1993:1–1994:4 which is assumed to capture the significant shift in unemployment that occurred in this period.[12]

The situation on the labour market and the collective agreements are of great importance to wage formation in the short term

By estimating the model and conducting an impulse-response analysis[13] it is possible to see the short-term effects on wage formation in Sweden of the variables used in the model.[14] Figure 4 shows the results of such an analysis. An increase in the collective agreement levels of one percentage point leads to an increase in wages of 1.6 percentage points after four quarters. An increase in unemployment of one percentage point leads to a fall in wages of over 0.8 percentage points after six quarters. The situation on the labour market and the collective agreements are thus of

[11] Short-term statistics on pay and statistics on central-agreement levels have been compiled by the National Mediation Office since the beginning of the 1990s. These series have been extended back in time using processed data from the structural wage statistics produced in connection with SOU 1988:35 and SOU 1990:63.

[12] See Appendix A for more information on the estimated Bayesian VAR model.

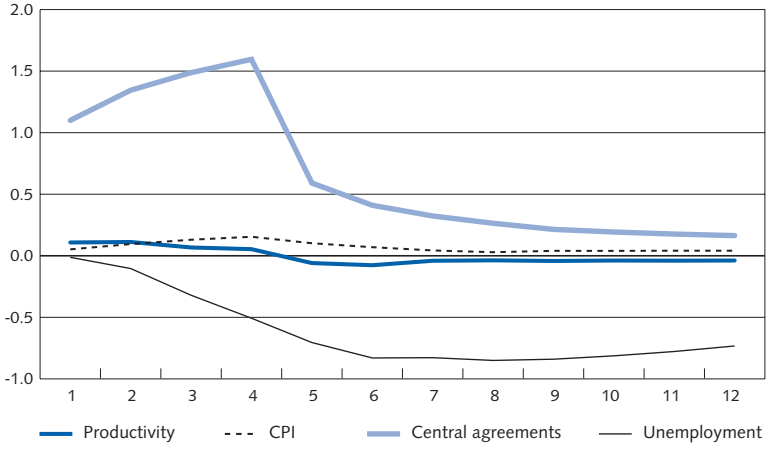
[13] In a so-called impulse-response analysis, one equation at a time is shocked with an impulse of a magnitude equal to 1. The reactions of all the variables in the model to the impulse are then measured, that is the responses of the model's variables are measured.

[14] In the long term it may be reasonable to believe, on the basis of economic theory, that there is a significant link between the wage level, the price level and the level of productivity, i.e. a constant wage share. In a Bayesian VAR model, however, no long-term links are estimated. Instead a prior distribution is used, that is an assessment made prior to the estimate, for instance how high the long-term sustainable rate of wage increases will be.

relatively high significance for wage formation in the Swedish economy in the short term according to this model specification. Wages react quickly to the agreement level, while unemployment has a gradual impact over a longer period of time.

Changes in the CPI and productivity, on the other hand, have only marginal direct effects on wage formation. A one percent increase in productivity leads to an increase in wages of 0.11 percentage points after two quarters, while a one per cent increase in the rate of inflation leads to an increase in wages of 0.15 percentage points after four quarters. Changes in unemployment, productivity and the CPI may, however, affect wages indirectly via the collective agreements. The impulse-response analysis does not, however, show any significant direct effects via the collective agreements. It should be pointed out that the results presented above are specific to this model.

Figure 4. Results of an impulse-response analysis for the BVAR model. The effects on wage increases (annual percentage change) throughout the economy of positive shocks to productivity, the CPI, unemployment and central agreements.
Percentage points

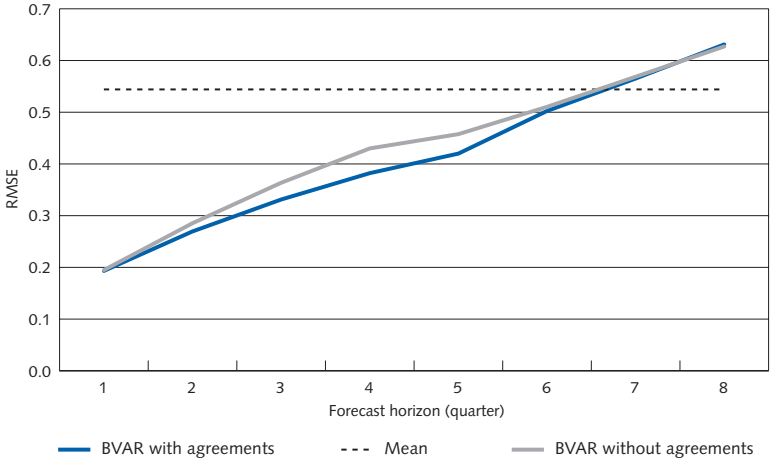


Source: the Riksbank.

Should the collective agreements be included in the model?

The impulse-response analysis indicates that the collective agreements have relatively significant impacts on wage formation in the short term. But should collective agreements really be included in a wage formation model? One way of testing this is to estimate two models: one that contains a series for central agreements and one that does not. We can then perform recursive forecast evaluations for both models. If the forecasting ability of the model that contains the series for collective agreements is

Figure 5. Results of forecast evaluations for two Bayesian VAR models (with and without central agreements).
RMSE for wage development (annual percentage change) throughout the economy for the period 2001:1–2008:4



Source: the Riksbank.

better than the forecasting ability of the model that does not, then the former model should be used to forecast the development of wages in the economy.

The forecasting ability of the models with regard to the development of wages is evaluated in terms of the root mean square error (RMSE). A model with a low RMSE has a better forecasting ability than a model with a high RMSE. The model forecasts are then evaluated in relation to the mean value for the rate of wage increases in the entire economy during the period 2001:1-2008:4.

Figure 5 shows the results of the forecast evaluation. After six quarters, the mean forecast's RMSE is lower than the model forecasts' RMSE, that is after six quarters the mean value is a better forecast than the models' forecasts. This means that the models are primarily useful as forecasting tools up to a horizon of six quarters. Within a forecasting horizon of six quarters, the model that includes central agreements provides better forecasts of wage development than the model that excludes central agreements.

Model forecasts provide a complement to the assessment of wage development

The historical and institutional review in this study shows that a lot has happened in the field of wage formation in Sweden since the 1980s. This makes it difficult to adequately estimate wage formation in an econometric model. Despite these difficulties, we make an attempt to do so in this study.

The results of the estimate show that the collective agreements and the situation on the labour market have a direct impact on wage formation in Sweden in the short term. Changes in the CPI and productivity, on the other hand, have only marginal short-term effects on wage formation. A forecast evaluation shows that forecasting ability improves if the collective agreements are included in the models.

It is, however, important to remember that the forecasts produced in econometric models only provide support or act as a complement to the assessment of wage development in the future. The Riksbank's assessment is also influenced by other information. One example of this is the government's announcement regarding changes in the statutory employers' contributions. Such changes are relevant to the assessment of the development of wage costs in the future and they are usually announced six months or a year before the change is implemented. Agreements entered into between the social partners on new levels for premiums for various collective insurance schemes may also influence the Riksbank's assessment. One example of this is the new agreement concluded between LO and the Confederation of Swedish Enterprise on one of the supplementary pension schemes which, among other things, stipulates the level of the premiums for the period 2008–2012. The Riksbank also constantly monitors the wage formation process on the Swedish labour market. For example, the Riksbank regularly analyses the agreements that are entered into. The "Framework agreement on lay-offs and training" that was signed at the begining of March is one example of an agreement that will have an impact on wage formation in the manufacturing industry.

Appendix A

The estimated Bayesian VAR-model is presented below.

$$(1)\qquad \begin{bmatrix} \Delta \ln q_t - \varphi_1' D_t \\ u_t - \varphi_2' D_t \\ \Delta \ln p_t - \varphi_3' D_t \\ \Delta \ln A_t - \varphi_4' D_t \\ \Delta \ln w_t - \varphi_5' D_t \end{bmatrix} = \sum_{\gamma=1}^{k=4} B_\gamma \begin{bmatrix} \Delta \ln q_{t-\gamma} - \varphi_1' D_{t-\gamma} \\ u_{t-\gamma} - \varphi_2' D_{t-\gamma} \\ \Delta \ln p_{t-\gamma} - \varphi_3' D_{t-\gamma} \\ \Delta \ln A_{t-\gamma} - \varphi_4' D_{t-\gamma} \\ \Delta \ln w_{t-\gamma} - \varphi_5' D_{t-\gamma} \end{bmatrix} + \begin{bmatrix} v_{1t} \\ v_{2t} \\ v_{3t} \\ v_{4t} \\ v_{5t} \end{bmatrix},$$

where Δ denotes first differences, *ln* natural logarithms, q_t productivity, u_t the percentage of unemployed according to the ILO-definition, p_t the CPI, A_t collective agreements, w_t wages, B_γ parameter matrices of the dimension (5x5) and k the number of lags. $D_t = [1 \;\; d_{1t} \;\; d_{2t}]$ is a vector that contains an intercept and two shift dummies where d_{1t} $\{0 \text{ if } t < 1991{:}1;$ $1 \text{ if } t \geq 1991{:}1\}$ and d_{2t} $\{0 \text{ if } 1993{:}1 < t > 1999{:}4;\ 1 \text{ if } 1993{:}1 \leq t \leq 1999{:}4\}$; $0 \text{ if } t > 1994{:}4$. $V_t = [v_{1t} \;\; v_{2t} \;\; v_{3t} \;\; v_{4t} \;\; v_{5t}]$ is a vector with residuals where $V_t \sim N(0,\Omega)$, that is the residuals are normally distributed with the mean value zero and Ω is a covariance matrix. The model's impulse-responses are based on the model's structural form, which in turn stems from a Cholesky factorisation.

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