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Analysis of revisions in short-term wage statistics

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The Riksbank regularly produces forecasts of the development of wages in the Swedish economy. The wage statistics used as a basis for the Riksbank's various wage forecasts are the monthly short-term wage statistics. This commentary analyses the revisions of wage outcomes that are made on an ongoing basis in these statistics over a periods of 12 months. The revisions follow a systematic pattern. One can therefore use the revisions and the initial preliminary wage outcomes to forecast future definitive wage outcomes. The commentary also presents a method for doing this. The method provides highly-accurate estimates of definitive wage outcomes, which is important to the Riksbank's forecasts of future wage developments.

Revisions of outcomes are common in macroeconomic statistics such as the National Accounts and the short-term wage statistics. This can cause problems as economic and political decisions are often based on analyses of the most recently published outcomes. However, if the preliminary outcomes are revised in a systematic way, this systematic process can be used to forecast the final outcome. This economic commentary analyses revisions in the monthly short-term wage statistics provided by the National Mediation Office. One of the properties of these statistics is that the outcomes are revised on an ongoing basis over a period of 12 months. It thus takes 12 months for the preliminary statistical outcomes to become definitive. A formal test shows that the revisions, that is the differences between definitive outcomes and first preliminary outcomes, follow a systematic pattern. It is therefore possible to use the first preliminary wage outcomes to forecast future definitive wage outcomes. The commentary also presents a method for doing this. This method provides highly-accurate forecasts.

The Riksbank's wage forecasts are based on the short-term wage statistics

The Riksbank regularly produces forecasts of the development of wages in the Swedish economy which are then presented in the Monetary Policy Reports and Updates. The wage statistics used as a basis for the Riksbank's various wage forecasts are the monthly short-term wage statistics provided by the National Mediation Office.[2] The short-term wage statistics are derived from a survey sample of the business sector (with a sample of approximately 5 700 companies in 2010) and a census survey of the public sector.[3] In order to get a measure of wages for the economy as a whole, the National Mediation Office weights the statistics using calculated wage sums.

In the short-term wage statistics, monthly or hourly paid wages, that is wages excluding sick pay, holiday pay, bonuses, redundancy payments and taxable benefits, are specified.[4] The National Mediation Office corrects the statistics primarily in terms of reductions in working hours and one-off payments that replace local wage supplements. The short-term wage statistics consist of monthly statistics on the development of wages in the economy as a whole from January 1995 and quarterly statistics that are available from and including the third quarter of 1992.

1 The authors would like to thank Michael K. Andersson, Mikael Apel, Joanna Gerwin, Jesper Hansson, Björn Lagerwall and Christina Nyman for their valuable comments. Any errors in the commentary are solely the responsibility of the authors. The views presented in the commentary are those of the authors, not of the Riksbank.
2 The Riksbank also forecasts the development of hourly wages in accordance with the National Accounts, the development of labour costs per hour and the development of unit labour costs.
3 Wage statistics for blue-collar workers in the manufacturing industry have been published quarterly since the 1940s. The statistics were expanded in 1991 when surveys of wages for blue-collar and white-collar workers throughout the business sector began. The decision to expand the statistics followed proposals in the public enquiries SOU 1988:35 and SOU 1990:63. The Swedish Agency for Government Employers, the Swedish Association of Local Authorities and the Swedish Federation of County Councils have produced wage statistics for the central-government, municipal and county-council sectors since 1991. Statistics Sweden was made responsible for wage statistics for the municipalities and county councils in January 1999 and for the central-government sector in January 2001. Since January 1995, surveys for the business sector, the municipalities and the county councils have been conducted every month. Monthly surveys of wage statistics in the central-government sector did not begin until January 2000.
4 The short-term wage statistics specify actual hourly wages for blue-collar workers in the business sector. However, for white-collar workers in the business sector and for employees in the public sector agreed monthly salaries are specified. Wages including and excluding variable supplements are reported separately for blue-collar workers and white-collar workers in the business sector. See for example the National Institute of Economic Research (2008) for a more detailed description of the wage statistics.

Between 1995 and 1997 the rate of wage increases fluctuated sharply (from 2.3 per cent in January 1995 to 7.1 per cent in May 1996, measured as an annual percentage change), but since 1997 the rate of wage increases has been relatively stable at around 3.6 per cent (see Figure 1). Since mid-1992, wages have increased by an average of 3.7 per cent per year.

The short-term wage statistics are preliminary for 12 months

The outcomes in the short-term wage statistics are revised on an ongoing basis over a period of 12 months.[5] It thus takes 12 months for the preliminary statistical outcomes for a specific month to become definitive. The time lag in the short-term wage statistics is due to the fact that retroactive wage payments are regularly incorporated into the statistics. A retroactive wage payment may, for example, relate to the difference between the new and the former rates of pay under a central agreement, and its incorporated into the short-term wage statistics retroactively from the date at which the previous collective agreement expired. Retroactive wage payments may also be due to delays in the local wage formation process. Statistics Sweden's own definition of retroactive wages in the survey is as follows: "Retroactive wages are wages that have been paid after the completion of local or central collective bargaining and that relate to months prior to the month in which the wages are paid."

The revision of the short-terms wage statistics means that 11 preliminary outcomes are published for each month, that is a first preliminary outcome, a second preliminary outcome and so on up to an eleventh preliminary outcome. The twelfth outcome is considered to be the definitive outcome. The revision of the first preliminary outcome is, on average, the greatest. The average size of the revisions then declines gradually as new preliminary outcomes are received. Figure 2 shows how the average difference between the definitive outcomes and the preliminary outcomes for wages in the economy as a whole decreases as more revisions are made to the short-term wage statistics. On average, the first preliminary outcome is revised upwards by just over 0.5 percentage points. The second preliminary outcome is revised upwards by almost 0.4 percentage points on average. After seven preliminary outcomes the average revision is only marginal (less than 0.1 percentage points). It can be added that downward revisions of the preliminary outcomes at the sector and branch level do sometimes occur in individual months, but in general revisions are upwards.

In the period January 2004 to June 2009, the average revision was greater in the public sector than in the business sector. In the public sector, the first preliminary outcome was revised by an average of 0.8 percentage points, while in the business sector the average revision was 0.4 percentage points.

The size of the revisions in the short-term wage statistics varies from month to month. Figure 3 shows the size of the average revision between first preliminary outcomes and definitive outcomes for wages throughout the economy for the respective months since January 2001.[6] The revisions have been highest in April and May. This is probably because wage revisions have been conducted during these months, that is new wage levels have been introduced in accordance with new wage agreements for a large part of the labour market.

5 It should be mentioned in this context that a revision period of 12 months is not remarkable in the case of economic statistics. The National Accounts, for example, are revised retroactively over a period of several years.

6 For this analysis, we have gathered data on the first preliminary outcomes in the business sector and the public sector from and including January 2001. The time series for the first preliminary outcomes for the economy as a whole are weighted using the National Mediation Office's ongoing weightings which are based on the wage sums in the short-term wage statistics. It is difficult to extend the time series much further back in time as some of the producers of the statistics lack documentation on the first preliminary outcomes. Another reason for this is that the monthly collection of wage statistics for the central-government sector did not begin until January 2000. For more information about this see the Riksbank (2002).

Revisions and predictability

Revisions of outcomes are common in macroeconomic statistics. Analyses are often based on the most recently-published outcome (and previous preliminary outcomes are ignored). In the economic literature, "news" and "noise" are established terms with regard to the revision of statistics. [7]

A revision that is due to "news" means that the preliminary outcome is an optimal forecast of the definitive outcome. In other words, when a preliminary outcome is published, one has used all the information available – it would not have been possible to make a better forecast at that time. Additional revisions will reflect only the information that becomes available later.

In the case of "noise", however, the preliminary outcome constitutes the true value including a measurement error. The revisions are thus not due to any new information but are only designed to correct problems with the preliminary estimates, for example bias. The preliminary outcome is therefore not an optimal forecast of the definitive outcome.

The relationship between revision (r_t), preliminary outcome (X_t^P) and definitive outcome (X_t^D) can be described as $r_t = X_t^D - X_t^P$. If the revisions are correlated with preliminary outcomes they can reduce noise and are thus predictable. For example, high preliminary outcomes may entail that the revisions will be small and vice versa. The revisions are in this case systematic and an econometric model containing first preliminary outcomes may be useful to estimate the size of future revisions. If, on the other hand, the revisions are uncorrelated with preliminary outcomes then the revisions are driven by news and can thus not be predicted. The revisions are therefore random and an econometric model provides no useful information for determining the size of future revisions. Preliminary outcomes will in this case be optimal forecasts of definitive outcomes.

A formal test of the predictability of the revisions

In practice, both news and noise may exist in the data and it may therefore be appropriate to test for this. In the initial position it is quite clear that revisions in short-term wage statistics can be characterised as noise reducing. Information on new retroactive wage payments as a result, for example, of delays in the local wage formation process, is incorporated into the statistics on an ongoing basis, which means that the revisions will be greater than zero. The preliminary outcomes are thus (systematically) lower than the definitive outcomes. The recurring preliminary outcomes correct the level error in the first preliminary outcome, which means that the error gradually falls to zero over the course of 12 months. The preliminary outcomes will therefore not be optimal forecasts of the definitive outcome.

We nevertheless choose to test this using a formal test called the Mincer-Zarnowitzs (1969) test. In this test we study the relationship between the revisions and the preliminary outcomes by estimating the revisions (r_t), that is the difference between definitive outcomes (W_t^D) and first preliminary outcomes , as a function of the first preliminary outcomes, namely:

$$r_t = \alpha + \beta W_t^P + u_t .$$

The equation tests the null hypothesis that $\alpha = \beta = 0$, that is that the revisions are unpredictable. If this hypothesis is rejected, we can conclude that there is a link between the revisions and the first preliminary outcomes. This would mean that the first preliminary outcomes could be used to forecast future revisions. If, on the other hand, the null hypothesis can not be rejected, we can conclude that there is no link between the first preliminary outcomes and the revisions. In this case, it would therefore not be possible to use the first preliminary outcomes to forecast future revisions.

7 See for example Mankiw, Runkle and Shapiro (1984) and Mankiw and Shapiro (1986). The term "news" means that the revision is due to new information while the term "noise" means that the revision reduces some of the measurement errors (noise) that occur in the preliminary outcomes.

Table 1 presents the results of the test. In the joint F-test, the null hypothesis $\alpha = \beta = 0$ can be rejected, which is the expected result. The test thus indicates that the revisions are predictable. The revisions follow a systematic pattern and can be characterised as noise reducing. The low coefficient of determination in the estimates indicates that the predictability in the revisions is also low. The estimated constant shown in Table 1 means that the revisions, on average, will amount to 1.28 percentage points when the first preliminary outcome is zero. The constant is thus of significant size. This may imply that there is a clear bias in the first preliminary outcomes – a bias or noise that is reduced as more preliminary outcomes become available.

Table 1: Results of the Mincer-Zarnowitzs test for a link between revisions and first preliminary outcomes in the short-term wage statistics in the period January 2001–June 2009

Constant	1.28 (6.28)
First preliminary outcomes	-0.22 (-3.35)
F-statistic	11.23 (0.00)
Coefficient of determination	0.10
Number of observations	102

Note: The dependent variable is the size of the revision between definitive outcomes and first preliminary outcomes measured in percentage points. The t-values for the hypothesis that the coefficients are equal to zero are presented in brackets alongside the respective coefficient estimates. The F-statistic presents the result of a joint F-test of the hypothesis that all the coefficients are zero. The p-value for the F-statistic is presented in brackets.The coefficient of determination is measured using R^2.

Models for revisions in short-term wage statistics

The test results thus indicate that the revisions in the short-term wage statistics follow a systematic pattern. This means that the first preliminary outcomes can be used to forecast future definitive outcomes. The Riksbank has therefore developed econometric models for this purpose. Such models have the potential to improve forecasts for the development of wages and thus the background material and data on which monetary policy decisions are based.

Various time series models are used at the Riksbank to model and forecast the revisions between first preliminary wage outcomes and definitive wage outcomes. Both autoregressive terms (AR) and moving average terms (MA) are used in the models, which simply means that historical data for the series in question, in this case the revisions, is included in the estimates.[8] The specifications also contain seasonal dummies to capture the systematic pattern in the revisions.[9] Specific time-dummy variables are also included when needed with the aim of capturing extreme values. The equation below shows a general specification of the models that are estimated.[10]

$$r_t = \alpha + \beta W_t^P + \sum_{i=1}^{p} \gamma_i r_{t-i} + \sum_{s=1}^{11} \delta_s D_{s,t} + \sum_{j=1}^{k} \varphi_j \hat{u}_{t-j} + u_t$$

The variation in the revisions are explained by the first preliminary outcome (W_t^P) and the inherent dynamic in the revisions. Other determining variables can be included in the specification to explain the variation in the revisions. One such variable is, for example, centrally-agreed wages that co-vary relatively well with definitive outcomes. Figure 4 shows how the series concerned co-vary in the Riksbank's models for estimating future definitive wage outcomes. Using these models, the Riksbank produces forecasts of the magnitude of the revisions $\hat{r}_t$, which in turn – together with the first preliminary outcome – provide estimates of definitive wages $\hat{W}_t^D = W_t^P + \hat{r}_t$.

8 Autoregression means that observations of a time series are correlated with earlier observations of the same time series.
9 It should be mentioned in this context that the collective-agreement periods have been relatively homogenous during the estimation period concerned, which has helped to make the seasonal dummies a significant factor in the estimates. If the starting point and the duration of the contractual periods are changed, these variables may become insignificant.
10 The authors can provide exact specifications of the models on request.

The models provide highly-accurate forecasts

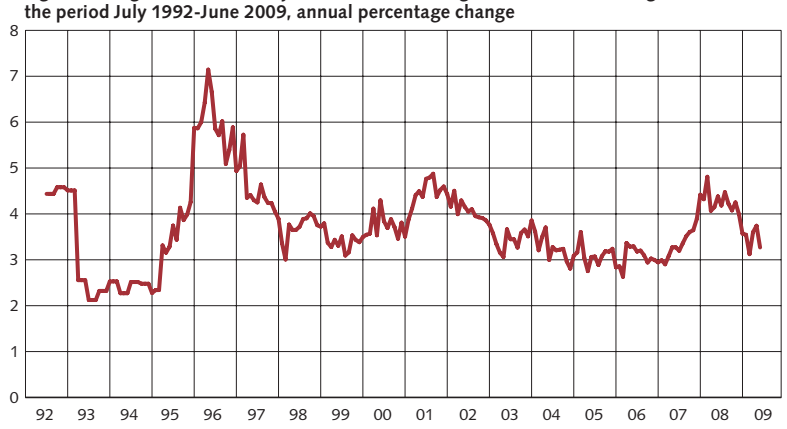
Forecast evaluations show that the models that the Riksbank has developed to estimate the definitive wage outcomes have a good forecasting ability.[11] One evaluation shows, for example, that approximately 85 per cent of the model forecasts over a 12-month horizon fall within a tolerance interval of ±0.10 percentage points around the definitive outcome.[12] The high accuracy of the model forecasts is exceptional in forecasting contexts, but is of course due to the fact that the revisions follow a systematic pattern and thus can be used to forecast the future definitive outcomes. In addition, a customary forecast evaluation in which the root mean square error (RMSE) is used shows that the models, on average, have a better forecasting ability for all forecasting horizons compared to a forecasting method that uses a mean value of the definitive outcomes. To sum up, it can thus be noted that their good forecasting ability makes the times series models useful tools for the assessment of the level of future definitive wage outcomes.

Summary

This economic commentary shows that there are clear indications that the revisions in the short-term wage statistics, that is the differences between definitive outcomes and first preliminary outcomes for wages, are systematic. One can therefore use the revisions and the first preliminary outcomes to forecast future definitive wage outcomes. Various evaluation methods show that such estimates of the revisions are highly accurate.

Figures

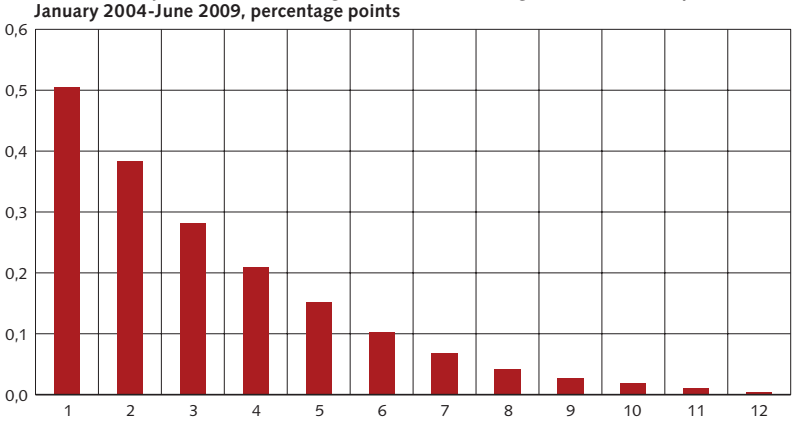
Figure 1. Wages in the economy as a whole according to the short-term wage statistics for the period July 1992-June 2009, annual percentage change



Sources: The National Mediation Office and Statistics Sweden.

11 For more general information on the forecasting ability of models see, for example, Andersson and Löf (2007).
12 One way of evaluating the forecasting ability of the models is to set an interval around the definitive outcomes and study what proportion of the forecasts fall within this interval for an appropriate forecasting horizon, for example 12 months for statistics that are revised over a period of 12 months. Such an interval can be selected on the basis of what a forecaster consider to be acceptable in terms of forecasting, that is a tolerance interval.

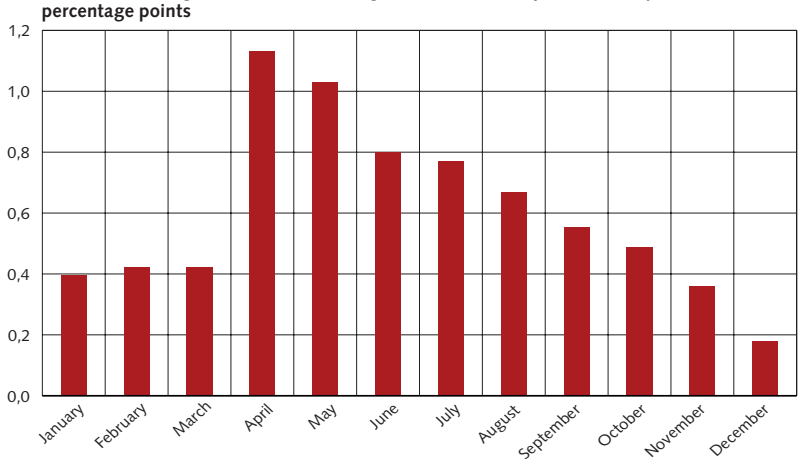
Figure 2. The average differences between definitive and preliminary wage outcomes in the economy as a whole according to the short-term wage statistics for the period January 2004-June 2009, percentage points



Note: 1 indicates the first preliminary outcome, 2 the second preliminary outcome and so on. 12 indicates the definitive outcome.

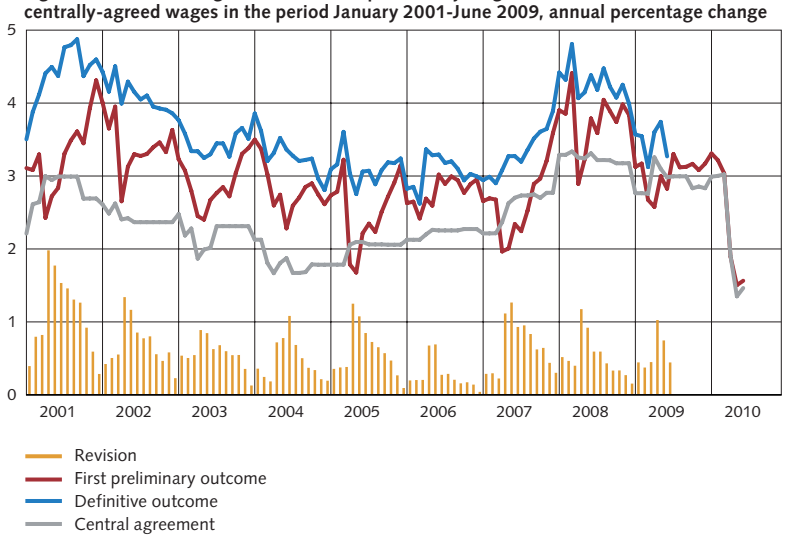
Sources: National Mediation Office, Statistics Sweden and the Riksbank.

Figure 3. The average magnitude of revisions per month for wages in the economy as a whole according to the short-term wage statistics for the period January 2001-June 2009, percentage points



Sources: National Mediation Office, Statistics Sweden and the Riksbank.

Figure 4. Definitive wage outcomes, first preliminary wage outcomes, revisions and centrally-agreed wages in the period January 2001-June 2009, annual percentage change



Sources: National Mediation Office, Statistics Sweden and the Riksbank.

References

Andersson, M. K. and M. Löf (2007), "The Riksbank's new indicator procedures", *Sveriges Riksbank Economic Review* 1, pages 77-90.

National Institute of Economic Research (2008), "Löneökningar enligt olika statistiska källor" (Wages increases according to various statistical sources), article in *Lönebildningsrapporten 2008 (Wage Formation Report 2008)*, pages 93–98.

Mankiw, N. G., D. E. Runkle and M. D. Shapiro (1984), "Are Preliminary Announcements of the Money Stock Rational Forecasts?", *Journal of Monetary Economics*, 14, pages 15–27.

Mankiw, N. G. and M. D. Shapiro (1986), "News or Noise: An Analysis of GNP Revisions", *Survey of Current Business*, May, pages. 20–25.

Mincer J. and V. Zarnowitz (1969), "The Evaluation of Economic Forecasts" in Mincer J. (ed.), *Economic Forecasts and Expectations*, NBER, New York.

SOU (1988:35), *Offentlig lönestatistik – Behov och produktionsformer (Public wage statistics – Needs and forms of production)*, interim report from the 1987 Commission on Wages, Stockholm.

SOU (1990:63), *Svensk lönestatistik (Swedish wage statistics)*, interim report from the 1987 Commission on Wages, Stockholm.

Sveriges Riksbank (2002), "Wages statistics and the status of agreements in spring 2002", article in *Inflation Report 2002:2*, pages 45-50.