

IMF Working Paper

The Costs and Benefits of Various Wage Bargaining Structures: An Empirical Exploration

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Policy Development and Review Department

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Abstract

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The literature on the relationship between the unemployment rate and wage bargaining fails to separate the offsetting effects of a reduction in competition associated with centralized bargaining and the increased awareness of unemployment externalities. This paper uses OECD data to distinguish these effects. While wages have become more sensitive to changes in the unemployment rate in countries that have switched to centralized wage-bargaining arrangements, the industry wage is not particularly sensitive to internal factors (relative price and productivity shifts) in economies with centralized/industry-level bargaining arrangements. The latter effect dominates in terms of persistently high unemployment and weaker growth.

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I. INTRODUCTION

The relationship between the wage bargaining structure of an economy and its macroeconomic development has been a prominent feature of the academic literature since the aftermath of the supply shocks of the 1970s. Following the failure of standard macroeconomic models to explain the international variation in macroeconomic adjustments in response to the oil crisis, differences in institutional structures came to the fore as a potential explanatory factor. Crouch (1990) analyzed the relationship between an index of corporatism (based on the authority of the dominant union federation over its member unions) and inflation and the unemployment rate. He found a negative correlation between both variables and the corporatism index throughout the 1960-85 period, results which were supported by Bruno and Sachs (1985). However, Flanagan (2000) highlighted the difficulty in interpreting these correlations because it is not clear which elements of corporatism influence the relationship.

To address these concerns many researchers have isolated the wage-bargaining framework in each country and sought to discover whether this has any relationship to labor market outcomes. A seminal paper written by Calmfors and Driffil (1988) used the trade-off between the real wage level and employment in the union utility function and in the labor demand curve as a basis for discussing union bargaining power. They postulated an inverted U-shaped relationship between the degree of centralization in wage bargaining and the unemployment rate among advanced economies, with the transmission mechanism occurring through wage developments. This relationship can be rationalized as follows. At the firm level, the employment effects of wage increases depend on the price elasticity of demand for the firm's product. Under the assumption of a high degree of competition at this level, the employment response to a change in wages would be expected to be high. To mitigate this effect and avoid a build up in unemployment the wage would adjust rapidly to any shock. Market power is more pronounced at the industry level because close substitutes for industry-wide products are hard to find. Unions exploit this market power to secure higher wages and, in doing so, respond less aggressively to a shock to labor demand. While there are no product substitutes at the national level, centralized bargaining units often internalize unemployment and fiscal externalities through moderate wage demands. By bargaining as a group national unions incorporate into their wage bargaining strategy the understanding that their actions affect the likelihood that their own members become unemployed.

While different theoretical models give different results on whether decentralized or centralized wage bargaining structures deliver the most moderate aggregate wage outcome, there is a general consensus that both these structures are preferable to bargaining at the industry level (see Flanagan et al.). This view is supported in recent work by Cukierman and Lippi (1999, CL below) who take account of the degree of central bank independence in addition to the wage bargaining structure. A dissenting view is provided by Guzzo and Velasco (1999, GV below) who generate a model which produces a U shaped relationship between the unemployment rate and the wage bargaining system (rather than the conventional inverted U shape) implying that the preferred outcome is a small number of unions. In GV's model the elasticity of substitution between different types of labor

converges to a fixed parameter rather than becoming infinite as the number of unions becomes very large. Consequently, each union retains some monopoly power and the inability to internalize the consequences of its actions is detrimental to welfare.

Many of the empirical papers testing for the presence of a relationship between the wage bargaining structure and labor market performance have generated inconclusive results because they have not taken into account the fact that an increase in the degree of centralization generates two opposing effects on real wages and unemployment. Greater centralization reduces the substitutability between the labor of different unions and therefore the degree of competition between them, raising real wages and unemployment. On the other hand, greater centralization is associated with heightened concerns about the effects of inflation on employment and this is reflected in moderate wage demands and lower unemployment. The purpose of this paper is to distinguish empirically between the two effects. This is accomplished in two steps. First, the paper analyzes the sensitivity of aggregate wage costs to changes in the unemployment rate to determine whether coordinated wage settlements can maintain aggregate wage flexibility over the cycle (section 2). Second, the paper considers the development of wages at the 2-digit industry level to determine whether wages at this disaggregated level respond to internal (relative price movements, productivity) and/or external (aggregate) conditions (section 3). The paper finds that wages have become more sensitive to changes in the unemployment rate in countries which have adopted more centralized wage bargaining arrangements and less sensitive in countries which have switched to branch level agreements. On the disaggregated level, wages are very sensitive to internal factors in countries with decentralized wage agreements but do not respond to these factors in a number of countries with branch or centralized level bargaining.

Before examining empirically the role of different wage-bargaining systems in a number of OECD countries, we shall first describe the evolution of these systems over time. The most comprehensive study of wage bargaining frameworks was conducted by the OECD in connection with its Jobs Study. The OECD categorized the bargaining level among its economies for 1980, 1990, and 1994 (see table 1). The table indicates that wage bargaining in Canada, Japan, and the United States has remained decentralized over this period while the wage bargaining structure in the United Kingdom became more decentralized during the 1980s. Wage bargaining regimes in the Scandinavian countries have become less centralized over time, except in Norway (see appendix I for a description of the changes in the wage bargaining regimes implemented in various countries). Norway moved to a more centralized wage bargaining system in the late 1980s, associated with the income controls imposed by the government. This centralized wage determination framework was reinforced in 1992 in the Solidarity Agreement, a tripartite agreement between the government, the employees and employers. In contrast, wage determination in Sweden, Denmark, and Finland became more decentralized over this period.² Spain shifted from a centralized to a branch level wage

² The timing of the move to more decentralized bargaining in Finland appears to be 1993 (rather than before 1990 as suggested by the OECD) when, for the first time wage, negotiations were conducted entirely on the sectoral level.

bargaining structure in 1986 while Italy's experience is mixed: in 1993, when it introduced a new wage-negotiating framework, the degree of centralization decreased but the coordination of wages increased.³ Finally, wage agreements in Germany, France, and the Netherlands have remained at the industry level over the past two decades.

There is some disagreement about the exact ranking of the degree of centralization of bargaining regimes. For example, Iversen has developed an index of centralization based on a weighted average of agreements concluded on various bargaining levels over the 1973-93 period. He finds, consistent with the OECD analysis, that Norway has the most centralized wage bargaining regime over this period, followed by the other Scandinavian countries and Austria. In contrast to the OECD analysis he finds that the bargaining regime in France is decentralized. This finding, however, is consistent with the results later in this paper which indicate that industry wages in France are sensitive to relative price and productivity movements, in contrast to most other centralized/intermediate bargaining regimes.

II. WAGE BARGAINING AND THE UNEMPLOYMENT EXTERNALITY

The main focus of this section of the paper is to determine whether changes in the wage-bargaining frameworks have affected the sensitivity of real wages to changes in the unemployment rate. A number of cross-country studies have analyzed real wage behavior at the aggregate level with Layard et al.'s book on unemployment generally recognized as the reference analysis in this area of study. They found that the sensitivity of the real wage to the unemployment rate was highest in countries with fairly centralized wage bargaining systems (Norway, Sweden (until 1983), Austria, and Switzerland) although high replacement rates in some of these countries partially offset this effect. They also found a high degree of nominal wage inertia among these countries, attributable to the understanding among the social partners in these countries of the impact that nominal wage increases have on future aggregate price inflation.

More recently, the OECD (1997) conducted a test to identify whether Calmfors and Driffil's inverted U-curve relationship between the unemployment rate and the wage bargaining system had held up during the 1990s. They regressed unemployment rates, inflation, real earnings growth, and earnings inequality on dummies representing countries with the three main wage bargaining regimes: centralized, industry level, and decentralized. They found that earnings inequality was significantly lower in countries with centralized and intermediate bargaining frameworks compared to those with decentralized bargaining structures and the unemployment performance was significantly better for countries with centralized bargaining structures. However, the estimated equation could not distinguish between countries with centralized or intermediate bargaining in terms of their real wage and

³ This is not captured in the OECD presentation because it indicates no change in the nature of wage bargaining during the 1990s although it recognizes that wage negotiations became more coordinated over this period.

inflation performance and this finding led the authors to conclude that the U shaped relationship could not be supported by the data.

Up to now little attention has been given to the effects of changes in the wage bargaining structures of particular countries, many of which took place in the early 1990s. This is an issue which this paper tries to address through estimating wage equations over the 1970-98 period for the following countries: Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Norway, Spain, Sweden, United Kingdom, the United States. The basic specification for the wage relationship builds on the theoretical literature of union bargaining strategies. In many theoretical applications the wage locus results from the outcome of a Nash bargaining maximization problem of the combined utility levels of firms and unions, with the relative weights dependent on the power of the union in the bargain. To be concrete let us assume a competitive product market so that the firm maximizes the following revenue function

$$\max AP^e f(n)\varepsilon - wn$$

where A is productivity, P^e is the expected product price, $f(n)$ is the production function, ε is a random variable with mean unity, w is the firm wage and n is employment.

This results in an expression for profits based on real unit labor costs

$$\Pi = g(w / AP^e \varepsilon)$$

The Nash bargaining expression is as follows

$$\max w[(1-l)(V(w) - V_0(b, \bar{e}))^\beta [\Pi]^{1-\beta}]$$

where Π is the expected profit of the firm, l is the layoff probability, $V(w)$ is the utility gained while working, and V_0 is the utility of a laid off person, often represented as follows

$$V_0 = \bar{e}(1 - p(\bar{u})) + bp(\bar{u})$$

where $p(\bar{u})$ is the probability of being unemployed, b is the unemployment benefit, and \bar{e} is the average wage in the economy.

The expression is maximized with respect to wages and yields an expression for each firm's wage. Under the assumption that all firms are identical, each firm's wage can be aggregated up to the wage for the total economy and expressed as a function of the following variables

$$W = f(P^e, A, \bar{u}, b, \beta)$$

See Nickell and Wadhvani (1990) and Nymoen and Rodseth (1999) for examples with precise functional forms.

An important element which has been left out of the above analysis is the tax rate. The model is appropriate in an economy without taxes but once taxes are included a wedge appears between the price index relevant to employers and to employees. This wedge depends on social security and labor income taxes. While most models argue that the effects of changes in taxes on the real wage are absent in the long run, short run effects could be sizeable because of the time it takes for the real wage to adjust to these changes.

On the basis of the above theoretical considerations, this paper estimates a wage equation (inclusive of social security costs) based on log changes in the price level and productivity, changes in the ratio of social security costs to gross wages and other labor taxes to GDP, and the unemployment rate; lagged wage, price and productivity levels are included as long-run determinants.⁴ While the inclusion of both the social security and direct tax variables is appropriate given Nickell's observation (1996) that the total tax burden matters to the worker and not just the payroll tax component, the need to separate both effects is less obvious. The distinction between the two types of taxes is made in this paper to identify different effects. The lagged level variables are introduced into the equation in the spirit of error-correction specifications in which wages respond to short term deviations in the various variables and to any long-run disequilibrium between wages, prices and productivity.

The stationarity of the data is considered before discussing the precise empirical specification. Unit root tests suggest that the variables are stationary in first differences although they are not conclusive (Table 2). In particular the CPI inflation rate and the unemployment rate appear to be non stationary for most countries. However, in many empirical studies these variables are considered to be stationary so the choice was made to keep the degree of stationarity the same for all variables. Cointegration tests were conducted between the nominal wage, the price level and productivity to ascertain the existence of a long-run level relationship between these variables. These tests indicated the presence of at least one cointegrating vector for all the countries analyzed (Table 3).⁵ The coefficient estimates on the cointegrating vectors, chosen on the basis of replicating theoretically correct signs, indicate that with the exception of Belgium, all the coefficients on the CPI are extremely close to unity. This is also true of the productivity variable with the exception of Belgium, Italy and the Netherlands.

One of the main purposes of this paper is to discover whether the relationship between the real wage and the unemployment rate differs across various wage bargaining regimes. To do so we distinguish periods during which countries changed their wage bargaining regimes. On

⁴ The replacement rate is not included in the initial specification to facilitate comparisons with the earlier literature which excluded this variable because it was not available.

⁵ For Norway, a cointegrating relationship could not be identified between the nominal wage, the price level and the real level of productivity but one was found between the wage and nominal productivity.

the other hand some researchers have hypothesized that the decline in inflation during the 1990s in most countries may have reduced the sensitivity of wages to changes in the unemployment rate because of the presence of nominal rigidities. For example, survey results for the United States document a reluctance by employers to reduce nominal wages and by employees to accept such reductions. A common explanation given for such behavior is that a cut in real wages brought about by a reduction in the nominal wage (at zero inflation) is considered by a significantly larger percentage of persons to be more “unfair” than an equivalent reduction in the real wage brought about by an increase in the rate of inflation. Agell and Lundborg (1998) in a survey of Swedish manufacturing firms find that among 153 responding firms, only two had experienced money wage cuts over the 1991–97 period even though the unemployment rate had risen by over 8 percentage points over this period. Moreover, only 3 percent of firms had encountered underbidding of blue collar workers (5 percent for white collar workers) over the recent period.

To take account of these different effects two variables which interact with the unemployment rate are introduced into the analysis. One variable takes the value of unity for the period over which a new wage bargaining regime was in place, and is zero at other times (*udnr*), and the other variable is unity over the 1990-98 period for countries whose wage bargaining regimes remained unchanged (*ud90*). It would have been preferable to introduce both variables for both sets of countries but because of multicollinearity problems only one variable was included for each set of countries. In terms of interpreting the results, if a large number of countries with unchanged wage bargaining regimes experienced a reversal of the sensitivity of the wage to changes in the unemployment rate, this would suggest that the decline in inflation might be responsible for the change in the relationship between the real wage and the unemployment rate in the other countries.

Based on these observations, the following equation for wage costs was estimated for each country using three stage least squares with two lagged variable instruments for each contemporaneous independent variable. The test statistics are calculated from consistent standard errors based on White’s covariance matrix.

$$\Delta wcost = \alpha \Delta cpi + \beta \Delta cpi(-1) + \chi \Delta prod + \kappa \Delta dtax + \delta u(-1) + \gamma udnr(-1) + \nu ud90(-1) + \mu \Delta sstax + pec(-1)(1)$$

where *wcost* is the wage cost, *cpi* is the consumer price index, *prod* is labor productivity, *u* is the unemployment rate, *dtax* is the direct tax rate, *sstax* is the social security tax rate, *cc* is the error correction term, and *udnr* and *ud90* are described above (details on variable definitions are provided in Appendix II).

Turning to the estimation results, the diagnostic statistics are adequate in that the Q test statistic for the pooled regression shows no signs of serial correlation and the explanatory power of the regression is high (Table 4). Moreover, most of the variable estimates follow economic priors. Higher prices and labor productivity lead to higher wage costs and the average adjustment lag to the long run equilibrium is three years (defined as the inverse of

the average error correction coefficient). Short-run changes in direct taxes and social security taxes are significant for France and Norway—countries at the upper end of the tax wedge scale—and the change in social security taxes is also significant for Finland and Sweden.⁶ Moreover, the coefficients on the social security taxes are considerably higher than for direct taxes for Finland and Sweden suggesting that changes in these taxes have a more powerful short term effect on wages.

The error correction term is significant for all countries with the speed of adjustment varying between a half life of two years for the U.S. to seven years for Germany, Denmark and Sweden. The finding of wage inertia for Denmark and Sweden is consistent with our earlier remark about the extent to which these countries have internalized price shocks through their coordinated wage bargaining regimes. This is also true of Norway because a cointegrating vector could not be found between wages and prices.

Touching on the responsiveness of wages to movements in the unemployment rate, the effect of the unemployment rate is significantly negative for each country except for Italy, Norway, the UK and the United States. The effect is strongest for Finland, Spain and Sweden with coefficients ranging between -0.7 and -0.9 . The strong effects for these countries are consistent with the existing literature which shows that wages in Finland and Sweden were very sensitive to the unemployment rate during the 1970s and 1980s although much of this effect came from inflation bursts following devaluations. The strong cyclical sensitivity found for Spain matches the findings of Layard.

The most interesting aspect of the results is the way in which the sensitivity of real wages to movements in the unemployment rate changed following changes in the wage bargaining structure in a number of countries. In 1986 Spain switched from bargaining at the centralized level to branch level bargaining and this was followed by a similar change in the wage bargaining structure for Denmark, Sweden, and Finland at the beginning of the 1990s. This development would normally be associated with a reduction in the emphasis placed on the cyclical position of the economy in the wage bargaining rounds. This hypothesis is partially borne out in the data because the significant negative coefficient on the unemployment rate over the whole period is somewhat offset by a significant positive coefficient for Finland and Sweden following the complete switch to bargaining at the branch level. For Italy, the effect goes in the opposite direction. Since 1992 when wage indexation was abolished and increased emphasis was placed on coordinated wage agreements, the wage moderating effects of increased coordination have more than offset the likely wage push from branch level negotiations. For Norway, the wage regime has become more centralized since the late 1980s but this is not reflected in the data in an increased sensitivity to changes in the unemployment rate.

⁶ The tax variables were eliminated for all countries except Finland, France, Norway, and Sweden, because they were insignificant.

To facilitate comparisons with the earlier literature equation (1) ignored the replacement rate and active labor market programs, two variables which are often associated with movements in the real wage in theoretical models. Since these variables have now been made available they are introduced into the modified specification below.⁷ The replacement rate captures changes in the shadow wage so that an increase in the replacement rate should lead to higher wages, *ceteris paribus*. The variable measuring the importance of active labor market programs is based on estimates of expenditures on active labor market programs and is defined as:

$$(LMPX/U)/(GDP/LF)$$

where LMPX is expenditure on labor market programs, U is the number of unemployed, GDP is nominal GDP, and LF is the labor force. This variable measures expenditures on active labor market programs relative to output per labor force member and follows Nickell's (1997) suggestion.

The theoretical effects on the real wage of increases in labor market programs are ambiguous because they involve a trade off between the utility gained from entering a program relative to being unemployed (positive effect on the real wage) and the reduction in employment resulting from an expansion in labor market programs (negative effect on the real wage). Calmfors (1993) found that real wages in Sweden increased when part of the labor force shifted between open unemployment and labor market programs whereas micro studies have generally found that labor market programs do not increase wage pressures. Indeed, Rodseth and Nymoen (1999) in an update of the work of Calmfors could not find significant wage effects of labor market programs for Denmark and Finland and found that increased use of labor market programs actually reduced wage pressures in Norway and Sweden.

Before estimating a relationship which includes both variables it is necessary to revisit the issue of stationarity. Since the variable capturing active labor market programs is proxied by an expenditure ratio it is stationary by construction. The variable measuring the shadow wage is the product of the replacement rate and the wage rate and is therefore non-stationary. To determine whether a linear combination of the wage, the price level, the level of productivity, and the replacement wage is stationary, Johansen cointegration tests were conducted. The results indicated the presence of at least one cointegrating vector for all countries (Table 5) and the choice of the cointegrating vector was made on the basis of replicating theoretically

⁷ Time-series on the replacement rate across countries has recently been made available by the OECD. The measure is based on averaging the replacement rate in years 1, 2-3, and 4-5. Blanchard and Wolfers note that averaging the estimate over such a long period has drawbacks because, given the exit rate from unemployment, it is unlikely that the generosity of benefits in year 4 and 5 would play much of a role in wage formation. Estimates of expenditures on ALMPs have been published annually by the OECD since 1986.

correct signs. The coefficient estimates indicate that the price index is approximately unity in all cases but that the productivity estimate differs between 1.5 and 0.1. The replacement rate has the correct sign in all cases except for Italy and the estimates vary in a fairly narrow range between 0.1 and 0.56. Error correction terms were calculated on the basis of these estimates and the following regression was estimated:

$$\Delta wcost = \alpha \Delta cpi + \beta \Delta cpi(-1) + \chi \Delta prod + \kappa \Delta dtax + \delta u(-1) + \gamma dnr(-1) + \nu ud90(-1) + \mu \Delta sstax + \rho ec(-1) + \zeta almpex(-1)$$

All variables are defined as before with the addition of *almp*, the active labor market program variable and *uben* (the product of the replacement ratio and the real wage) in the error correction term.

With the exception of Denmark the error correction terms are significant and vary between -0.17 and -0.9 (Table 6). Finland has the highest coefficient with half of the adjustment to the long-run relationship taking place within one year in that country. The average error correction estimate is -0.3, comparable to the value in the simpler specification.

The variable measuring increased expenditure/use of active labor market programs is only included for those countries with significant coefficients (Denmark, France, Germany, Norway and the U.S.) and shown in Table 6. Expenditures on active labor market programs during the 1990s for Germany and Denmark were the highest in the sample (except for Sweden) at 1.4 percent and 1.6 percent of GDP which may account for the significant positive estimates for these countries. For all countries except France, the coefficient estimate is significantly positive so that increased expenditure on active labor market programs leads to an increase in wage costs. The coefficient estimates indicate that a doubling of the ratio of expenditures per unemployed to output per labor force member would raise wage growth in Germany and the U.S. by 1 percentage point per annum and in Denmark and Norway by ½ percentage point per annum. For France, the effect goes in the opposite direction with an increase in expenditures on active programs resulting in more moderate wages.

The inclusion of the replacement rate and expenditures on ALMPs affects the significance of some of the unemployment rate variables in the estimation. For example, the coefficient estimates for Germany and Norway over the recent period are significantly negative. The change for Germany is not consistent with the supposition that the relationship should have remained essentially unchanged in recent years since there were no major changes in the wage bargaining structure. Indeed, since reunification took place during this period, the relationship might have been expected to be positive. For Norway, the change in sign and significance is consistent with the increased emphasis placed on centralized bargaining in the late 1980s and reinforced following the Solidarity Initiative implemented by the unions, employers and the government in 1992.

In general, changes in the wage bargaining structure across countries have significant effects on the relationship between the unemployment rate and the real wage. However, as

mentioned above, the results could be driven by other factors such as the low inflation environment over the recent period. In fact, while the low inflationary environment during the 1990s should have reduced the impact of changes in the unemployment rate on wage growth, the coefficient estimate is negative for all countries whose wage bargaining regimes remained unaltered. Moreover, the real wage became significantly more sensitive to changes in the unemployment rate for Norway and Italy following changes to more centralized regimes which is opposite to what one would have hypothesized if nominal rigidities played an important role. On balance, it is fair to say that wage bargaining frameworks play an important role in influencing the sensitivity of wages to changes in the unemployment rate among OECD countries.

III. WAGE BARGAINING AND THE RESPONSIVENESS OF THE REAL WAGE TO INTERNAL AND EXTERNAL FACTORS

In Section II, we noted that centralized wage bargaining systems provided the benefit of mitigating the unemployment externality. We now turn to an evaluation of the cost of this type of bargaining framework, identified as a lack of wage flexibility. Countries with centralized wage bargaining frameworks have made a social choice to restrict the degree of wage inequality in their economies, evident in various cross-country measures of wage inequality. The cost of this decision is that the adjustment to changes in the relative demand and supply of goods generally takes place through changes in quantities rather than prices, and this adjustment can be protracted. In addition, wage compression can inhibit immigration and the incentives to acquire schooling and other forms of human capital (e.g. Edin and Topel 1997) although it can favorably affect incentives to invest in human capital on the employer side (Acemoglu and Pischke 2000).

Historically, wage differentials in Nordic countries have been much less than in the United States associated with the strong preference for coordinated wage increases in the former countries. Blau and Kahn (1996) have shown using micro data sets that wages at the 90th percentile are 5 times as high as wages in the 10th percentile in the United States but only twice as high in Norway and Sweden. In Sweden a marked reduction in overall wage dispersion and in the relative earnings of highly educated workers occurred during the 1960s, the 1970s, and the early 1980s. Moreover, although wage differentials along various dimensions have widened since the mid-1980s (Edin and Holmlund 1995), they are still small in comparison with other countries. Blau and Kahn find that most of the difference in the wage distribution across countries occurs at the lower end of the wage distribution.

A narrow wage structure often results in a narrow employment structure since unprofitable firms have to exit because they are unable to reduce their wages to reflect firm specific effects and remain profitable. Davis and Henrekson (2000) have analyzed this issue by comparing the industry distribution of employment in Sweden and the United States through time. Their basic hypothesis is that the compression of wages in a more centralized system (Sweden) has affected employment patterns. Consistent with this hypothesis, they find that centralized wage setting in Sweden shifted the industry distribution of employment away from industries with high wage dispersion among workers and from industries with a low and

high mean wage. When the wage setting process became less centralized in the mid-1980s, this process was partially reversed.

Historically, analyses of inter-industry or percentile wage distributions have generally been static, emphasizing the wage distribution at one point in time (Summers and Katz 1988). A notable exception is provided by Holmlund and Zetterberg (1991) who present a dynamic analysis of the way wages respond to sector specific shocks over the 1960–85 period. They find that 2-digit industry wages in the United States show substantial responsiveness to changes in the sector's relative price and productivity performance but only a limited relationship to the aggregate wage in the economy. In contrast, they find that wages in the Nordic countries (Sweden, Norway, Finland) have only a weak association with sectoral developments but a much stronger association with the aggregate wage. This supports the view that the wage bargaining structure is a vital element in understanding labor market developments across countries.

This section amplifies the analysis of Holmlund and Zetterberg (hereafter HL) through the use of more recent data and a broader range of countries. The theoretical underpinnings of the wage relationship are provided in HL's piece and broadly follow the model in section II above. They set up a wage bargaining framework in which the union maximizes its utility function based on the difference between the industry wage and an outside alternative, subject to the profit maximizing constraint of the firm. This leads to an industry/union wage which depends on the price deflator and productivity developments in the industry, the CPI, the unemployment rate, the replacement ratio, and the outside wage. To conserve degrees of freedom, the empirical specification is conducted in terms of the real wage in each 2-digit industry and the outside wage is measured as the aggregate wage across all industries .

It would be preferable to identify a long-run level relationship between the real wage, the relative price, productivity and the aggregate wage. However, since each country has 6 or 7 industries this would involve estimating a very large number of cointegrating vectors. Pesaran, Shin, and Smith (1999) have addressed this problem using the pooled mean group estimator in which they average short-run coefficients across cross-section units but assume that the long-run cointegrating vectors are the same across these cross-section units. This paper has chosen to isolate the analysis in terms of first differences but extending the analysis to incorporate long-term relationships would be a fruitful area of research.

The determinants of the change in the real wage are as follows:

$$\Delta rw = \alpha \Delta aggrw + \beta \Delta rdef + \delta \Delta prod + \Pi u(-1) \quad (2)$$

where rw is the wage deflated by the CPI, $rdef$ is the 2-digit industry deflator deflated by the CPI, $prod$ is labor productivity, $aggrw$ is the aggregate wage in the industrial sector, and u is the aggregate unemployment rate.

This equation was estimated for each of the following countries: France, Germany, Italy, the United Kingdom, Denmark, Sweden, Finland, Norway, Belgium, Canada, the United States, and Japan. Except for the United Kingdom, Belgium and Japan data on the following industries were used: basic metals, chemical products, food, engineering equipment, paper and pulp products, textiles, and wood products. For the United Kingdom all the above industries were used except for basic metals and for Belgium and Japan, all industries were used except for wood products. The data period extends from 1970–91/96 depending on the country in question (details are provided in Appendix 3). The equations were estimated by 3SLS with consistent standard errors based on White's adjustment. Sectoral variation was allowed for the coefficients of each of the two digit industries in a particular country with the coefficient on the unemployment rate constrained to be the same across the 2-digit industries of a particular country. To simplify the presentation the coefficient estimates on productivity growth, the relative price deflator, the aggregate wage, and the error correction term have been averaged across industries and the standard error defined as

$$\sqrt{\sum (\alpha_{ij} - \bar{\alpha}_j)^2 / (n - 1)n}$$

where α_{ij} is the coefficient estimate of industry i in country j and $\bar{\alpha}_j$ is the average estimate for country j . Coefficient estimates greater than 1.65 standard deviations have been identified with an asterisk.

Any traces of heteroscedasticity in the regression have been taken into account through White's adjustment and no autocorrelation problems exist with the exception of the Danish and German equations (Table 7). The effects on real wages of movements in internal factors (productivity and relative price changes) are generally largest and most significant for the countries with decentralized wage bargaining systems. On the other hand, the aggregate wage variables generally have the weakest impact on the real wage in these countries. Wages in all four countries with decentralized wage bargaining systems—Canada, the United States, the United Kingdom, and Japan—respond significantly to both productivity and relative price movements. This is also true for France, Denmark and Germany.⁸ Notwithstanding this fact, I have chosen to exclude the latter two countries from the group with flexible wages because the coefficient estimates on the change in productivity and on the relative price deflator are small. Moreover, although the coefficient estimates are fairly low for the United States, the coefficients were significant in 10 of the 14 sectoral cases in contrast to only 6 and 7 for Germany and Denmark, respectively. With the exception of Norway, wages in countries with the most centralized wage bargaining structures (Belgium, Finland and Norway) do not respond to internal conditions. In countries that negotiate wages at the branch or industry

⁸ The finding that internal factors are important in France is consistent with the work of Cahuc et al. who demonstrate that the bargaining power of workers in France (defined as the weight attached to the expected revenue of the worker) is low and comparable to that found for Canada.

level, wages in Italy do not respond to internal labor market conditions whereas Danish and German wages respond to both relative price and productivity shifts, and Swedish wages respond to productivity changes. While all countries respond significantly to movements in the aggregate wage, the size of the coefficient is much higher in countries with less flexible wages. Finally, most of the coefficients on the unemployment rate are significant although two of the significant coefficients have the wrong sign (Norway and Belgium).

One of the main arguments in favor of wage differentiation is that it allows wage adjustment in companies which are performing poorly and hence moderates the attrition effect. On the contrary, when workers in weak industries are paid the same wage as those in expanding industries, wage costs gradually build up and become unsustainable over time. To discover whether the lack of wage differentiation in some countries identified in Table 7 translates into the overshooting of the aggregate wage, Figure 1, panel A presents the growth in real unit labor costs over the 1970–98 period for three country categories. The three categories correspond to the degree of wage adjustment in response to sector specific variables and include countries with flexible wages (Canada, France, Japan, the UK, and the US), those with moderately flexible wages (Denmark, Germany, Norway, and Sweden), and those with rigid wages (Belgium, Finland, Italy).

The chart shows that since the early-1970s, the growth in real unit labor costs has diverged between countries with rigid wages and those with flexible and moderate wages and this divergence has remained over time. If we exclude Japan from the flexible wage category the difference between this category and the moderate wage category has become evident since the late-1980s. Indeed, by 1998 the cumulative difference between countries with rigid and flexible wages (excluding Japan) is over 16 percentage points and it is over 6 percentage points between countries with moderately rigid and flexible wages.

A corollary to this development is evident in the way labor flows have adjusted over the past quarter century. When wages are slow to respond to economic shocks, adjustment must take place through changes in employment and unemployment. To explore this possibility, unemployment rates were averaged for the three groups of countries. Up until the early 1990s the unemployment rates of the country groupings moved closely together (Figure 1, panel B). However, since then, the curves have diverged with the unemployment rates of countries with moderate and rigid wages ratcheting up during the early 1990s. Since then these unemployment rates have come down but in 1998 the differences with respect to the flexible wage category remain substantial at 2 and 4 ½ percent for the moderate and rigid wage categories, respectively.

Traditionally, while conceding that the lack of wage differentiation leads to increased aggregate unemployment, Swedish labor economists have argued that real wage restraint achieved in expanding sectors can overturn the negative output impact of a lack of wage flexibility in other sectors through strong productivity gains. This view is supported by the recent analysis of Hibbs and Locking (2000). They add a wage dispersion index to a Cobb Douglas production function of Swedish manufacturing output to test whether the increase in wage dispersion led to a decline in output. Consistent with their underlying hypothesis they

discover that over the 1972-93 period, an increase in wage dispersion between firms in different sectors contributed to a decline in output. However, the most deleterious effects of wage compression would be expected to take place in the uncompetitive sheltered sector but this sector was excluded from Hibbs and Locking's analysis. Moreover, it is unclear whether wage restraint can survive for long in the expanding sectors of the economy unless workers are truly immobile.

To broadly gauge the effect of wage compression on output, the cumulative growth in output since 1970 was compared for the three country categories identified above. Contrary to the results of Hibbs and Locking for Sweden, countries with rigid and moderately rigid wages have experienced weaker output growth than flexible wage countries over the past thirty years (Figure 2). To test statistically whether these differences are significant a regression analysis was conducted on the output growth rates for each economy to determine whether the average growth rate for the countries with flexible wages was significantly higher than the average growth rate in countries with moderately rigid wages and rigid wages. Table 8 indicates that over the 1970-98 period the average growth rate among countries with flexible wages was 2.7 percent per annum, 2.3 percent per annum in countries with moderately rigid wages, and 2.4 percent per annum in countries with rigid wages. Moreover, the output growth rates for the countries with flexible wages are significantly higher than the growth rate of output of the countries with rigid and moderately rigid wages.

Although this analysis has shown links between macroeconomic performance and the nature of the wage bargaining regime, there are many other competing factors, some of which are isolated to the labor market. For example, a number of authors have emphasized the relationship between the extent of employment protections laws in particular countries and the level of the unemployment rate. According to the OECD, employment protection laws are most strict in Italy, Germany, Portugal, Belgium and Finland, and three of these five countries have been documented in this paper to have the least flexible wages (Table 9). On the other side of the spectrum, Canada, Japan, the United Kingdom and the United States have the most liberal employment laws in addition to the most flexible wages.

IV. CONCLUSION

Since the mid-1970s there has been active debate on the pros and cons of various wage-bargaining regimes but little progress towards unanimity. It is difficult to be unequivocal on this issue because the various regimes trade off the benefits of internalizing unemployment externalities against limited sectoral and regional wage adjustment. However, while recognizing the presence of many competing factors, it appears that wage sensitivity to unemployment changes in countries with narrow wage structures is not powerful enough to offset the lack of wage flexibility across sectors and regions within a country and prevent the need for long-lasting labor adjustments. Moreover, while the extent to which output is affected in the long run by wage compression remains an open question, this paper has shown that over the past thirty years, significant output growth differences have occurred between economies with flexible wages and those with more rigid wage structures.

Table 1. Degree of Centralization of Wage Bargaining System

	1980	OECD Index		Iversen Index
		1990	1994	1973-93
Belgium	2+	2-	2+	0.338
Canada	1	1	1	0.071
Denmark	2+	2	2	0.467
Finland	2.5	2-	2+	0.445
France	2	2	2	0.114
Germany	2	2	2	0.353
Italy	-2	2	2	0.185
Japan	1	1	1	0.299
Netherlands	2	2	2	0.392
Norway	2	2-	2+	0.569
Spain	2+	2	2	-
Sweden	3	2-	2	0.485
U.K.	2	-2	1.5	0.182
U.S.	1	1	1	0.071

Sources: OECD (1997), Iversen (1999).

Notes: For the OECD data a value of 1 is assigned to the decentralized/uncoordinated system, 2 to the intermediate/branch system, and 3 to the centralized wage-bargaining system. The Iversen index varies between 0 and 1; a value close to 1 indicates a centralized bargaining regime.

Table 2. Stationarity Tests

Variables	Test Statistics	Belgium	Denmark	Finland	France	Germany	Italy	Holland	Norway	Spain	Sweden	U.K.	U.S.
ΔWCOST	W.Symmetric	*	*						*		*		
	Dickey Fuller				*					*	*		
	Phillips Perron					*							
ACPI	W. Symmetric			*									
	Dickey Fuller			*						*	*	*	*
	Phillips Perron												
APROD	W.Symmetric	*	*	*		*	*	*	*	*	*	*	*
	Dickey Fuller	*			*						*		
	Phillips Perron	*	*		*	*				*	*	*	*
ΔDTAX	W. Symmetric			*			*	*	*				*
	Dickey Fuller		*	*	*	*	*	*	*	*	*	*	*
	Phillips Perron	*	*	*	*	*	*	*	*	*	*	*	*
ASSTAX	W. Symmetric			*					*	*	*	*	
	Dickey Fuller				*				*	*	*	*	*
	Phillips Perron	*	*				*		*	*	*	*	*
U	W. Symmetric					*							*
	Dickey Fuller			*		*							*
	Phillips Perron					*							*

Table 3. Johansen Cointegration Trace Test Statistics

Country	Null Hypothesis			Coefficients on Cointegrating vector			
	$H_0:r=0$	*	$H_0:r \geq 1$	wcost	cpi	prod	
Belgium	46.3	*	7.5	1	-0.69	-1.56	
Denmark	62.3	*	7.5	1	-0.93	-1.05	
Finland	55.8	*	9.6	1	-0.98	-1.2	
France	79.6	*	18.4	*	1	-1	-1.05
Germany	45	*	10.2	1	-0.99	-0.97	
Italy	47.6	*	4.9	1	-0.91	-1.53	
Netherlands	58.7	*	13.5	1	-1.06	-0.59	
Norway 1/	50	*	12.1	1	-	-0.99	
Spain	61	*	8.2	1	-0.98	-1.29	
Sweden	47.4	*	17.5	*	1	-0.91	-1.26
United Kingdom	57.4	*	10.5	1	-1.05	-1.02	
United States	33.4	*	8.3	1	-0.87	-1.07	

Notes: * indicates significance at the 10 percent level.

1/ For Norway the cointegrating vector is between the nominal wage and productivity.

Table 4. Determinants of Nominal Wage Changes

	Δ CPI	Δ CPI(-1)	Δ PROD	U(-1)	U(-1).DNR	U(-1).D90	EC(-1)	Δ DIR TAX	Δ SS TAX
Belgium	0.38 *	0.43 *	0.51 *	-0.61 *		0.03	-0.21 *		
Denmark	0.31 *	0.27 *	0.68 *	-0.6 *	-0.05		-0.16 *		
Finland	1.06 *	-0.24 *	0.43 *	-0.94 *	0.48 *		-0.4 *	-0.03	1.2 *
France	0.89 *	0.07	0.34 *	-0.44 *		-0.03	-0.35 *	0.64 *	0.33 *
Germany	0.6 *	-0.09	0.69 *	-0.49 *		-0.1	-0.14 *		
Italy	0.87 *	0.06	0.45 *	0.05	-0.44 *		-0.38 *		
Netherlands	0.49 *	0.2	0.25	-0.65 *		-0.27 *	-0.26 *		
Norway	0.99 *	-0.36	-0.07	-0.79	0.35		-0.31 *	0.59 *	0.6 *
Spain	0.76 *	0.006	0.66 *	-0.69 *	0.04		-0.41 *		
Sweden	0.69 *	-0.29 *	-0.16	-0.69 *	0.31 *		-0.16 *	0.33	1.2 *
United Kingdom	1.34 *	0.39	0.02	0.36		0.04	-0.53 *		
United States	0.7 *	-0.07	0.77 *	-0.14		-0.15 *	-0.65 *		
Diagnostic Statistics									
R squared	0.92								
Q stat(1)	0.48								

Table 5. Johansen Cointegration Trace Test Statistics

	Null Hypothesis			Coefficients on Cointegrating vector					
	H0:r=0	H0:r<=1	H0:r<=2	wcost	cpi	prod	uben		
Belgium	66.4	*	19.3	1	-0.73	-1.49	-0.2		
Denmark	90.1	*	34.2	*	8.2	1	-0.95	-0.43	-0.25
Finland	52.9	*	20.2	1	-1.05	-0.51	-0.31		
France	53.1	*	31.7	*	16	1	-0.69	-0.88	-0.54
Germany	48.9	*	18.5	1	-1.16	-0.36	-0.56		
Italy	62.7	*	20.9	1	-1.02	-1.08	0.002		
Netherlands	69.1	*	23.4	1	-1.2	-0.13	-0.1		
Norway 1/	50.6	*	30	*	14.7	1	-	-0.8	-0.05
Spain	70.6	*	30.8	*	10.2	1	-1.26	-0.65	-0.14
Sweden	45.2	*	23.1	1	-0.88	-0.75	-0.24		
United Kingdom	67.8	*	23.4	1	-0.97	-1.2	-0.33		
United States	47.3	*	15.3	1	-0.82	-1.09	-0.11		

Notes: *indicates significance at the 10 percent level.

1/ For Norway the cointegrating vector is between the nominal wage, productivity, and the nominal reservation wage.

Table 6. Determinants of Nominal Wage Changes with Replacement Rate and ALMP Variables Added

	Δ CPI	Δ CPI(-1)	Δ PROD	U(-1)	U(-1).DNR	U(-1) D90	EC(-1)	Δ DIR TAX	ASS TAX	ALMP/EX
Belgium	0.33 *	0.51	0.44 *	-0.61 *		-0.005	-0.25 *			
Denmark	0.32 *	0.35	0.66 *	-0.64 *	-0.04		-0.1			0.004 *
Finland	1.45 *	0.41	0.31 *	-0.37 *	0.22 *		-0.9 *	0.61 *	0.54 *	
France	1.03 *	-0.28 *	0.04	-0.47 *		-0.01	-0.25 *	0.57 *	0.42 *	-0.008 *
Germany	-0.17	-0.03	0.89 *	-1.67 *		-0.19 *	-0.64 *			0.008 *
Italy	0.84 *	-0.22	0.3 *	-0.95 *	-0.22 *		-0.59 *			
Netherlands	0.47 *	0.36 *	0.27	-0.54 *		-0.16 *	-0.26 *			
Norway	0.83 *	-0.19	-0.21	0.006 *	-0.3 *		-0.22 *	0.43 *	1.03 *	0.006 *
Spain	0.54 *	-0.03	0.53 *	-0.44 *	-0.05		-0.17 *			
Sweden	0.4 *	-0.23 *	-0.27	-0.7 *	0.36 *		-0.19 *	0.28	0.98 *	
United Kingdom	1.03 *	0.09	-0.1	0.07		-0.01	-0.23 *			
United States	0.56 *	0.09	0.65 *	-0.001		-0.06	-0.36 *			0.01 *
Diagnostic Statistics										
R squared	0.92									
Q stat(1)	1.63									

Table 7. Coefficient Estimates of Industry Wage Equations

	Variables			U(-1)	Diagnostic Statistics	
	Δ PROD	Δ RDEF	Δ AGGRW		R Squared	Q Stat (1)
Countries with flexible wages						
Canada	0.55 *	0.15 *	0.67 *	-0.23 *	0.67	0.9
United States	0.10 *	0.09 *	0.81 *	0.06	0.75	1.2
United Kingdom	0.39 *	0.27*	0.59 *	-0.16 *	0.59	0.1
Japan	0.25 *	0.19 *	0.63 *	-0.24	0.6	0.8
France	0.26 *	0.28 *	0.68 *	-0.11 *	0.5	3.2
Coefficient average	0.31	0.19	0.68	-0.14		
Countries with moderately flexible wages						
Denmark	0.09 *	0.10 *	0.93 *	-0.01	0.78	16.2 **
Germany	0.10 *	0.08 *	0.77 *	-0.03	0.75	21.8 **
Norway	0.07 *	0.03	0.89 *	0.09 *	0.72	0.3
Sweden	0.10 *	0.04	0.95 *	-0.14 *	0.67	1.3
Coefficient average	0.09	0.06	0.89	-0.02		
Countries with rigid wages						
Finland	0.07	0.02	0.91 *	-0.05 *	0.67	4.5
Italy	0.05	0.05	0.80 *	-0.08	0.62	3.6
Belgium	0.09	-0.01	0.94 *	0.11 *	0.68	1.1
Coefficient average	0.07	0.02	0.88	-0.01		

Notes:

* indicates coefficients which are greater than 1.65 standard deviations.

** indicates significance at the 10 percent level.

Table 8. Average Output Growth Estimates for Countries
with Varying Degrees of Wage Flexibility

β_{rig}	0.024 *
β_{mrig}	0.023 *
β_{flex}	0.027 *
Ho: $\beta_{rig}=\beta_{mrig}=\beta_{flex}$	
Chi-squared(2)= 4.64	*
Ho: $\beta_{rig}=\beta_{mrig}$	
Chi-squared(1)= 1.35	

Notes: * indicates significance at the 10 percent level.

Table 9. Ranking of Strictness of Employment-Protection Laws 1/

	Ranking for Strictness of Protection Against Dismissals	Ranking for Strictness of Fixed-Term Contracts	Average of Both Rankings
Belgium	5	16	10.5
Canada	1.7
Denmark	4	2.5	3.25
Finland	9.5	11.5	10.5
France	6	13	9.5
Germany	9.5	14.5	12
Italy	14	14.5	14.25
Japan	3.7
Netherlands	7	7.5	7.25
Norway	8	11.5	9.75
Spain	15	7.5	11.25
Sweden	11	6	8.5
United Kingdom	2	2.5	2.25
United States	0.4
Not in sample			
Greece	12	10	11
Ireland	3	2.5	2.75
Portugal	16	9	12.5
Austria	13	5	9
Switzerland	1	2.5	1.75

Source: OECD Jobs Study.

1/ Figures for Canada, the U.S., and Japan are estimates based on regression analysis.

Figure 1. Labor Market Developments

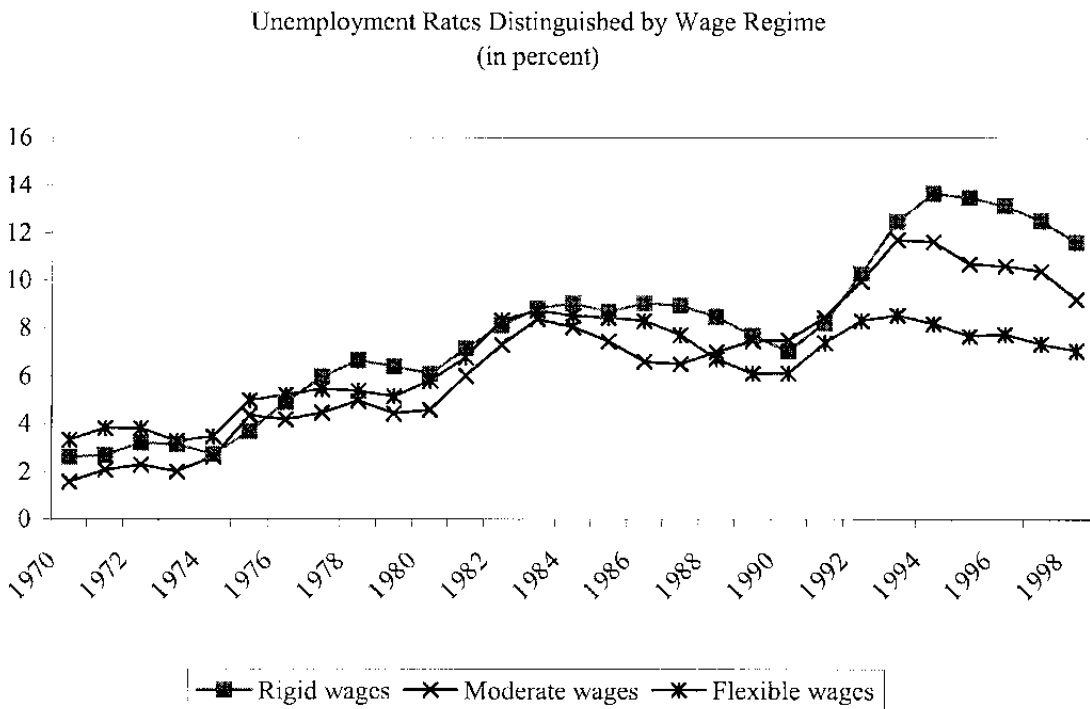
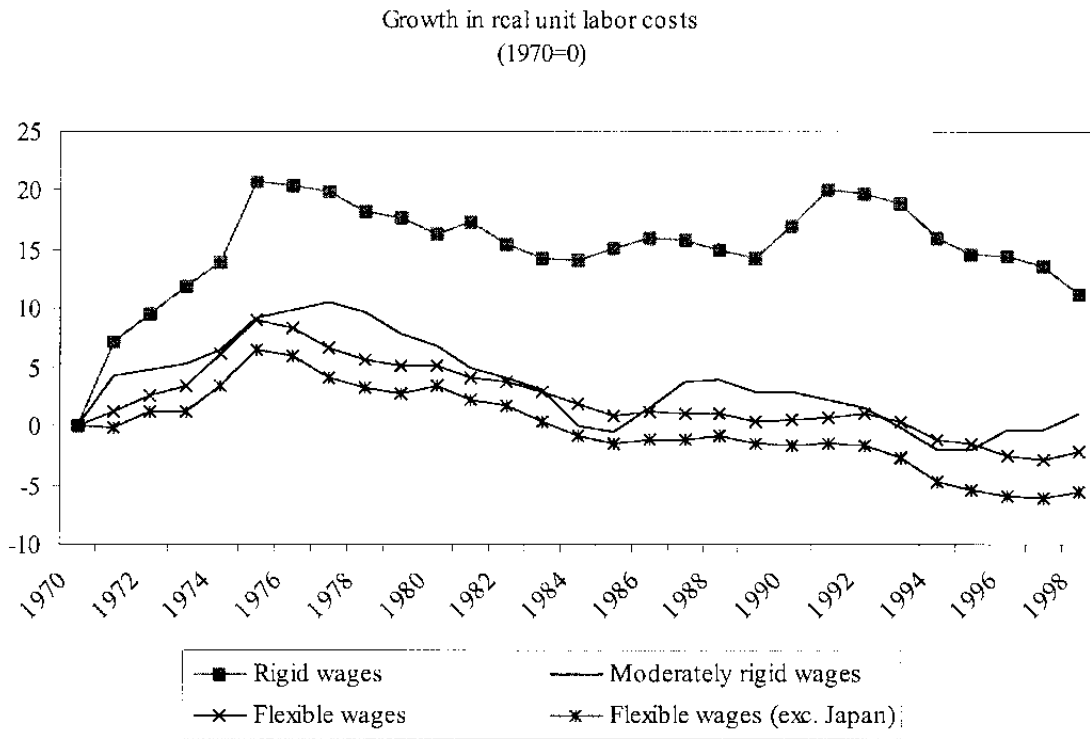
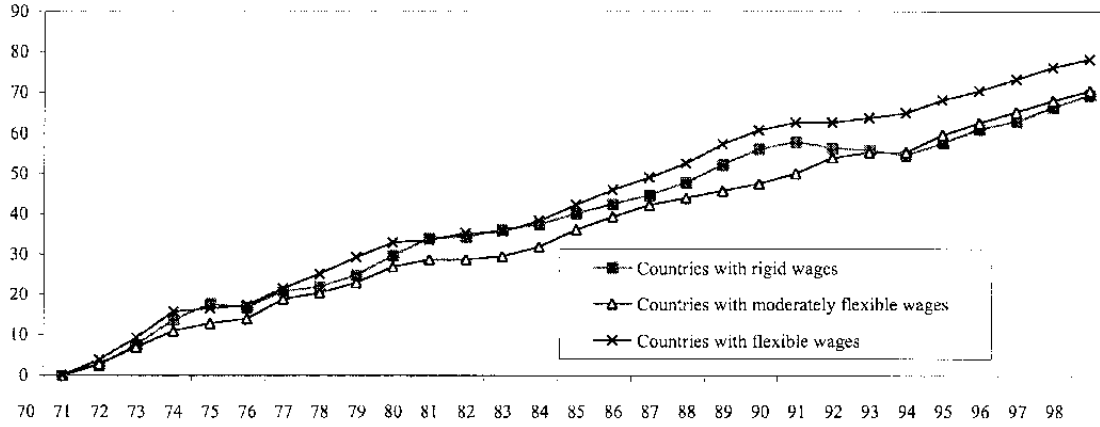


Figure 2. Cumulative Real Output Change
(in percent of the level in 1970)



The Timing of Changes in the Nature of Wage Bargaining

Denmark

In common with the other Nordic countries, wage determination has been fairly centralized in Denmark. However, during the 1990s, wage negotiations at an intermediate level have become much more prevalent. Whereas in 1989, about 50 percent of wage agreements were conducted centrally, this figure declined to only 15 percent in 1996.

Finland

Wage negotiations take place at three levels in Finland: nationwide framework agreements, legally binding agreements made at the branch level, and collective agreements at the plant level. While the nationwide agreements are not binding at the branch level, a majority of the branches have followed the general wage guidelines. This was especially true during periods of high inflation because indexation clauses in the branch/collective agreements were only legal if they adhered to the national agreements. Over the recent low-inflation period this concern has diminished. Indeed, in 1993, in an effort to promote wage decentralization, wage negotiations were conducted entirely on the sectoral level and in 1994/95 there was no national agreement although in 1996/97 wage bargaining became more coordinated with the coverage of the national agreement fairly high.

Italy

In 1993 Italy introduced a new wage-negotiating framework which formalized a two-level wage bargaining structure with the second level of bargaining taking place at the individual enterprise level and applicable to all firms (under the previous system only large firms were able to benefit from a second level of bargaining). In addition, it abolished its wage indexation regime (*scala mobile*) with the result that national contracts began placing increased emphasis on economic developments at the aggregate level.

Norway

Centralized wage bargaining has played a prominent role in the Norwegian economy since 1935. However, during the high inflation environment of the 1970s and 1980s the strategy of containing wage pressures broke down. In response, the unions, the employers, and the government got together during the early 1990s to ensure the effectiveness of the incomes policy framework. This led in 1992 to the implementation of an incomes policy (part of a tripartite economic framework) which targets lower wage growth in Norway than among its trading partners.

Spain

Between 1978 and 1986 national agreements played an important role in wage determination. Since the elimination of these centralized agreements in 1986 bargaining has taken place at

the branch level with additional regional and firm level negotiations. Bargaining takes place according to a cascading system in which the outcome of agreements at the broader levels are accepted as minimum standards for the lower levels. Although the labor market reform of 1994 made it possible for firms to opt out of these agreements, this option has seldom been exercised.

Sweden

Centralized wage bargaining began in 1938 and remained intact until 1983 when the engineering industry broke away from the central agreement arguing that centralized wage contracts were not taking adequate account of conditions prevailing in specific industries. During the late 1980s a variety of bargaining systems were tried which led to the abandonment of centralized wage bargaining by the employers federation in 1990. Since, then negotiations have been carried out at the sectoral level between the employers' associations and trade unions of the various branches.

Variable Definitions

Wcost: wages and social contributions divided by total employment

CPI: consumer price index

Prod: real GDP divided by total employment

Dtax: direct tax revenues divided by nominal GDP

Sstax: social security contributions divided by the sum of social contributions and wages

U: standardized unemployment rate

Uben: the replacement rate multiplied by the wage. The replacement rate is the average of 18 gross replacement rates based on three household types (single, dependent spouse and spouse in work); three time periods (the first year, the second and third years, and the fourth and fifth years of unemployment); and two earnings levels (average and two thirds of this level).

Almpex: expenditure on labor market programs per unemployed relative to nominal GDP per workforce member. The labor market programs include the cost of public employment services and administration, labor market training, youth measures, subsidized employment, and measures for the disabled.

Sample Periods for Different Country Estimates

	Industry Data
Belgium	1972 93
Denmark	1972 93
Canada	1972 93
Finland	1972 96
France	1972 92
Germany	1972 93
Italy	1982 95
Japan	1972 96
Norway	1972 91
Sweden	1972 93
United Kingdom	1972 93
United States	1972 96

Note: For the aggregate data analysis, the sample period is 1975 98 for all countries.

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