Explaining unemployment: Some lessons from Nordic wage formation*

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Abstract

In the 1980s Nordic wage setting mechanisms and labor market policies were seen by some economists as examples to follow, since they seemed to yield low unemployment. Others ascribed the good performance to conditions on the demand side. Exploiting data also from the 1990s, we take a new look at some questions from this debate. The theoretical discussion, based on fairly standard bargaining models, shows that these models allow aggregate demand to have a more durable influence on unemployment than is commonly perceived. The empirical analysis does not support the view that the increase in Nordic unemployment was caused by a shift in the wage curves. Nor does it support that Nordic countries have particularly high real wage flexibility or that active labor market policies keep down total unemployment rates. Productivity growth is important for the level of equilibrium unemployment. There is sufficient similarity between the Nordic countries that wage equations may be estimated more efficiently by pooling the data.

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1 Introduction

While OECD unemployment soared after the oil price shocks in 1974 and 1979, Finland, Norway and Sweden preserved low unemployment through most of the 1980s (see Figure 1). This attracted wide attention. Solutions to the European unemployment problem were seen in Nordic labor market institutions, notably active labor market policy and centralized bargaining. The latter was claimed to produce high “real wage flexibility” (see e.g. Layard, Nickell and Jackman (1991)). Nordic economists were often sceptical. Some credited the success more to demand factors and exchange rates, see Lindbeck (1997) and Rodseth (1997) for recent statements. Calmfors and Forslund (1991) questioned the contribution of active labor market programs. There was also the question of why Denmark, with similar bargaining institutions as the other Nordics, had considerably higher unemployment after the mid 1970s. Even in Finland unemployment soared after OPEC!

The dramatic increase in unemployment in Norway, Sweden and Finland around 1990 cast more doubt on the old institutional explanations. However, new institutional explanations have been advanced. Ljungqvist and Sargent (1995) saw the increased unemployment as the long-term effect of social policies whose detrimental effect on the labor market appeared only a long time after they were instated. The work of Lockwood and Manning (1993) and Hersoug (1984) lead to the suggestion that high tax progressivity had produced wage moderation and high employment before 1990, and that large cuts in marginal tax rates were responsible for high unemployment later.

Thus, for those who want to find causes and cures for unemployment, the behavior of Nordic wages may provide important information. Hence, a reinvestigation of wage equations along the lines of Calmfors and Nyemoen (1990) is warranted. Was there a structural change in Nordic wage formation? Did the equilibrium unemployment rate change, and if so, why? Is Denmark structurally different from the others? Are the Nordic countries characterized by high real wage flexibility?

Dynamic wage equations of the kind we estimate are a cornerstone in Layard et al. (1991)
and many other studies of unemployment and wage formation. The interpretation usually focus on the wage curve and equilibrium unemployment. As we shall argue, if the typical estimation results are taken seriously, disequilibrium phenomena may be more important, and the equilibrium unemployment rate may depend strongly on productivity growth. Thus, the paper also offers some general lessons on the interpretation of estimated wage equations.

In the next section we review the economic theory. In Section 3 we present the data and discuss some econometric issues. The estimation results are presented in Section 4, while Section 5 concludes.

2 Theory

Imagine a small open economy. There are a large number of identical firms. All of them produce for the world market and are price takers. All have production functions that are homogeneous of degree one in labor and capital. Each firm and its local union first bargain for the wage rate. (We discuss centralized bargaining later). The firm then decides how much labor to employ.

The firm's objective is to maximize profits. In the short run its capital stock is given, and its
profit function is
\[ \Pi = \pi(\omega) K \]  
where \( \Pi \) is real profits, \( \pi \) profits per unit of capital, \( \omega \) the real wage, and \( K \) the capital stock.

The union’s objective is to maximize the utility of an employed worker, \( \nu(\omega) \), where \( \nu' > 0 \) and \( \nu'' \leq 0 \). The outcome of the wage bargain is the real wage which maximizes the Nash-product

\[ [\nu(\omega) - n_0(\Omega, U)]^\beta [\pi(\omega) K]^{1-\beta} \]

\( n_0 \) is a fall-back or reference utility which depends positively on the average real wage in the economy, \( \Omega \), and negatively on the economy-wide unemployment rate, \( U \). \( \beta \in [0, 1] \) measures the relative bargaining strength of the unions. The first order condition is

\[ \frac{\nu'(\omega)\omega}{\nu(\omega) - n_0(\Omega, U)} - \frac{1-\beta}{\beta} \frac{n(\omega)\omega}{\pi(\omega)} \]

where we have used the fact that the firm’s demand for labor is \( N = n(\omega) K = -\pi'(\omega)K \).

Since all firms are identical, we can solve for the aggregate wage level by setting \( \Omega = \omega \) in (2). Provided that the derivative \( n_0\Omega \) is not too large, this yields a downward sloping relationship between the real wage and unemployment, \( \omega = g(U) \), which is called the wage (setting) curve. The left hand side of (2) when \( \Omega = \omega \),
\[ \mu = \frac{\nu'(\omega)\omega}{\nu(\omega) - n_0(\omega, U)}, \]
can be used as an indicator of union wage pressure. Anything which raises \( \mu \) for a given level of \( \omega \) shifts the wage curve upwards. Thus, when the reference utility goes up, this raises the wage level.

The reference utility \( n_0 \) has two alternative interpretations. In one \( n_0 \) is an inside opportunity, the utility the workers receive during a conflict. In the other \( n_0 \) is an outside opportunity, the expected utility if they leave the firm. Among the outside opportunities are work in another firm, participation in labor market programs and open unemployment, with or without benefits. The probability of ending up in each state depends on the unemployment rate and on the supply of program places. Hence, in this case the reference utility is a weighted average of the utilities.
obtained in the different alternatives. Work in other firms in expectation yields the average wage, which is one reason why \( n_0 \) depends positively on \( \Omega \). The reference utility also depends positively on the replacement rate, which is defined as the ratio between unemployment benefits and the wage rate.

The total unemployment rate includes both program participants and openly unemployed. Participants in labor market programs are usually assumed to obtain higher welfare than if they were openly unemployed. Participation is voluntary, although for some it may be the only way to get benefits. There is often a queue to get in. Thus, for a given total unemployment rate, an increased supply of program places is expected to increase the reference utility and shift the wage curve upwards. The reference utility also depends on how effectively the unemployed compete with the presently employed for work. For persons who do not qualify for unemployment benefits an increased supply of program places means increased incentives to register at job centers. This may raise the measured total unemployment rate without increasing the competition for jobs, and, hence, shift the wage curve upwards for a given total unemployment rate\(^1\). While they are in a program, participants may also be less willing to take alternative jobs\(^2\).

If we take the view that only ‘internal’ alternatives matter, it is less obvious that the replacement rate or the program share (or even the unemployment rate) should be in the wage equation. However, outside alternatives may still influence the bargained wage if they affect union preferences directly.

So far we have concentrated on the union side of (2). By a simple substitution we can simplify the producer side. By definition

\[
\frac{n(\omega)\omega}{\pi(\omega)} = \frac{\omega/a}{1 - \omega/a}
\]

where \( a \) is average labor productivity and \( \omega/a \) is the wage share.

\(^1\) The possibility of a registration effect has often been overlooked, and there is little hard evidence to substantiate it. However, when we regress the measured labor supply of Norwegian women on the supply of program places, we find a statistically significant positive effect.

\(^2\) In addition labor market programs may have positive long run effects on labor supply and productivity without shifting the wage curve. For a more comprehensive discussion of programs, see Calsdor (1994) and Calsdor and Lang (1995).
while the wage share and unemployment seem to have had no trends. This is compatible with the wage curve only if \( \mu \) is independent of \( \omega \). The wage curve can then be written

\[
\frac{\omega}{a} = g(U)
\]  

The arguments in the union utility function should probably be the consumer, not the producer, real wage. It is often assumed that union wage pressures increases with the wedge between consumer and producer real wages. However, if \( \mu \) is independent of \( \omega \), \( \mu \) must also be independent of the size of the wedge. This means that a proportional tax on labor income or on consumption, has no effect on the wage curve. This is a maintained assumption in the sequel.

The degree of progressivity of the tax system may still have an effect. A high marginal tax rate reduces the gain from a wage increase in the numerator of (2), see Hersoug (1984). However, a progressive income tax can also reduce the gain from being employed, the denominator in (2), see Røedseth (1999). Hence, the total effect of increased tax progressivity is ambiguous.

The above model can be extended in various directions without fundamentally changing the nature of the wage curve. One can allow for monopolistic competition, union preferences over employment as well as wages, and different degrees of centralization in bargaining. In the sequel the focus is on the wage curve, not on the exact nature of the bargaining model that lies behind it. Hence, there is no need to discuss alternative bargaining models further. Note, however, that in theory a high degree of centralization means that an increase in the replacement rate or in the supply of program places is less likely to shift the wage curve upwards, since at the national level the workers will have to pay for the welfare of the unemployed.

The wider setting

In Figure 2 the wage curve is drawn as a function of total employment, \( N \), on the assumption that unemployment is a decreasing function of \( N \). In equilibrium \( N \) is determined by the intersection

\(^3\)A possible alternative explanation is that \( \mu \) is homogeneous of degree zero in \( \omega \) and some other argument that has the same trend as \( a \). Productivity in home production has been suggested as a candidate. However, if the trend is the same in household and market productivity, the obvious explanation is not some freak technological coincidence, but that hours are adjusted in such a way as to equate on the margin the value of household and market work. We are then back to the case where \( \mu \) is independent of \( \omega \), at least in the long run.
of the wage curve and the aggregate labor demand curve

\[ N = n(\omega)K \quad \text{where} \quad n' < 0 \]  

(5)

as illustrated by point A. (For simplicity we use the symbols as if the number of firms was just one. Multiplying with the number of firms in appropriate places does not change anything). The rate of return on real capital is \( \pi(\omega) \). Over time the capital stock grows or declines depending on whether \( \pi(\omega) \) is higher or lower than the real rate of return in international financial markets, \( \rho_* \). This means that the long run equilibrium is characterized by

\[ \pi(\omega) = \rho_* \]  

(6)

which alone determines the equilibrium real wage \( \bar{\omega} \). The long run labor demand curve is horizontal at \( \bar{\omega} \) in Figure 2, and the long run equilibrium is where this intersects with the wage curve. Thus, point A is both a short run and a long run equilibrium. In the long run unions and wage bargaining have no influence on the real wage. Instead, the wage equation determines employment, and, thus, implicitly unemployment (see Rodseth (2000, ch. 5.9 and 7.4)).

The dynamics following a shift in the wage curve to the dotted line are illustrated informally in the figure. From the starting point A there is a rapid movement towards the new short run equilibrium B, where profits are too low for the capital stock to be sustained. Slow adjustments of the capital stock means that it takes a long time to move from B to the new long run equilibrium at C. As the movement goes on, the short run labor demand curve shifts to the left, meaning that the short run equilibrium moves along the new wage curve towards C.

In the simplest model there is no room for demand management by the government. However, if we allow for government employment or for non-traded goods, the picture is still the same as in Figure 2, except that the position of the short run demand curve is influenced by demand management. Note then that if the government keeps total employment constant at a level above the long run equilibrium, the real wage increases, but only until the economy hits the wage curve.

\footnote{The way the long run equilibrium is determined here is different from in Layard \textit{et al.} (1991), where the rate of return requirement is replaced by a requirement of balanced trade. However, in the long run national savings must adapt to the external borrowing constraint somehow. This need not place any restriction on the real wage.}
It does not increase without limits, and the loss of profitability is limited. Furthermore, since the model contains real variables only, the inflation rate is indeterminate. Nothing says that inflation must accelerate or that there must be a continuous loss of competitiveness even if unemployment is kept below its equilibrium level. Unemployment below the long run equilibrium level cannot be sustained forever. It may be maintained for quite a while, though, if the decline of the capital stock in the traded goods industry is slow and the expansion of government demand is matched by increased taxes.

As in many earlier studies including Calmfors & Nymoen (1990), the estimated wage equation is for manufacturing only. If we identify manufacturing with the traded goods industry, the focus can be defended with the special role that the traded goods industry plays in the determination of the long run equilibrium. Real producer wages in the traded goods industry are determined by the production technology and the requirement that capital must yield the international rate of return. Hence, unemployment must somehow adjust in order to contain the threat to international competitiveness that is specific to the traded goods industry. Thus, wage formation in manufacturing is crucial for unemployment in long run equilibrium, while wage formation in the
non-traded goods industries plays a secondary role. Indirectly wages in the non-traded sector may still be important, as they may influence wages in the traded goods industries through relative wage effects or through the relative prices of non-traded goods.

The wage equation

As just acknowledged, there will be short run dynamics around the wage curve. Our estimated wage equation allows for this and has a fairly standard form:

$$\Delta wc_t = \beta_0 + \beta_1 \Delta cpit + \beta_2 \Delta pt + \beta_3 \Delta at + \beta_4 (wc_{t-1} - p_{t-1} - a_{t-1}) + \beta_5 u_{t-1} + \beta_6 z_{t-1} + \beta_7 \Delta z_t + \varepsilon_t$$  \hspace{1cm} (7)

where $wc$ is hourly wage cost, $cpit$ the consumer price index, $p$ the producer price index, $a$ average labor productivity, $u$ the total unemployment rate, $z$ a vector of other explanatory variables, and $\varepsilon$ a stochastic error term. All variables are in logs. The $\beta$s are unknown parameters to be estimated, and the subscript $t$ is for time period. Note that $wc - p - a$ is the same as the log of the wage share. More lags may be included in the equation. The vector $z$ will contain variables such as the replacement rate, active labor market programs, and possibly taxes and other wedge variables. The error term $\varepsilon$ is assumed to be independently normally distributed with conditional expectation zero and constant variance. The wage curve is recovered from (7) when all rates of change are set to zero.

As above, long run equilibrium is defined by requiring that the rate of return on capital is equal to the rate of return in international capital markets. Suppose that the international rate of return is constant, that technical progress is purely labor augmenting, and that capital goods are traded. Then in long run equilibrium the wage share is constant, which means that wage costs grow at the rate

$$\Delta wc = \Delta p + \Delta a$$
From this and the wage equation (7), assuming $\Delta z = 0$, we get a long run equilibrium condition

$$wc - p - \rho r = \frac{\beta_0}{\beta_4} - \frac{\beta_6}{\beta_4} u - \frac{\beta_6}{\beta_4} + \frac{1 - \beta_4}{\beta_4} \Delta cpi$$

$$+ \frac{1 - \beta_2}{\beta_4} (\Delta p + \Delta a - \Delta cpi) + \frac{\beta_2 - \beta_4}{\beta_4} \Delta a$$

(8)

This steady state relationship can be simplified considerably by two common assumptions:

- **Dynamic homogeneity**, $\beta_1 + \beta_2 = 1$, which means that the long run equilibrium is independent of the rate of inflation.

- **The scope restriction**, $\beta_2 = \beta_3$, which means that only $\Delta p + \Delta a$, not its individual components, matters. $\Delta p + \Delta a$ is the scope for wage increases when $\rho_d$ is constant.

Even if the two assumptions are granted, the long run equilibrium condition (8) does not quite reduce to the wage curve (4), since the term $\Delta p + \Delta a - \Delta cpi$ remains. This term can be interpreted as the scope for increase in the consumer real wage. If there are no changes in taxes or in terms of trade, $\Delta cpi = \Delta p$ and the the scope is equal to the average productivity growth in the economy, $\Delta a$.

As above, the long run labor demand curve is horizontal at the level of $wc - p - a$ that gives capital the international rate of return. However, since the position of the equilibrium ‘wage curve’ (8), depends on the rate of productivity growth, the same will be true for equilibrium unemployment. This is an unacknowledged feature of many estimated wage equations.\(^5\)

3  Data and some econometric considerations

As mentioned, the unemployment histories of the Nordic countries show some marked dissimilarities. Given this, the pattern of wage growth in manufacturing was surprisingly similar (Figure 3). Nominal wage growth peaked in the mid 1970s in all countries, then fell to the level of the late 1980s. There was a new, lower peak, at the end of the last boom, before it fell to the lowest level

\(^5\) The rate of productivity growth influences the position of the equilibrium wage curve whenever wage growth depends on the rate of change of consumer prices or the wedge between consumer and producer prices. The estimated coefficients for the wedge variables in the wage equations of Layard et al. (1991) indicate that productivity growth is a quantitatively important factor in their explanation of equilibrium unemployment, although the emphasis in the text is on other factors.
of the observation period. Consumer price inflation shows the same general pattern, but with an extra peak after OPEC II. Real wages then stagnated and even fell. Real wage growth resumed during the boom in the mid or late 1980s, in Finland somewhat earlier.

Wage shares show no clear trends, which means that the growth in producer real wages has been roughly in line with productivity (Figure 3). However, there has been relatively long swings. In Sweden and Norway the second half of the 1970s stands out with high wage shares. Denmark seems to have experienced a particularly long swing, and the stationarity of the wage share there can be questioned.

The data set, and a brief description of sources, can be downloaded from Nymoen’s home page. National accounts are the source for wage shares, wage levels, producer prices, productivity and pay roll tax rates.

Data on replacement rates were supplied to us by individual researchers. The methods used differ, mainly because the different researchers have made different assumptions about income levels and the lengths of unemployment spells.

A special data set with detailed information on the number of participants in labor market

\footnote{http://f5k.uio.no/nymoen A more detailed documentation is in Evjen and Langset (1997).}
Figure 4: Wage shares in gross product, manufacturing.

programs has been created. The number of participants include those in training and in job creation schemes. Programs aimed specifically at the disabled are not included. The distinctions between job schemes and regular employment and between training programs and regular education are difficult both conceptually and in practice. On the whole, we believe that our series are fairly consistent over time and between countries. The volume of labor market programs has increased with the level of unemployment, but the program shares (the shares of the unemployed who participated in programs) have fluctuated widely (Figure 3). In the estimated wage equation labor market programs are represented by the variable $t_{mp}$ which is the log of the share of open unemployment in total unemployment (the log of one minus the program share). This functional form is preferred because it is convenient for hypothesis testing, and because it has the reasonable property that the elasticity of the wage rate with respect to the program share increases with the program share itself.

It is important to avoid double counting of the unemployed. This forced us to use national unemployment figures even where standardized unemployment rates were available\(^7\). In some

\(^7\)Since standardized unemployment rates for Denmark became available, they have usually been around two percentage points lower than the national figures, while for the three other countries the national figures have more often been below the standardized rates.
countries it has also forced us to use the numbers registered at employment offices instead of labor force surveys. We use official figures for the labor force. These are not always consistent in the way they treat participants on labor markets programs. Unfortunately there seems to be no way to correct for this in the earlier part of the sample. Probably the resulting errors are small.

Nearly all contemporaneous modeling of wages and prices take the view that stochastic trends are an integral part of the apparent non-stationarity of these series. Typically, wages or prices are seen as being integrated of order 1 or 2. In this paper we assume that all variables are I(1), at most\(^8\). Given this, the left hand side of (7) is I(0). On the right-hand side we then need a "mapping" from I(1) to I(0) in order to achieve a balanced equation and to stay clear of problems of spurious regression.

A simple way to test for cointegration in single equation models is provided by Kremers, Ericsson and Dolado (1992) In our context, if we assume that \( u_t \sim I(0) \), the hypothesis that \((wc_t - p_t - pr_t) \sim I(1)\) can be tested by comparing the \( t \)-value of \( \hat{\beta}_{4,OLS} \) with the usual Dickey Fuller table. More generally, we may assume that both \( u_t \) and \((wc_t - p_t - pr_t) \) are I(1). The hypothesis about no-cointegration can then be tested by comparing the \( t \)-value of \( \hat{\beta}_{4,OLS} \) with

\(^8\)Table 7 in Røedeth and Nymoen (1999) contain Dickey-Fuller statistics supporting this.
the appropriate critical value in MacKinnon (1991). This procedure extends to more than two I(1) variables, e.g. contained in the $\beta_i z$ term, and is the test for cointegration reported below.

In Rodseth and Nymoen (1999) we argue on the basis of Johansen and Juselius (1994), that the worry about identification of aggregate wage equations in a closed economy expressed in Manning (1993) seems exaggerated in our context where we estimate sectoral wage equations for open economies. A more difficult identification problem, which we have not attempted to address, is related to the possible endogeneity of labour market policy.

The econometric wage equations in the next section result from our implementation of the well known general-to-specific methodology, see e.g. Hendry (1995, Chapter 9.15). One starts with a general unrestricted model (GUM) both in terms of the number of explanatory variables and in terms of lag structure. The GUM has residuals that are innovations with respect to this information set. Then variables and lags are successively eliminated from the equation by imposing parameter restrictions which are not rejected by the data until one arrives at an equation which is parsimonious in the number of parameters and statistically well specified.\textsuperscript{9}

A main issue in the present paper is the degree of similarity among the Nordic countries. If the general-to-specific procedure is carried out for each country separately on the relatively small sample sizes, the resulting equations may exaggerate the differences. One answer may be to conduct the reduction process under the constraint that the same variables are retained for all countries. However, if all variables and all lags which are significant for one country are kept in the equations, one easily ends up with an overparametrized model. Thus, one has to compromise.

4 Empirical results

We started with the same list of variables and lags for all countries. The list included\textsuperscript{10}

\begin{itemize}
  \item $\Delta cpi_t$, $\Delta p_t$ and $\Delta q_t$ (growth in consumer and producer prices and in productivity), all with
\end{itemize}

\textsuperscript{9}Thus, by explicit model design we seek to minimize the losses due to the reductions selected. Hoover and Perez (1999) and Hendry and Krolzig (2000) mark new advances in the evaluation of contested methodologies. The earlier discussion is summarized in e.g. Granger (1990).

\textsuperscript{10}One could argue that we should also have included the change in the average rate of income tax. However, when this variable was added, it was in most cases insignificant and the estimates did not change much. When a measure of tax progressivity was added to the Norwegian equation, it was also insignificant, and the point estimate did not have the expected sign. Tax issues are dealt with in Nymoen and Rodseth (1996) and Rodseth (1999).
current value and one lag.

- $\Delta pt_t$, ($pt_t$ = the log of one plus the rate of pay-roll tax), and $\Delta h_t$ ($h_t$ = the log of normal working hours per year) without lag.

- $\Delta u_t$, $u_{t-1}$, $\Delta lm_p$ and $lm_{p-1}$ ($u$ and $lm_p$ being respectively the total unemployment rate and the share of open unemployment in total unemployment, both in logs).

- $s_{t-1} = w_{t-1} - p_{t-1} - a_{t-1}$ (the wage share) and $r_{pr_{t-1}}$ (the after tax replacement rate) with one lag.

- Income policy dummies for Norway.

In order to keep the number of idiosyncrasies at a minimum we wanted to avoid national dummies. However, for Norway dummies for incomes policy are necessary to get a well specified equation. Incomes policy in the other countries is discussed below.

The levels variables in the model are directly motivated by economic theory and their coefficients are of particular interest. We therefore report unrestricted estimates for the coefficients of $(wc - p - a)_{t-1}$, $lm_{p-1}$, $u$, and $r_{pr_{t-1}}$, and because of their interest, also for $\Delta lm_p$ and $\Delta u$. For the remaining variables we carried out the following reduction procedure:

- Test for dynamic homogeneity. This was not rejected at the five per cent level, and dynamic homogeneity was imposed\textsuperscript{11}.

- Test whether $\Delta p$ and $\Delta a$ can be combined in a scope variable ($\Delta scope = \Delta p + \Delta a$). As this was not rejected for any of the countries, we proceeded on this assumption.

- Test for zero and equality restrictions on the remaining coefficients. Generally restrictions were imposed when they were within a band of plus / minus one standard deviation. For ease of comparison it was eventually decided to keep $\Delta pt$ in the equation in all cases.

\textsuperscript{11}There is still some doubt about dynamic homogeneity for Finland related to events in the 1990s, see Rodseth & Nyemoen (1999).
<table>
<thead>
<tr>
<th>Variable</th>
<th>Denmark</th>
<th>Finland-M</th>
<th>Finland-A</th>
<th>Norway</th>
<th>Sweden</th>
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<td>0.643***</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>


SER: 0.0188  0.0146  0.0106  0.0098  0.0189

Standard deviations in parenthesis. * indicates significant difference from zero at 10 per cent level, ** at 5 per cent level, and *** at 1 per cent level; two-sided test statistics for coefficients. Additional instruments used were $\Delta w_{t-1}$, $\Delta p_{t-1}$, $\Delta pr_{t-1}$, $\Delta CPI_{t-1}$, $\Delta Imp_{t-1}$ (the log rate of change of the import price index), $\Delta Imp_{t-1}$, $\Delta at_{t-1}$ (the log rate of change of one minus the average tax rate, not available for Denmark) and, for Norway only, $\Delta vat$ (the change in the log of one plus the rate of VAT).

*Main equation for Finland. Estimated by OLS, which is adequate since the coefficients of $\Delta CPI$ and $\Delta Scope$ are restricted to unity and zero respectively.

$^d$Alternative equation based on a shorter sample and with two policy dummies.

$^e$No lag for Denmark and Finland, lagged one year for Norway and Sweden. The coefficients for $\Delta CPI$ and $\Delta Scope$ are constrained to add to one for all countries.

$^f$Average over two years for Norway. No lags for the others.
The final results are shown in table 1, while diagnostics for the equations are in table 2. Since there may be a strong contemporaneous effect from wages to both producer and consumer prices, instrument variables are used\textsuperscript{12}. After some general comments on the estimated equations, we shall in turn discuss stability, short run dynamics, real wage flexibility, labor market policy and incomes policy. For Finland table 1 also reports an alternative equation (‘Finland-A’) that will be motivated commented later. Until then all comments relate to ‘Finland-M’.

Table 2: Diagnostic statistics for the wage equations in table 4.

<table>
<thead>
<tr>
<th></th>
<th>Denmark</th>
<th>Finland-M</th>
<th>Finland-A</th>
<th>Norway</th>
<th>Sweden</th>
</tr>
</thead>
<tbody>
<tr>
<td>AR</td>
<td>$F(2,15) = 0.29$</td>
<td>$F(2,21) = 3.36^*$</td>
<td>$F(2,16) = 2.00$</td>
<td>$F(2,16) = 0.05$</td>
<td>$F(2,19) = 0.10$</td>
</tr>
<tr>
<td>ARCH</td>
<td>$F(1,15) = 0.14$</td>
<td>$F(1,21) = 0.17$</td>
<td>$F(2,17) = 0.01$</td>
<td>$F(1,16) = 0.06$</td>
<td>$F(1,19) = 0.11$</td>
</tr>
<tr>
<td>Similarity\textsuperscript{a}</td>
<td>$F(26,17) = 0.88$</td>
<td>$F(31,23) = 1.57$</td>
<td>$F(27,18) = 1.79$</td>
<td>$F(29,21) = 1.29$</td>
<td></td>
</tr>
<tr>
<td>Normality</td>
<td>$\chi^2(2) = 1.44$</td>
<td>$\chi^2(2) = 0.15$</td>
<td>$\chi^2(2) = 1.77$</td>
<td>$\chi^2(2) = 1.06$</td>
<td>$\chi^2(2) = 0.75$</td>
</tr>
<tr>
<td>Validity\textsuperscript{b}</td>
<td>$\chi^2(5) = 7.84$</td>
<td>$\chi^2(7) = 2.00$</td>
<td>$\chi^2(7) = 11.57$</td>
<td>$\chi^2(6) = 10.56$</td>
<td></td>
</tr>
<tr>
<td>Forecast\textsuperscript{c}</td>
<td>$\chi^2(7) = 4.45$</td>
<td>$\chi^2(7) = 9.32$</td>
<td>$\chi^2(7) = 43.9^{***}$</td>
<td>$\chi^2(5) = 2.19$</td>
<td>$\chi^2(7) = 25.5^{***}$</td>
</tr>
<tr>
<td>$t_{ECM}$</td>
<td>$-1.66$</td>
<td>$-2.91^*$</td>
<td>$-5.38^{**}$</td>
<td>$-2.54$</td>
<td>$-3.92^{***}$</td>
</tr>
</tbody>
</table>

Standard deviations in parenthesis. * indicates significant difference from zero at 10 per cent level, ** at 5 per cent level, and *** at 1 per cent level. One-sided test statistics.

\textsuperscript{a}Test of the null that the observations are derived from an equation with all slope coefficients equal to the average of the slopes in the four countries (based on Finland-M).

\textsuperscript{b}Test of instrument validity. Tests the overidentifying restrictions.

\textsuperscript{c}Tests the null that all parameters have been constant after 1987 (1989 for Norway).

Note first that none of the usual diagnostic statistics (autoregressive errors, heteroscedasticity and non-normality) are significant. Nor is the test for instrument validity. The standard errors of the regressions range from 1 per cent for Norway to 1.9 per cent for Denmark and Sweden. In comparison the mean wage growth was around ten per cent in all countries, and the standard deviations were around four per cent.

As explained in Section 3, equilibrium correction may be tested by looking at the t-value of the coefficient on the lagged wage share in an OLS-regression. This statistic, reported as $t_{ECM}$ in table 2, strongly indicates equilibrium correction for Sweden, and at a lower level of significance for Finland. For Norway we are close to rejecting the null of no equilibrium correction. Given the different behavior of the wage share in Denmark, it is no surprise that the evidence of equilibrium

\textsuperscript{12}Technically the left hand side variable in the regressions is $\Delta w - \Delta p$, and the variable that is instrumented is $\Delta s = \Delta r p$.
correction is weaker there. The power of the test is low when equilibrium correction is slow relative to the length of the observation period.

If we can assume that the wage share is stationary, the standard t-test for the coefficient on $s_1$ is valid, and provides a stronger test for the null of no equilibrium correction in wage setting. This test strongly supports equilibrium correction in three of the countries, Denmark again being the exception. Several other studies which find a tendency to the same type of equilibrium correction in Nordic countries.\(^{13}\)

The long-run elasticities reported in table 3 are meaningful only if there is equilibrium correction. In our judgment the sum of the evidence points strongly in that direction. In any case many contemporary discussion of unemployment and wage formation are based on the premise that there is an upward sloping wage curve. A prominent example is Layard et al. (1991). Thus, it must be of interest to see what the estimates tell us given that this hypothesis is maintained. The upper half of table 3 gives us the coefficients of the wage curve as it is usually written with the real wage as the dependent variable. In section 2 it was concluded that in the long run the wage curve determines unemployment, not the real wage. Therefore, the lower half of table 3 reports the coefficients of the wage curve when it is written with unemployment as the dependent variable.

**Similarity**

A strong conclusion from table 1 is that, except perhaps in the short run dynamics, there is no statistically significant evidence of dissimilarity between the countries in the responses to the explanatory variables. All coefficient estimates are within two standard deviations of each other and have the same sign. The only exceptions are $\Delta \ln p$ for Norway and $\Delta \ln c$ for Finland. The latter is an artifact of the reduction procedure.

An “average” equation can be formed by setting the slope coefficients equal to the average of the estimates in table 1, but allowing the intercepts to differ. In table 1 we have used an $F$-test

\(^{13}\) See e.g. for Finland Salkkosen and Teräsvirta (1985) and Holm, Honkapohja and Koekela (1994), for Norway Johnsen (1995) and Nyamo (1989), for Sweden Forslund and Rissager (1994), for all four OECD (1997). Studies based on the regional variation in wages and unemployment have not always found negatively sloped waged curves, see Albank (1999).
<table>
<thead>
<tr>
<th></th>
<th>Denmark</th>
<th>Finland-M</th>
<th>Finland-A</th>
<th>Norway</th>
<th>Sweden</th>
</tr>
</thead>
<tbody>
<tr>
<td>Of the real wage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>with respect to</td>
<td>u</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( lmp )</td>
<td>-0.16</td>
<td>-0.07</td>
<td>-0.10</td>
<td>-0.11</td>
<td>-0.16</td>
</tr>
<tr>
<td>( rpr )</td>
<td>-0.44</td>
<td>-0.21</td>
<td>-0.168</td>
<td>-0.27</td>
<td>-0.25</td>
</tr>
<tr>
<td>( \Delta \bar{\pi}^a )</td>
<td>-3.29</td>
<td>-5.93</td>
<td>2.81</td>
<td>-3.569</td>
<td>-1.65</td>
</tr>
<tr>
<td>Of unemployment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>with respect to</td>
<td>( lmp )</td>
<td>-2.82</td>
<td>-2.88</td>
<td>-1.78</td>
<td>-2.41</td>
</tr>
<tr>
<td>( rpr )</td>
<td>2.91</td>
<td>4.59</td>
<td>1.33</td>
<td>1.11</td>
<td>0.01</td>
</tr>
<tr>
<td>( \Delta \bar{\pi}^{14} )</td>
<td>-20.88</td>
<td>-83.21</td>
<td>-29.69</td>
<td>-31.68</td>
<td>-10.13</td>
</tr>
<tr>
<td>( s(= w - p - a) )</td>
<td>6.35</td>
<td>-14.03</td>
<td>-10.57</td>
<td>-8.87</td>
<td>-6.13</td>
</tr>
</tbody>
</table>

Standard deviations in parenthesis.

Semi-elasticity, \( \Delta \bar{\pi} \) (the average rate of productivity growth in the economy) represents the scope for real wage increase).

Based on the residual sums of squares to compare the fit of the national and the average equation.

In no case do the national equations perform significantly better than the average equation.

None of the long-run coefficients reported in table 3 differ by more than two standard errors either. However, this is in some cases more due to the lack of precision in the estimates than to their similarity. The lack of precision probably reflects that the sample is short relative to the speed of adjustment.

If the structure is really the same, there may be large efficiency gains from combining information from all four countries. A forecasting experiment underscores this. The equations in table 1 were estimated with sample end in 1987. Forecasts from the individual equations and an average equation with different country intercepts were compared. The root mean square errors errors of the forecasts were from the country equations D: 0.0179, F: 0.0181, N: 0.0161, S: 0.0352 and from the average equation D: 0.0113, F: 0.0113, N: 0.0113, S: 0.0220. Thus, for Denmark and Sweden the average equation performed substantially better than the national equation. For Finland and Norway there was not much difference. Surely the structure is not exactly identical in the four countries. However, national idiosyncrasies seem unimportant relative to parameter uncertainty.
There is one important caveat. The constant terms are not comparable. Similarity is in the response to the explanatory variables, but not necessarily in the levels of equilibrium unemployment.

**Stability**

Has the structure of wage formation in the Nordic countries changed after 1987? Figure 4 plots the one-step residuals ($\mu_t - \beta_t x_t$ in the usual notation) and the corresponding equation standard errors, $\pm 2\sigma$. The plots show no obvious signs of structural breaks. This impression is confirmed by recursive plots of the estimated coefficients (available from the authors). In no case do the coefficients move outside the confidence intervals estimated on earlier data.

As a further check on parameter stability, table 2 reports a $\chi^2$-statistic that is equal to the ratio between the squared forecast errors and the estimated variance of the error term (sample end 1987). This is sometimes used as a test on the hypothesis that all coefficients have been constant since the estimation period. However, the test does not take account of parameter uncertainty and, hence, rejects the null far too often in short samples like ours. For three of the countries the root mean square errors of the forecasts are at the same level as the estimated standard error of the equation (sample end 1987) ($\pm 20$ per cent), and scores on the $\chi^2$-test are low. However, the score for Sweden indicates a possible instability. We return to this when discussing incomes policy below.

Stability may also be considered in relation to the results in Calmfors & Nymoen (1990). In the appendix we compare the estimated equations then and now. With respect to the variables that are included in the present study, the results for Finland, Norway and Sweden are fairly similar. There are some differences in the lag structure and in which variables are included, but these are mainly due to the different reduction procedure. For Denmark data revisions (including a later sample start) lead to more fundamental changes: unemployment density drops out, adjustment speeds towards the wage curve are radically reduced and the equation becomes more similar to the

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15In ordinary least squares better tests for parameter stability are available. Neither the Hansen test nor the Chow test indicate any structural break after 1987 in spite of that OLS and IV estimates are close, see table 8 in the Appendix of Rodseth & Nymoen (1999).
others. Also for Norway data revisions weaken the influence of a couple of variables that are not included in the present study. Given the new data sets, the equations from Calmfors & Nymoen (1990) appear stable for all countries, in the sense that when the estimation period is prolonged to 1994, all coefficients stay within their previous confidence bounds.

What about stability in the early part of the sample? We have calculated “Chow”-statistics for structural stability from the beginning of the sample until 1969. The exact distribution of this statistic in the present case is not known, but a comparison to the relevant $F$-distribution may give a rough idea. The resulting statistics are (5 per cent points of the $F$-distribution in parenthesis): Denmark 9.4 (4.5), Finland 1.8 (2.7), Norway 2.6 (3.0), Sweden 0.6 (2.9). The figure for Denmark should not be taken too seriously, since it is based on a reduction of the sample by just one observation. It reflects a relatively large residual for Denmark in 1968. Something unusual happened, but not necessarily a structural shift. The “Chow”-statistics for the other countries are reasonably low, although no definite conclusions can be obtained for Norway and Finland. The sample can be extended backwards by one year at a time, while the “Chow” test is still computed with reference to 1969-1994. For Norway the “Chow” statistic then increases year by year when we go beyond 1967, a pattern consistent with a change in structure in 1967.
For Finland the statistics first increases when 1968 is included, then falls rapidly until it jumps upwards again in 1964. Thus, 1968 stands out as a unique episode (to which we shall return). If there was a structural break in Finland, it must have been between 1964 and 1965.

**Short run dynamics**

Because the results are sensitive to the reduction procedures, we do not emphasize the different coefficients and lags for the price variables. Except for Finland, though, it appears that both the cost of living and the scope for wage increases have an effect.

The change in normal working hours, $\Delta h$, was included in the wage equations because of the lumpiness of hours reductions. Actually the lumpiness is most pronounced for Norway, where hours reductions were concentrated on just four years, but the variable seems to be more important for Denmark and Finland.

Increases in pay-roll taxes consistently seem to raise wage costs in the short run, although the standard deviations are high. The latter may partly be due to a lack of variation in pay-roll taxes, but our impression is that years with major social security reforms create difficulties. The sharp result for Sweden may be due to the fact that the social security system there was well established before our sample started.

**Real wage flexibility and adjustment speeds.**

Real wage flexibility, according to one definition, is the same as the long run elasticity of the real wage with respect to unemployment. In our model this elasticity is the same for total and open unemployment. The average of the estimates reported in the second line of table 3 is 0.126. As in earlier studies, Sweden is a bit on the high side, Finland a bit on the low side, and the differences are economically significant. Considering the standard deviations, however, it is impossible to claim that real wage flexibility is greater in one country than in another.

Layard et al. (1991, Chapter 9) reported that Finland, Norway and Sweden had particularly high real wage flexibility. This is not confirmed here. Our estimated real wage flexibilities are lower than theirs except for very low unemployment rates (below 1.5 per cent in Sweden, even
lower in Finland and Norway)\textsuperscript{16}. At total unemployment rates around six per cent the real wage flexibility in Denmark, Norway and Sweden seems to be near the median of the countries studied in Layard \textit{et al.} (1991), and in Finland even lower. In Calmfors & Nymoen (1990) the estimated real wage flexibility was 0.13 for Denmark, 0.03 for Finland, 0.17 for Norway and 0.22 for Sweden (calculated at 5 per cent total unemployment for Finland). The average of these numbers is 0.138, almost the same as for the new estimates. However, the new estimates narrow the range to (0.07, 0.16).

When we use the same specification as in table 1, there is no clear trend in how the new observations affect the point estimates for real wage flexibility. Starting from 1987, the estimates increased from 0.08 to 0.16 for Denmark, decreased from 0.10 to 0.07 for Finland, increased from 0.10 to 0.11 for Norway and decreased from 0.22 to 0.16 for Sweden.

In Section 2 we emphasized that even if unemployment is kept below its long run equilibrium level, the wage curve will limit wage increases. Suppose the total unemployment rate is kept at four rather than eight per cent. Our estimated wage curves then show that the resulting long run increase in the real producer wage is in the range from 5 (Finland) to 12 (Sweden) per cent. This appears to be significant in terms of international cost competitiveness. However, it is hardly high enough to invalidate explanations of low unemployment based on aggregate demand.

The coefficient in front of the lagged wage share in table 1 is the speed of adjustment towards the wage curve. The point estimates are in the range (0.16, 0.29), indicating a halving time of between two and four years. A devaluation works by reducing the producer real wage and moving the economy off the wage curve. The halving time is an upper limit on the time it takes before the economy is halfway back to the wage curve again. The reason it is an upper limit, is that a devaluation also affects wage increases through the short run dynamics ($\Delta c_p$ and $\Delta p$), and possibly through the unemployment rate. The full story can only be deduced from a complete model of wage and price formation, and this is beyond the scope of the present paper.

The change in the unemployment rate is marginally significant for Norway, and has the expected
\footnotetext{\textsuperscript{16}The comparison is to the coefficient $\gamma_1$ in table 2 on p. 406 of Layard \textit{et al.} (1991). Actually their estimated real wage flexibility for Norway was quite low, as is clear from the appendix to their Chapter 9. In the main text they use an average of their own estimate and one by Allegrofis and Manning.}
negative sign also for Denmark and Finland. Suppose that a demand shock lowers unemployment.

A negative coefficient in front of $\Delta u$ then wage increases which then will bring the economy back
to the wage curve are faster than indicated by the halving times we just mentioned.

**Labor market policy**

The first column of table 4 shows t-statistics for the hypothesis that only total unemployment, not
its composition, matter for wage formation. The statistics are just the t-values for the coefficients
for $Imp$ in table 1. With one exception they are all negative, but not significantly different from
zero. A negative sign means that for a given total unemployment rate, an increase in the program
share increases wage pressure. Calmfors & Nymoen (1990) similarly found that labor market
programs increased wage pressures in Denmark, Finland and Sweden, but not in Norway\(^7\). They
obtained higher t-values, probably because they omitted more statistically insignificant. The
different result for Norway is due to the change in specification.

The second column of table 4 presents t-statistics for the hypothesis that the coefficients for
$Imp$ and $u$ are equal, meaning that only open unemployment, $u + Imp$, reduces wage pressure.
Here a negative sign means that for a given open unemployment rate an increase in program
participation, and thus in total unemployment, increases wage pressure. Clearly we should expect

\(^7\)The classical study which found wage-increasing effects of labor market programs relative to open unemployment
positive signs. However, with two exceptions they are negative. The similarity in results is in spite of that $lmp$ has followed very different paths from country to country.

How should one react to these findings? Take the long run first. For the individual countries there are no significant results. However, there is a consistent pattern. When $\beta_{lmp} = 0$, and the error terms are independent between countries, the likelihood of getting four t-values lower than -0.65 (the highest value in the first column) is less than one per cent. Taken together the results thus seem to indicate that, for a given total unemployment rate, a larger share on programs increases wage pressures. In fact all point estimates are higher for $\beta_{lmp}$ than for $\beta_u$. That is what the negative signs in the second column tells. By the same logic we applied to the first column, we are almost forced to the conclusion that an increased total unemployment rate raises wage pressure if it is not accompanied by an increased open unemployment rate. However, the degree of significance is lower in this case, as the lower t-values indicate.

Still these results should not be regarded as the final words on the long run effects of labor market programs. Our experience is that wide confidence intervals often go together with lack of robustness to small changes in specification. Micro studies tend to indicate that labor market programs do not increase wage pressures (Forslund (1994), Edin, Holmlund and Östros (1995), Raun and Wulfsberg (1997)). The policy implications of our estimates (and those of Calmfors & Forslund (1991)) depend entirely on to what extent they are due to the welfare effect or the registration effect. In equilibrium the registration effect raises measured total unemployment because unemployment becomes more visible, while regular employment is unaffected. It is the welfare effect that is harmful for regular employment. Consider the long run elasticities of $u$ with respect to $lmp$ in table 3. For values of $lmp$ within the sample these indicate that one extra worker on programs raises total unemployment in equilibrium by between 1.3 and 3 workers. In other words, if programs have no effect on labor supply, one worker in programs may generate as much upward wage pressure as three in regular employment. The welfare effect seems unlikely to be that strong. Hence, if the estimates are taken at face value, one is lead to suspect that something else is going on too, possibly a registration effect. An alternative interpretation is that
$\Delta mp$ (and possibly also $r_{pr}$) is an indicator for a broader range of policies that reduces the threat of unemployment for presently employed workers.

The results on the short run effects of labor market programs are even less clearcut. Rodseth & Nymoen (1999) argue that the strong and statistically significant negative effect of programs on wage growth in Norway is spurious. $\Delta mp$ follows a distinct cyclical pattern. Its significance is derived from its ability to predict the large wage increases that followed the strongest booms in the sample. An alternative explanation is that the unemployment rate does not adequately measure the pressure in the labor market at the height of booms.

The coefficients for $r_{pr-1}$ in table 1 are positive for all countries, although only just so for Sweden. It is marginally significant for Finland. If labor market programs tend to raise wages through welfare effects, one should expect that high replacement rates would also increase wages. The pattern is consistent with this, but the evidence is not strong.

A closer look at what is behind the Finnish result reveals that the replacement rate comes into the equation not because a high replacement rate explains the period with high unemployment, but because it explains high wage increases around 1970 when unemployment was low. An obvious alternative explanation of the high wage increases is the low level of unemployment. The estimated effect of unemployment in Finland is unusually low. If we shorten the sample by dropping the early years, the coefficient for $r_{pr}$ is reduced and becomes statistically insignificant, while the coefficient for $u$ increases towards the same level as in Norway and Denmark. This is the case in the alternative equation for Finland in table 1.

### Incomes policy

Incomes policy has a long tradition in the Nordic countries (see Calmfors (1990)). In all of them some form of incomes policy was also a response to the macroeconomic events of the late 1980s and early 1990s.

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18In the Nordic countries unemployment benefits are more or less proportional to wages up to a ceiling. While our measure of $r_{pr}$ for three of the countries mainly reflect the proportional element, the measure for Sweden is determined by the ceiling. Because the adjustment of the ceiling has often lagged in periods with rapid wage increases, there has been a tendency to a negative correlation between $r_{pr}$ and wage increases which is absent in the other countries, and which may explain the different result for Sweden.
In econometric studies incomes policy is usually represented by a number of exogenous dummies. This may be a dubious procedure when policy responds more or less continuously to actual wage pressures. The dummies cannot detect what was always there. Even worse, they may be correlated with the error term in the wage equation as incomes policy responds to aspects of the labor market unobserved by the econometrician. Even the direction of the bias that this creates is ambiguous, since measures to reduce wage increases may be taken either because upward wage pressures are unusually strong, or unusually low. The latter case is a real possibility when unions realize that they are not in a position to obtain high wage increases and enlist the government in their effort to sell this to the rank and file.

Ideally we would prefer to first estimate wage equations without policy dummies. Implicitly we then treat incomes policy as an integral part of the wage formation process, and the estimated coefficients are conditional on the policy regime in the observation period. A change in the policy regime will then appear as a structural break. However, even if the regime does not change, within the sample there may be unique events that turn up as unusually large residuals and that are related to incomes policy. Sometimes these events deviate so much from the regular pattern that it is impossible to get econometrically well-specified equations without accounting for them by dummies. Such episodes may also be influenced by truly exogenous political events. Hence, it may make sense to condition on income policy dummies, but bear in mind their possible endogeneity.

Incomes policy has been pursued most vigorously in Norway, where special laws were used from September 1978 to December 1979 to forbid wage increases and again in 1988 and 1989 to extend to the whole labor market the wage increases agreed on by the main labor market organizations. In table 1 the 1979 and 1988 dummies are highly significant. The 1989 dummy has been found significant in a number of other studies\textsuperscript{19}. Its value here is reduced because of the inclusion of $\Delta imp$\textsuperscript{20}. As discussed above, the effect of $\Delta imp$ is probably spurious. If we remove $\Delta imp$ from the equation, the 1989 dummy becomes significant.

\textsuperscript{19}See e.g. Bowitz and Cappelen (2001) and Johansen (1995).

\textsuperscript{20}Other studies also find significant negative effects of the 1978-79 wage freeze on wage increases in 1980. When we do not, it is because the low inflation in 1979 is insufficient to explain the relatively low wage increases from 1979 to 1980. However, everyone knew that past inflation was a poor indicator of expected inflation in 1980, because there was a price freeze in 1979. Thus, an alternative interpretation where incomes policy worked in 1980 is possible.
The case of Norway illustrates the problems discussed above. The years 1979 and 1988 deviate so much from the normal pattern that we could not follow our preferred strategy. However, the regulations came after relative unit labor costs in Norway had increased strongly and when it was feared that increased unemployment was ahead. Hence, if wage laws are part of the normal response, using dummies means that we underestimate the ability of the Norwegian labor market to respond to disequilibrium. The fact that the wage laws were accepted by the unions without much protest in 1979, and actively supported in 1988–89, indicates that wage increases might have been relatively low in any case. However, when the size of the coefficients are considered in relation to the normal size of residuals also in the other countries, it is hard to avoid the conclusion that the wage laws contributed substantially to reduced wage increases in the two periods. According to the estimated adjustment speed, the effect of incomes policy in Norway fades out with a halving time of about three years.

In Denmark a law enacted in March 1985 set guidelines and ceilings for wage increases in the years 1985-1987. The law came at a time when the economy was booming, the wage share was relatively low, and high wage increases were expected. Apparently the result was not as intended, as one can see already from figure 4. The equation in table 1 has virtually zero residuals in 1985 and 1986, and the largest positive residual in the estimation period in 1987 (close to 2.9 per cent). Dummies for the three years yield coefficients: 1985: 0.021 (0.022), 1986: 0.017 (0.022) and 1987: 0.055 (0.023). The latter is significant at the five per cent level. Since the reason for the law was a fear of high wage increases, the dummies may not give a fair impression of its effect. As for 1987, this was the end of a strong boom, and also the Norwegian equation has difficulties in explaining high wage increases in similar circumstances in 1987. The fact that the Danish residuals are so small relative to the coefficients for the dummies, shows that there are reasonable alternative explanations for most of the increase in wage costs in this period. Still the guidelines set in 1985 under conditions of somewhat higher inflation may have contributed to higher wage growth two

\[ \text{Coefficient} = 0.011 \ (0.014) \]

\[ \text{Coefficient} = 0.055 \ (0.023) \]

\[ \text{Coefficient} = 0.021 \ (0.022) \]

\[ \text{Coefficient} = 0.017 \ (0.022) \]

\[ \text{Coefficient} = 0.055 \ (0.023) \]

\[ \text{Coefficient} = 0.021 \ (0.022) \]

\[ \text{Coefficient} = 0.017 \ (0.022) \]

\[ \text{Coefficient} = 0.055 \ (0.023) \]
years later.

In Finland incomes policy after 1987 seemed to follow traditional patterns. There was little compulsion, but some kind of policy initiative almost every year. There seems to be little sense in using dummies. However, Finland had a large devaluation in 1967 followed by comprehensive incomes policies in 1968 and 1969. This included a law that abolished all index clauses. Previous studies (Saikkonen & Teräsvirta (1985) and Tyrväinen (1995)) have found that wage increases were reduced significantly in both years. The equation in table 1 has negative residuals then (-0.0213 and -0.0100). Dummies yield coefficients: 1968: -0.047 (0.018), 1969 -0.034 (0.0179), both statistically significant. Hence, these years may have been exceptional.

When dummies for 1968 and 1969 are included, some of the other parameters change. This, and the tendency to instability in the early 1960s, is the reason that table 1 includes the alternative equation Finland-A. This is more similar to the equations for the other countries: It includes a scope term and the effect of the level of unemployment is stronger. However, Finland-A did not result from a systematic reduction procedure. When estimation ends in 1987, the alternative equation also systematically overpredicts wage increases in the following years. This shows up as a high forecast-χ², which may indicate a structural shift in direction of more wage moderation. However, cutting the sample in 1987 gives only 11 degrees of freedom, and in recursive estimation none of the coefficients move outside their initial confidence intervals.

In Sweden a three year wage contract concluded at the central level was supposed to keep wage increases moderate through 1991-93. The residuals in the equation in table 1 were 1991: -0.0029, 1992: 0.0223, 1993: -0.0049. When we include dummies for these years in the equation from table 1, the coefficients we get are (standard deviations in parenthesis): 1991: 0.008 (0.026), 1992: 0.039 (0.026), 1993: 0.011 (0.031). None are statistically significant, nor is a dummy for all three years. If anything, the agreement seems to have raised wage increases in 1992.

In 1983 the Swedish Employers Confederation stopped bargaining with its counterpart LO at the central level. Bargaining at the industry level continued, though. Unlike Forshund & Risager

\footnote{We have also looked at earlier episodes of incomes policy in Sweden without finding statistically significant dummies. These episodes include 1984-85 (the post devaluation period, coefficient -0.008 (0.013)), and 1974-76 (coefficient 0.026 (0.017)).}
(1994) we find that this may have affected wages. A dummy for 1983-90 yields a coefficient of -0.027 (0.011), significant at the 5 per cent level. This seems to indicate that decentralization actually lead to more moderate wage settlements. Again one should not jump to conclusions. The period that really stands out as exceptional in the Swedish experience is 1975-81 with its consistently high wage share. A dummy for these years is highly significant (coefficient 0.045 (0.017)) and knocks out the 1983-90 dummy completely. The period after 1982 then does not appear to deviate from the period with centralized bargaining before 1975. In 1975-81 Sweden used massive subsidies and within-firm labor market programs to prevent layoffs. If unions care about employment, this may have increased wage pressures.

**Shifts in the wage curve and equilibrium unemployment**

Changes in the level of unemployment that persist over time are usually explained as changes in equilibrium unemployment. Equilibrium is found at the intersection of the wage curve and the labor demand curve. Since we have not estimated the latter, we can give no estimates of the level of equilibrium unemployment. However, our estimates allow us to calculate the magnitude of the shift in the wage curve. In our model such shift are caused primarily by changes in the replacement rate, the supply of labor market programs and the rate of productivity growth, c.f. the discussion of (8) at the end of section 2.24.

Table 5 shows the estimated shifts in the wage curves since 1965-73. Their size is measured both horizontally and vertically, in terms of a percentage increase in real wages and in terms of a percentage point increase in the total unemployment rate. The latter measure depends on the level of the real wage. In the calculations we use the average labor shares for the whole sample. Note that it is the change in the average positions of the wage curve (i.e. given the sub-period averages of \( \text{lmp, rpr and } \Delta \bar{a} \)) that are computed. For Finland the alternative equation is used. The reason is that we find it plausible that the scope variable has a positive coefficient in the wage equation. A zero coefficient maximizes the size of the shift caused by different rates of productivity growth.

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24 We approximate the scope for real wage increases by the average economy-wide rate of productivity growth. The period averages of \( \Delta P + \Delta a - \Delta p_i \) cannot be used, since they are influenced by the deviation between actual and equilibrium wage increases. A better measure might have included trends in the terms of trade in the world market.
Table 5: Shift in wage curve since 1965-73. Per cent.

<table>
<thead>
<tr>
<th>Country</th>
<th>Change in actual $u$</th>
<th>Change in $\Delta n$</th>
<th>Change in $rpr$</th>
<th>Change in $imp$</th>
<th>Change in $\omega$</th>
<th>Change in $u$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>4.4</td>
<td>6.0</td>
<td>9.4</td>
<td>5.7</td>
<td>5.6</td>
<td>14.5</td>
</tr>
<tr>
<td>Finland</td>
<td>2.8</td>
<td>5.9</td>
<td>9.2</td>
<td>5.2</td>
<td>6.0</td>
<td>12.6</td>
</tr>
<tr>
<td>Norway</td>
<td>-0.1</td>
<td>1.9</td>
<td>-0.1</td>
<td>2.9</td>
<td>1.9</td>
<td>0.6</td>
</tr>
<tr>
<td>Sweden</td>
<td>0.8</td>
<td>4.6</td>
<td>3.5</td>
<td>3.8</td>
<td>3.3</td>
<td>1.3</td>
</tr>
</tbody>
</table>

$^a$Percentage shift in the wage curve as caused by the change in the average value of each explanatory variable. Measured in the direction of $\omega$. Finland-A is used.

growth, as can be seen from equation (8). This in turn introduces some implausible shifts in the equilibrium wage curve for Finland, see Røedseth & Nymoen (1990).

Since the base period, the estimated wage curve has shifted upwards everywhere, but more in Denmark and Finland than in Norway and Sweden. Everywhere reduced productivity growth gave a main contribution to that. shift. The effect was strongest in Finland, which has the lowest scope coefficient. However, reductions in $rpr$ there from the late 1970s served to dampen the shift. In Denmark the shift was reinforced by increased ‘generosity’ towards the unemployed, first in the form of better benefits, then in the form of labor market programs. Norway also raised the replacement rate, but a reduced program share kept down the overall shift. In Sweden in contrast a high program share reinforced the upward shift in the wage curve in the late 1970s. Except in Norway, the wage curve seems to have shifted down again towards the end of the period, with higher productivity growth contributing to this.

An important caveat is that the periods we look at may be too short to discern long run

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$^{25}$In contrast, Bøhn (1994) in his survey reports that “one invariably finds the effect of the productivity slowdown to be unimportant”. 

30
changes in the rate of productivity growth. After OPEC I the fall in the rate of productivity
growth was stronger in Denmark and Finland than in Norway and Sweden. (The opposite was
the case for manufacturing, though). The poor productivity performance may have been a result
of, rather than a cause for, the greater increase in unemployment rates.

Measured in the direction of unemployment the shifts in the wage curve are small relative
to the large actual increases in unemployment that are reported in the last column of the table.
Hence, it appears that the demand side of the labor market must have played an important part
in the increase in unemployment in Denmark from the early 1970s to the early 1980s, and in all
Nordic countries around 1990.

As mentioned, in the long run unemployment is determined by the intersection of the wage
curve and a horizontal labor demand curve that depends on the international rate of return.
The elasticity of unemployment with respect to the wage rate along the wage curve, reported in
the lower half of table 3, shows the potential of high real interest rates to increase equilibrium
unemployment. In the long run the elasticity of the wage share with respect to the real interest
rate is \((1 - \alpha)(1 - \sigma)\) where \(\alpha\) is the wage share and \(\sigma\) is the elasticity of substitution. If \(\alpha = 0.7\nand \(\sigma = 0.5\), the elasticity of the wage share with respect to the real interest rate is 0.15. This
should be multiplied with the elasticities of unemployment with respect to the wage share from
table 3 to find the effects on equilibrium unemployment. For Norway this gives an elasticity of
1.3. If the required rate of return went up from say 6 to 8 per cent (an increase of one third) this
would mean that the equilibrium unemployment rate increased by close to one half (somewhat less
for Denmark and Sweden, somewhat more for Finland). This example is no proof, but it shows
that high international real interest rates in the 1980s may have raised equilibrium unemployment
markedly.

5 Conclusions

The main findings are: 1) There is no evidence of a structural shift in Nordic wage formation
between 1987 and 1994. 2) There is no evidence of important structural differences in the wage
equations for Denmark, Finland, Norway and Sweden. Almost all coefficients are within two standard deviations of another. 3) Real wage flexibility is not particularly high in the Nordic countries. 4) No strong conclusions can be drawn about the effects of active labor market programs, but the weight of the evidence indicates that an increase in the supply of such programs increases the equilibrium total unemployment rate. 5) Shifts in the wage curve cannot explain the dramatic increase in unemployment around 1990. However, shifts in the wage curve appear to have increased wage pressures substantially in the late 1970s in all countries except Norway. These shifts were partially reversed later. 6) Reduced productivity growth was a main cause of the shifts in the wage curve, but increased generosity towards the unemployed also played a role, especially in Denmark. 7) Income policies have had discernible dampening effects on wages only when enforced by strong legal measures.

What are the implications for the wider debate about the causes of unemployment? According to the estimates, only a small part of the variation in unemployment over time can be explained by shifts in the wage curves. Conversely, most of the action must have been on the demand side. Labor demand is a crucial determinant of the equilibrium unemployment rate. In addition, the estimated equilibrium correction in wages is sufficiently slow that large demand shocks may cause disequilibria that remain significant for several years. This also gives some role for devaluations and successful wage freezes. However, their effects fade out more quickly than real demand shocks, since the latter also move the equilibrium unemployment rate.

Recognizing the importance of aggregate demand does not mean the same as promoting demand management. In section 2 we argued that in the really long run labor demand in small open economies is independent of the domestic demand for goods and services. The effects of domestic demand shocks eventually fade out as high wage costs undermine the traded goods industries. This is not the place for a comprehensive discussion of the macroeconomic history of the Nordic countries. However, in Norway the discovery of North Sea oil permitted a long-lasting expansion of aggregate demand and squeeze of the traditional traded goods industries. Sweden could continue to expand government demand longer than most others because initially it had unusually solid
government finances, and because much of the expansion was of the balanced-budget kind, causing one of the highest tax levels in the world. Still the policy could not go on for ever. Attempts at keeping unemployment below long run equilibrium with an expansionary fiscal policy will fail in the end. Devaluations lose their effect when they become anticipated.

In the 1980s the liberalization of the credit markets was a main driving force on the demand side in all four countries. The boom and bust cycle that this created obviously played a role in the rise of unemployment around 1990. Since dynamic homogeneity was assumed and expectations not modeled explicitly, the estimated equations have less to say about the consequences of different anti-inflation policies.

The empirical results do not support supply side explanations of the rise in unemployment around 1990. Nor do they support the view that the previous low unemployment in three of the countries was explained by institutions that gave particularly high real wage flexibility, or that labor market programs help to keep measured unemployment rates down. A full cost benefit analysis may still show that labor market programs are worthwhile because of positive labor supply or productivity effects, but that is another story.

However, one should not forget that the estimated equations give a large role for supply side variables. Both the level of social protection against unemployment and the rate of productivity growth seem to be important explanations of unemployment. The adverse movements in the wage curves of Denmark and Finland after 1974 are examples.

Samples are short relative to the speed of convergence. Hence it is difficult to obtain precise estimates of how the many potential explanatory variables influence the positions of the wage curves. The present study has shown that their may be efficiency gains from combining estimates from similar countries.\(^{26}\)

\(^{26}\)One can probably also increase efficiency by throwing out some variables that seem to be less important according to our results (for example Δimp). In Rønde & Nymo (1990) we have given some examples, but we do not regard them to be of general interest.
References


Appendix: A comparison to Calmfors & Nyemoen (1990)

The wage equations estimated here and in Calmfors & Nyemoen (1990) differ for a number of reasons: 1. Data are taken from different sources. 2. Our samples in some cases start later, because of problems with data consistency. 3. The list of variables taken as the starting point for the reduction process differ. 4. The way the reduction process was conducted differ. 5. The estimation method differs (we use IV, Calmfors & Nyemoen (1990) OLS). 6. Our sample has seven new observations (1988-1994).

In spite of these differences the estimated wage equations have a number of properties in common. They display the same type of equilibrium correction, the slopes of the wage curves are not significantly different, and, except for Denmark, the adjustment speeds are roughly the same. The replacement rate came out as significant in the old Finnish equation, and insignificant in the others, as now. Dynamic homogeneity is accepted in all cases. However, there are also some marked differences in the results. In tables 6 - 9 the estimated equations from Calmfors & Nyemoen (1990) are reported in a way that makes them easily comparable to our results, and an attempt is made to show the source of the differences.

In the tables column 1 shows the estimates in Calmfors & Nyemoen (1990). Column 2 shows that most parameter estimates are not much affected by the data revisions and the later sample start. The main exception is Denmark where the shorter sample reduces significantly the estimated coefficients for the the lagged unemployment rate and the lagged wage share to levels which are comparable to those in other countries. The coefficients in front of the union density variables are also reduced, and lose statistical significance. For Norway the lagged level of the import price drops out of the equation.

Column 3 shows that the seven new observations have only modest effects on most coefficients when we stick to the model of Calmfors & Nyemoen (1990). This can be seen as another indication that wage formation in the Nordic countries was fairly stable in 1988-94. Note, though, that the changes in the coefficients on the unemployment variables, the wage share and the replacement rate are often large enough to be of considerable economic significance.
Except for Denmark, the greatest difference between the new equations and those in Calmfors & Nyås (1990) are due to the different variable lists and reduction procedures applied, as is seen from a comparison of columns 3 and 4 in the tables27. The variables included in Calmfors & Nyås (1990) and excluded a priori in our equations are for Denmark: the union density and the inverse of the union density; for Norway: the log of the ratio between import and consumer prices, and the change in import prices over two quarters; for Sweden: the change in the average tax rate over two quarters. We tried to add these to the equations in table 1. None were statistically significant even at the ten per cent level. With one exception, they were also insignificant when the original equations were reestimated on the new data. The exception was the change in import prices in Norway.

Union density in Denmark, measured as union members in per cent of the labor force, was fairly constant until 1974, increased gradually from then until about 1983, and then stayed fairly constant again. The path of the unemployment rate was fairly similar, although with more ups and downs after 1983. The story implicit in Calmfors & Nyås (1990) is that increased union density intensified wage pressure and raised the equilibrium unemployment rate. Adjustment towards equilibrium was fairly quick. Our story is instead one of slower adjustment towards equilibrium.

27The differences between OLS and IV estimates (not shown) is only minor.
Table 6: Comparison of old and new wage equation: Denmark

<table>
<thead>
<tr>
<th>Variable</th>
<th>CN</th>
<th>Revised data</th>
<th>New observations</th>
<th>New equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta cpi$</td>
<td>-0.177 (0.040)</td>
<td>-0.136 (0.074)</td>
<td>-0.143 (0.071)</td>
<td>0.658 (0.290)</td>
</tr>
<tr>
<td>$\Delta cpi_{-1}$</td>
<td>0.350 (0.059)</td>
<td>0.146 (0.009)</td>
<td>0.217 (0.085)</td>
<td>0.342 (0.290)</td>
</tr>
<tr>
<td>$\Delta p$</td>
<td>0.650 (0.009)</td>
<td>0.854 (0.009)</td>
<td>0.783 (0.084)</td>
<td>0.342 (0.290)</td>
</tr>
<tr>
<td>$\Delta pr$</td>
<td>0.350 (0.059)</td>
<td>0.146 (0.009)</td>
<td>0.217 (0.085)</td>
<td>0.342 (0.290)</td>
</tr>
<tr>
<td>$\Delta pt$</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>0.274 (0.411)</td>
</tr>
<tr>
<td>$\Delta h$</td>
<td>-0.350 (0.059)</td>
<td>-0.146 (0.009)</td>
<td>-0.217 (0.085)</td>
<td>-0.627 (0.516)</td>
</tr>
<tr>
<td>$\Delta u$</td>
<td>0.092 (0.085)</td>
<td>0.035 (0.009)</td>
<td>-0.207 (0.014)</td>
<td>-0.017 (0.018)</td>
</tr>
<tr>
<td>$\Delta u_{-1}$</td>
<td>-0.082 (0.013)</td>
<td>-0.047 (0.021)</td>
<td>-0.052 (0.019)</td>
<td>-0.032 (0.010)</td>
</tr>
<tr>
<td>$\Delta imp$</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>$s_{-1}$</td>
<td>-0.659 (0.116)</td>
<td>-0.133 (0.200)</td>
<td>-0.030 (0.165)</td>
<td>-0.200 (0.167)</td>
</tr>
<tr>
<td>Constant</td>
<td>7.617 (1.349)</td>
<td>1.458 (1.335)</td>
<td>0.822 (1.186)</td>
<td>-0.060 (0.041)</td>
</tr>
<tr>
<td>$\Delta P_m$</td>
<td>0.177 (0.040)</td>
<td>0.136 (0.074)</td>
<td>0.143 (0.071)</td>
<td>0.009</td>
</tr>
<tr>
<td>$UD_{0-1}$</td>
<td>-0.052 (0.009)</td>
<td>-0.012 (0.011)</td>
<td>-0.007 (0.009)</td>
<td>0.009</td>
</tr>
<tr>
<td>1/($UD_{0-1}$)</td>
<td>-267.0 (48.17)</td>
<td>-49.4 (44.1)</td>
<td>-32.7 (39.4)</td>
<td>-0.148 (0.158)</td>
</tr>
<tr>
<td>SER</td>
<td>0.0106</td>
<td>0.0173</td>
<td>0.0175</td>
<td>0.0188</td>
</tr>
<tr>
<td>AR1-2</td>
<td>$F(2,16) = 3.15$</td>
<td>$F(2,11) = 0.75$</td>
<td>$F(2,18) = 1.72$</td>
<td>$F(2,15) = 0.29$</td>
</tr>
</tbody>
</table>

Dependent variable $\Delta w$. First three equations are OLS, last equation IV estimates identical to those in table 1. Standard deviations in parentheses. $P_m$ is import prices (log), $UD$ is union density (per cent). $u$ is the log of open unemployment in first three equations, total unemployment in the last equation. Coefficient restrictions in the first three equations: $\beta_{\Delta cpi} + \beta_{\Delta cpi_{-1}} + \beta_{\Delta pr} + \beta_{\Delta P_m} = 1$, $\beta_{\Delta P_m} = -\beta_{\Delta cpi}$, $\beta_{\Delta pt} = 1$, $\beta_{\Delta pr_{-1}} = \beta_{\Delta pr} = -\beta_{\Delta h}$.

Table 7: Comparison of old and new wage equation: Finland

<table>
<thead>
<tr>
<th>Variable</th>
<th>CN</th>
<th>Revised data</th>
<th>New observations</th>
<th>New equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta cpi$</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>$\Delta cpi_{-1}$</td>
<td>0.174 (0.055)</td>
<td>0.180 (0.111)</td>
<td>0.114 (0.108)</td>
<td>0.174 (0.055)</td>
</tr>
<tr>
<td>$\Delta p$</td>
<td>-0.174 (0.055)</td>
<td>-0.180 (0.111)</td>
<td>-0.114 (0.108)</td>
<td>-0.174 (0.055)</td>
</tr>
<tr>
<td>$\Delta pr + \Delta pr_{-1}$</td>
<td>0.175 (0.059)</td>
<td>0.103</td>
<td>0.101 (0.087)</td>
<td>0.175 (0.059)</td>
</tr>
<tr>
<td>$\Delta pt_{-1} / \Delta pt$</td>
<td>-0.174 (0.055)</td>
<td>-0.180 (0.111)</td>
<td>-0.114 (0.108)</td>
<td>0.771 (0.481)</td>
</tr>
<tr>
<td>$\Delta h$</td>
<td>-0.751 (0.068)</td>
<td>0.142 (0.026)</td>
<td>0.113 (0.024)</td>
<td>0.055 (0.031)</td>
</tr>
<tr>
<td>$rpr$ / $rpr_{-1}$</td>
<td>0.102 (0.102)</td>
<td>0.142 (0.026)</td>
<td>0.113 (0.024)</td>
<td>0.055 (0.031)</td>
</tr>
<tr>
<td>$\Delta U / \Delta u$</td>
<td>-0.007 (0.003)</td>
<td>-0.004 (0.005)</td>
<td>-0.004 (0.002)</td>
<td>-0.002 (0.004)</td>
</tr>
<tr>
<td>$U / u_{-1}$</td>
<td>-0.002 (0.001)</td>
<td>0.000 (0.002)</td>
<td>-0.003 (0.001)</td>
<td>-0.012 (0.004)</td>
</tr>
<tr>
<td>$\Delta imp$</td>
<td>-0.038 (0.080)</td>
<td>-0.035 (0.053)</td>
<td>-0.035 (0.053)</td>
<td>-0.038 (0.080)</td>
</tr>
<tr>
<td>$s_{-1}$</td>
<td>-0.315 (0.042)</td>
<td>-0.409 (0.091)</td>
<td>-0.277 (0.063)</td>
<td>-0.169 (0.058)</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.379 (0.000)</td>
<td>0.138</td>
<td>0.121 (0.018)</td>
<td>0.027 (0.029)</td>
</tr>
<tr>
<td>SER</td>
<td>0.0074</td>
<td>0.0132</td>
<td>0.0140</td>
<td>0.0146</td>
</tr>
<tr>
<td>AR1-2</td>
<td>$F(2,17) = 0.69$</td>
<td>$F(2,17) = 1.51$</td>
<td>$F(2,24) = 0.84$</td>
<td>$F(2,21) = 3.36$</td>
</tr>
</tbody>
</table>

Dependent variable $\Delta w$. First three equations are OLS, last equation IV estimates identical to those in table 1. Standard deviations in parentheses. $U$ in the first three equations is the level of open unemployment, $u$ in the last equation is the log of total total unemployment rate. Coefficient restrictions in the first three equations are $\beta_{\Delta cpi} = 1$ and $\beta_{\Delta cpi_{-1}} = -\beta_{\Delta pr}$, $\beta_{\Delta pr} = -\beta_{\Delta pr_{-1}}.$
Table 8. Comparison of old and new wage equation: Norway

<table>
<thead>
<tr>
<th>Variable</th>
<th>CN</th>
<th>New data</th>
<th>New obs.</th>
<th>New equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta cpi$</td>
<td>0.643 (0.070)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\Delta p$</td>
<td>0.429 (0.056)</td>
<td>0.314</td>
<td>0.320</td>
<td>0.178 (0.086)</td>
</tr>
<tr>
<td>$\Delta p_{t-1}$</td>
<td>0.168 (0.047)</td>
<td>0.318 (0.092)</td>
<td>0.268 (0.077)</td>
<td>0.178 (0.086)</td>
</tr>
<tr>
<td>$\Delta p^r + \Delta p_{t-1}$</td>
<td></td>
<td></td>
<td></td>
<td>0.178 (0.086)</td>
</tr>
<tr>
<td>$\Delta p^e$</td>
<td></td>
<td>0.439 (0.339)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\Delta h$</td>
<td>-1.0</td>
<td>-1.0</td>
<td>-1.0</td>
<td>-0.231 (0.210)</td>
</tr>
<tr>
<td>$\Delta u_{t-1}$</td>
<td>-0.037 (0.0076)</td>
<td>-0.017 (0.007)</td>
<td>-0.013 (0.006)</td>
<td>-0.020 (0.005)</td>
</tr>
<tr>
<td>$\Delta m_{t-1}$</td>
<td></td>
<td></td>
<td></td>
<td>0.117 (0.052)</td>
</tr>
<tr>
<td>$s_{t-1}$</td>
<td>-0.213 (0.040)</td>
<td>-0.081 (0.058)</td>
<td>-0.101 (0.049)</td>
<td>-0.180 (0.070)</td>
</tr>
<tr>
<td>$\Delta c_{t-1}$</td>
<td>0.083 (0.007)</td>
<td>-0.032 (0.033)</td>
<td>0.015 (0.025)</td>
<td>-0.055 (0.019)</td>
</tr>
<tr>
<td>$i_{1979}$</td>
<td>-0.079 (0.009)</td>
<td>-0.084 (0.013)</td>
<td>-0.083 (0.013)</td>
<td>-0.044 (0.013)</td>
</tr>
<tr>
<td>$i_{1980}$</td>
<td>-0.040 (0.009)</td>
<td>-0.042 (0.007)</td>
<td>-0.042 (0.007)</td>
<td></td>
</tr>
<tr>
<td>$i_{1988}$</td>
<td></td>
<td></td>
<td></td>
<td>-0.059 (0.014)</td>
</tr>
<tr>
<td>$i_{1989}$</td>
<td>-0.048 (0.014)</td>
<td></td>
<td></td>
<td>-0.005 (0.017)</td>
</tr>
<tr>
<td>$cp_{t-1}$</td>
<td>-0.156 (0.027)</td>
<td>-0.002 (0.045)</td>
<td>-0.005 (0.039)</td>
<td></td>
</tr>
<tr>
<td>$P_{t-1}$</td>
<td>0.156 (0.027)</td>
<td>0.002 (0.045)</td>
<td>0.005 (0.039)</td>
<td></td>
</tr>
<tr>
<td>$\Delta P_{t-1}$</td>
<td>0.202 (0.060)</td>
<td>0.184 (0.046)</td>
<td>0.206 (0.084)</td>
<td></td>
</tr>
</tbody>
</table>

S.E. 0.0091 0.0126 0.0126 0.0008  
AR1 2 $F(2, 17) = 0.90$ $F(2, 16) = 0.67$ $F(2, 21) = 0.43$ $F(2, 16) = 0.05$

Dependent variable $\Delta u$. First three equations are OLS, last equation IV estimates identical to those in table 1. Standard deviations in parenthesis. $P_{t}$ is import prices in logs. $u$ is the log of the open unemployment rate in the first three equations, of the total unemployment rate in the last. Coefficient restrictions in first three equations: $\beta_{\Delta u} + \beta_{\Delta u_{t-1}} + \beta_{\Delta p_{t-1}} + \beta_{\Delta p^r_{t-1}} = 1$, $\beta_{\Delta u_{t-1}} = -1(\beta_{\Delta p_{t-1}} + \beta_{\Delta p^r_{t-1}} + \beta_{\Delta p_{t-1}})$, $\beta_{\Delta p_{t-1}} = \beta_{\Delta p^r_{t-1}}$ and $\beta_{p_{t-1}} = \beta_{p^r_{t-1}}$. 

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Table 9: Comparison of old and new wage equation: Sweden

<table>
<thead>
<tr>
<th>Variable</th>
<th>CN</th>
<th>Revised data</th>
<th>New observations</th>
<th>New equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta cp$i</td>
<td>0.466</td>
<td>(0.100)</td>
<td>0.354</td>
<td>0.025</td>
</tr>
<tr>
<td>$\Delta cp'i_{-1}$</td>
<td>0.400</td>
<td>(0.071)</td>
<td>0.405 (0.203)</td>
<td>0.584 (0.208)</td>
</tr>
<tr>
<td>$\Delta p$</td>
<td>0.400</td>
<td>(0.071)</td>
<td>0.405 (0.203)</td>
<td>0.584 (0.208)</td>
</tr>
<tr>
<td>$\Delta p_{-1}$</td>
<td>0.134</td>
<td>(0.055)</td>
<td>0.241 (0.218)</td>
<td>0.391 (0.190)</td>
</tr>
<tr>
<td>$\Delta pr$</td>
<td>0.600</td>
<td>(0.071)</td>
<td>0.595 (0.203)</td>
<td>0.416 (0.208)</td>
</tr>
<tr>
<td>$\Delta h$</td>
<td>-0.573</td>
<td>(0.061)</td>
<td>-0.432 (0.211)</td>
<td>-0.013 (0.136)</td>
</tr>
<tr>
<td>$rmp_{-1}$</td>
<td></td>
<td></td>
<td></td>
<td>0.000 (0.041)</td>
</tr>
<tr>
<td>$\Delta u$</td>
<td>-0.016</td>
<td>(0.010)</td>
<td>0.005 (0.029)</td>
<td>0.030 (0.025)</td>
</tr>
<tr>
<td>$u_{-1}$</td>
<td>-0.046</td>
<td>(0.008)</td>
<td>-0.044 (0.027)</td>
<td>-0.056 (0.020)</td>
</tr>
<tr>
<td>$\Delta imp$</td>
<td>-0.001</td>
<td>(0.044)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$imp_{-1}$</td>
<td>-0.070</td>
<td>(0.054)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$s_{-1}$</td>
<td>-0.209</td>
<td>(0.028)</td>
<td>-0.229 (0.027)</td>
<td>-0.200 (0.082)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.061</td>
<td>(0.007)</td>
<td>-0.150 (0.106)</td>
<td>-0.188 (0.077)</td>
</tr>
<tr>
<td>$0.5(\Delta at + \Delta at_{-1})$</td>
<td>-0.573</td>
<td>(0.061)</td>
<td>-0.432 (0.211)</td>
<td>-0.013 (0.136)</td>
</tr>
</tbody>
</table>


$SER$     0.0079  0.0228  0.0254  0.0189

AR1-2 $F(1,18) = 1.65$  $F(2,14) = 0.56$  $F(2,20) = 0.34$  $F(2,19) = 0.10$

Dependent variable $\Delta w$. First three equations are OLS, last equation IV estimates identical to those in table 1. Standard deviations in parenthesis. $at$ is the log of one minus the average tax rate. $u$ is the log of the open unemployment rate in the first three equations, of the total unemployment rate in the last. Coefficient restriction in first three equations: $\beta_{\Delta cp'i} + \beta_{a} + \beta_{u_{-1}} = 1$. 

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