Wage Drift and Bargaining: Evidence from Norway

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Empirical equations, based on a theoretical bargaining model, are estimated on data for wage drift in six industries and in the aggregate manufacturing sector in Norway. It is shown that the central wage settlement has a strong impact on aggregate and relative wages in the short run, and that this effect is not offset by wage drift. Wage drift is also found to depend negatively on the size of inventories. This is interpreted as arising from the effect of the initial size of the inventories on the cost to the firm of an industrial conflict.

INTRODUCTION

The wage determination system in the Scandinavian countries consists of two main parts. First, there are nationwide negotiations between the unions’ and employers’ confederations. Second, there is wage drift, that is wage increases arising from negotiations at the firm level. In the last decade wage drift has contributed to around two-thirds of the total wage increases in the manufacturing sector in Norway, and in the Swedish manufacturing sector its share is about 40 per cent (Calmfors and Forslund, 1989).

The large size of the drift leaves it with a potentially decisive role in the wage formation process. One could imagine that the wage drift works to counteract the central agreement, so it in fact undoes the results of the central settlements. In this case one could no longer regard the wage-setting process in the Scandinavian countries as centralized; on the contrary, it should be thought of as highly decentralized. This would undermine much of the discussion about corporatism (see e.g. Bruno and Sachs, 1985; Calmfors and Drifill, 1988).

This point relates not only to the aggregate wage level, but also to relative wages. The amount of wage drift differs considerably between various groups of employees. The difference is biggest between the private and the public sector, but there is also a significant difference between various groups within the private sector. And while the central settlements usually involve extra increments to low-paid employees, the high-paid employees regularly get the lion’s share of the drift. Thus, several papers have put forward the hypothesis that extra increments to low-paid workers in the central wage settlements lead to higher wage drift for high-paid workers, restoring some sort of equilibrium wage differentials (Söderström and Uddén-Jondal, 1982; Isachsen et al., 1982).

These assertions that the effects of the central settlements are undone through wage drift seem to be consistent with the most common theoretical explanation of wage drift. Most earlier work has attributed drift to excess demand for labour, and the empirical studies (cf. Hersoug, 1983, for a survey) have mainly used Phillips-curve types of relations, though sometimes modified to include variables like profits and output prices.
Yet earlier research has not concluded that central wage settlements are undone by the drift; on the contrary, the general finding is that there is only a small interdependence, if any, between centrally negotiated wage increases and wage drift (cf. e.g. Jacobsson and Lindbeck, 1969; Flanagan, 1989; Hersoug, 1983). Rødseth and Holden (1989) also reach the conclusion that central wage settlements matter, by utilizing the institutional feature of two-year central wage contracts. However, in spite of the general picture of these findings, no satisfactory theoretical explanation has been put forward to explain why central settlements should matter. The present paper aims to fill this gap.

In this paper, wage drift is viewed as the result of wage bargaining at the firm level, where unions obtain a nominal wage increase by threatening to disrupt production. To simulate the wage negotiations, I use the asymmetric Nash bargaining solution, where the disagreement points are specified to represent the parties' utility levels during a conflict (following Binmore et al., 1986). Here I employ the institutional setup of local wage negotiations in Norway, where the employers' and the unions' federations have agreed not to use strikes or lock-outs in the local bargaining. The workers will, however, have the opportunity to use other kinds of industrial action, for example work-to-rule, without the firm being allowed to reduce their remuneration. Thus, both parties' disagreement points will depend on the initial wage level, including the central wage increase, which because of this will have a one-for-one direct impact on the resulting wage outcome. Consequently, the wage drift should not undo the central settlements; on the contrary, there should be no direct impact of the central increase on wage drift.

There is another motivation for undertaking this study. Wage equations based on bargaining models have been made in increasing numbers in recent years. However, but for laboratory experiments (see e.g. Binmore et al., 1985; Roth, 1988), little work has been done to investigate how important the bargaining process actually is. This paper aims to do that, by making use of insight gained through non-cooperative bargaining games, which suggests that the disagreement points in the Nash bargaining solution should depend on what happens if there is a delay in the bargaining. I assume that the cost to the firm of a conflict that involves reduced output depends on the size of the inventories before the conflict. The basic intuition is that the smaller the size of the inventories, the less time it will take before reduced output causes the firm to be unable to supply its customers. Thus, big inventories should strengthen the firm's position in the bargaining. If one accepts this assumption, it seems crucial for the empirical relevance of bargaining theory that a negative correlation between inventories and wage increases is observed.

Two different data sets have been used to investigate these issues. Both consist of annual wage drift data for the Norwegian manufacturing sector. The first data set consists of aggregate data for the period 1963–86, and the second, of disaggregated data (for six Norwegian industries) for the period 1970–85.

The paper is organized as follows. In the next section I shall give a brief description of the composition of the wage drift in Norway, and I shall argue that wage drift can be viewed as a result of local wage negotiations. The bargaining model is set out in Section II, while Section III presents the empirical specification and results. Finally, there are some concluding remarks in Section IV.
I. The Wage Drift

Almost all workers in the manufacturing sector in Norway are covered by collective agreements. For these workers, there are central wage negotiations every second year which determine changes in the prevailing wage rates, and these wage changes (increases) are paid out to all workers. Usually there is also intermediate and less comprehensive central bargaining in the years between. Once a year, after the central negotiations, in most firms there will also be negotiations about local increments to the wage rates that prevail after the central negotiations. These local increments constitute the main part of what is called wage drift. In the wage statistics, however, the wage drift data are calculated as the difference between the total annual increase in average hourly earnings (including overtime) and the annual increase that is due to central wage negotiations. Since wage drift is derived as a residual, it will consist of more than the increments given in the local bargaining. The wage drift figures will comprise

—direct increases of the wage rates at firm level: this could be personal increments, or for a group or all of the workers;
—changes in the remuneration system (e.g. from piece-work to time-work), giving changed hourly wage;
—increased efficiency as a result of changes in methods of operation, increased intensity of labour, or increased experience and practice (only with piece-work);
—changes in the use of overtime or shiftwork;
—structural changes in employment, i.e. changes in the composition of employment between low-paid and high-paid jobs: this could occur between industries, between firms in the same industry, or between skill groups in the same firm.

As the theoretical framework is based on a bargaining model, it is of interest to see to what extent the various components of the wage drift can be said to be determined by bargaining. A direct increase in the wage rate is clearly a bargaining issue. Changes in the remuneration system are normally also a subject for bargaining. Moreover, when the wage drift can be traced back to more efficient methods of production, whether or not to change the piece rates will be a matter of negotiation. When the piece rates are not adjusted correspondingly, this can be seen as a negotiated wage increase.

It is not reasonable, however, to assume that the last two types of wage drift follow from a bargaining process. Thus I have corrected the wage drift figures for changes in use of overtime (in the aggregate study, only from 1972). The aggregate data are also corrected for changes in the distribution of employment between industries.

Wage drift for the whole manufacturing sector is measured as the increase from first quarter to first quarter of the subsequent year, for the period 1963–86. The disaggregated wage drift data are for six industries for the period 1970–85, and are measured from third quarter to third quarter for the observations 1969/70–1978/9 and from fourth quarter to fourth quarter for the observations 1979/80–1984/5. The industries are textiles, wood, paper production, electrochemicals, fabricated metals, and building and construction. The first five are within the manufacturing sector, where they cover about 55 per cent of the whole sector.
II. THE BARGAINING MODEL

The outcome of the local wage bargaining is assumed to be given by the asymmetric Nash bargaining solution. (This solution can also be justified as the outcome of a non-cooperative game; see Binmore et al., 1986.) That is,

\[ W = \arg \max_{\pi} (\pi - \pi_0)^c (W - q)^{1-c}, \]

where \( \pi, \pi_0, W \) and \( q \) are the firm's and union's utility functions and disagreement points. I assume linear utility functions, where the utility of the firm is the profit level (deflated by the consumer price index)

\[ \pi = \max_L \left[ R(L) - \{W(1+t) + g_s(W/W^a, U)\}L \right], \]

where \( R(L) \) is the revenue function of the firm, \( W \) is the hourly wages, \( W^a \) is the hourly wages in alternative employment, \( L \) is the employment level in hours, \( t \) is the payroll tax rate, \( g \) is the total costs per quit, \( U \) is the unemployment rate or some alternative measure of labour market pressure, and \( s \) is the quit rate where \( s_1, s_2 < 0 \) and \( s_{11}, s_{12} > 0 \). All values are deflated by the consumer price level. The relationship between profit and both relative wages and labour market pressure through the quit rate follows the quit version of the efficiency wage models; see e.g. Salop (1979). The utility of the union is simply represented by the real wage level. This follows Oswald (1984), and can be defended by assuming majority voting rules and that firings and/or layoffs occur by inverse seniority.

The employment level is set unilaterally by the firm. This assumption seems to be closest to facts; cf. Moene and Seierstad (1989).

As to the disagreement points, the unions' and employers' confederations in Norway have agreed not to use strikes and lock-outs in the local bargaining. None the less, the workers may threaten to withdraw cooperation or work-to-rule (cf. Moene, 1988). In this case profit will fall. Yet the workers are in fact following the rules, so the firm is not allowed to reduce their wages.\(^2\) Hence the disagreement point of the union is equal to the going wage of the workers, given by

\[ q = W_{-1} + z, \]

where \( W_{-1} \) is the nominal wage level from last year and \( z \) is the nominal wage increase resulting from the central wage negotiations (both deflated by the current year's consumer price index).

The disagreement point of the firm is the profit level during work-to-rule,

\[ \pi_0 = \left[ R_0(L) - \{q(1+t) + g_s(q/W^a, U)\}L \right], \]

where \( R_0(L) \) is the revenue during work-to-rule. The employment level is assumed to be the same as given by (2); this follows the common practice of sidestepping the problem of what the firm will do with the employment level during a conflict.

The revenue of the firm during work-to-rule will depend on a number of factors. I shall focus on the importance of the size of the inventories of the firm. The smaller the initial size of the inventories, the shorter the time it will take before the inventories are depleted during a work-to-rule, and the shorter the time before the firm is unable to supply its customers. Thus the revenue
during work-to-rule, $R_0$, will be smaller the smaller is the initial size of the inventories.

The first-order condition of (1) can be written

$$c\pi_w/(\pi - \pi_0) + (1 - c)/(W - q) = 0. \tag{4}$$

Furthermore, I approximate the quit function by the first-order Taylor expansion

$$s(W/W^a, U) - s(q/W^a, U) = s^1(W/W^a, U)(W - q)/W^a. \tag{5}$$

Substituting out for $\pi_w$, $\pi$ and $\pi_0$ in (4), and using (5), yields

$$W - q = H(c, t, g, W/W^a, W^a, U)(R - R_0)/L \tag{6}$$

where $H(\cdot) = (1 - c)/\{1 + t + gs_1(W/W^a, U)/W^a\}$ and the partial derivatives
are $H_1, H_2, H_4, H_5, H_6 < 0$ and $H_3 > 0$. Thus, (6) gives the deflated nominal wage increase resulting from the local wage bargaining.

One special aspect of the model is worth particular emphasis. The central wage increase affects both parties' disagreement points through $q$; thus it will have a one-for-one direct effect on the wage outcome $W$. There should be no direct effect of the central increase on wage drift. There will, however, be some indirect effects. Central wage increments will of course increase wage costs, and thus influence the employment decision of the firm. This will affect wage drift through revenue per worker (see Holden, 1988) and through the situation at the labour market. Central increments will also have an effect through relative wages.

We wish to test whether there is any direct impact from the central increments on wage drift. Therefore, we shall consider an alternative, rather standard, theoretical model for the wage determination at the firm level, where the central increase will be offset entirely by wage drift—this is true in the standard efficiency wage model. (For a justification of models of this type, see Akerlof and Yellen, 1986.)

The profit function of the firm is

$$\pi = BF\{L, e(W/W^a, U)\} - W(1 + t)L, \tag{7}$$

where $B$ is an indicator for the productivity level and $e$ is an indicator for the workers' efficiency. The first-order condition for the wage level is $\pi_w = BF_2e_1/W^a - L(1 + t) = 0$, which gives the following structural form wage equation:

$$W = G(B, W/W^a, W^a, U, t). \tag{8}$$

In an economy consisting of firms of this type, the wage level (and thus relative wages) will be determined by equations like (8) for each firm. Central wage increases will have no impact on the wage level in this economy; they will be offset entirely by lower wage increases given locally at each firm, i.e. by lower wage drift.

In order to obtain a framework that allows for both models, I shall not impose the restrictions underlying (6), but will use it mainly to provide explanatory variables. I substitute for $q$ in (6), add the central wage increase, $z$, to both sides, and divide by $W_{-1}$ on both sides to get

$$W - W_{-1})/W_{-1} = F(U, g, t, \theta, c, W/W^a, W^a, R/LW_{-1}) + z/W_{-1}, \tag{9}$$
where the left-hand side now is the rate of growth in nominal wages. $\theta$ is an indicator for the fraction of normal productivity that obtains during a conflict; it is assumed to be increasing in the size of the inventories.

Now consider the alternative model, (8). Let us start by rewriting it as a general dynamic equation in logs:

\[(10) \quad \log (W) = \delta_0 + \delta_1 \log (W_{-1}) + \text{remaining terms},\]

where the lagged dependent variable is included to allow for possible inertia in the wage determination. Subtracting $\log (W_{-1})$ from both sides of (10) yields

\[(11) \quad D \log (W) = \delta_0 + (\delta_1 - 1) \log (W_{-1}) + \text{remaining terms},\]

where $D$ is the first difference operator. Note that $D \log (W) = (W - W_{-1})/W_{-1}$ if $D \log (W)$ is not too large, so (9) and (11) have approximately the same dependent variable. Hence a general formulation that encompasses (9) and (11) is

\[(12) \quad (W - W_{-1})/W_{-1} = \beta_0 + \beta_1 \log (W_{-1}) + \beta_2 \log (W_{-1}) + \text{remaining terms},\]

where $\beta_1 = -\beta_2 = 1$ corresponds to (9), whereas $\beta_1 = 0, \beta_2 = \delta_1 - 1$ corresponds to (11).

Notice that the two alternative models have very different interpretations. It is not possible to solve for the wage level in the bargaining model (9), because it is conditional on the central wage increase. In the alternative model (11), however, the central wage increase has no impact on the wage level; thus it is possible to solve for the wage level.

As the firm knows that bigger inventories reduce wage drift, it will be inclined to keep a larger stock of inventories. However, if these strategic considerations lead to only a constant increase in the desired size of the inventories at the time of the bargaining, this will not affect the wage equation.

III. EMPIRICAL SPECIFICATION AND EVIDENCE

We now turn to the empirical specification of (12). I have experimented with various functional forms of the aggregate unemployment rate $U$ (ILO standard, which is based on a labour force study, AKU) and the aggregate vacancy rate $V$. Most of the other variables are from the national accounts and follow the industry classification used there, which is broadly consistent with the classification used for the wage and the inventory data.

As a measure of inventories, I utilize the difference between the actual and the normal size of the stocks in each industry, measured by a volume index, $1970 = 100$. The normal size of the stocks is defined as the five-year moving average of the actual size. The aggregate series covers own products only, but the industry series includes stocks of raw materials too. The original inventory data are quarterly, but I use annual averages, over the same quarters as the wage drift variable. In the building and construction industry the inventory variable is equal to zero, because there are no inventories in this industry.

As regards the revenue concept, $R/L$, I have used gross product, net of indirect taxes and subsidies (which is equal to factor income plus depreciation of capital), per man-hour. I divide gross product by average hourly earnings in the quarter from which the wage drift data start (i.e. the first quarter when
wage drift is measured from first quarter to first quarter). $R/L$ is also a suitable proxy for the productivity indicator $B$ in the alternative model.

In the industry estimations, the alternative wage is assumed to be average hourly earnings in the aggregate manufacturing sector. The relative wage is lagged to avoid any simultaneity problems. However, I also include the percentage increase in the aggregate wage. In the aggregate estimations I have dropped the relative wage term.

Costs of quitting are omitted because of lack of suitable data.

From September 1978 to January 1980, there was a price and income freeze. The aggregate wage drift data are measured from first quarter to first quarter, so the freeze will cover half the 1978 observation and virtually the whole 1979 observation. Thus I have used a dummy equal to one in 1978 and two in 1979. The disaggregated wage drift data are measured from third quarter to third quarter, so essentially only the 1979 observation is affected. Thus this observation is removed from the estimations of disaggregated wage drift.

A difficult issue is the institutional development in this period. According to NOU (1977) and a preliminary study by Moene and Seierstad (1989), local wage negotiations have become more widespread during the 1960s and 1970s. The Moene–Seierstad study indicates that this development has been weaker in the 1980s. Regrettably, no figures on this development are available. To allow for this institutional development I have used a trend that is increasing until 1980 and constant from then on. Clearly, like any choice of a simple trend function, this is arbitrary, but neglecting the institutional development would bias the coefficients of all other explanatory variables.

Figure 1 illustrates the wage drift, the central wage increase and the inventory variable in the aggregate manufacturing sector. The wage drift has varied considerably, and is also higher in the 1970s and 1980s than in the 1960s.

**Results on aggregate data**

The results of the estimations of aggregate wage drift are presented in Table 1. Rather than comment on each equation, I shall discuss the main findings.

Inventories have a significant negative impact on wage drift in all equations, which is evidence in favour of the bargaining theory. Note that the vacancy rate, the increase in productivity in volume, and the ratio of gross product to wages are also included as explanatory variables. The effect of the size of the inventories is not negligible: according to equation (2), a 10 per cent reduction in inventories (from the 1970 level) will raise wage drift by 0.76 percentage points.

The second important result is the effect of the central wage increase on wage drift. The restriction implied by my model is easily accepted—an $F$-test for identical coefficients (with opposite signs) on $\log(W_{t-1}) + z/W_{t-1}$ and $\log(W_{t-1})$ yields $F(1, 74) = 0.16$; the critical value at five per cent level is 3.97. The implied coefficient on the central wage increase $z/W_{t-1}$ is always close to unity as predicted by my model and is definitely larger than zero. One should, however, be somewhat cautious when interpreting this result, as there might exist omitted variables (e.g. expectations) that would bias the coefficient. Instrumental variables estimation (equations (3) and (5)) should, however, alleviate this problem. Moreover, it is difficult to imagine a bias of the order of magnitude necessary if the 'true' coefficient on the central wage increase is
equal to zero. Thus I shall draw the conclusion that central wage settlements do matter, at least in the short run.

It seems to be difficult to detect any effect at all on wage drift from the ratio of gross product to wages. There does, however, appear to be a small positive effect of increases in the ratio of gross product to wages. The trend has a strong impact in all equations, no matter which variables are included. This lends support to the view that the institutional changes have contributed to higher wage drift.

As expected, the vacancy rate has a significant positive impact on wage drift in all equations. The vacancy rate is significant also when the unemployment rate is included, while the unemployment rate in this case had a $t$-value of less than 1 (not reported).

The level of the payroll tax rate also entered the model with the correct sign, but the coefficient is small and imprecisely determined (not reported). Yet increases in the payroll tax rate seem to have an almost significant negative impact on wage drift.

No effect could be detected of the growth in productivity (cf. equation (6)). Changes in productivity are likely to be correlated with changes in the marginal product of labour. Thus the lack of effect of changes in productivity is discouraging for a simple market force explanation of wage drift.

Other variables which were included in the model, but entered with small and insignificant coefficients, include: the growth in the consumer price index, the growth in the import price index, changes in and levels of direct and indirect tax rates, a dummy for the first year of the central wage contract, a dummy for central wage settlements conducted industry by industry, and a dummy for a catch-up effect in 1980, after the price and incomes freeze.

Results on disaggregated data

The results of the pooled regressions on the industry data are presented in Table 2. In general, the results are similar to the results on the aggregate data,
### Table 1
**Aggregate Data for 1963–86**

Equations for nominal wage increases in percentages, ordinary least squares ((1), (2), (4) and (6)) and instrumental variables ((3) and (5))

<table>
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<tr>
<th></th>
<th>(1)</th>
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<th>(3)*</th>
<th>(4)</th>
<th>(5)*</th>
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<td><strong>Inventories</strong></td>
<td>-0.069*</td>
<td>-0.076*</td>
<td>-0.087*</td>
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<td>-0.041*</td>
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<td>(2.89)</td>
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<td><strong>Log (W_{−1}) + z/W_{−1}</strong></td>
<td>0.969*</td>
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<td>(20.24)</td>
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<td><strong>Log (W_{−1})</strong></td>
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<td>-0.941*</td>
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<td>(20.83)</td>
<td>(23.87)</td>
<td>(14.27)</td>
<td>(26.38)</td>
<td>(16.43)</td>
<td>(25.48)</td>
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<tr>
<td><strong>Log (V)</strong></td>
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<td>2.175*</td>
<td>2.428*</td>
<td>2.800*</td>
<td>3.362*</td>
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<td>(4.93)</td>
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<td>(4.15)</td>
<td>(5.53)</td>
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<td><strong>R/LW_{−1}</strong></td>
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<td><strong>D(R/LW_{−1})</strong></td>
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<td>(2.07)</td>
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<td><strong>Dt</strong></td>
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<td>-0.708*</td>
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<td>(1.22)</td>
<td>(0.93)</td>
<td>(2.29)</td>
<td>(2.26)</td>
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<td><strong>Constant</strong></td>
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<td>9.457*</td>
<td>6.213*</td>
<td>7.703*</td>
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<td><strong>Time trend, increasing till 1980</strong></td>
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<td></td>
<td>(2.55)</td>
<td>(2.91)</td>
<td>(2.33)</td>
<td>(2.38)</td>
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<td><strong>D log (R/LP)</strong></td>
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*Instrumental variables estimation for 1964–86 where log (W_{−1}) + z/W_{−1} and R/LW_{−1} (D(R/LW_{−1})) are treated as endogenous, and additional instruments used are (R/LW_{−1}), trend, dummy for first year in the central wage contract period, and growth in prices for competitive imports in equation (3) and log (W_{−1}), (R/LW_{−1}), Dt_{−1}, dummy for first year in the central wage contract and growth in prices of competitive imports in equation (5). Absolute T-values in parentheses. D is the first difference operator, * indicates significance at 5% level, D log (R/LP) is the rate of growth in productivity (deflated gross product per man-hour, so P is the value added deflator). All rates and rates of growth are measured as percentages to facilitate interpretation of the coefficients.

but I have been able to detect an effect of more variables in the industry estimations. This is not surprising, as the disaggregated data provide both cross-section and times-series variation. The preferred equation is equation (1) in Table 2.

Inventories have a negative effect on wage drift, of similar magnitude as the effect in the aggregate estimations. The effect is always significant at the 10 per cent level, and in two of the regressions also at the five per cent level. Note that the result also holds in the equation including year dummies, where all aggregate time variation is removed.

In all equations, the central wage increase has a coefficient close to unity and is highly significant. As in the aggregate data, the restriction implied by
my model is easily accepted—an F-test for identical coefficients (with opposite
signs) on log (W_{-1}) + z / W_{-1} and log (W_{-1}) yields F(1, 74) = 0.32, where the
critical value at the five per cent level is 4.99. Including the percentage increase
in the aggregate wage does not affect this result; cf. equation (6). These findings
support the results found in the aggregate data, and indicate that industry-
specific central wage settlements also have an impact on relative wages.

This conclusion is also tested in one other way. In equation (4) I have
included the difference between the central increase in the industry and the
aggregate central increase. A negative coefficient on this variable would suggest
that, if the workers in an industry were unfavourably treated in the central
settlements (relative to how they are usually treated, since industry dummies
are included), then wage drift in this industry will be higher than it would
have been otherwise. Such an effect would limit the scope for short-term impact
on relative wages from the central settlements. However, no such effect could
be found; the coefficient is even positive, though imprecisely determined.

To test whether the use of go-slow in the fabricated metals industry affects
the relationship between the central wage increase and wage drift, I allowed
for a different coefficient on log (W_{-1}) + z / W_{-1} in this industry. However, this
coefficient was only slightly and insignificantly lower in the fabricated metals
industry; the difference was 0.01 with a t-value of 1.1 (not reported).

The ratio of gross product to wages (lagged one year) enters the equation
with a positive but insignificant coefficient when industry dummies are
included. One might, however, think that some of the variation captured by
the industry dummies is due to industry variation in the ratio of gross product
to wages. Hence it seems pertinent to also try estimating the model without
industry dummies (equation (2)). The ratio of gross product to wages turns
out to be almost significant at the 10 per cent level.

In contrast to the aggregate results, there does not seem to be any effect
of increases in the ratio of gross product to wages; cf. equation (5).

The trend that proxies the institutional development has a positive but
insignificant effect (coefficient 0.275, t-value 0.56; equation not reported as
the other coefficients were not much affected), similar in size to the effect
estimated in the aggregate model. When allowing for different trends in the
various industries, none of the coefficients were significant and the hypothesis
of a common trend was not rejected in an F-test—F(5, 68) = 1, 86; the critical
value at the five per cent level is 2.32. Clearly, more research is needed on
this point.

Turning now to the labour market, the vacancy rate also performs best in
the estimations using disaggregated data. Its coefficient is significantly positive
in almost all equations. There does, however, also appear to be a positive
effect of the inverse of the unemployment rate. As in the estimations using
aggregate data, increases in the payroll tax rate have a negative impact on
wage drift.

Relative wages appear to have a negative impact on wage drift, which is
significant at the 10 per cent level. One should note that, because industry
dummies are included, this variable should be interpreted as the deviation
from the average relative wage over the estimation period. The fact that
high-wage industries generally have higher wage drift is taken care of by the
industry dummies. The negative effect of the relative wages can thus be
described as a sort of error correction mechanism: if the relative wage in an
Table 2
Ordinary Least Squares Estimations of Nominal Wage Increases

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)*</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inventories</td>
<td>-0.040*</td>
<td>-0.049*</td>
<td>-0.040</td>
<td>-0.039*</td>
<td>-0.051*</td>
<td>0.040</td>
</tr>
<tr>
<td>Log (W_i−1) + z/W_i−1</td>
<td>(1.98)</td>
<td>(2.36)</td>
<td>(1.77)</td>
<td>(1.92)</td>
<td>(2.44)</td>
<td>(1.98)</td>
</tr>
<tr>
<td>Log (W_i−1)</td>
<td>1.013*</td>
<td>0.957*</td>
<td>1.048*</td>
<td>0.992*</td>
<td>1.088*</td>
<td>0.965*</td>
</tr>
<tr>
<td>(11.50)</td>
<td>(10.82)</td>
<td>(6.11)</td>
<td>(9.43)</td>
<td>(11.36)</td>
<td>(6.20)</td>
<td></td>
</tr>
<tr>
<td>Log (W_i−1)</td>
<td>-1.006*</td>
<td>-0.944*</td>
<td>-1.205*</td>
<td>-0.987*</td>
<td>-1.066*</td>
<td>-0.958*</td>
</tr>
<tr>
<td>(12.49)</td>
<td>(11.69)</td>
<td>(7.15)</td>
<td>(10.26)</td>
<td>(12.56)</td>
<td>(6.35)</td>
<td></td>
</tr>
<tr>
<td>1/U</td>
<td>2.890</td>
<td>3.167</td>
<td>2.883</td>
<td>4.357</td>
<td>2.821</td>
<td></td>
</tr>
<tr>
<td>(1.21)</td>
<td>(1.26)</td>
<td>(1.20)</td>
<td>(1.32)</td>
<td>(1.17)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log (V)</td>
<td>2.469*</td>
<td>3.541*</td>
<td>2.434*</td>
<td>2.725*</td>
<td>2.309</td>
<td></td>
</tr>
<tr>
<td>(2.14)</td>
<td>(2.98)</td>
<td>(2.09)</td>
<td>(2.24)</td>
<td>(1.87)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(R/LW)_−1</td>
<td>0.009</td>
<td>0.008</td>
<td>0.017</td>
<td>0.009</td>
<td>0.009</td>
<td></td>
</tr>
<tr>
<td>(0.87)</td>
<td>(1.61)</td>
<td>(1.43)</td>
<td>(0.88)</td>
<td>(0.89)</td>
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<td></td>
</tr>
<tr>
<td>D(R/LW)_−1</td>
<td>0.002</td>
<td>0.003</td>
<td>0.000</td>
<td>0.001</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>(W/W_i−1)_−1</td>
<td>0.159</td>
<td>0.146*</td>
<td>0.150</td>
<td>0.131</td>
<td>0.167</td>
<td></td>
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<tr>
<td>(1.75)</td>
<td>(1.57)</td>
<td>(1.58)</td>
<td>(1.18)</td>
<td>(1.79)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dt</td>
<td>-1.211</td>
<td>-1.412*</td>
<td>-1.315</td>
<td>-0.768</td>
<td>-1.113</td>
<td></td>
</tr>
<tr>
<td>(1.83)</td>
<td>(2.06)</td>
<td>(1.83)</td>
<td>(1.08)</td>
<td>(1.59)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DD log (cpi)</td>
<td>0.257*</td>
<td>0.244*</td>
<td>0.251*</td>
<td>0.215*</td>
<td>0.253*</td>
<td></td>
</tr>
<tr>
<td>(3.15)</td>
<td>(2.80)</td>
<td>(3.00)</td>
<td>(2.00)</td>
<td>(3.03)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D log (pb)</td>
<td>0.119*</td>
<td>0.103</td>
<td>0.105*</td>
<td>0.124*</td>
<td>0.114*</td>
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<tr>
<td>(2.42)</td>
<td>(1.97)</td>
<td>(2.02)</td>
<td>(2.42)</td>
<td>(2.19)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(4.37)</td>
<td>(4.37)</td>
<td>(4.37)</td>
<td>(4.37)</td>
<td>(4.37)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-4.263</td>
<td>-4.263</td>
<td>-4.263</td>
<td>-4.263</td>
<td>-4.263</td>
<td></td>
</tr>
<tr>
<td>Year dummies</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>[(W−W_i−1)/W_i−1]</td>
<td>0.066</td>
<td>0.066</td>
<td>0.066</td>
<td>0.066</td>
<td>0.066</td>
<td></td>
</tr>
<tr>
<td>Industry dummies</td>
<td>(0.38)</td>
<td>(0.38)</td>
<td>(0.38)</td>
<td>(0.38)</td>
<td>(0.38)</td>
<td></td>
</tr>
<tr>
<td>Textiles</td>
<td>-5.118</td>
<td>-7.549*</td>
<td>-3.553</td>
<td>-15.377</td>
<td>-5.603</td>
<td></td>
</tr>
<tr>
<td>(0.57)</td>
<td>(2.46)</td>
<td>(0.36)</td>
<td>(1.13)</td>
<td>(0.61)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(0.42)</td>
<td>(2.29)</td>
<td>(0.22)</td>
<td>(1.01)</td>
<td>(0.47)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paper product.</td>
<td>-1.729</td>
<td>-4.332*</td>
<td>-0.173</td>
<td>-12.118</td>
<td>-2.213</td>
<td></td>
</tr>
<tr>
<td>(0.19)</td>
<td>(2.02)</td>
<td>(0.02)</td>
<td>(0.88)</td>
<td>(0.24)</td>
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</tr>
<tr>
<td>Electro-chem.</td>
<td>-1.400</td>
<td>-4.142</td>
<td>-0.111</td>
<td>-11.231</td>
<td>-1.854</td>
<td></td>
</tr>
<tr>
<td>(0.16)</td>
<td>(1.87)</td>
<td>(0.01)</td>
<td>(0.81)</td>
<td>(0.20)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fabric metals</td>
<td>-0.027</td>
<td>-2.292</td>
<td>1.562</td>
<td>-10.839</td>
<td>-0.535</td>
<td></td>
</tr>
<tr>
<td>(0.00)</td>
<td>(1.43)</td>
<td>(0.16)</td>
<td>(0.79)</td>
<td>(0.06)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Build./constr.</td>
<td>2.017</td>
<td>-</td>
<td>3.519</td>
<td>-9.392</td>
<td>1.599</td>
<td></td>
</tr>
<tr>
<td>(0.22)</td>
<td>(0.35)</td>
<td>(0.66)</td>
<td>(0.17)</td>
<td>(0.17)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


In equation (2), (W/W_i−1)_−1 is defined as the deviation of the actual value from its industry mean. CPI is the consumer price index, PB is an index for competitive import prices, (z/W_i−1)_−1 and (z/W_i−1)_−1 are central wage increase in percentages in the industry and in aggregate manufacturing, respectively, and [(W−W_i−1)/W_i−1]_−1 is the percentage wage increase in aggregate manufacturing. See also Table 1.
industry is lower than 'normal' (i.e. the average value over the estimation period), then this will raise wage drift in this industry.

The growth in competitive import prices has a significant positive impact on wage drift. This could easily be incorporated in the theoretical bargaining model above. Import prices are the most suitable proxy for competitors' prices. Growth in competitors' prices will improve the firm's market position and increase the expected rate of return on investments, hence import prices are likely to affect the wage bargaining.

No effect of import prices on wage drift was found in the aggregate estimations. A likely explanation of this discrepancy is that import prices probably are a much better indicator for competitors' prices at the industry level.

An increase in the rate of inflation, defined as the rate of growth in the consumer price index, also seems to have a positive effect on wage drift. This could also be incorporated in the theoretical bargaining model. We can interpret increased inflation as unexpected inflation. If the union has a strong desire to achieve the real wage level it expects, then increased (unexpected) inflation raises the union's marginal utility of nominal wages, resulting in higher wage drift.4

A problem concerning this result is that no similar effect was found in the aggregate data. This indicates that there is no effect of inflation in the part of the manufacturing sector not included in the disaggregated data set. There is no obvious reason for this, so data for the rest of the manufacturing sector are needed to provide an explanation beyond pure speculation.

IV. Concluding Remarks

This paper has attempted to explain wage drift in the manufacturing sector in Norway. Based on a theoretical bargaining model, empirical equations are estimated on data for wage drift in the aggregate manufacturing sector and in six industries. The main conclusions are as follows.

First, the results give strong support to the view that central wage settlements have a considerable impact on aggregate and relative wages in the short run. While the size of the wage drift is so large that it might have offset the central wage increases entirely, the evidence indicates that there is no such offsetting effect. This result is predicted by the theoretical model. The intuition is that both the firm's and the union's disagreement points in the local wage bargaining depend on the initial wage level, including the central wage increase; thus, the initial wage level will have a one-for-one impact on the resulting wage.

The second main finding is that wage drift is shown to depend negatively on the size of the inventories in the industry. Within a bargaining framework, this effect is interpreted as resulting from the negative relationship between the cost to the firm of a conflict and the initial size of the inventories. Thus, firms are more inclined to accept high wage demands to avoid a conflict when the size of the inventories is small.

Wage drift is also affected by other variables. Labour market pressure contributes to higher wage drift, and this relationship seems to be best captured by the vacancy rate. Payroll tax rises lead to lower wage drift, so a considerable fraction of payroll tax increases is shifted over to the workers. There also
appears to be an error correction mechanism operating on relative wages, in the sense that, if the relative wage in an industry is low compared with its normal value, then this will tend to raise wage drift in that industry. In contrast to the predictions of the model, however, the ratio of gross product to wages had only a small positive effect on wage drift in the industry data, and no effect in the aggregate data.

ACKNOWLEDGMENTS

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APPENDIX: DATA SOURCES

*Central Bureau of Statistics*

*NOS wage statistics:* All wage data used in the estimations on aggregate wage drift, all based on average hourly earnings for adult male workers in manufacturing.

*National account:* Gross product net of taxes and subsidies, value added deflator, payroll tax rate, import prices, for aggregate manufacturing and each industry.

*Other CBS data:* Industry data for wage drift and central wage increases (for construction see Bruce, 1989), and for inventories; labour force, unemployment rate (ILO standard, i.e. AKU data), direct and indirect taxes, man-hours, overtime rate in first quarter.

*Bank of Norway*

Consumer price index (yearly average), inventories in aggregate manufacturing.

*OECD*

*Main economic indicators:* Vacancies divided by the labour force to get the vacancy rate.

*Norwegian Employers’ Federation*

Average hourly earnings, excluding and including overtime, for adult male workers in aggregate manufacturing and for each industry.

NOTES

1. The description of the institutional set-up is taken largely from NOU (1977).
2. In the fabricated metals sector, the workers have the right to openly go-slow, and the firm is allowed to reduce remuneration accordingly. This is neglected in the theoretical model but is tested for in the empirical analysis. Piece-rates are neglected because they constitute only a small part of total pay.
3. The hypothesis of common slope coefficients in equation (1) in Table 2 was not rejected in an $F$-test: $F(49, 21) = 1.50$, and the critical value at the 5 per cent level is $1.84$.
4. This is most easily seen in the extreme case in which the union utility function is concave, where the difference between the actual and expected real wage level is the only argument.
REFERENCES


