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Karsten Albæk, Rita Asplund, Stig Blomskog, Erling Barth, Björn Rúnar Guðmundsson, Vifill Karlsson, Erik Strøjer Madsen

Studiestræde 6, DK-1455 Copenhagen K., Denmark
Tel. +45 35 32 30 82 - Fax +45 35 32 30 00
http://www.econ.ku.dk

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by

Karsten Albæk,
Institute of Economics, University of Copenhagen,
Rita Asplund,
The Research Institute of the Finnish Economy, ETLA, Helsinki,
Stig Blomskog,
University College of South Stockholm and the Swedish Institute for Social Research, University of Stockholm,
Erling Barth,
Institute for Social Research, Oslo and University of Tromsø,
Björn Rúnar Guðmundsson,
Ministry of Finance, Iceland and the National Economic Institute of Iceland
Vifill Karlsson,
The Icelandic University College of Business Administration.
Erik Strøjer Madsen,
Aarhus Business School and Centre for Labour Studies, Aarhus.

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Abstract

This paper analyses wage formation in the Nordic countries at the regional level by the use of micro-data. Our results deviate systematically from the main conclusions drawn by Blanchflower and Oswald (1994). We find no stable negative relation between wages and unemployment across regions in the Nordic labor markets once regional fixed effects are accounted for. Wage formation at the regional level is characterized by considerable persistence, but unemployment exerts no immediate influence on wages at the regional level. There is no evidence of a wage curve, nor of a Phillips curve, at the regional level in the Nordic countries. The results are consistent with a theoretical model where central bargaining agents determine a national wage increment, and local bargaining agents determine wage drift.

1. INTRODUCTION

The book “The Wage Curve” by Blanchflower and Oswald (1994) “..attempts to document the existence of an empirical “law” of economics” (p. 1). They present an impressive amount of evidence of a negative relationship between regional wages and the level of unemployment, and argue that “What emerges from the data is a pattern linking pay and unemployment. ... The nature of the relationship appears to be the same in different countries. The wage curve in the United States is very similar to the wage curves in, for example, Britain, Canada and Norway.” (p 5). Stated in quantitative terms: “In the countries studied in this book, the estimated unemployment elasticity of pay is approximately -0.1.” (p. 361). The competitor to the wage curve is dismissed: "The idea of a Phillips curve may be inherently wrong. Using micro-economic data, and controlling for fixed effects, the autoregression found in macroeconomic wage equations tends to disappear" (p. 361).

Their conclusions gain support in a review by Card (1995) who, despite several critical remarks, concludes: “There is a ‘wage curve’. Furthermore, the tendency for the wage curve to show up for different kinds of workers, in different economies, and at different times, suggests that the wage curve may be close to an “empirical law of economics”, (p. 798). The work by Blanchflower and Oswald (1994) has spurred the interest in applying microdata to the analysis of the relation between wage formation and labor market tightness; a discussion of the potential of microdata for this purpose is contained in Blanchard and Katz (1997) and (1999).

It is probably fair to say that the results by Blanchflower and Oswald (1994) have served as a benchmark for subsequent empirical research in the area. It is a main reference, and the impression is that researchers have made considerable effort to reconcile their results to the main conclusions of Blanchflower and Oswald. The main conclusion is that there is a stable negative relation across regions in a country between the wage level and the unemployment level (both measured in logs). This relation is revealed, when wages are rinsed from regional fixed effects, and represents in this sense a transitory or short-term relationship between wages and unemployment.

In this paper we conduct an analysis of wage formation on micro data for the Nordic countries. To the best of our knowledge this is the first study since the wage curve book by Blanchflower and Oswald (1994) that systematically tries to make a multi-country comparison of wage formation based on micro-data.[i] Our primary aim is to establish some - hopefully robust - empirical results, which can enter into the cumulative knowledge of the profession in this important area. The main outcome of our empirical analysis is that no support whatsoever is obtained for the conclusion mentioned above. Our results deviate systematically from the main conclusions drawn by Blanchflower and Oswald, and the magnitude of the deviations signifies that unemployment does not have the kind of role in wage formation in the Nordic labor markets as the one described by Blanchflower and Oswald. There is no "wage curve" in the Nordic countries once fixed region effects are introduced.

The analysis of the interplay between wage formation and unemployment has for many years been a central theme in the econometric analysis of time series data. A main reason for the interest in this topic is the role, which wage formation plays in determining the amount and persistence of unemployment. The results from the time-series literature deviate from the results of Blanchflower and Oswald (1994) in the sense that the time-series results display rather different degrees of wage flexibility across countries and institutions. Blanchflower and Oswald (1994), p. 6, cite in a note from the special supplement to Economica 1986 the editors' conclusions that "wages seem to be more responsive ... in economies that are more corporatist in nature" (Economica, 1986:S19). Blanchflower and Oswald (1994) attribute the difference in the results to omission of suitable control variables in the time series literature as well as to aggregation problems. Obviously, our results here are at the first glance at even more odds with the conclusion from the time-series literature, since we seem to find no wage curve at all.

While we are sympathetic to the fact that time-series analyses often lack necessary controls and suffer from problems of aggregation, we offer another explanation for the apparently diverging results from these two strands of analysis. The reason is simply that the different types of studies utilize different dimensions of the variation in the underlying data. We present below an empirical model that may provide a unifying framework for

interpreting the results from studies based on different types of data. Only good micro data over a long period of time can, in a satisfactorily manner, analyze all the relevant dimensions of this problem. But since micro data often lack long series, a combination of time series and cross sectional analysis will be main tools for the profession for a long time still.

While we do not find a transitory wage curve for the Nordic countries, we do find a rather strong negative significant relationship between the long-term average regional levels of unemployment and wages. It seems that the mechanisms operating in the US or the UK according to Blanchflower and Oswald (1994), do affect wage levels also in our countries. They do not, however, operate in the short-run. A main candidate for explaining this lack of regional short-run flexibility in wages is the rather centralized bargaining systems in our countries.

We present a model of two-tier bargaining, which is consistent with our observations. The main assumption in the model is that the central bargaining agents determine national wage increments on top of which the local bargaining units add wage drift. One consequence of this model is that there are wage differences across regions, but the short-run adjustments are rather small. The model has the implication that the elasticity of wages with respect to local unemployment is smaller the higher the degree of centralization in wage bargaining. Furthermore, the long-term elasticity of wages with respect to local unemployment is more negative than the corresponding transitory effect (keeping labor supply constant even in the long term). This model, including both central and regional wage formation, is thus consistent with the apparently puzzling fact that our empirical findings point to no transitory wage curve effects, while several internationally comparative time series studies have suggested that the Nordic countries display rather high levels of real wage flexibility. See e.g. Alogoskoufis and Manning (1988), Layard et al. (1991) and Rødseth and Nymoen (1999).

The paper is organized as follows. Section 2 presents a brief theoretical framework. In section 3 we discuss, along different dimensions, the estimates of the relationship between wages and unemployment. Section 4 presents the negative relationship between wages and unemployment, which is obtained from the pooled data.

This relationship disappears when regional fixed effects are introduced in section 5. In section 6 we show how the cross-sectional co-variation between regional wages and unemployment rates is negative in the Nordic countries. This section also contains an empirical decomposition of the wage-unemployment elasticity obtained from the time-series literature in the variation arising on the regional and the national level, respectively. Section 7 attempts to reconcile our results with the ones in Blanchflower and Oswald (1994). In section 8 we explore the dynamic aspect of wage formation, i.e., we investigate whether there occurs persistence in regional wages in the Nordic countries. Section 9 concludes.

2. THEORETICAL FRAMEWORK

In this section we set up a model of local wage formation and labor demand interacting with a centrally determined wage settlement. The question we want to analyze is the following: What is the role of local labor market conditions for local wages in an economy with some degree of centralized wage bargaining? The Nordic countries are heavily unionized, and centralized nation-wide bargaining plays an important role. It might be such that wage flexibility at the aggregate level in such an institutional setting co-exists with small or no wage flexibility in the regional dimension.

The main idea of this section is to pin down this idea in a formal setting, such that a more precise discussion becomes possible. The aim is to construct a simple model, which can be used for analyzing the relationship between unemployment rates and wage levels at the regional and at the national level. It provides a framework for understanding the kinds of relationship that are identified in the different estimating equations, which are put forth and discussed in the next section of the paper, and for interpreting the concomitant empirical results.

At the outset we specify a wage formation model at the regional level, and then we aggregate this regional relationship in two different dimensions. First we aggregate wages and unemployment in regions over time in order to describe the long-run relationship between the wage level and the unemployment rate across different regions.

Next we aggregate wages and unemployment over regions in order to describe the relation between the wage level and the unemployment rate at the macro level.

The key assumption in our model is that the central agents agree on a national wage increment only, taking historical relative wage levels between the regions as given. In addition to the centralized wage setting, we assume the existence of wage drift, which depends on local conditions. This allows for local conditions, especially labor market tightness, to affect the relative wage level between regions.

We assume that w_{rt}, the logarithm of the wage level at year t in region r, is determined as follows

$$w_{rt} = \theta y_{rt} + (1-\theta)\{(1-c)e(1-u_{rt}) + cw_{rt}^{n}\} \qquad (1)$$

The wage level is determined as a weighted average between the logarithm of the productivity level y_{rt} and the entity in the curled parenthesis. If workers in the regions have high bargaining power, θ, the wage level is close to the productivity of the workers. In the converse case, where the local bargaining power is small, two additional factors become important: the wage level determined at the national level, w_{rt}^{n}, and local labor market tightness, as measured by the logarithm of the unemployment rate in the region, u_{rt}. If the index of centralization in wage bargaining, c, is high, the centralized wage setting plays a major role relative to local labor market tightness, and conversely, if c is low, local unemployment plays a crucial role in determining the regional wage level. The degree of impact of the regional unemployment rate on the wage level depends on a constant, e.[ii]

The process producing the local wage equation is not modeled explicitly, but equation (1) may be viewed as a logarithmic approximation to a wage equation derived from a bargaining model. Blanchflower and Oswald (1994) discuss such models in their theoretical section. The formulation in (1) could be considered an amendment of the formulation in Blanchard and Katz (1999), such that both centralized and decentralized components in the wage formation process enter explicitly. The parameter θ may be interpreted as the local union's bargaining power. The terms in the curled parenthesis

should reflect a combination of factors affecting the expected pay off for workers during a potential conflict, see Moene (1988). Holden (1998) studies a situation where the conflict pay off is the centrally agreed wage level. In that case, there is no influence from local labor market conditions on the subsequent wage drift. In our framework here, we allow for local labor market conditions to affect wage drift, and Holden's (1998) model appears as a special case (when c=1).

The centralized bargaining is not explicitly modeled in the present context. Instead it is assumed that the outcome of the centralized bargaining is a change in the wage level, Δ_t, which is assumed to be the same in all regions. The wage level in region r stipulated at the national level becomes

$$w_{rt}^{n} = w_{rt-1} + \Delta_t ,$$

where w_{rt-1} is the wage level in region r the previous year.

When inserting the above expression for w_{rt}^{n} into (1), we get

$$w_{rt} = \theta y_{rt} + (1-\theta)(1-c)e(1-u_{rt}) + (1-\theta)cw_{rt-1} + (1-\theta)c\,\Delta_t \qquad (2)$$

In this formulation, the coefficient to the logarithm of the unemployment rate, -(1-θ)(1-c)e, is the wage elasticity. The lagged wage rate enters with the coefficient (1-θ) c. If this entity is equal to one, the lagged wage level can be moved to the left-hand side of the equation, and estimation could take place in changes in the wage level instead of wage levels. I.e., if (1-θ) c =1, we would have a Phillips curve representation of wage formation at the regional level.

In the empirical sections we will estimate equations where regional wage rates for different years enter on the left-hand side and local unemployment rates and lagged regional wages on the right-hand side, that is, we will try to identify the two elasticities in (2) just mentioned. In addition, we will present empirical results based on wage levels

and unemployment rates aggregated in two different dimensions: over years and over regions.

Aggregating over years corresponds to obtaining a long-run relation from equation (2) by assuming that the steady state conditions $w_{rt} = w_{rt-1} = w_r$, $y_{rt} = y_r$, $\Delta_t = \Delta$ and $u_{rt} = u_r$ are fulfilled. This entails that the steady state regional wage level becomes

$$w_r = \frac{\theta y_r + (1-\theta)(1-c)e - (1-\theta)(1-c)eu_r + (1-\theta)c\Delta}{1-(1-\theta)c}. \qquad (3)$$

Thus, the long-run wage-unemployment elasticity becomes -(1-θ)(1-c)e/(1-(1-θ) c). Given that (1-θ)c < 1, the denominator in this expression is less than one, and the long-run elasticity is thus larger than the short-run elasticity. The present formulation of the interplay between local and centralized wage setting entails that the long-run wage elasticity is larger the short-run elasticity.

When aggregation takes place over regions instead of over years, a nation-wide or macro level wage relationship corresponding to equation (2) is obtained. The nationwide wage level at time t, $\bar{w}_t$, is consequently determined as

$$\bar{w}_t = \theta \bar{y}_t + (1-\theta)(1-c)e(1-\bar{u}_t) + (1-\theta)c\bar{w}_{t-1} + (1-\theta)c\Delta_t, \qquad (4)$$

where the entities on the right-hand side in equation (2) are aggregated in a similar way.

To the extent that wage settlement in centralized wage negotiations is responsive to labor market tightness, the change in the nationwide wage level, Δ_t, depends on the logarithm of the aggregate unemployment rate $\bar{u}_t$. Thus, the wage elasticity with respect to unemployment at the macro level becomes

$$\frac{\partial \bar{w}_t}{\partial \bar{u}_t} = -(1-\theta)\left\{(1-c)e - c\frac{\partial \Delta_t}{\partial \bar{u}_t}\right\}. \qquad (5)$$

That is, wage flexibility at the macro level depends on two terms. The first term in the curled parenthesis reflects the extent of the responsiveness of wages to regional unemployment. The next term in the curled parenthesis reflects the extent to which higher aggregate unemployment leads to smaller increases in the centralized wage negotiations.

According to this formulation, wage flexibility at the local level necessarily shows up at the aggregate level. The wage-unemployment elasticity -(1 -θ)(1-c)e from the regional wage equation (2) is one of the two components in the macro-level elasticity. A special case arises when e = 0 or c = 0, such that the wage-unemployment elasticity at the regional level is zero. However, also this case of no wage flexibility at the regional level, is compatible with wage flexibility at the macro level. If the change in the nationwide wage level, Δ_t, is sufficiently responsive to the aggregate unemployment rate $\bar{u}_t$, the second term in (5) will assure wage flexibility at the macro level.

3. EMPIRICAL DIMENSIONS OF THE WAGE CURVE

The relationship between wages and unemployment has been studied empirically along several dimensions. In this section, we present a formal model, which enables us to distinguish in the data between the different dimensions of the wage curve. We first set up a model allowing for three different impacts of unemployment on wages. The first is the wage curve arising within regions from the short-term relationship between regional unemployment and wages, the second is a long-term relationship between permanent differences in regional unemployment and wages, and the third is the potential effect of aggregate unemployment on average wages. We then discuss which of these effects are picked up when implementing different types of empirical strategies.

The point of departure for the empirical analysis is the following estimating equation, where w_{irt}, the logarithm of the wage rate for individual *i* in region *r* in year *t*, is described by individual characteristics, x_{irt}, and the unemployment rate in the region, u_{rt},

$$w_{irt} = \alpha + \gamma_t + \delta_r + \delta u_{rt} + \beta x_{irt} + v_{irt}. \qquad \text{(a)}$$

In addition to the explanatory variables, the equation contains year dummies (time effects identical over regions), γ_t, region dummies (or fixed regional effects), δ_r, a constant term, α, and an error term for the individual, v_{irt}.

This is the equation advocated by Blanchflower and Oswald (1994). The estimate of the coefficient to the unemployment rate δ, the elasticity of wages with respect to unemployment, is their preferred estimate. It is the estimate of the elasticity of "The Wage Curve" in the terminology of Blanchflower and Oswald (1994).

As equation (a) contains fixed regional effects on wages, any permanent differences in wage levels between regions are contained in the regional dummies, and δ could thus be interpreted as the transitory effect of unemployment on wages. Note that including a regional dummy is equivalent to performing the analysis based on variables measured as the deviation within regions from the regional specific means. In the theoretical model of the previous section, we obtain from (2) the following expression when subtracting out the region specific mean of the wage level

$$w_{rt} - w_r = \theta(y_{rt} - y_r) + (1-\theta)(1-c)e(u_r - u_{rt}) + (1-\theta)c(w_{rt-1} - w_r) + (1-\theta)c(\Delta_t - \Delta)$$

which means that the coefficient for unemployment picks up the appropriate transitory wage curve elasticity (1-b)(1-c)e. If productivity differentials between regions are of a long-run nature, say from differences in natural resource endowments, they are swept out in the fixed region effect model since, in that case, $y_{rt} = y_r$.

The equation also contains year dummies, which is equivalent to performing the analysis based on deviations from year specific means. Subtracting out the aggregate means from each year in (2) gives

$$w_{rt} - w_t = \theta(y_{rt} - y_t) + (1-\theta)(1-c)e(u_t - u_{rt}) + (1-\theta)c(w_{rt-1} - w_{t-1})$$

The most important thing to notice is that the national wage increase, Δ, cancels out of the equation once we introduce year dummies. This implies that the effect of aggregate unemployment on the centrally bargained wage increments is effectively swept out of the analysis. This point was recognized by Blanchard and Katz (1999), who discuss the consequences of aggregate unemployment influencing reference wages in local wage determination.

As noted, any permanent differences in wage levels between regions are not described in (a) but are contained in regional dummies. As a conceptual exercise, the permanent or long-term differences in the regional wage levels, as evaluated by the regional dummies, δ_r, could be explained in an equation. Consider the following relationship between the regional fixed effects as explained by the logarithm of the average unemployment rate in the regions $\bar{u}_r.$, average individual characteristics in the regions $\bar{x}_r.$, and region specific variables Z_r like natural resources, climate etc.

$$\delta_r = a + d\bar{u}_r. + b\bar{x}_r. + cZ_r + \varepsilon_r \qquad \text{(b)}$$

The expected sign of the coefficient *d* to the unemployment rate is positive, if a region's permanent high unemployment is compensated by higher wages. That is, if the combination between wage levels and unemployment results in a smaller income level than in other regions, migration out of the region will prevail until the expected income level has been equalized. This is the line of thought in the Harris-Todaro (1990) migration model. But the long-term relationship could arise from other mechanisms as well, from rent sharing or local bargaining as discussed in the previous theoretical section indicating a negative long-run relation between the regional wage level and the regional unemployment rate was obtained.

Analogous to (b), the development in the wage level over time could be considered as a macro-relationship of the following form

$$\gamma_t = A + D\bar{u}._t + B\bar{x}._t + CG_t + E_t, \qquad \text{(c)}$$

which relates the time-specific effect, γ_t, to the logarithm of the average unemployment rate across regions at time t, $\bar{u}._t$. In addition, the equation contains average individual characteristics $\bar{x}._t$ and relevant time specific variables G_t, e.g. the oil price or changes in the bargaining system. For the Nordic countries, we may think of D, the aggregate wage curve effect, as arising from the centralized bargaining system: The central bargaining units take the average unemployment rate into consideration in the bargaining process. Note that the coefficient to a variable like $\bar{u}._t$ would not have been identified if it had been included in equation (6), which contains time dummies.

We now have a framework which allows for a short term effect of local unemployment on regional wages, δ; a long term effect capturing the impact of permanent differences in local unemployment on regional wages, d; and finally an aggregate wage curve operating at the national level only, D.

It is worth noting that the literature on centralization and real wage flexibility (e.g. Layard et al. 1991) should primarily be interpreted as a statement about D, rather than about δ which is the primary concern of Blanchflower and Oswald.

In the following sections we explore the relationship between wages and unemployment in the Nordic countries along these different dimensions. We first present estimates from the pooled individual level data, i.e., estimates of (a) excluding the fixed regional effects, γ_t. Then the estimates of (a) including fixed regional effects are presented.

The cross-sectional interplay between wages and unemployment is obtained from the variation between region specific averages: the logarithm of the wage rate, $\bar{w}_r.$, the logarithm of the unemployment rate $\bar{u}_r.$, and average personal characteristics $\bar{x}_r.$. The averages are obtained either by including the mean of the year dummies in the pooled data sets or by averaging the regional dummies from year specific regressions. We get

$$\overline{w}_r. = a + \overline{\gamma} + \delta_{between}\overline{u}_r. + \beta_{between}\overline{x}_r. + cZ_r + \nu_r, \qquad \text{(d)}$$

which produces between region estimates. Now, inserting equation (b) into equation (a) and taking the region specific mean shows that

$$\delta_{between} = \delta + d, \qquad \text{(e)}$$

which implies that the cross-sectional variation, $\delta_{between}$, is obtained as the gross of the transitory effect, δ, and the permanent effect, d, of unemployment on wages.[iii]

Finally, we consider the wage-unemployment elasticity obtained from the analysis of time-series analysis which can be decomposed in an analogous way. The standard model in most recent time-series studies is a regression of the logarithm of the nation-wide wage level $\overline{w}_{.t}$ on the logarithm of the nation-wide unemployment rate $\overline{u}_{.t}$ and different controls

$$\overline{w}_{.t} = \alpha + \delta_{time}\overline{u}_{.t} + \beta_{time}\overline{x}_{.t} + CG_t + \overline{u}_t \qquad \text{(f)}$$

Inserting (c) into (a) and taking the average per unit of time shows that:

$$\delta_{time} = \delta + D. \qquad \text{(g)}$$

This implies that it is possible to obtain an estimate of D by calculating the difference between the time unit estimates and the within region estimates. Since the above model (f) is the method adopted in most time series studies, we may interpret the difference between the time series estimates and our fixed-region effects as an estimate of the aggregate wage curve effect operating at the national level. This point offers an explanation of the differences in wage flexibility results obtained from time-series studies and conventional micro-level studies.

The decomposition in (g) corresponds to the analogous decomposition (5) in the theoretical section. On the left-hand side we have the macro effect of unemployment on wages, which is decomposed into two components on the right-hand side. Firstly the effect at the regional level and secondly the effect at the national level.

Accordingly, observing a high degree of wage flexibility in time series studies is compatible with observing no wage flexibility in the fixed region effects model, once we realize that the time series observation is the sum of the transitory and aggregate effects of unemployment on wages.

Finally, note that the G-variable in (f) may involve various kinds of dynamic specifications, such that it is fully possible that both the Phillips curve and the wage curve give a correct description of the wage formation process. This point, as recognized by Blanchard and Katz (1998), is concealed in the wage curve literature through the use of dummy variables for time.

4. WAGES CURVES FROM POOLED SAMPLES

The first results we present are wage-unemployment elasticities for data pooled over all years of observations. The observation unit is individuals in different regions and years contrasted against unemployment rates in the corresponding regions and years. The pooled sample results are mixtures of the elasticities in the different dimensions that will be considered in more detail in the next sections. We report results for the sample split up into private sector employees and public sector employees and explain why we concentrate on private sector employees only in the rest of the paper.

Formally, the pooled sample elasticities are obtained by applying equation (a) in the previous section without the regional dummies, δ_r. Because both wages and unemployment are in logs, the interpretation of the coefficient to the unemployment rate, δ, is the elasticity of wages with respect to unemployment. Implicit in this formulation is the assumption that the elasticity is constant regardless of the level of unemployment.

One advantage of the logarithmic form is that it facilitates comparisons between countries, since the results are invariant to currency differences.

Blanchflower and Oswald (1994) find the by now famous estimate of δ so prevalent, both in time and space, that they almost propose it as an empirical "law": the elasticity of wages with respect to unemployment is -0.1. This implies that a 10 percent increase in regional unemployment, e.g. from 5 to 5.5 percent, decreases wages by one percent. Correspondingly, a doubling of the unemployment rate induces a drop in wages by 10 percent.

For the Nordic countries Blanchflower and Oswald (1994) conduct an investigation for Norway only. They report an elasticity of -0.08 as their preferred estimate. For Sweden they merely quote a result of -0.06 from another study.[iv] In a subsequent section we will discuss the procedure followed by Blanchflower and Oswald (1994) for Norway and try to reconcile their results with the ones presented here.

Table 1 reports the main results from estimating wage curves for the Nordic countries on pooled sample data.[v] The control variables (the x'es) include years of education, experience, seniority, gender, occupational dummies and industry dummies. The inclusion of year dummies implies that the impact of inflation is swept out.

Table 1 about here

In the public sector the wage curve effect is very small in all Nordic countries compared to the magnitude stated in Blanchflower and Oswald (1994). The highest estimate is the one for Finland (-0.04). For Norway and Sweden the point estimate is not significantly different from zero. We may thus conclude that the regional variation in public sector wages is not very sensitive to local labor market conditions. This result is not surprising since the bargaining system is rather centralized in the public sector. Furthermore the norm of equal pay for equal work is particularly strong in this sector. There is altogether very low regional variation in public sector wages in the Nordic countries.[vi]

The lack of a relationship between regional wages and unemployment in the public sector obviously affects the estimate for the whole labor market, which is contained in the last rows of Table 1. In all countries, the elasticity of wages with respect to regional unemployment is smaller for the combined sample of the public and the private sector than for the private sector alone. As we in the following will argue that the wage curve elasticities reported by Blanchflower and Oswald (1994) are overstated, we focus entirely on private sector wages in the subsequent analysis.

Using the pooled sample data, the size of the estimated wage-unemployment elasticity in the private sector is -0.06 for Denmark, -0.10 for Finland, -0.02 for Iceland, -0.06 for Norway and -0.05 for Sweden. Thus, the magnitude of the elasticity for Finland corresponds to the ones in Blanchflower and Oswald (1994), while the elasticity for Denmark, Norway and Sweden is about half of this magnitude. For Iceland it is even smaller.

With respect to evaluating the significance of the wage elasticities in Table 1 a caveat is necessary, as the number of regions (and consequently the variation in regional unemployment rates) is considerably less than the number of workers (i.e., the number of observations). If the errors for the wage rates of different workers are correlated within regions, the classical assumptions for the estimating equations are not fulfilled. The consequence is that the standard errors are not correct, and it is likely that the standard errors reported in Table 1 are too small, see Moulton (1986). Blanchflower and Oswald (1994) report many results on individual observations like the ones in Table 1 without correction of the possible bias of the standard error. However, they also apply a method to take this into account, namely an aggregation of wage observations to one observation per region, and this is also done later in this paper.

5. THE DISAPPEARING WAGE CURVE: FIXED REGION EFFECTS RESULTS

The wage curve estimated for the Nordic countries in the previous section dissolves once we introduce regional fixed effects. This is an important result,

contradicting the claims of Blanchflower and Oswald (1994). A fixed effects estimation is their preferred procedure, and deviations from the standard wage elasticity result of -0.10 are often contributed to lack of data, which renders fixed effects estimation impossible. The relationship between regional wage levels and unemployment rates in the Nordic countries is thus of a long-term nature rather than a relationship between short-term levels.

Formally, the equation to be estimated on individual data is the one from the previous section where the regional dummies, δ_r, are added to the equation, i.e., equation (a) above. These dummies identify the potential regional wage level that is fixed over time, and are, accordingly, a measure of "permanent" differentials in wage levels across regions. Running an ordinary least squares regression of this model specification will effectively sweep out all these "permanent" differences between regions. In other words, the effect of unemployment levels on wages is measured based on the variation within each region only, and the result may be interpreted as the effect of "transitory" changes in unemployment.

Blanchflower and Oswald (1994) stress the importance of using fixed-region effects models to investigate the relationship between regional unemployment and wages. Theoretically, in a long-run migration equilibrium, the relationship between permanent unemployment and wages should be positive. If a region has high unemployment, higher wages are required to compensate for this unfortunate feature of the local labor market. In the short-run, in contrast, wage curve mechanisms are supposed to apply. Blanchflower and Oswald find that the long-run relationship between wages and unemployment is indeed positive in the US, while they do not find this to be the case in the UK. A positive long-run correlation between wages and unemployment will tend to bias the results obtained from the pooled sample downward (towards zero) and they, therefore, argue that a fixed-region effect model is the correct specification.

Table 2 reports the main fixed-region effects estimated for the Nordic countries. The first row displays estimates from a fixed region effect model based on regional unemployment rates. In this specification, all "permanent" variation is swept out as

described above, and the coefficients reflect "transitory" effects only. All wage elasticities are small and insignificant.

Table 2 about here

In the next two rows, we report results using unemployment rates at the municipality and the commuting area level, with control for region. This implies that in addition to transitory variation around the regional mean, the permanent variation between, respectively, municipalities and commuting areas within each region is also accounted for. The wage elasticity remains small and insignificant, except for Denmark. The result for Denmark should, however, be viewed in light of the extremely large number of observations (more than 400 thousand) and the very low point estimate of less than 2 percent.

Accordingly it seems fair to conclude that the wage curve for the Nordic countries disappears once we introduce fixed region effects. The results are unambiguous: we do not find significant elasticities of wages with respect to regional unemployment once permanent differences across regions are accounted for.

We next present results based on region-cross-year specific averages. We calculate region-specific averages for each year included in the data set and choose instead of individuals these region-cross-year averages as our unit of observation. OLS regressions based on these averages, including regional dummies, produce more correct estimates of the standard error of the coefficients as the number of observations are now the same as for the regional unemployment rate appearing in our data (see, e.g., Moulton (1986) and the discussion in Card (1995))[vii].

In Table 3 we report results from region-cross-year cell means. We note that for Denmark, Finland, Norway and Sweden, the fixed region effects estimates confirm our previous results in Table 2 of no transitory wage curve effects in the Nordic countries. The coefficients range from –0.018 for Finland to 0.012 for Sweden, with only the Danish coefficient being significantly different from zero, but again extremely small (-0.0084). The result for Iceland is surprising, implying a transitory wage curve effect of minus 6

percent. This result combined with the result in Table 2 warrants some further investigation.

Table 3 about here

To the extent that the error terms for individuals within regions are correlated one would expect an increase in the standard errors when comparing the first row in Table 2 with the standard errors in Table 3. For Finland and Sweden there is actually a certain increase in the standard errors, while the standard errors for Denmark and Norway decrease.

It seems that the Nordic wage curve estimated from cross section data (as reported from the pooled sample in the previous section) is the outcome of a negative relationship between the level of wages and long term differences in unemployment rates across regions. Transitory fluctuations in relative unemployment do not induce changes in relative wages between regions. It may, of course, be argued that the lack of a transitory wage curve effect could be due to too little within region variation in unemployment.[viii] However, our failure to detect a transitory wage curve effect cannot simply be explained by large standard errors relative to the magnitude of the point estimates. Apart from Iceland, all our point estimates are extremely small and none of the estimates are within 2 standard errors of the benchmark elasticity of -0.10. We find it reasonable to attribute the apparent lack of regional wage flexibility compared to the US and the UK to the centralized bargaining systems in force in the Nordic countries.

The results of the previous section showed that the pooled sample estimates of the wage-unemployment elasticity in the Nordic countries were mostly below the preferred estimate of -0.10 in Blanchflower and Oswald (1994). The reason for these low elasticities is not that the short-run elasticities are drawn downwards when confounded by positive long-run elasticities. On the contrary, the short-run elasticities turn out to be close to zero and, consequently, we must expect the long-run elasticities to be negative in the Nordic countries. This is further explored in the following section.

6. LONG-RUN AND AGGREGATE RELATIONSHIPS BETWEEN WAGES AND UNEMPLOYMENT

The long-run relationship between regional wages and unemployment in the Nordic countries has to be different from that obtained from data for the US and the UK given the results in the previous sections. We present some estimates of the more permanent relationship between regional wages and unemployment, utilizing "between region" estimates of the coefficients as discussed in section 3.

Moreover, the lack of wage flexibility in the short-run seems to contrast sharply with the real wage flexibility reported for several of the Nordic countries in time-series studies. We therefore conclude this section by showing more formally that wage rigidity across regions may very well be consistent with aggregate wage flexibility, mainly because the two methodologies draw on different dimensions of variation in the data. The conclusion is that real wage flexibility in the Nordic countries is obtained through the centralized bargaining system reacting on aggregate employment conditions, rather than by local wage setting adjusting to local labor market conditions.

Table 4 reports the elasticity between two different measures of the average region-specific wage level and the region-specific unemployment rate. For these regressions, we have aggregated our pooled data to merely one observation per region. The first row gives the results from a regression of the mean log regional wage on the log unemployment rate (including averages of the year dummies). For Iceland, we find a positive, but insignificant elasticity of 0.014. For the other countries, the elasticity of regional wages is negative ranging from an insignificant -0.06 for Denmark to a highly significant -0.25 for Norway.

Table 4 about here

The next row reports results from a regression of the mean log wage residual on the log unemployment rate. The log wage residuals are the region specific means of the

residuals from pooled individual wage regressions including years of schooling, experience, experience squared, seniority, gender, industry and occupational dummies as well as year dummies. Again Iceland displays a positive, but insignificant wage elasticity. The estimated elasticity for Denmark is slightly higher in this specification, -0.07, but still not significant. For the remaining countries, we find a significant negative relationship between regional wages and unemployment.

These coefficients capture both the short- and the long-term interaction between wages and unemployment, and can thus be interpreted as a mix of the short- and long-term wage curves reported so far. For Denmark, Finland, Norway and Sweden, all showing short-term wage elasticities close to zero (Tables 2 and 3), the conclusion seems to be the following:

A wage curve effect is discernible also in Denmark, Finland, Norway and Sweden. Higher regional unemployment induces a lower regional wage level. However, this relationship is not working in the short-run, but rather in the longer run. As stated above, we attribute the lack of short-term wage flexibility to the rather centralized wage setting systems of these economies. The observed long-term relationship, nevertheless, warrants a more careful discussion.

In contrast to US results, we find no traces of a migration equilibrium in these four countries, that is, a positive association between wage and unemployment in the long run. According to Card (1995), p. 789, "... average levels of unemployment across states are weakly positively correlated with average wages, ..." in the US. The evidence for the US points unambiguously towards such a positive cross-sectional correlation, but the evidence is indirect, and the references cited in the present paper do unfortunately not seem to contain quantitative assessments for the US comparable to the one for the Nordic countries in Table 4.[ix] Card (1995) continues "For the British data, the addition of region dummies rarely affects the estimated wage curve elasticities, perhaps reflecting the grater degree of "permanence" in the geographic patters of British unemployment ....".[x] Also the Nordic countries are characterized by a high degree of permanence in relative performance across regions, which could be taken as an indication of equilibrium forces of labor mobility working slower in these countries than in the highly mobile US.

The lack of such a positive cross-sectional relationship between wages and unemployment could thus be due to a lower degree of worker mobility within the Nordic countries, especially compared to that of the US. However, we are not aware of any other empirical evidence to support this assertion.[xi]

For Iceland, however, we do find a negative transitory wage curve in Table 3, whereas the positive, albeit not significantly so, coefficient in Table 4 could indicate that there might be a positive long term relationship between wages and unemployment in Iceland. In line with theory, this may be the result of a more mobile work force in Iceland than in the rest of the Nordic countries.[xii]

For Denmark, Finland, Norway and Sweden, the question remains: how do the long-term regional wage differentials arise if they do not add up from short-term adjustments? Our findings could of course be due to some omitted variable, producing a negative correlation between regional wages and unemployment in the long-run. It seems nonetheless reasonable to suggest that, in line with the theoretical model, the forces working in more decentralized economies, such as rent sharing mechanisms (and efficiency wages), are present in the Nordic countries as well, but with a slower speed of adjustment due to the fact that a significant part of the wage change arises from the centralized level. Combined with low regional mobility, this may produce a long-term negative correlation between regional unemployment and wages. Moreover, this is the correlation that shows up as wage curves for Norway and Sweden in Blanchflower and Oswald (1994) as discussed in the next section.

Simultaneously, the evidence from the time series literature, both from our countries and from international cross country studies, points to rather high levels of real wage flexibility in the Nordic labor market. How can we reconcile our findings with this observation? The answer might simply be, that the wage flexibility of the Nordic countries arises at the aggregate level as a response to aggregate unemployment, while the wage flexibility of the US originates from wage flexibility at the local level.

We end this section by presenting a table summarizing the results of the Nordic wage curves along the dimensions analyzed above. Panel A of Table 5 presents the difference between the elasticity estimated on region specific averages (Table 4) and the

fixed region effects estimates (Table 2). As discussed above this difference represents an unbiased estimate of the coefficient d in equation (b), i.e. the long-term regional wage curve effect.[xiii] In the notation of section 3, equation (e), we find d as the difference between $\delta_{between}$ and δ . We find a significant and large long-run regional wage curve for Finland, Norway and Sweden. Also for Denmark the wage elasticity across regions is negative, but insignificant. For Iceland we observe a positive but insignificant long-term relationship between wages and unemployment.[xiv]

Table 5 about here

Panel B of Table 5 states the time-series estimates for Denmark, Finland, Norway and Sweden obtained in Nymoen et al. (1998). This is a recent investigation on wage formation at the macro level conducted in another Nordic project. The reported estimates are long-run estimates of the elasticity of wages with respect to total unemployment (including labor market program participants) from error-correction models using manufacturing wages from 1960 to 1994. Since both the sample and the specification are different from ours, the calculated "aggregate wage curve" also reported in the table should be interpreted with caution.

The exercise in this part of the table corresponds to equation (g) in section 3. The time series estimates of the first row of Table 5, Panel B, correspond to δ_{time} on the left-hand side of equation (g). The second row contains the coefficients of the regional fixed effects model corresponding to δ , the first term on the right-hand side of equation (g). The last row corresponds to the second term, D, on the right-hand side of equation (g), and is calculated as the difference between the first and the second row. This term reflects the variation between the wage level and unemployme nt common to regions and is therefore labeled the "National wage curve". In terms of the bargaining model of section 2, it is to be interpreted as the effect arising from centralized bargaining. In other words, Panel B of Table 5 decomposes the aggregate time series estimates of wage elasticities into the wage elasticity, which is in focus in Blanchflower and Oswald (1994), and a response of wages to unemployment at the national level.

According to the time-series study, the wage-unemployment elasticity is of about the same magnitude in three of the countries, Denmark, Norway and Sweden, where the point estimates are insignificantly different from the value -0.15, while the estimate for Finland is somewhat lower (-0.05). The components of this variation arising from regional variation in wages are small in size according to the figures in row 2. Instead, the major variation in aggregate times series stems from the variation in wages and unemployment that is common across regions (third row of Table 5, Panel B). In other words, the wage flexibility in the Nordic countries arises at the national level, not at the regional level.

7. RECONCILING THE EVIDENCE

As we have found no support for the empirical results reported in Blanchflower and Oswald (1994) it is worth looking in more detail at their results for the only Nordic country included in their study. Norway is explicitly mentioned in the beginning of "The Wage Curve" book as a country with a wage curve "very similar" to the one in the United States, as mentioned in the introduction of this paper. The book contains one table for Norway, Table 7.17, which presents 6 elasticity estimates. The data is a survey for the years 1989, 1990 and 1991 and contains a total of 2,599 observations in the pooled sample. Different controls are included in the estimations, which do not take clustering at the regional level into account.

The first three estimates are elasticities for each of the sample years. The forth is a pooled sample estimate including time dummies for these three years combined, which yields an elasticity of -0.10 with a t-statistic of 2.64. The fifth estimate is a fixed effects estimate with regional dummies, and this yields an insignificant wage elasticity of -0.01 as the t-statistic is 0.12. Blanchflower and Oswald (1994), p. 335, then note that "Only four of these regional dummies were found to be significantly different from the remaining fifteen dummies".[xv] The sixth and last estimate is accordingly an estimate, which is obtained when only these four regional dummies are included, and this yields an elasticity of -0.08 with a t-value of 2.19. This estimate is the preferred one - it enters as

the estimate for Norway in the introductory article Blanchflower and Oswald (1995), which contains a table, "Wage Curves in 12 Nations", presenting one wage-unemployment elasticity per nation. The authors conclude that "The estimated unemployment elasticity of pay for Norway is, according to the tables, consistent with estimates for the other countries examined in the book", see Blanchflower and Oswald (1994), p. 334.

These quantitative results reported by Blanchflower and Oswald (1994) for Norway actually do not seem to be at variance with the ones presented in the present more detailed study for Norway and the other Nordic countries. The pooled sample result for Norway is -0.60, which is within the 5 percent confidence interval for the point estimate of -0.10 by Blanchflower and Oswald (1994). The fixed effects result for Norway is 0.00, which is almost identical to the -0.01 in Blanchflower and Oswald (1994).

The reason for the difference between the pooled sample results and the fixed effects results is a correlation between the regional dummies and the regional unemployment rates. When most of the regional dummies are deleted, and only a minor fraction retained in the estimation, then it is natural that the resulting estimate of -0.08 is closer to the pooled sample result than to the fixed effects result.

Unfortunately, it is not possible to compare the outcome of this exercise for Norway with an analogous one for the US on the basis of the information in Blanchflower and Oswald (1994). In the US fixed effects estimations, a full set of dummies corresponding to either 50 states or different regions in the various data sources seem to be used throughout the book. Now, it is likely that a fair share of the US states has an average wage that is not far away from the average wage rate in the US after controlling for unemployment and individual characteristics like experience, schooling, gender, marital status, race, private sector, part time, and industrial affiliation. A qualified conjecture is, that deleting the dummies for those states, which do not have a wage rate that is significantly different from the average wage rate in the US, most likely will pull the fixed effects wage elasticity of -0.10 towards the pooled sample result, that is, towards zero.[xvi] Omitting some of the devise that removes the positive cross-sectional variation in

the data for the United States must necessarily bring parts of this variation back into the data.

The final estimate for Norway in Blanchflower and Oswald (1994) is thus based on a procedure that is not applied in the case of the United States.[xvii] When applied on Norwegian data, the methodology for obtaining the "wage curve" estimate for the United States produces an estimate indistinguishable from zero. So in our view it is reasonable to conclude, that the evidence put forward in Blanchflower and Oswald (1994) about the short-run regional variation between wages and unemployment for Norway is actually in accordance with the evidence in this paper: there is none.[xviii]

This also applies to different subgroups of workers. One of the innovative features in the work of Blanchflower and Oswald (1994) is that they use micro-data to trace the different responsiveness of wages on unemployment for subgroups on the labor market. For example, the wage flexibility for less educated seems to be larger than for workers with higher education. This seems to hold also for younger workers relative to older workers. This evidence of heterogeneity on the labor market is for example contained in a table with wage elasticities for subgroups in the review by Card (1995), a table that has recently been reproduced and applied in Browning et al. (1999).

It is conceivable that such heterogeneity of wage responses for different worker subgroups is also present in the Nordic countries. However, such heterogeneity is not present in the short-run regional wage variation, i.e., after controlling for fixed regional effects. The average wage curve elasticity for workers with less and with more education combined is zero, it is zero for younger and older workers combined, and tables for wage curve elasticities for subgroups in the Nordic countries contain nothing but zeros, for details see Albæk et al. (1999).

8. DYNAMIC ASPECTS OF REGIONAL WAGE FORMATION

Compared to the various estimates reported for the US and the UK, it seems that wage formation in the Nordic countries does not show the same responsiveness to local labor market conditions as approximated by the regional unemployment rate. If the

unemployment rate does a reasonably good job in capturing the influence from economic conditions and if movements in the wage rate are not substantially influenced by other factors, the expectation would be that the wage rate in the Nordic countries shows a high degree of regional persistence.

Persistence implies that if the wage level is high in one period, it is likely to be high also in the next period. A natural way to investigate whether or not this is the case is to include the wage level in the previous period in an equation describing the wage level in the current period. As noted by Blanchflower and Oswald (1994) this method also provides us with a test of the wage curve specification versus the Phillips curve, i.e., whether the left-hand side of the wage equation should be in levels or changes in levels (see also the discussion in section 2).

Our Danish data contains observations from the largest number of years (12 years). In Table 6 we report results from various wage specifications including lagged wages for Denmark. The first two columns report results from an equation for the wage level, which includes the regional wage lagged one period and regional unemployment. The wage variable is the regional average of the residuals after controlling for individual characteristics. Also, the regression is weighted by the number of sample individuals in each region and year.

Table 6 about here

In column 1, which does not include regional dummies, the lagged wage level comes out with the coefficient 0.9750, which indicates a very high level of persistence. The coefficient of the unemployment variable is negative but very small and not significantly different from zero. In the next column, regional dummies are included as well. The coefficient of the lagged wage variable drops, but is still highly significant and rather large (0.52). The magnitude of the coefficient still points to fairly high persistence in wage levels, although not to the same degree as in the previous equation excluding the regional dummies.

These results are in sharp contrast with one of the main findings in Blanchflower and Oswald (1994). Their equations comprising regional dummies and a lagged wage variable produced a coefficient close to zero for both the US and the UK. Consequently, they concluded that the Phillips curve specification, which is the traditional specification in the analysis of wage formation on time series data, is not a valid specification in the analysis of wage formation on micro data. In order to distinguish the analysis of wage formation on micro data from the analysis on macro data, they concocted the term "wage curve", the title of their book, a curve that was supposed to replace the Phillips curve. As is evident from the present results this claim is not supported by the evidence obtained from Danish data.

High absolute values of the coefficient for the lagged wage variable, which favors the Phillips curve in contrast to the wage curve, are also reported in Blanchard and Katz (1997). They used US wage data, while Blanchflower and Oswald (1994) worked on US income data. In order to reconcile the divergent results, Blanchard and Katz (1997) replicated the analysis on CPS income data and obtained a small coefficient for the lagged income variable. This lead Blanchard and Katz (1997), p. 64, to make the conjecture that the use of income instead of wages was the reason for the small coefficient of the lagged endogenous variable obtained by Blanchflower and Oswald (1994). Or, stated differently, measurement error in the dependent variable, when using income instead of wages, might cause problems in a dynamic specification of the wage formation process, resulting in a low estimate of the coefficient for the lagged income variable.

In order to shed further light on this issue, the analysis in columns 1 and 2 of Table 6 is replicated in the next two columns, with wages replaced by income. According to the results in column 3 with the regional dummies omitted, the persistence in income is of about the same magnitude as the persistence in wages (column 1). However, when regional dummies are added in column 4, the coefficient of the lagged income variable drops to 0.37. Although the drop in size when comparing column 2 and column 4 is about two standard errors, the coefficient of the lagged income variable is still significantly different from zero and larger than the ones reported from US data. Persistence prevails according to the Danish data, also when income is used in place of wages.

The difference between income and wages, the measurement error, originates from the number of working hours. In the last two columns of the table, therefore, persistence in working hours is investigated. According to the results in column 5 the degree of persistence in working hours is quite high in the different regions. However, most of this effect is picked up by the regional dummies as indicated by the results in column 6.[xix]

It is important to note, that the coefficients of the lagged right-hand side variable in Table 6 are biased towards zero, when the regional fixed effects are included. The bias is larger the smaller the number of time periods. In this context twelve years is a reasonably large number so it is conceivable that the bias does not account for all the difference between the coefficients estimated with and without the fixed effects.[xx] It is worth noting that Blanchard and Katz (1997) obtain coefficients close to one to the lagged wage rate on US data, even after having included regional fixed effects. For the UK, Brian Bell (1997) also reports significant autoregression in wages.[xxi]

The Danish data is the only data set, which allows us to trace the adjustment process in wage formation over a comparatively long time period. For the other countries we have observations for a smaller number of years, and for Finland and Norway the observations are not adjacent, there is a two-year lag in the observations.

In Table 7 we report lagged specifications from Finland, Iceland and Norway as well (Sweden is omitted in this table, as there are 10 years between the two observations available).[xxii] The Finnish and Norwegian data consist of observations from three points in time, with two years between each survey. Hence, we first do a replication of the three-point-two-year sample frame of these two countries on the Danish data set to see if our specification gives robust results with different sampling schemes. The first column in Table 7 replicates the results for Denmark for the whole sampling period stated in Table 6. The second and third columns report the results for two data sets for Denmark, replicating the Finnish and Norwegian sampling scheme (i.e., three years with a two-year lag between the observations). The first row in the table reports the coefficient and the standard error to the lagged wage in the estimating equation. The second row shows the one-year-effect calculated as the square root of the coefficient in the first row in the cases

where there is a two-year lag among the observations in the data. The calculated one-year effects for Denmark come very close to the coefficient reported in the first column.[xxiii] We thus proceed by including the results for Finland and Norway, even though the sampling plan differs from that of Denmark and Iceland.

Table 7 about here

It turns out that for all four countries the lagged wage coefficient is significant and rather large, ranging from 0.73 (Iceland) to close to 1 (Denmark).[xxiv] This clearly indicates a high level of regional wage persistence in the Nordic labor markets. We thus reject the wage curve specification, a finding, which is in accordance with our observation from the fixed region effects model in the previous section.

The coefficients to the lagged wage rate are fairly close to one and one might therefore consider accepting the competitor to the wage curve, the Phillips curve.[xxv] On the other hand, the coefficient of log unemployment is extremely small and insignificant, which leads us to reject the Phillips curve model as well. All in all, not much happens with regional relative wages in the Nordic countries in the short-run.

This is in contrast to the results for the US in Blanchard and Katz (1997) where the coefficient to unemployment is significantly different from zero in equations containing lagged regional wage rates. For the UK, the coefficient to unemployment is on the borderline of significance when autoregression in wage rates is taken into account according to Bell (1997).

The result presented in the present paper does nevertheless not imply that a Phillips curve description of the wage formation process in the Nordic countries can be rejected. The unemployment coefficient in Table 6 and Table 7 cannot be compared to corresponding coefficients based on time series data. As discussed in the previous section, the aggregate time series variation in the micro data has been purged as a consequence of including year dummies. Again this leads us to conclude that the observed real wage flexibility of the Nordic countries arises from reactions at the national

level on aggregate labor market conditions, probably due to the rather centralized systems of wage formation.

9. CONCLUSIONS

This paper has analyzed wage formation at the regional level in the Nordic countries by the use of micro-data. The point of departure was the by now famous study by Blanchflower and Oswald (1994), establishing a negative relationship between wage levels and unemployment rates across regions and over time. This main result from their micro-level analysis they call “The Wage Curve”.

Blanchflower and Oswald (1994) estimate the elasticity of wages with respect to unemployment to be around minus 10 percent for a large number of countries. They argue that this wage flexibility operates on a short-term basis, indicating that also transitory changes in regional unemployment rates translate into wage changes. This is to be kept distinct from the long-run relationship between regional wages and unemployment that arises from a migration equilibrium, where higher permanent levels of unemployment require higher wage levels to compensate for worse local labor market conditions. Our findings concerning the Nordic wage curve can be summarized as follows.

At the outset we reported, for all five Nordic countries, wage curve results for pooled data with regional fixed effects omitted. The estimated elasticities of private sector wages with respect to unemployment range from minus 5 to minus 10 percent, with Finland showing the strongest wage response to regional differences in unemployment. Public sector wages are not sensitive to local labor market conditions, for which reason we confined all subsequent analyses to private sector wages.

Hereafter, fixed region effects were introduced in the analysis. Basically this means that all persistent regional differences in wage levels and unemployment rates are swept out, and the analysis is performed only on the year-to-year changes in wages and unemployment across regions. The results are thus to be interpreted as capturing the dependency of wages on transitory changes in regional unemployment rates. Indeed,

according to Blanchflower and Oswald (1994) this is the appropriate approach when trying to explore the wage curve.

After having controlled for fixed regional effects we are no longer able to detect a wage curve in any of the Nordic countries. In other words, transitory changes in regional unemployment rates do not seem to translate into changes in relative wages across regions. This implies that the conclusion put forward by Blanchflower and Oswald (1994) regarding the prevalence and stability of a wage curve in a large number of countries does not stand against closer scrutiny for the Nordic countries. The Nordic wage curves simply do not survive the introduction of fixed regional effects.

Moreover, it seems that the long-term relationship between regional wages and unemployment is negative rather than positive. This indicates that the simplest version of the migration-equilibrium model does not hold in our countries, and could suggest that local productivity and labor market conditions have lasting effects on relative wages.

The evidence on wage formation in the Nordic countries put forward in the present paper does actually not seem to be at variance with the limited analysis for Norway contained in Blanchflower and Oswald (1994). In order to obtain the standard elasticity result of -0.10 for this country, Blanchflower and Oswald (1994) adopted a procedure, which is not applied elsewhere in their study.

Finally, we considered persistence in wage formation by including the lagged wage rate in the equations. In the results presented by Blanchflower and Oswald (1994) this variable had a coefficient close to zero, which they interpreted to lend further support for the existence of a wage curve and, consequently, lead them to reject the Phillips curve. For the Nordic countries, in contrast, the lagged wage rate comes out with a coefficient, which is significantly different from zero. This points to considerable persistence in regional wage formation in the Nordic countries. However, the estimates of the lagged wage variable are not high enough to support a Phillips curve relation, either.

These negative conclusions with respect to the short-run impact of unemployment on wage flexibility at the regional level in the Nordic countries do not entail that there is no wage flexibility whatsoever in our countries. The inclusion of year dummies in the analysis of wage formation at the micro level effectively purges any effects from

unemployment to wages at the macro level. Hence, flexibility in wage formation at the macro level might very well co-exist together with a modest role of unemployment in the regional dimension.

Our results are consistent with our theoretical model, where a central union determines national wage changes in order to keep a target-level of aggregate unemployment, and there is local wage drift affected by local labor market conditions.

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Appendix. Data and sample statistics

The estimation of the wage curve is based on comparable data sets for the Nordic countries. The data are representative for the private (excluding agricultural and fishing) sector as well as the public sector and the key variables used in the estimations are defined in a comparable way. The hourly wage is calculated as the worker's earnings divided by the reported working hours. For all countries schooling, experience and seniority are measured in years and the industry classification follows the ISIC nomenclature.

The data for Denmark and Iceland are from registers, whereas the data for Finland, Norway and Sweden come from surveys and are mostly self-reported. However, for Finland the information on earnings and completed education is from registers. Table A1 provides more detailed information on the definitions of some variables.

The sample for Denmark is drawn randomly from a labor market data base (IDA) containing register data collected by Statistics Denmark. The sample used includes 34,723 workers in 1993. The Finnish sample for 1993 include 2,468 employees from the Labour Force Survey, which is a random sample from the whole population conducted by Statistics Finland. The Icelandic data is a sample drawn from administrative data collected by the association of Icelandic employers. The sample used includes 12,799 employees in 1992. The data for Norway come from the Norwegian Study of Organizations and Employees (NSOE) from 1989 and 1993, and from the Level of Living Survey (LLS) for 1991, both conducted by the Statistics Norway. The sample includes 5,516 employees for the years 1989, 1991 and 1993. The Swedish data come from the Level of Living Survey (LNU) conducted by the Swedish Institute for Social Research and Statistics Sweden (SCB). The observations consist of a randomly selection of individuals between 16 and 76 years and the sample used includes 3,198 employees for the year 1991.

The unemployment rates at county and municipality level origin from the following sources. For Denmark the unemployment rates at county and local levels come

from register data collected in November each year and published by Statistics Denmark. The county-specific unemployment rates for Finland reflect the average annual level as calculated by Statistics Finland, whereas the municipality unemployment rates refer to Ministry of Labor's unemployment data for October in each year. For Iceland the unemployment rate at county and local level is from the National Economic Institute of Iceland. Regional unemployment rates for Norway are for the main part taken from Fjortoft (1995) based on figures from the Directory of Labour (Arbejdsdirektoratet). The corresponding data from Sweden come from the National Labour Market Board in Sweden. Sample means and standard deviations of key variables for the five countries are given in Table A2.

Table A1. Variable definitions and collection method

Hourly wage	Denmark:	Tax register information on annual taxable earnings divided by an estimate of hours worked (calculated from contributions to a pension fund).
	Finland:	Tax register information on annual taxable earnings divided by normal self-reported working hours.
	Iceland:	Employer reported wage rates for individuals.
	Norway:	Self-reported earnings divided by self-reported hours.
	Sweden:	Self-reported earnings divided by self-reported hours. The self-reported information is compared and controlled with annual registers of earnings of tax declaration.
Education[a)]	Denmark:	Register data from educational institutions.
	Finland:	Official register data on highest completed educational degree.
	Iceland:	Not available.
	Norway:	Register data on highest completed education
	Sweden:	Self-reported years of schooling.
Experience	Denmark:	Number of years as wage earner, calculated from pension fund contributions.
	Finland:	Self-reported years of work experience.
	Iceland:	Not available.
	Norway:	Self-reported years of work experience.
	Sweden:	Self-reported years of work experience.
Seniority[b)]	Denmark:	Calculated from matched plant-worker data.
	Finland:	Self-reported.
	Iceland:	Not available.
	Norway:	Self-reported.
	Sweden:	Self-reported.
Occupation:		4-5 main categories in each country
Industry:		In all four countries 2-digit ISIC industry dummy variables.

Notes: [a)] The education variable used in the estimations is defined as the total years of schooling. [b)] Length of years of the current employment relationship.

Table A2. Sample mean statistics for the last sample year, private-sector employees

Variables	Denmark	Finland	Iceland	Norway	Sweden
	(1991)	(1993)	(1992)	(1993)	(1991)
Hourly wages	146.87	63.60	544.56	102.21	83.25
	(60.86)	(28.65)		(43.81)	(30.97)
Regional unemployment	9.79	17.45	3.0	5.64	3.02
	(2.60)	(3.03)		(0.87)	(0.72)
Municipality unemployment	9.91	19.84	n.a.	5.67	3.17
	(2.52)	(3.66)		(1.21)	(1.23)
Education in years	11.38	11.13	n.a.	11.42	11.19
	(2.52)	(1.87)		(2.10)	(2.80)
Experience in years	15.59	18.54	n.a.	18.57	18.00
	(10.08)	(10.42)		(11.37)	(12.52)
Seniority in years	3.93	10.03	n.a.	9.77	8.99
	(3.88)	(9.07)		(8.83)	(9.52)
Gender	0.34	0.45	0.50	0.35	0.35
	(0.47)	(0.50)		(0.48)	(0.48)
Blue-collar worker	0.43	0.45	0.74	0.39	0.51
	(0.50)	(0.50)		(0.49)	(0.50)
Union membership[a)]	0.84	0.78	1.00	0.53	0.78
	(0.37)	(0.41)		(0.50)	(0.42)
Sample size	34,723	1,487	12,799	2,034	1,741

Notes: Standard deviations in parenthesis. [a)] For Denmark: membership of unemployment insurance funds. For Iceland: The data stems from the association of Icelandic employers.

Tables in the text:

Table 1. Basic wage curve results, pooled sample, coefficients for ln(regional unemployment). Dependent variable: ln(hourly wage).

		Denmark	Finland	Iceland	Norway	Sweden
Sector:		80-91	89,91,93	92-96	89, 91, 93	81,91
Private sector	Coeff.	-0.0629*	-0.1022*	-0.0290*	-0.0610*	-0.0515*
		(0.0018)	(0.0090)	(0.0062)	(0.0144)	(0.0110)
	No. obs.	416,314	6738	48,673	5472	3663
Public sector	Coeff.	-0.0227*	-0.0378*	n.a.	-0.0167	0.0081
		(0.0048)	(0.0107)		(0.0161)	(0.0108)
	No. obs.	30,039	3872		3465	2981
Public and private	Coeff.	-0.0508*	-0.0797*	n.a.	-0.0482*	-0.0272*
		(0.0038)	(0.0069)		(0.0109)	(0.0081)
	No. obs.	66,950	10,610		8937	6652
No. of regions		16	13	8	19	24

Notes: Standard errors are given in parentheses. An asterisk indicates significance at the 5 percent level. The explanatory variables include for Denmark, Finland, Norway and Sweden years of education, experience, experience squared, seniority, gender, occupational dummies, industry dummies and year dummies. For Iceland, the explanatory variables include dummies for seniority, age, gender, industry and year.

Table 2. Wage curve results with fixed regional effects, private sector, coefficients for ln(unemployment). Dependent variable: ln(hourly wage)

	Denmark	Finland	Iceland	Norway [a)]	Sweden
Unemployment variable:	80-91	89,91,93	92-96	89, 91, 93	81,91
Regional unempl. rates	-0.0011	0.0198	-0.0068	0.0011	0.0313
	(0.0060)	(0.0183)	(0.0087)	(0.0235)	(0.0322)
Municipal unempl. rates	-0.0154*	-0.0068	n.a	-0.0158	-0.0059
	(0.0021)	(0.0105)		(0.0226)	(0.0121)
Commuting area [b)] unemployment rates	-0.0184*	-0.0044	n.a	-0.0161	0.0059
	(0.0042)	(0.0132)		(0.0269)	(0.0211)
No. of observations	416,314	6738	61,640	5516	3664

Notes: Standard errors in parentheses. An asterisk indicates significance at the 5 percent level. The explanatory variables include schooling, experience, experience squared, seniority, gender, occupational dummies, industry dummies and year dummies. For Iceland the explanatory variables are dummies for gender, occupations and industry. [a)] The Norwegian observations of municipality and commuting area unemployment are from one year only (1989) and cover 2318 observations. [b)] Commuting areas are constructed by combining municipalities according to the degree of commuting across municipality borders.

Table 3. Wage curve results with fixed regional effects, coefficients for ln(unemployment). Dependent variable: average regional ln(wage)

	Denmark	Finland	Iceland	Norway	Sweden
Explanatory variable:	80-91	89,91,93	92-96	89,91,93	81,91
Regional unempl. rate	-0.0084*	-0.0184	-0.0625*	0.0033	0.0121
	(0.0035)	(0.0270)	(0.0250)	(0.0213)	(0.0365)
No. of observations	192	36	40	57	48

Notes: Standard errors in parentheses. An asterisk indicates significance at the 5 percent level. The explanatory variables include year dummies, region-cross-year specific average years of schooling, experience, experience squared, seniority, and gender. For Iceland, the controls are dummies for gender and occupation.

Table 4. Wage curve results from between-regional variation in average wage rates, coefficients for means of ln(regional unemployment)

	Denmark	Finland	Iceland	Norway	Sweden
Dependent variable:	80-91	89,91,93	92-96	89,91,93	81,91
Average wage level	-0.0571	-0.1682*	0.0144	-0.2464*	-0.0864*
	(0.0679)	(0.0556)	(0.0849)	(0.1009)	(0.0302)
Average wage residual [a)]	-0.0719	-0.1357*	0.0070	-0.0987*	-0.0585*
	(0.0484)	(0.0178)	(0.0696)	(0.0520)	(0.0185)
No. of observations	16	13	8	19	24

Notes: Standard errors in parentheses. An asterisk indicates significance at the 5 percent level. The regressions include average log unemployment for the region and a constant. The regression for average wage level includes the averages of the year dummies as well. [a)] The residuals are from individual regressions with the following explanatory variables: year dummies, years of schooling, experience, experience squared, seniority, gender, occupational dummies and industry dummies. For Iceland the explanatory variables are dummies for year, gender, occupation, age and industry.

Table 5. Wage curve estimates along different dimensions, coefficients for means of ln(regional unemployment)

Dimensions:	Denmark	Finland	Iceland	Norway	Sweden
Panel A:					
1. Region specific averages	-0.0571	-0.1682*	0.0144	-0.2464*	-0.0864*
(Table 4)	(0.0679)	(0.0556)	(0.0849)	(0.1009)	(0.0302)
2. Fixed region effects	-0.0011	0.0198	-0.0068	0.0011	0.0313
(Table 2)	(0.0060)	(0.0183)	(0.0087)	(0.0235)	(0.0322)
3. "Long term regional wage curve"	-0.0560	-0.1880*	0.0212	-0.2475*	-0.1177*
(1 minus 2)	(0.0682)	(0.0585)	(0.0853)	(0.1036)	(0.0441)
Panel B:					
1. Aggregate time-series estimates [a)]	-0.123*	-0.048*	n.a.	-0.138*	-0.170*
(Nymoen et al 1998)	(0.036)	(0.022)		(0.018)	(0.058)
2. Fixed region effects	-0.0011	0.0198		0.0011	0.0313
(Table 2)	(0.0060)	(0.0183)		(0.0235)	(0.0322)
3. "National wage curve"	-0.122*	-0.068*		-0.139*	-0.201*
(1 minus 2)	(0.036)	(0.028)		(0.030)	(0.066)

Notes: Standard errors in parentheses. An asterisk indicates significance at the 5 percent level. The standard errors of the differences are calculated using standard formula for independently distributed variables. [a)] The time series estimates are the long-run elasticities reported Nymoen et al (1998). The time series estimates are from observations from 1960 to 1994 for manufacturing only and includes total unemployment. Since the specifications of (1) and (2) are not identical, the elasticities reported here do not correspond exactly to the estimators discussed in the text.

Table 6. The relation between average regional wages, income, working hours, and regional unemployment, Denmark, private sector, 1980-91

Dependent variable:	Wages	Wages	Income	Income	Hours	Hours
Explanatory variables:	(1)	(2)	(3)	(4)	(5)	(6)
Lagged dependent	0.9750*	0.5191*	0.9881*	0.3668*	0.6422*	0.0201
variable	(0.0124)	(0.0641)	(0.0162)	(0.0682)	(0.0607)	(0.0710)
Log unempl. rate	-0.0003	-0.0025	-0.0019	-0.0057	-0.0076*	-0.0017
	(0.0019)	(0.0031)	(0.0019)	(0.0044)	(0.0025)	(0.0033)
Regional dummies	No	Yes	No	Yes	No	Yes
R squared	0.9752	0.9821	0.9603	0.9751	0.4963	0.7326

Notes: Standard errors in parentheses. An asterisk indicates significance at the 5 percent level. The dependent variable and the lagged dependent variable are the regional mean residuals from year-specific OLS log wage regressions. Controls include schooling, experience, experience squared, seniority, gender, occupational dummies and industry dummies. The means are calculated for 16 regions over 12 years (i.e., 176 number of observations) on the basis of 416,314 individual wage observations. The regressions are weighted by the number of employed workers in the regions, assessed from the sample of individual observations.

Table 7. Dynamic models for the Nordic countries, private sector.

Dependent variable: ln(regional wage)

	Denmark	Denmark	Denmark	Finland	Iceland	Norway
Explanatory variables:	1980-91	81,83,85	86,88,90	89,91,93	1992-96	89,91,93
Lagged dependent variable	0.9750*	0.9454*	0.9625*	0.7663*	0.7323*	0.7280*
	(0.0124)	(0.0325)	(0.0256)	(0.1227)	(0.1975)	(0.1059)
Calculated one year coefficient (sqrt. coeff)	-	0.9723*	0.9811*	0.8754*	-	0.8532*
		(0.0167)	(0.0131)	(0.0701)		(0.0621)
Log unempl. rate	-0.0003	0.0004	-0.0007	-0.0017	-0.0016	-0.0147
	(0.0019)	(0.0047)	(0.0048)	(0.0014)	(0.0412)	(0.0237)
Regional dummies	No	No	No	No	No	No
No. of observations	176	32	32	32	32	37
R squared	0.9752	0.9417	0.9652	0.3218	0.3218	0.4467

Notes: Standard errors in parentheses. An asterisk indicates significance at the 5 percent level. The dependent variable and the lagged dependent variable are the regional mean residuals from year-specific OLS log wage regressions. Controls include schooling, experience, experience squared, seniority, gender, occupational dummies and industry dummies. The regressions are weighted by the number of employed workers in the regions, assessed from the sample of individual observations. The standard error of the one-year auto-regressive coefficient to the wage rate is calculated by the delta method.

Notes:

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[i] Previous studies of the Wage Curve from the Nordic countries include Nicolaisen and Tranaes (1996) for Denmark, Parjanne (1997) and Pekkarinen (1998) for Finland, Raaum and Wulfsberg (1996), Longva and Raaum (1998), and Dyrstad and Johansen (1999) for Norway, and Östros (1990), Edin et al. (1993), and Blomskog (1997) for Sweden.

[ii] In order to keep things simple, we do not distinguish between nominal and real entities in this section.

[iii] As it can be shown that the between- and within-region variation in the data is orthogonal, the estimates of $\delta_{between}$ and δ are independent (the same applies for $\beta_{between}$ and β). This implies that the standard error of the difference between them may be calculated simply as the square root of the sum of the variances of the estimated coefficients.

[iv] The result for Norway is taken from model 4 in table 7.17, in Blanchflower and Oswald (1994). The Swedish figure is reported from Edin et al. (1993), see ibid. pp. 355-356.

[v] See the appendix for a description of the data used in this study.

[vi] The standard deviation of wages across regions in the public sector in the Nordic countries is considerably smaller than the regional dispersion in private sector wages, see the assessment in the report Albæk et al. (1999).

[vii] The alternative, a feasible GLS estimation of the variance component model, is neither attempted in Blanchflower and Oswald (1994) or in this paper.

[viii] Indeed, the correlation of regional unemployment between two selected years is quite high, ranging from 0.46 for Norway to 0.9 for Finland.

[ix] Despite the impressing number of tables in Blanchflower and Oswald (1994), this source does seemingly not contain an assessment of the magnitude of the cross-sectional variation in wages and unemployment across regions for the US. The positive correlation do, however, show up in, for example, Table 4.6, where the average unemployment rate in regions enters with a positive coefficient in a regression with yearly regional wage rates as the dependent variable and early regional unemployment rates included on the right hand side.

[x] However, Bell (1997) actually obtains a comparatively small, but significant positive cross-sectional elasticity for Britain in a regression, which also contains the average houseprices in the regions.

[xi] In this connection it might be of interest to note, that policy measures aiming at preventing depopulation of regions remote from the main economic centers in the Nordic countries have played an important role in these countries.

[xii] However, since the fixed effects regressions on individuals (Table 2) and on regions (Table 3) did not produce similar results, we are reluctant to draw any strong conclusions from these results.

[xiii] The models are not exactly identical to those discussed above, since the long-term model does not include the means of the individual variables. If the average values of the individual characteristics are correlated with both wages and unemployment, this may bias the coefficient reported.

[xiv] Note that if we used the fixed effect model from the region-cross-time specifications, we would obtain an even larger and significantly positive long-run estimate for Iceland.

[xv] It is likely that Table 7.17 in Blanchflower and Oswald (1994) contains a printing error such that the number of regional dummies for the fifth estimate should have been 19 instead of the 18, which is the number of regional dummies according to the table. This would have made the table compatible with the text, where it is also noted that "The unemployment rate is measured across 20 regions".

[xvi] For a comparison and discussions of the difference between a pooled sample and a fixed effect estimation for the US, see for example Blanchflower and Oswald (1994), p. 121-122, and for a statement about the positive long-run wage-unemployment relationship across US regions, see for example p. 181.

[xvii] Actually, it seems as though deleting regional dummies have only been applied for two other countries in order to produce the preferred estimates in Blanchflower and Oswald (1995). In the case of Austria the main effect of dropping 5 out of 8 regional dummies is an increase in the precision of the point estimate, there is only a minor change in the wage-unemployment elasticity from -0.08 to -0.09, see Blanchflower and Oswald (1994), p. 316. However, in the case of Holland, dropping 4 out of 11 dummies changes the point estimate from an insignificant -0.06 to a significant wage-unemployment elasticity on -0.17, see Blanchflower and Oswald (1994), p. 323-324.

[xviii] Our evidence is supported by the recent study by Dyrstand and Johansen (1999). They include both regional and aggregate unemployment rates in a wage equation for regional Norwegian manufacturing wages, and conclude that the effect of unemployment on wages mainly arises through central settlements rather than through wage setting at the firm level.

[xix] It should be noted, that the coefficients of the wage and hours equations do not add up to the coefficients in the income equations, which is the case in a static specification where the lagged wage level is omitted.

[xx] See the analytic results in Nickell (1981). The number of observations in the cross-sectional dimension is so small that it makes no sense to apply a GMM method in an attempt to correct the estimates for the bias.

[xxi] The specifications closest to the ones in Table 6 in the present paper, column (1) and (2), yields a coefficient to the lagged wage rate on 0.9753 without fixed regional effects and 0.7155 including the fixed regional effects, which is not far away from the Danish results.

[xxii] We do not present results when regional fixed effects are included. With the small number of years in the present table, the bias is so large that the coefficients cannot be trusted.

[xxiii] We only show the result from two different experiments from Denmark 81-85 and 86-90, but all other possible four-year combinations give very similar results with this specification.

[xxiv] The variance of the one-year lagged coefficients to the wage rate is calculated from the two-year lagged coefficients by application of the delta method. The formula is $var(\lambda) = var(\lambda^2)/4\lambda^2$, where λ is the coefficient to the wage level lagged one year.

[xxv] The standard errors are valid under the null, no first order autoregressive process, and the distance from the coefficients to one is either less than or close to two standard errors.