DISCUSSION PAPER SERIES

No. 1706

WAGES AND THE BARGAINING REGIME IN A CORPORATIST SETTING: THE NETHERLANDS

Joop Hartog, Edwin Leuven and Coen Teulings

HUMAN RESOURCES

CE PR

C re for Economic Policy Research

WAGES AND THE BARGAINING REGIME IN A CORPORATIST SETTING: THE NETHERLANDS

Joop Hartog, Edwin Leuven and Coen Teulings

This Discussion Paper is issued under the auspices of the Centre's research programme in **Human Resources**. Any opinions expressed here are those of the authors and not those of the Centre for Economic Policy Research. Research disseminated by CEPR may include views on policy, but the Centre itself takes no institutional policy positions.

The Centre for Economic Policy Research was established in 1983 as a private educational charity, to promote independent analysis and public discussion of open economies and the relations among them. It is pluralist and non-partisan, bringing economic research to bear on the analysis of medium- and long-run policy questions. Institutional (core) finance for the Centre has been provided through major grants from the Economic and Social Research Council, under which an ESRC Resource Centre operates within CEPR; the Esmée Fairbairn Charitable Trust; and the Bank of England. These organizations do not give prior review to the Centre's publications, nor do they necessarily endorse the views expressed therein.

These Discussion Papers often represent preliminary or incomplete work, circulated to encourage discussion and comment. Citation and use of such a paper should take account of its provisional character.

ABSTRACT

Wages and the Bargaining Regime in a Corporatist Setting: The Netherlands*

In a corporatist country like the Netherlands, wages should not be distinguished by union membership status, but by bargaining regime. Acknowledging only the firms' bargaining regime, we find small differences between four regimes and certainly no distinction between 'covered' and 'uncovered' firms. Distinguishing – within covered firms – between workers covered and uncovered by collective bargaining, including a model with partially unobserved sector selection, we find somewhat larger bargaining regime effects, and sometimes substantial coverage effects. Estimation of the latter, is seriously troubled by unobserved heterogeneity, however.

Joop Hartog
FEE-MICRO
University of Amsterdam
Roetersstraat 11
1018 WB Amsterdam
THE NETHERLANDS
Tel: (31 20) 525 4298
Fax: (31 20) 525 4254
Email: hartog@butler.fee.uva.nl

Edwin Leuven and Coen Teulings
Department of Economics
University of Amsterdam
Roetersstraat 11
1018 WB Amsterdam
THE NETHERLANDS
Tel: (31 20) 525 5241/4252
Fax: (31 20) 525 4310/4254
Email: leuven@fee.uva.nl
coen@fee.uva.nl

NON-TECHNICAL SUMMARY

In European labour markets the distinction of wages between union members and non-members has no meaning. In these markets bargaining is not restricted to the company level and agreed wages are not confined to union members, but equally apply to other workers in other firms. In these countries, to assess the effect of differences in labour market institutional settings, one should differentiate the sample according to the bargaining regimes. In this paper we do just that for the Netherlands. Wages can be set by firms without any collective bargaining (which applies to 28% of workers), they can be set in company-level bargaining (13% of workers), in industry-level bargaining (48%), or they can be set by the mandatory extension of an industry agreement (11%). An industry-level agreement can be extended by the Minister of Social Affairs to firms not represented at the bargaining table.

We analyse over 23,000 observations on individual wages in the private sector, taken from company records. To assess the effect of the bargaining regime, we control for experience, education, gender, hours worked and firm size. Relative to industry-level bargaining, company-level bargaining generates 0.5% higher wages. Under mandatory extension, wages are 3.8% lower, and without collective bargaining, wages are 4.1% lower. Such small differences between bargaining regimes fit in with a relation that is emerging from international research: the more centralized (or corporatist) the bargaining, the smaller the differences. Differences in the Netherlands are much smaller than differences between the union and the non-union sector in decentralized countries such as Canada and the United States (easily 10–20%) and also smaller than differences between bargaining regimes in the United Kingdom (estimated at 8–10%).

In terms of wage structure, there is no abyss between the covered and the uncovered sector. The exception is the gender gap: coverage by collective bargaining reduces the gap between men and women's wages from 14% to 10%. If one regime stands out, it is the company bargaining regime, with highest returns to education, the highest reward for additional hours and the highest wage increase for increasing firm sizes.

The results as stated apply to average workers in a firm in any of the regimes. Not all workers in a firm are covered by a collective agreement, however, even if the firm itself is covered. Top management is always excluded from the collective agreement. Unfortunately, there is no simple rule for determining the upper boundary of a collective agreement. Although the exclusion refers to the

highest wage levels, there is no explicit cut-off salary level. Often, the exclusion is in terms of functional positions and this may vary across firms. There are also exclusions at the bottom end of the pay scale, although these are even less explicitly related to a particular level of the wage rate. Collective agreements often do not cover workers with a less permanent or less secure position in the firm. Such 'marginal workers' (temporary workers, part-timers) usually have a low wage rate. Thus individual non-coverage in a covered firm can have two faces: top-level management and low-paid 'weak-attachment' workers. While we know whether an individual worker is covered or not, we do not know whether a non-covered worker is at the high end or at the low end of the wage distribution. We must apply a specific econometric technique to acknowledge this, and inevitably this adds some uncertainty to the conclusions.

We make a more refined estimate of the pure effect of the bargaining regime by only considering wages for workers actually covered by the agreement that binds the firm. The pure effect of the bargaining regime is then a wage spread of about 12%. This materializes from wages in the mandatory extension sector of some 12% below those under company bargaining. Industry bargaining generates about the same wage level as company bargaining and so does the no-bargaining regime.

The pure effect of individual coverage by collective bargaining is to be found as the difference between wages for covered and for non-covered workers, within the bargaining regime applying to the firm. Generally, coverage reduces wages, but this merely seems to signify that non-covered workers hold mostly senior management positions. Only for the industry bargaining regime have we been able to disentangle high- and low-wage non-coverage. There, we find that non-covered workers in the weak attachment sector would gain 17% from obtaining coverage, while senior management workers would loose 12%.

The wage effect of the bargaining regime is an important issue for the efficient allocation of labour. Standard competitive theory tells us that labour of a given quality should earn the same wage rate everywhere, to ensure that employment decisions are properly coordinated through the market. An institutionally boosted wage may lead to underemployment in that market segment. While our initial results suggested small overall wage differentials by international standards, the more refined estimates suggested that for specific sub-groups the effects may be substantial.

1 INTRODUCTION

In European labour markets, the distinction of wages between union members and non-members has no meaning. In these markets, bargaining is not restricted to company level, and the agreed wages are not confined to union members, but equally apply to other workers in other firms. There is no simple dichotomy, and individual union membership is not a distinguishing feature. To understand wage variation, one should not differentiate according to union membership, but according to the bargaining regimes as relevant in the particular institutional setting. In this paper we will do just that for the Netherlands. With respect to the coverage of firms by collective bargaining, we will distinguish between the regimes of company bargaining, industry bargaining, mandatory extension and no collective bargaining. Within firms, we will distinguish between workers who are covered and workers who are not covered by the collective agreement that covers the firm.

The proper differentiation of wages follows from the institutional structure of bargaining in the nation's labour market.[2] In the United States, where a union can win the exclusive right to represent the firm's workers in an election, bargaining regime and union status virtually coincide: in 1988, 16% of the workers belonged to a union and 20% were covered by a collective agreement. In continental Europe, union involvement in collective bargaining is not directly dependent on (or followed by) union membership, and collective agreements are often extended by law or custom to firms not represented in the original bargaining process. Industry level bargaining (or sometimes even national bargaining) leaves the door wide open for free-ridership. For example, in Germany (in 1988) 35% of the workers belonged to a union but 90% were covered by a collective labour agreement. The situation in the Netherlands is quite similar: 25% union membership, 72% covered by collective bargaining.[3]

While there is a large literature on the union wage mark-up in the United States[4], and a smaller literature for the similar institutional setting of Canada[5], not much is known about wage differentials by bargaining regime in Europe. Blanchflower and Freeman (1992) report on wage differentials between union members and non-members in Austria and Germany, but it is not clear what this means, because membership status cuts right across bargaining regimes[6]. Barth, Naylor and Raaum (1994) study wage differentials in Norway between firms covered only by national bargaining and firms with additional local bargaining. Dell'Aringa and Lucifora (1993) also analysed the effect of firm level bargaining on top of national bargaining, for Italy, but they focussed on wage dispersion rather than wage levels. For the United Kingdom, there is an excellent study by Mark Stewart that acknowledges the rich variety in bargaining structures, including closed shop arrangements, multiple union recognition by employers, various levels at which bargaining can take place and interaction between all these features (Stewart, 1987).

Our contribution is in line with the growing awareness of the relevance of institutional arrangements for the outcomes in the labour market (Bruno and Sachs, 1985; Calmfors and Driffill,

---

[2] Detailed information on institutional arrangements for collective bargaining for twelve OECD countries, is given in Hartog and Theeuwes (1993).

[3] The data are from Flanagan, Hartog and Theeuwes (1993).

[4] See e.g the survey in Pencavel (1991).

[5] See Robinson and Tomes (1984).

[6] Van den Berg (1995, p 124) reports that wage differentials between union members and non-members in the Netherlands are negligible. Applying the Lee (1978) model with endogenous switching produced bizarre and incredible results.

1988). The Dutch case is a good example of a European corporatist labour market, and in fact our paper relates to a larger comparative analysis on the effect of corporatism (Teulings and Hartog, 1997). We start, in the next section, with a characterization of the Dutch institutional setting. After introducing our dataset, we will then present our estimates of wage equations that properly reflect the institutional environment. We will first follow the distinction between covered and uncovered firms and then distinguish between covered and uncovered workers within covered firms. We then conclude on the wage effects of the different types of coverage and relate our results to the international literature.

2 THE DUTCH INSTITUTIONAL SETTING

The Dutch institutional setting is governed by two key laws on collective agreements. The 1927 Law on the Collective Agreement makes such an agreement binding for all workers in the firm, not just members of the union signing the agreement. Formally, it is possible to negotiate in the agreement that contract terms only apply to union members, but if so, this cannot be exclusively for a particular union: they should apply to members of any union. The 1937 Law on Mandatory Extension states that if a collective agreement covers a substantial majority of the industry, the Minister of Social Affairs can extend the agreement to the entire industry. By now, a substantial majority means 55 per cent of the workers employed by employers that are directly bound by the agreement. To get extension, at least one party that signed an agreement must send a request to the Ministry of Social Affairs. The Ministry checks some formal criteria and publishes the request to allow other parties to raise objections against extension. Formally, the Ministry is obliged to ask the Wage Committee of the Foundation of Labour (see below) for advice. In practice, advice is only asked when objections are raised. After receiving the advice, the Ministry comes to a decision on the request. The maximum duration of an extension is two years. The Foundation of Labour is a private institution with trade union and employer federations as its members. In this organisation, bargaining parties meet and consult each other, give joint recommendations to their members regarding wage restraint, training, and additional employment policies. Sometimes a Central Agreement has been negotiated in the Foundation of Labour.

The system of mandatory extension enables contracting partners to extend contracts in a large number of industries. Only in retail trade and wholesale, there are so many firms and their size is so small that it is difficult to satisfy the requirement of substantial majority of the workers to be bound directly. Instead, joint public bodies (PBO's) of employers and trade unions have been installed by law in most of these branches. Negotiations on industry agreements take place within these bodies, which then have the legal right to extend the agreements to the whole industry without interference of the Ministry. These agreements are called *rulings*. The character of rulings differs from usual industry contracts in the sense that they are really imposed upon the firms in the branch, as most firms are too small to affect the outcome.

By now, only 24 per cent of the workers is member of a union. Most unions belong to one of three federations that are member of the Foundation of Labour. Formally, the legal basis of labour relations allows free entry of new unions. Anyone can start a union and ask for negotiations with an employer. The employer is free to honor this request or to ignore it. He may choose to negotiate with one union and not with another, or he may use different channels, like works councils. There are no formal representation rules, no compulsory elections, no rules on bargaining or bargaining structures. Due to the law of 1927, when an employer signs a contract with a single union, this contract automatically applies to all its employees. Other unions then are simply left out of the bargain. This happens infrequently, but when employers demand concessions in harsh times, it sometimes occurs that one union agrees, and that the others can only follow suit,

their protests not withstanding.

On the employers side, there are two federations at the central level which are now in the process of merging into a single federation. Membership consists both of firms and of lower level employer organisations, often organised by industry. These lower level organisations are involved in the actual bargaining. Their involvement depends on the situation: industry organisations bargain directly with unions (e.g. metal, banking), but one organisation mainly provides support for employers who conduct the negotiations themselves.

This institutional setting yields four relevant bargaining regimes in the private sector. First, a company can negotiate its own collective agreement with one or more unions, second, a company can be part of an industry agreement, third, it can be roped in by an extension of an industry agreement, and finally, a firm can be uncovered by any collective bargaining. Whenever there is a collective contract in the firm, this does not necessarily imply that all employees are covered. Top level management is always excluded from the collective agreement. Furthermore, other categories of workers may be excluded. Mostly, these are low-paid workers with a more or less secondary employment position with the firm (e.g. temporary workers). In our estimates below, we refer to these workers as weak attachment workers. The formal rules for exclusion are not clear and we have no good information on exclusion practices.

Table 1 Employees bound by Collective Labour Agreements (CLA's) in 1990

	(Millions)	%
CLA or Extension		
Extended industry agreements		
- directly covered	2.1	46
- by extension	0.5	11
Industry Agreement	0.1	2
Firm Agreement	0.6	13
Subtotal	3.3	72
Not bound by a CLA	1.3	28
Total Private- and subsidized sector	4.6	100

Source: Ministry of Social Affairs and Employment (1991), Table 2.2, page 14.

Table 1 gives an overview of the coverage situation in 1990 (the joint effect of firm and individual coverage). Most collective agreements are industry agreements, although the share of company agreements has been rising. In 1990, 82 per cent of the covered workers were covered by an industry agreement, and 18 per cent by a company agreement. In 1975, the latter share was still 14.6 per cent. In practice, all industry contracts are extended. Only a very small number of workers is covered by non-extended industry contract. Casual evidence suggests that this is mainly because either every firm in the industry joins the contract 'voluntarily' or because requesting extension has some disadvantage for the signing parties.[7] It should be noted that an industry contract does not always cover an 'industry' as defined in the standard industry classification that

---

[7]For example, the agreement may include a pension system that does not suit the firm.

is used for statistical purposes. An industry may indeed have a wide coverage, but it may also be restricted to a sector within an industry. Some care should be taken when interpreting the difference between 'mandatory extension' and 'industry agreement', as many extended agreements are classified in the latter category. Formally, the criterion for classification in both categories is whether the firm that is covered by the extended agreement is member of the relevant employer organisation. We are not sure that this is done properly in all cases. For example, nearly all firms in the construction industry are categorized as having an 'industry agreement', while extension is certainly relevant there. The main group of firms in the category mandatory extension/ruling are those covered by the rulings in retail trade.

Most authors that developed rankings of national labour market structures put the Dutch labour market on the high end of corporatism.[8] In an influential contribution on labour market performance and bargaining level, Calmfors and Driffill (1988) opt for an intermediate position. This is understandable as industry level bargaining, in between company and national level bargaining, is dominant. They ignore, however, the high degree of co-ordination between bargaining strategies developed in the federations of unions and employers. They furthermore ignore the formal and informal interaction at the national level between unions, employers and the government. Considering the strongly developed system of co-ordination, we think of the Netherlands as a highly corporatist country. While the organisational structure of the labour market is open at the bottom, it is rather closed at the top. Established unions have a clear advantage over new unions that might attempt to enter because the former have, through their affiliation with federations, access to the Foundation of Labour.

3 THE DATA

The Dutch data we use are supplied by a government agency that monitors wage policies and the implementation of collective agreements. The data are taken from private sector company records, guaranteeing a high degree of precision of measurements, because of the accounting basis and because definitions are not disturbed by communication errors. Our dependent variable is the gross hourly wage, excluding compensation for overtime, shift work and working conditions (in many wage systems, specially for blue-collar work, there is explicit compensation for 'inconveniences', such as hazards, dirt, smoke, etc.). The most serious shortcoming of the dataset is the omission of tenure. All we know is whether a worker was hired recently, as an 'entrant', or has been with the firm for a longer period. Otherwise, it is a dataset of excellent quality. The observations refer to the year 1991. The dataset allows us to classify firms by the four relevant bargaining regimes: (i) industry agreement, (ii) company agreement, (iii) mandatory extension/ruling, and, (iv) no collective agreement. We will use the term mandatory extension throughout this paper, but one should be aware of the high share of rulings in this category.

---

[8]Corporatism is defined as an institutional structure where organised interests (labour, employers) deal with each other and with the government, and where these organised interests have an important influence on the preparation and implementation of economic policies. Corporatism tends to be associated with centralisation of bargaining: collective bargaining at industry or even national level. Federations of unions and employer associations encompass large segments of the economy, and labour relations tend to be co-operative rather than antagonistic. Country rankings by corporatism are discussed in Teulings and Hartog (1997).

Table 2 Descriptive statistics by bargaining regime: means (standard deviations)

	Industry	Firm	Extension	No CLA	All
Experience (years)	18.60	19.67	16.67	16.20	18.01
	(11.09)	(10.36)	(11.46)	(10.90)	(11.09)
Education (years)	2.11	3.72	1.91	3.44	2.47
	(2.16)	(3.11)	(2.00)	(2.75)	(2.43)
Female (proportion)	0.33	0.20	0.45	0.38	0.34
Entrant (proportion)	0.19	0.17	0.20	0.19	0.19
Ln hours worked	3.48	3.63	3.41	3.54	3.49
	(0.49)	(0.26)	(0.56)	(0.42)	(0.48)
ln Firm size	4.05	5.78	3.06	3.48	3.95
	(1.40)	(1.16)	(1.52)	(1.37)	(1.49)
ln Wage	2.98	3.25	2.80	3.04	3.00
	(0.37)	(0.46)	(0.47)	(0.42)	(0.40)
Workers covered, %	0.95	0.84	0.31	0	0.70
N	15489	1175	1519	5006	23189

The data are characterized in Table 2. If we rank bargaining regimes by average values, the company bargaining regime consistently reaches extreme positions. It has the highest average wage, the highest potential experience (age minus schooling years minus six), education (measured in years beyond basic education), weekly hours worked and firm size (number of employees), and the lowest proportion women and entrants. Industry bargaining ranks in the middle for all these variables. The no-bargaining regime does not markedly stand apart in terms of the variables that we have available here. The data seem to suggest that the no-bargaining regime contains rather new industries, where workers have high education and relatively low experience, but since firm regime and individual coverage are lumped together, we have to be cautious in drawing such conclusions. Given the bargaining regime of the employer, the proportion of individuals actually covered by a collective agreement is highest under industry bargaining (95 per cent) and lowest for mandatory extension (31 per cent); the company bargaining regime is intermediate, with 84 per cent of the employees actually covered.

Table 3 Summary measures of the wage distributions (log wages)

		N	St.Dev.	Percentile Differential 50-10	Percentile Differential 90-50	Percentile Differential 90-10
All workers		23189	0.400	0.390	0.506	0.896
Industry agreement	All	15489	0.368	0.344	0.429	0.773
	Covered	14667	0.346	0.333	0.378	0.711
	Non-covered	822	0.522	0.655	0.642	1.297
Firm agreement	All	1175	0.461	0.358	0.774	1.131
	Covered	982	0.382	0.303	0.583	0.887
	Non-covered	193	0.438	0.477	0.606	1.083
Mandatory extension	All	1519	0.468	0.608	0.519	1.127
	Covered	475	0.416	0.586	0.541	1.127
	Non-covered	1044	0.483	0.611	0.491	1.103
No collective agreement		5006	0.421	0.428	0.608	1.036

Table 3 characterizes the wage distributions in the different bargaining regimes in our dataset. The standard deviation of earnings is highest in the mandatory extension and firm agreement regime. As expected, the earnings distribution seems to be most compressed in the industry agreement. Coverage compresses the wage distribution in all regimes. The effect of coverage seems to be especially relevant for the bottom of the wage distribution and its impact seems to be smallest in the mandatory extension regime where the 50-10 gap is already high. Among uncovered workers in firms covered by industry agreement, the 50-10 and 90-50 gap are both larger than in the other regimes, sometimes considerably. This probably reflects the presence of both high-level primary employment workers and low-wage secondary employment workers. Of the covered sectors, the industry agreement displays the lowest wage dispersion, mostly because of compression at the bottom. Mandatory extension is an a-typical regime in that coverage does not seem to have a big impact. Finally, the no-bargaining regime does not stand out as the sector with the highest wage variability as one might perhaps have anticipated from the emphasis of collective bargaining on uniform pay structures.

These preliminary results give a somewhat mixed picture of the different bargaining regimes. The firm agreement seems to stand apart from the other regimes, and the no-bargaining regime is at first sight relatively similar to the mandatory extension regime. The industry bargaining regime seems to be the more typical 'union' regime with relatively compressed wages. The results in table 3 do not take measured characteristics of the individuals into account and in the next section we will take a closer look at the differences in the prices of labour market skills in the different regimes.

4 ESTIMATION RESULTS

Like with union wage differentials, estimation of the effect of the bargaining regime will be hindered by the problem of selection bias. Those workers that are covered by a particular regime can be expected to be a non-random sample from total employment. The selectivity problem also applies to firms. The firms in a particular bargaining regime can be expected to be a non-random sample from the pool of firms. Hence, when wages in a particular regime are above average, this

..ue either to the selection of high quality workers into this regime, or to the presence of
.cts', or to the regime paying above market clearing wages. Every judgement will be
..il as long as no independent variables to control for the endogeneity of the bargaining
re available. However, the selectivity can be reduced with our data by not taking
: coverage but firm coverage as the point of reference. One of the main sources of
bias is high skilled workers not being covered, thereby underestimating the union
.l (Robinson, 1986). By defining coverage at firm level we evade the within-firm
/ problem. We get back to this problem in Section 4.2.

.onal source that will introduce a bias in our estimation is industry wage differentials.
.ence is widely documented. We do not favour one or the other explanation here, but we
it is improper to attribute all industry differentials to union activity. Hence, in section
il include industry dummies in our regressions. Taking this idea further, we will analyze
.of the bargaining regime within a single industry. We use wholesale, because that is the
.try where extended industry agreements and the no contract regime exist next to each
· we expect path dependence to be the main explanation for this mutual existence.
we are aware that this is just a partial answer to the selectivity problem, we consider
.ification not to worry too much about it in this section.

, 4.2, we shall concentrate on the within-firm effect of coverage. We will assume that the
..ce of selectivity is introduced through the individual. There are some means for at least
.ontrolling for this type of bias.[9] We will estimate switching regression models to
.iis. As noted above, most collective agreements have a ceiling. The wages of staff
.io are classified above this ceiling are not stipulated by the collective agreement. Hence,
. y switching regression would yield biased estimates of the effect of coverage. There, we
..ide the problem of selection bias. We shall postulate an explicit model of selection and
.odel to distinguish covered and uncovered workers in covered firms.

; Firm Effects: the effect of the bargaining regime

·he search for the effect of the bargaining regime with an individual wage equation that
re intercepts for the firm's bargaining regime, to estimate the average, standardized
.he wage level. The wage equation contains standard human capital variables like
experience, education and gender. The dependent variable is the log hourly gross wage
.xperience we use a third-degree polynomial, following the claim made by Murphy and
..)0) that the standard human capital specification with only a second-degree polynomial
..ite. Results are given in table 4.

.:ercepts in column (a) indicate, the differences in wage level between the bargaining
re no larger than 5 per cent. The hypothesis that the industry and firm agreement yield
.vage rate cannot be rejected at standard levels of statistical significance. The same holds
.ndatory extension and the no-agreement regime. The bargaining regime effect may well
.it for small firms and for big firms. Conversely, the well documented effect of firm size
.may vary by bargaining regime. In column (b) where we have separated the firm size
.argaining regime, we have also separated the standard errors'of estimate by regime.
.itory extension regime is the most heterogeneous, with a residual dispersion that is 30
..igher than in the industry bargaining regime.

_____

.onson (1989) for the discussion on the consistency of the different estimation methods that have been used

.union wage differentials.

Figure 1 Wages, Contract Regime and Firmsize
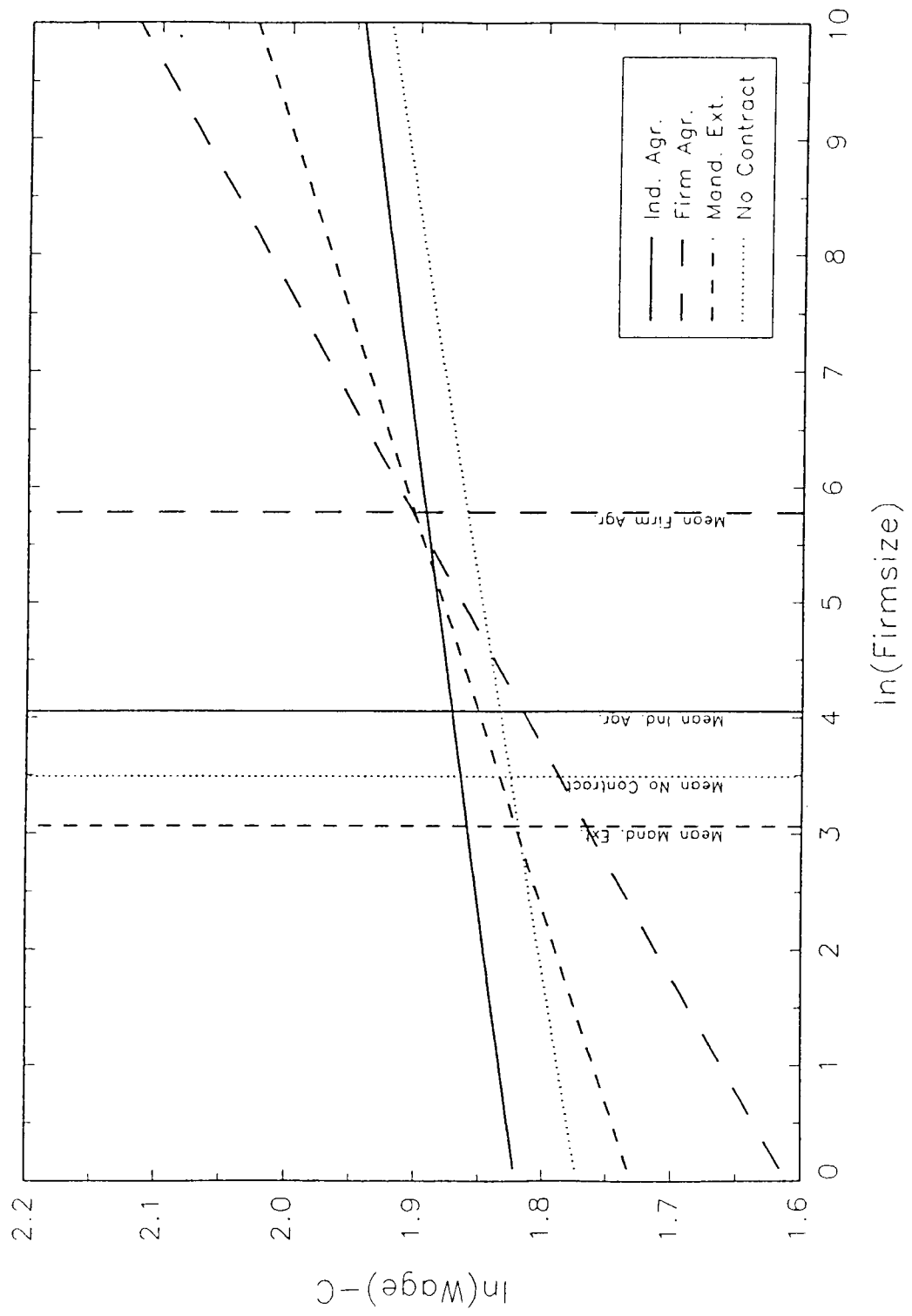
Table 4 The effect of the bargaining regime

	(a)	(b)
Experience/10	0.806 (0.010)	0.806 (0.010)
Experience**2/100	-2.561 (0.048)	-2.560 (0.047)
Experience**3/10000	2.574 (0.067)	2.574 (0.067)
Education (years)	0.095 (0.0007)	0.094 (0.0007)
Female	-0.110 (0.004)	-0.110 (0.004)
Entrant	-0.065 (0.004)	-0.065 (0.004)
Ln Hours	0.105 (0.003)	0.105 (0.003)
Intercept	1.805 (0.017)	1.822 (0.017)
Compared to Industry Agreement:		
Firm Agreement	0.005 (0.008)	-0.247 (0.033)
Mandatory Extension	-0.038 (0.006)	-0.090 (0.014)
No CLA	-0.041 (0.005)	-0.068 (0.011)
Ln firm size:	0.015 (0.001)	
Industry Agreement		0.010 (0.001)
Firm Agreement		0.055 (0.006)
Mandatory Extension		0.026 (0.004)
No CLA		0.017 (0.002)
R^2	0.712	0.713
S.E.E.	0.215	0.214
S.E.E. by regime:		
Industry Agreement		0.200
Firm Agreement		0.227
Mandatory Extension		0.267
No CLA		0.233
N	23189	23189

Note: Standard errors in parentheses. Including 30 industry dummies.

Figure 1 shows the effect of firm size for the different bargaining regimes. The curves for the three types of collective agreements cross at a firm size just over 300 employees. For all firm

sizes larger than the average size in the company bargaining regime (380 employees), the company bargaining regime generates the highest wages. At the mean firm size for firms under company agreement, the company agreement has the highest wages (in tied position with mandatory extension). At the mean firm size for firms under industry bargaining, industry bargaining leads to the highest wages. Mandatory extension and no-agreement firms, evaluated at their mean firm sizes, occupy intermediary positions for their wage levels. The firm size elasticity differs·markedly between·bargaining regimes. The survey of results in Brown and Medoff (1989) points to an elasticity of establishment size in the United States of about 0.03. In Teulings and Hartog (1997, Chapter 1) we report that the firm size elasticity in Canada, the United States and the United Kingdom is around .04 to .05, while in the Northern and continental European countries it is much smaller, at about .01 to .02. Here, we see that the effect is relatively strong if the firm has its own collective bargaining and that the effect is relatively weak in the case of an industry agreement, which by nature leaves less scope for variation by firm characteristics.

Table 5 presents wage regressions for each company bargaining regime separately. Clearly, the simple model of Table 4, column a), where the bargaining regime enters only by the intercept, is rejected. The introduction of separate firm size effects for each regime (Table 4, column b) yields a likelihood ratio test statistic of 75.6 (3 degrees of freedom). On top of that, in the same table, allowing for different variances of the error term for each regime improves the log-likelihood further, yielding a test statistic of 386.4 (3 degrees of freedom). The test statistic for the final step from the latter model to the separate regression in Table 5 is 655.6 (78 degrees of freedom). Needless to say, all steps are highly significant improvements of the model.

Table 5 Wage equations by bargaining regime

	Industry	Firm	Extension	None
Intercept	1.827 (0.019)	1.410 (0.123)	1.555 (0.102)	1.764 (0.044)
Experience/10	0.818 (0.012)	0.697 (0.064)	1.003 (0.042)	0.721 (0.022)
Experience**2/1000	-2.693 (0.057)	-2.189 (0.312)	-3.272 (0.196)	-2.038 (0.101)
Experience**3/100000	2.810 (0.080)	2.353 (0.457)	3.269 (0.268)	1.786 (0.138)
Education (years)	0.092 (0.0008)	0.115 (0.002)	0.094 (0.004)	0.092 (0.001)
Female	-0.098 (0.004)	-0.096 (0.017)	-0.102 (0.016)	-0.141 (0.008)
Entrant	-0.060 (0.004)	-0.044 (0.017)	-0.084 (0.018)	-0.078 (0.009)
ln Hours	0.107 (0.004)	0.191 (0.030)	0.096 (0.013)	0.092 (0.009)
ln Firm size	0.011 (0.001)	0.031 (0.007)	0.019 (0.005)	0.017 (0.003)
R^2	0.705	0.794	0.706	0.700
S.E.E.	0.200	0.209	0.254	0.231
N	15489	1175	1519	5006
Nr. of industry dummies	30	13	22	22

Note: Standard errors in parentheses.

Plotting the wage experience profiles (not reproduced here) shows that the profiles are more or less parallel. There is no marked effect of collective bargaining per se on the slope of the wage-experience profile. The returns to education are remarkably similar across regimes. The company bargaining regime generates a 2 per cent higher return for each year of schooling than the other bargaining regimes, where they are just over 9 per cent. The gender gap is also rather insensitive to the bargaining regime, provided there is a collective agreement. Collective bargaining itself reduces the gender gap by almost a third. With respect to entrants, there is a demarcation between industry/company and extension/none. However, we cannot read very much in these figures, as they will also depend on the tenure distribution in a bargaining regime: given the positive effect of tenure on wages, the entrants' disadvantage will be larger, the more the tenure distribution leans towards long tenures (actually, from this argument one would expect exactly the reverse from what is found above, as one would expect longer average tenure in the company and industry bargaining regimes). The hours effect stands out in the company agreement, just as the education effect. The firm size elasticities differ only marginally from those found in Table 4.

The comparison of the wage equations thus suggests several conclusions. The wage structure in the uncovered sector does not come out as obviously and markedly different from the bargaining sector. The only outstanding effect is the gender gap. The regime that really stands apart is company bargaining where we find the largest differences in coefficients compared to the other regimes. In other words, the company bargaining regime stands more apart from the remaining regimes than the no- bargaining regime.

The results in Table 5 allow for bargaining regime effects that differ across workers. But as Table 2 indicates, average worker characteristics are not strongly different between bargaining regimes. The big difference is in firm sizes. So, to get an adequate impression of the wage differences we predict the wage in each of the regimes for a reference worker for the average firm size in each regime, as well as for the overall average firm size: Table 6.

Table 6 Predicted wages for a typical worker*, by firm size:

	bargaining regime:	industry	firm	extension	none
Ln firm size					
4.05	("industry"-mean)	3.2389	3.1734	3.1378	3.1259
5.78	("firm"-mean)	3.2579	3.2270	3.1707	3.1553
3.06	("extension"-mean)	3.2280	3.1427	3.1190	3.1091
3.48	("none"-mean)	3.2326	3.1557	3.1270	3.1162
3.95	(overall-mean)	3.2378	3.1703	3.1359	3.1242

* man, 18 years of experience, education 2.5 years, Ln working hours 3.5

Comparing the predicted wages at the average firm size of a bargaining regime (i.e. the entries at the main diagonal), we note a 10% wage differential between industry and firm bargaining on the one hand, and mandatory extension/no bargaining on the other hand. Mandatory extension and no-bargaining yield the same wage levels at each firm size. A typical uncovered firm would only pay substantially higher wages if it became covered by industry bargaining. Similarly, a typical extension firm would also only pay substantially higher wages under industry bargaining. For the mean firm sizes considered here, we find that the industry bargaining regime generates the highest wage rates. This appears to support the claim by Calmfors and Driffill (1988) that industry level bargaining provides the best opportunities to shift the burden of higher wages to outsiders, and hence, provides the weakest check on demanding high wages. However, we should not forget that for large firms, firm level bargaining leads to the highest wages among the bargaining regimes (see Figure 1).

Considering dispersion, we observe that the residual variance is largest under mandatory extension and in the no-bargaining sector. Unions do appear to reduce wage inequality. Note that before standardization this was not the case: wage dispersion was larger in the company bargaining regime, it was smaller in the no-bargaining regime. Note, finally, that the correlation coefficient is higher in the bargaining regimes than in the no-bargaining sector, as might be expected from unions' emphasis on measurable variables rather than discretionary management decisions.

Table 7 The wage equation in wholesale

Experience/10	0.817	(0.036)
Experience**2/1000	-2.483	(0.177)
Experience**3/100000	2.505	(0.255)
Education (years)	0.099	(0.002)
Female	-0.111	(0.011)
Entrant	-0.082	(0.012)
Ln hours	0.144	(0.016)
Ln firm size	0.021	(0.003)
Intercept	1.530	(0.065)
Compared to No CLA:		
Industry Agreement	0.015	(0.009)
Firm Agreement	-0.025	(0.044)
Mandatory Extension	0.041	(0.017)
R^2	0.645	
S.E.E.	0.227	
N	2960	

Note: Standard errors in parentheses.

The wholesale trade industry is an exceptional case, because it is the only sector in which a no-contract regime exists next to industry agreements, and this allows us to analyze the effect of collective bargaining directly. The results are given in Table 7. The effect of the bargaining regime is very modest. An industry agreement yields 1.5 per cent higher wages, mandatory extension now leads to the highest wages, 4 per cent above the uncovered sector. However, this sector is very small, as most extended contracts are classified as 'industry agreements'. For company agreements, the number of observations is too small to allow reliable judgement.

Our data allow us to identify individuals working at the same firm. This feature makes it possible to decompose the error term in a firm specific component and an individual component. Table 8 presents figures for three subgroups: all workers together, workers in wholesale covered by mandatory extension and workers in wholesale in the no-contract regime. From these last two lines we conclude that mandatory extension reduces the intra-industry- between-firm dispersion of log wages substantially. Industry bargaining with mandatory extension seems therefore to act indeed as equalization device for the bargaining position of workers in different firms.

We conclude that in terms of the wage level, there is no difference between the uncovered sector and the mandatory extension regime. Industry level bargaining yields about 10% higher wages. In the firm bargaining regime, the firm size elasticity is comparatively large. For modest firm size, firm level bargaining would yield wages below industry level bargaining, but for large firms (above 900 workers), firm level bargaining generates the highest wages.

Table 8 Decomposition of residual variance in individual and firm effects

	Total	Firm	Individual
All workers	0.1908	0.0707	0.1772
Wholesale:			
Industry agreement	0.2080	0.0704	0.1957
No CLA	0.2226	0.0996	0.1991

The residual wage dispersion under company bargaining is equal to that under industry bargaining and it is not highest in the uncovered sector but in the mandatory extension sector. In terms of wage structure, there is no abyss between the covered and the uncovered sector. Only the gender gap seems to be standing apart. If one regime stands out, it is the company bargaining regime, with highest returns to education, the smallest dip for entrants, the highest reward for additional hours and the highest wage elasticity of firm size.

4.2 Within Firm Effects: the effect of individual coverage

In our analysis so far, we have studied the wage structure for the different bargaining regimes of the firm, ignoring whether the individual is covered or not. But not all workers in a firm are covered by a collective agreement even if the firm itself is covered. Top management is always excluded. Also, there are exclusions at the bottom end of the pay scale. Unfortunately, there is no simple rule for determining the upper or lower boundary of a collective agreement. At neither end is there an explicit cut-off salary level. Often, the exclusion is in terms of functional positions and this may vary across firms. Collective agreements often do not cover workers with a less permanent or less secure position in the firm. Such 'marginal workers' (temporary workers, part-timers) usually have a low wage rate. Thus, individual non-coverage in a covered firm can have two faces: top-level management and low-paid 'weak-attachment' workers. We will now distinguish between workers who are actually individually covered by the collective agreement and workers who are not, for each of the three regimes of firm coverage. For workers in firms covered by an industry agreement we will later add a further distinction among uncovered workers, by applying an extension of the Dickens and Lang (1985) model for unobserved sector selection.[10]

In Table 9, we have collected the results of switching regression wage equations.[11] Let's first consider the effect of the firm's bargaining regime by only looking at covered workers in the firms covered by some form of collective bargaining. We note that the mandatory extension regime has the highest absolute slope of the experience profile.[12] This may be explained from the steep minimum youth wage: in the extension sector, many young workers find employment. The company bargaining regime has smaller absolute slope than the industry bargaining regime.

---

[10]Application of this model to the other firm bargaining regimes was not satisfactory; see below.

[11]See the appendix for a description of the ordinary switching regression model; regressions in this section do not include industry dummies.

[12]We refer to the absolute slope, because it changes from positive to negative for high levels of experience. Thus, a smaller absolute slope implies a profile that is flatter throughout.

absolute slope than the industry bargaining regime. Uncovered firms offer an experience profile that is close to the one found for industry bargaining. The uniformity in the return to education, the high wage penalty for women in the industry agreement regime, and the high impact on wages of hours worked in the firm agreement regime are the most noticable outcomes. Apart from that, differences between covered workers seem to be relatively small across the bargaining regimes.

Before considering wages for uncovered workers in covered firms, let's look at the selection equations. Individual coverage is not significantly affected by experience. Higher education reduces the probability of being covered; this refers to non-coverage of high level management functions. Working more hours increases the probability of coverage, a reference to non-coverage of part-time workers. Women are more likely to be covered under company bargaining and extension, but under industry bargaining there is no difference with men. This might be related to job (level) segregation. The positive effect under company bargaining and extension would then signal that women are less likely to attain an uncovered high level management job. In the industry bargaining sector, this effect may be annihilated by the existence of a more substantial "weak attachment segment" (see below): women are more likely to belong to the group of marginal workers. The firm size effect also varies by the bargaining regime for the firm. Firm size is irrelevant for individual coverage in the company bargaining regime, has a negative effect under industry bargaining and a positive effect in the extension sector.

The wage equations for uncovered workers are more difficult to compare than those for covered workers. Non-coverage seems to increase differences; the coefficients are almost all larger in absolute values as compared to those of the covered workers in the same bargaining regime. The most apparent difference relates to the gender gap which amounts to more than 20 per cent in both the non-covered industry- and firm-agreement regime.

In the industry agreement, non-coverage not only means a large gender gap, it also exhibits the highest return to education with more than 15 per cent. This may be the result of the simultaneous presence of high-management and secondary workers in this group. There is no entrant penalty in the firm agreement sector, although it should be noted that we only have a small number of observations. The non-covered experience profiles are characterized by the fact that (apart from the mandatory extension regime) they do not flatten after some age but continue to rise.

As one might have anticipated, in firms covered by bargaining the residual wage dispersion is larger for the uncovered workers than for the covered workers: bargaining serves to set uniform standards for wage determination. The residual correlations between wages and selection differ between the firm bargaining regimes. Under company bargaining, the unobservables for wages and selection are uncorrelated. Under industry bargaining we find that unobservables that increase the probability of non-coverage increase the wages of uncovered workers, suggesting that the unobservables differentiate with respect to high level management functions. In the mandatory extension segment, unobservables that increase the probability of non-coverage reduce both covered and uncovered wages: unobservables in the selection equation pick out workers with poorer opportunities in both segments.

As can be seen from comparison of the results in Table 9 with OLS estimates reported in the Appendix, accounting for endogenous selection has no effect on the wage equation under company bargaining. This is in line with the independence of the error structure under that regime. Under industry bargaining, the covered wage equation is unaffected, but for uncovered workers, endogenous selection generates an estimated rate of return to education of 15% instead of 9%. Also, the firm size elasticity doubles. In the extension sector, we find that endogenous selection

Table 9 Ordinary (endogeneous) switching regression equations

	Industry			Company			Extension			No CLA
	Wc	Wnc	Selection	Wc	Wnc	Selection	Wc	Wnc	Selection	W
Constant	1.700 (.017)	.486 (.162)	2.319 (.178)	1.226 (.088)	1.855 (.389)	2.298 (.411)	1.0205 (.122)	1.497 (.079)	-1.554 (.309)	1.783 (.036)
Experience/10	.839 (.013)	.741 (.080)	-.065 (.130)	.672 (.062)	.568 (.205)	-.119 (.509)	1.200 (.087)	.950 (.059)	-.279 (.263)	.722 (.022)
Experience**2/1000	-2.786 (.061)	-1.925 (.354)	-.081 (.581)	-2.253 (.302)	-1.566 (1.014)	-.608 (2.518)	-4.621 (.480)	-2.986 (.275)	1.811 (1.435)	-2.049 (.103)
Experience**3/100000	2.930 (.086)	1.801 (.456)	-.339 (.766)	2.525 (.441)	1.640 (1.513)	.879 (3.719)	5.295 (.766)	2.859 (.368)	-3.900 (2.248)	1.806 (.140)
Education	.087 (.001)	.154 (.008)	-.187 (.007)	.099 (.003)	.104 (.026)	-.227 (.018)	.093 (.006)	.095 (.005)	-.044 (.019)	.094 (.001)
Female	-.130 (.004)	-.217 (.029)	-.021 (.043)	-.038 (.016)	-.265 (.125)	.724 (.176)	-.020 (.031)	-.077 (.024)	.607 (.077)	-.144 (.008)
Entrant	-.057 (.005)	-.076 (.034)	.004 (.052)	-.065 (.017)	.0003 (.051)	-.055 (.147)	-.082 (.030)	-.103 (.026)	-.136 (.094)	-.079 (.009)
ln Hours	.131 (.004)	.119 (.024)	.152 (.039)	.244 (.023)	--	--	.118 (.024)	.143 (.019)	.184 (.074)	.098 (.009)
ln Firmsize	.007 (.001)	.079 (.010)	-.107 (.013)	.030 (.005)	.117 (.020)	.016 (.046)	.046 (.008)	.034 (.007)	.143 (.023)	.020 (.003)
Std dev	.203 (.002)	.476 (.067)		.189 (.009)	.245 (.035)		.286 (.022)	.323 (.012)		.235
Correlation	-.022 (.071)	.865 (.032)		-.144 (.134)	-.115 (.591)		-.848 (.051)	-.603 (.080)		
N	14667	822		982	193		475	1044		5006
Mean Log-L	-.019355			-.134790			-.651306			

Note: Standard errors in parentheses. Wc, Wnc: wage for covered, non-covered workers
[a] There is no variation in the hours worked for the 193 non-covered individuals; the variable hours is therefore excluded from the selection equation and the non-covered wage equation.

16

has a large effect on the estimated gender gap: it is strongly reduced.

As noted before, the group of non-covered workers is expected to consist of two subgroups. We know explicitly whether a worker is covered or not by the collective agreement of the firm, but if not covered, we don't know whether s/he is in the top-level management segment or in the weak-attachment segment. We can allow for this distinction by using a model with unobserved sector selection as first developed by Dickens and Lang (1985) for a dual labor market. An observation is assigned to the sector where the wage fits best to the sector wage structure. Our extension is that we combine observed and unobserved sector selection. To be specific, we will estimate the following model. The wage equations for regime 1 (non-covered, senior management), regime 2 (non-covered, weak attachment), and regime 3 (covered), are:

$$\ln w_{1i} = X_i \beta_1 + u_{1i}$$
$$\ln w_{2i} = X_i \beta_2 + u_{2i}$$
$$\ln w_{3i} = X_i \beta_3 + u_{3i}$$

Subscript i refers to the individual and the subscripts 1,2,3 indicate three sectors of individual coverage (we only use observations for employees in firms that are directly covered by an industry agreement). We have two selection equations

$$I_{1i} = Z_i \gamma_1 - \varepsilon_{1i}$$
$$I_{2i} = Z_i \gamma_2 - \varepsilon_{2i}$$

and regime assignment as

$$I_{1i} > I_{2i} \text{ and } I_{1i} > 0 \quad \text{Non-covered: senior management}$$
$$I_{2i} > I_{1i} \text{ and } I_{2i} > 0 \quad \text{Non-covered: weak-attachement}$$
$$I_{1i} < 0 \text{ and } I_{2i} < 0 \quad \text{Covered}$$

We assume the error terms to have a joint normal distribution, with expectation zero and variance-covariance structure for the vector
$(u_1, u_2, u_3, \varepsilon_1, \varepsilon_2)$:

$$
\Omega =
\begin{array}{cccccc}
\sigma_1^2 & * & * & \sigma_{14} & \sigma_{15} \\
\cdot & \sigma_2^2 & * & \sigma_{24} & \sigma_{25} \\
\cdot & \cdot & \sigma_3^2 & \sigma_{34} & \sigma_{35} \\
\cdot & \cdot & \cdot & 1 & \rho \\
\cdot & \cdot & \cdot & \cdot & 1
\end{array}
$$

Unit variance for the selection equation errors is an inevitable normalization in this type of model. We restricted the covariance matrix in the following way: $\sigma_{15} = \sigma_{24} = \rho = 0$. In an earlier specification we did not impose any restrictions, but the estimation routine failed to converge. In hindsight this is understandable from the almost perfect sector selection we obtain within the uncovered segment: there are hardly any observations for wich the attribution to either the weak attachment or the senior segment is uncertain. The (maximum likelihood) estimates are given in Table 10.

The differentiation among the uncovered workers appears a relevant extension of the model, as can be judged from the log likelihood in this model as compared with that in Table 9. If we

predict sector selection within the uncovered segment, we obtain a very sharp distinction between senior management and weak attachment assignment. For many individuals, we either predict a very high probability for the weak attachment sector or a very low probability. This is a powerful argument in favor of the model. The Dickens and Lang model is often viewed rather skeptically. However, in our case we simply *know* that the distinction is real, even though we cannot observe it in our data. And the estimation results yield a very sharp distinction between the segments. This effective differentiation is characteristic for the industry bargaining regime. If we apply the same model to the other two regimes, we get very unsatisfactory results (the maximization routine does not converge to a solution and there is little gain in the Log likelihood). Under company bargaining, the selection equation in Table 9 decisively points to non-coverage for top level positions. Education increases non-coverage, gender increases it: the top is reserved for highly educated men. In the extension sector there is probably too much heterogeneity for a simple dichotomy among non-covered workers. The education effect is weaker, there is an effect of firm size as well, and the non-covered segment contains the large majority of the workers, rather than a small minority (Table 2).

The selection equations in Table 10 indicate the inclination to end up in the uncovered weak-attachment or the senior management segment, relative to the covered segment. Experience appears to have an insignificant effect on sector selection. High education strongly favours uncovered senior management positions. Women have a hard time getting to senior management positions, and are strongly pushed towards the weak-attachment segment. New entrants are not significantly selected into one or the other segment. Firm size significantly increases non-coverage, as seems plausible on both ends of the pay-scale: large firms have more openings on both ends. Long hours are associated with senior management, short hours with weak attachment. These are perfectly plausible results.

The wage equations point to some interesting differences. Education gets the highest rewards in the senior management segment and the lowest in the weak attachment segment, which is not surprising. Working more hours raises the hourly wage, and mostly so for uncovered senior management. Firm size increases wages in all segments, but not significantly so for the uncovered weak-attachment workers. The strong size effect for senior management could probably have been anticipated. For covered workers the effect is even smaller than the average effect for the industry agreement regime that was found in table 3. New entrants earn less than workers who have been with the firm for longer than a year, with the effect being largest for weak-attachment uncovered workers. The results for women contain a real surprise. Women earn less than comparable men, even if covered by an agreement: the gap is 13 per cent. Uncovered women in the senior management segment earn even 27 per cent less. But uncovered women in the weak-attachment segment experience no significant earnings differential with comparable men. This means that the data do not show discrimation in the weak-attachment segment. However, it is also conceivable that in this segment women are discriminated as much as men: probably many immigrants have a job in this segment. Unfortunately, we have no information on country of birth or family background.

The wage experience profiles are presented in Figure 2. Taking the profile for the covered workers for reference, uncovered weak-attachment workers have a fairly similar profile, with slightly widening wage gap at experiences beyond 40 years. Truly different is the profile for the senior management segment: uninterrupted wage growth with experience. Judging experience profiles by the (absolute) value of the slope, we find a rather unexpected result. The highest value applies to the weak attachment sector under industry bargaining. This may very well be a consequence of the rather steep profile included in the legal minimum youth wage: the first two regimes have relatively large shares of employees under age 23.

18

If we compare the simple switching regression with the unobserved sector selection model, we see that the wage equation for the covered workers is unaffected. For uncovered workers, the wage equation in the simple switching has coefficients that are a weighted average of those estimated for the two unobserved sectors. The weight is about .9 for the senior management coefficients excepts for the coefficient on entrants (.4) and on firm size (.15).

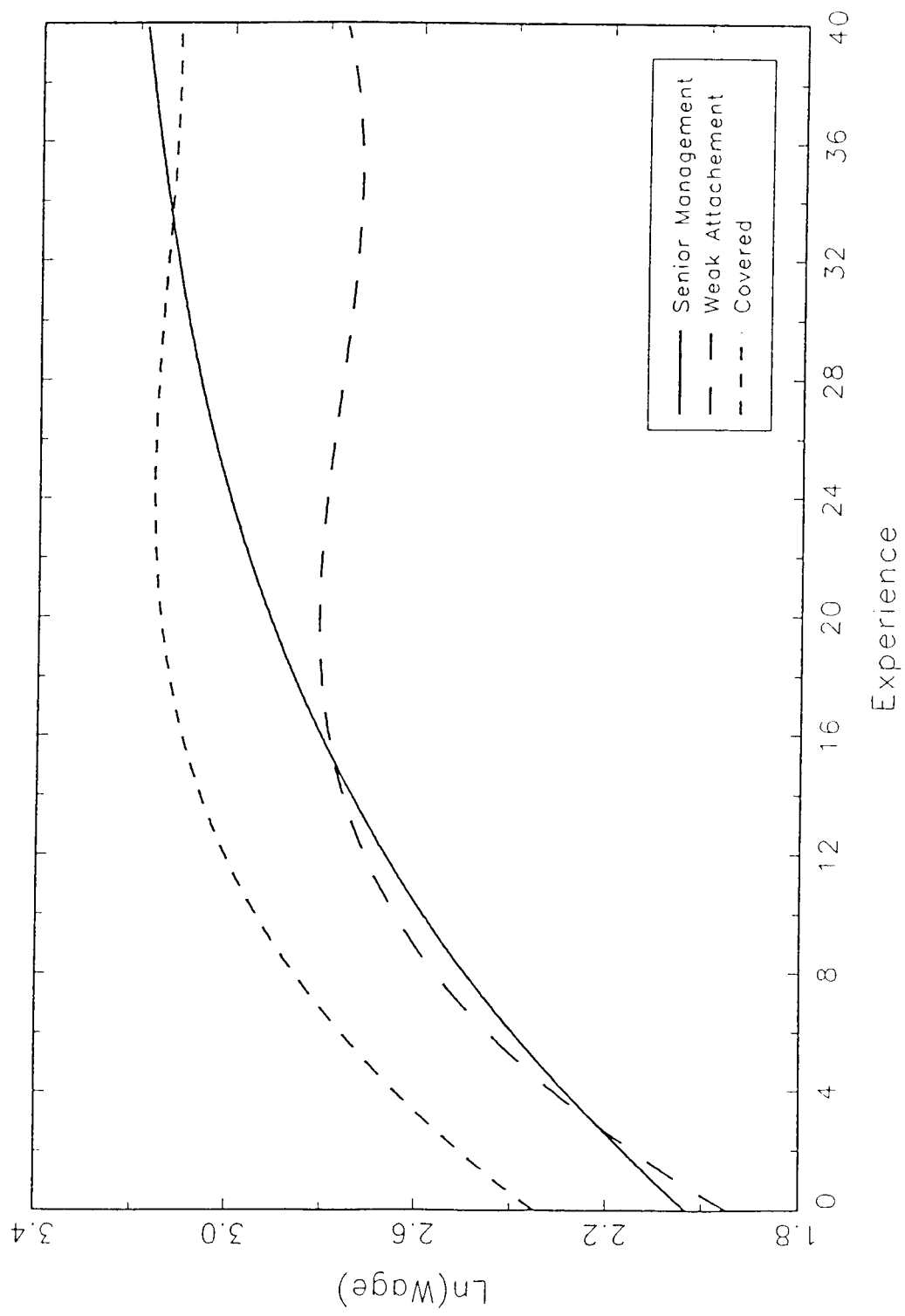Figure 2 Experience Profiles, Industry Agreement

Ln(Wage)

Experience

Senior Management
Weak Attachement
Covered

Table 10 Wage and Selection Equations

	Covered		Non-Covered			
			Weak-att.		Sr. Manag.	
Wage equation						
Intercept	1.694	(0.017)	1.445	(0.588)	-0.167	(0.551)
Experience/10	0.838	(0.012)	1.062	(0.111)	0.687	(0.106)
Experience**2/1000	-2.785	(0.061)	-4.175	(0.538)	-1.474	(0.469)
Experience**3/100000	2.930	(0.086)	5.082	(0.763)	1.180	(0.623)
Education (years)	0.086	(0.001)	0.066	(0.010)	0.168	(0.011)
Female	-0.133	(0.004)	0.118	(0.178)	-0.270	(0.056)
Entrants	-0.057	(0.004)	-0.105	(0.037)	-0.031	(0.047)
ln Hours	0.132	(0.003)	0.096	(0.057)	0.250	(0.124)
ln Firm size	0.006	(0.001)	0.022	(0.018)	0.083	(0.012)
Selection-equation						
Intercept			-2.141	(0.231)	-7.232	(0.767)
Experience/10			0.022	(0.188)	0.332	(0.182)
Experience**2/1000			0.251	(0.856)	-1.447	(0.800)
Experience**3/100000			-0.641	(1.134)	3.117	(1.033)
Education (years)			0.006	(0.019)	0.255	(0.012)
Female			0.809	(0.091)	-0.464	(0.181)
Entrant			0.020	(0.076)	-0.044	(0.083)
ln Hours			-0.268	(0.055)	1.050	(0.199)
ln Firm size			0.081	(0.021)	0.111	(0.018)

Variance-covariance matrix		(1)	(2)	(3)	(4)	(5)
(1) Wage, Sr. Management	u_1	0.249 (0.036)	*	*	-0.461 (0.045)	0
(2) Wage, Weak-att.	u_2		0.045 (0.003)	*	0	-0.019 (0.230)
(3) Wage, Covered	u_3			0.0413 (0.0002)	0.012 (0.013)	0.063 (0.015)
(4) Selection, Sr. Management	ε_1				1	0
(5) Selection, Weak-att.	ε_2					1

Note: Standard errors in parentheses.

4.3 Collecting results: the effect of the bargaining regime

After properly taking into account the differentiation of the labour market according to the
tional structure of collective bargaining, we are now in the position to make an estimate
wage effect of the bargaining regime *per se*. Since we have estimated separate wage equat
each of the bargaining regimes, we must necessarily conclude that this effect will differ by
employee. There are thus different methods for summarizing the effect. We will ad
standard procedure of predicting wages for selected reference individuals. In Table 11 we
the results. It gives predicted wages for a man with the average characteristics of the re
which he is observed (as specified by the rows of the table). The columns match the
specifications we have estimated; for comparison we added predictions from the OLS reg
as presented in the Appendix. The table allows to make many comparisons of wages. We
attempt to fill all entries, but there is sufficient information to answer two key questions: th
of the firm's bargaining regime and the effect of individual coverage.

The pure effect of the bargaining regime is a wage spread of about 12%. This materializ
wages in the mandatory extension sector of some 12% below those under company barg
Industry bargaining generates about the same wage level as company bargaining. 'i'
bargaining regime has wages about equal to those under industry bargaining. These con
are not sensitive to the estimation method. They generally hold under OLS and in the s
regression model, with one exception: a typical worker under industry bargaining or a
worker under company bargaining has 5% lower predicted wages under company bargaini
under industry bargaining, if the switching regression model is used.

These conclusions are based on five comparisons. We compare predicted wages for five ":
male workers": overall (row 13), covered, unspecified (row 14), covered, industry barg
(row 2), covered, company bargaining (row 7) and covered, mandatory extension (row 10
use the switching regression, we look at the predicted wage including the selection effec'
the focus is on the effect of the bargaining regime, we only look at wages for workers
covered under any regime (and thus at their predicted wages as covered workers in any r
except of course for the no-bargaining regime. While there is some variation across th
comparisons in predicted wage levels, the predicted differences between the bargaining r
are remarkably robust. The wage gap of mandatory extension with industry or co
bargaining is mostly 11 to 13%, but it is 8% for workers covered by company bargainin
predicted with the switching regression, and 15% for workers in the extension regim
predicted from OLS. [13]In Table 6, without distinction between covered and uncovered w
we had found a gap of some 11%, with industry bargained wages 6-7 % above co
bargained wages. The conclusion from Table 11 that company bargained wages are about c
industry bargained wages is more in line with the observation by bargaining officials from
and employers that a company can break away from an industry bargaining system and barg
own agreement if it pays a wage premium (of 5 to 10%).[14]

The pure effect of individual coverage by collective bargaining is to be found by holdi

---

[13]We take the difference between the ln wages as percentage differences in wages.

[14]See Freeman, Hartog and Teulings (1995); an analysis of the Dutch system of labour relations based on int
with key players is given in Chapter 7 of Teulings and Hartog (1997). Company bargained wages are only pr
below industry bargained wages for two cases using the switching regression model (workers covered by i
bargaining or by company bargaining). This might fuel reservations on the switching regression model. Howe
existing wage difference between two regimes is not necessarily the same as the difference demanded for allo
regime transfer.

firm's bargaining regime constant. Considering regime switches for the typical worker of a given group (i.e. covered versus non-covered for any given row), we find generally that coverage reduces wages. For the switching regression models that include the selectivity effect, coverage reduces wages by 3 to 25%, depending on the reference individual. The effects are largest for the reference worker observed in the company bargaining regime, and smallest for the reference workers observed in the extension regime. The most interesting and relevant results are effects on the diagonal blocks: coverage effects for reference workers as actually observed in a given bargaining regime. For actually covered workers, transition to non-coverage would increase wages by 12% in the industry bargaining regime, by 17% in the company bargaining regime and by 7% in the extension regime. (OLS predictions give wage effects of 14, 9 and 7%, respectively). Non-covered workers benefit from this non-coverage by 15% in the industry bargaining regime, by 25% in the company bargaining regime and by 7% in the extension regime. (The percentages are the samen under OLS). Thus, collective bargaining appears to moderate wages: actually covered workers would gain from non-coverage, the non-covered workers would loose if they would be brought under the terms of collective bargaining. The sign of these key comparisons on the main diagonal is sensitive to inclusion or exclusion of the selectivity term only under industry bargaining. Only for the reference individuals observed in industry bargaining do we find that coverage by the collective bargaining agreement increase wages, both for workers observed to be covered and for workers observed to be non-covered, if we exclude the selectivity effect from pre-dicted wages. The key question is of course whether in these analyses we have been able to correct sufficiently for worker and job heterogeneity. Among the non-covered workers, the high wage workers appear to dominate. For all comparisons of predicted wages, the group of non-covered workers has higher predicted wages than the covered workers. This holds for OLS predictions and for switching regressions, whether we include the selection effect or not (i.e. we compare row 2 and 3, 7and 8, 10 and 11, for every column). Thus, non-covered workers are on average high wage workers, and perhaps we have insufficiently been able to allow for unobserved heterogeneity. Only for the industry bargaining regime have we been able to disentangle high- and low-wage non-coverage. If we look at the results for this further distinction, we indeed find that non-covered workers in the weak attachment sector would gain 17% from obtaining coverage, while the senior management workers would loose 12%. Only the latter results are results one might have anticipated as pure effects of collective bargaining coverage: an increase for weak labor, a decrease for management. In the other firm bargaining regimes, we cannot make this distinction among the uncovered. In the company bargaining regime, if a typical uncovered worker would become covered, he would loose 45% in wages; the typical uncovered worker here is no doubt a high-wage senior management worker (see our discussion of the selection equations in 4.2). If a typical uncovered worker in the extension sector would become covered, he would loose 7%. In this regime, the typical non-covered worker is not easily classified as either a weak attachment worker or a senior management worker: most likely both types are prominent here.

To see if there are any spill-over effects, we may compare wage predictions for uncovered workers in each of the bargaining regimes. The typical worker in the no-bargaining regime, when switching to the position of uncovered worker in a covered firm, would loose 2% under mandatory extension, 7% under company bargaining and gain 10% under industry bargaining. These are non-negligable differences, but again, in spite of all our efforts, some non-heterogeneity may have been left to contaminate the estimates.

Table 11   Predicted Ln wages by bargaining regime, for individuals observed in each regime.[a]

Observed regime	Industry											Company						
	OLS			Switching Regression								OLS			Switching Regression			
	All	C	NC	C		All		WA/NC		SM		All	C	NC	C		NC	
				Xβ	Xβ+s	Xβ	Xβ+s	Xβ	Xβ+s	Xβ	Xβ+s				Xβ	Xβ+s	Xβ	Xβ+s
I: Industry																		
All	2.082	2.974	3.187	2.973	2.974	2.183	3.094					2.917	2.926	2.951	2.922	2.926	3.010	2.948
Covered (C)	2.969	2.961	3.072	2.961	2.961	2.159	3.080	2.74	2.74	2.03	2.00	2.900	2.911	2.931	2.907	2.911	2.991	2.928
Non-covered (NC)	3.216	3.194	3.343	3.193	3.194	2.618	3.344					3.229	3.193	3.303	3.185	3.193	3.351	3.302
Weak attachment (WA)				2.85	2.92			2.78	2.75	1.85	2.75							
Senior management (SM)				3.35	3.40			3.01	2.99	2.84	3.52							
C: Company																		
All	3.221	3.197	3.399	3.196	3.197	2.655	3.404					3.252	3.210	3.394	3.203	3.210	3.444	3.393
Covered	3.159	3.138	3.331	3.137	3.138	2.551	3.337					3.176	3.144	3.315	3.138	3.144	3.368	3.313
Non-covered	3.536	3.495	3.742	3.493	3.495	3.184	3.745					3.638	3.545	3.797	3.530	3.546	3.830	3.797
E: Extension																		
All	2.880	2.878	2.937	2.878	2.878	1.980	2.946					2.784	2.816	2.735	2.813	2.816	2.798	2.733
Covered	2.827	2.826	2.872	2.826	2.826	1.912	2.884					2.743	2.783	2.679	2.781	2.784	2.746	2.675
Non-covered	2.904	2.902	2.966	2.902	2.902	2.012	2.975					2.802	2.831	2.761	2.828	2.831	2.822	2.759
N: No CLA																		
All	3.050	3.046	3.134	3.046	3.046	2.279	3.139					3.016	3.021	2.970	3.015	3.021	3.025	2.968
Covered	3.004	2.995	3.103									2.947	2.953	2.963				
Non-covered	2.976	2.968	3.082									2.912	2.921	2.947				

Table 11 Predicted Ln wages by bargaining regime, for individuals observed in each regime", continued

Observed regime	Extension							No CLA
	OLS			Switching Regression				OLS
				C		NC		
	All	C	NC	Xβ	Xβ+s	Xβ	Xβ+s	All
I: Industry								
All	2.924	2.867	2.948	2.591	2.864	3.051	2.944	2.974
Covered (C)	2.909	2.852	2.934	2.576	2.849	3.037	2.930	2.960
Non-covered (NC)	3.180	3.136	3.204	2.849	3.127	3.312	3.205	3.222
Weak attachment (WA)								
Senior management (SM)								
C: Company								
All	3.193	3.134	3.222	2.876	3.127	3.336	3.217	3.229
Covered	3.126	3.068	3.0155	2.817	3.062	3.271	3.149	3.165
Non-covered	3.533	3.473	3.559	3.173	3.454	3.662	3.563	3.557
E: Extension								
All	2.804	2.755	2.825	2.469	2.753	2.925	2.824	2.862
Covered	2.747	2.703	2.770	2.449	2.704	2.885	2.767	2.808
Non-covered	2.830	2.778	2.850	2.478	2.776	2.943	2.849	2.887
N: No CLA	2.996	2.953	3.016	2.660	2.948	3.116	3.017	3.042
All	2.945	2.892	2.969					2.994
Covered	2.918	2.860	2.943					2.968
Non-covered	3.008	2.903	3.029					3.054

A man with observed characteristics at the mean values for his observed regime.

5 CONCLUSIONS

In Teulings and Hartog (1997) we have surveyed the international literature and we conclude that collective bargaining affects wage levels differently under different institutional arrangements. In the dual structure of North America, the average wage gap between the union and the non-union sector is estimated to be at least 20% in Canada (Robinson and Tomes, 1984; Robinson, 1989) and about 15% in the US during 'the 70s (Flanagan, 1993; Pencavel, 1991; Hirsch and Addison, 1986). In Australia, the gap has been estimated as 15 to 17% (Christie, 1992). In the UK the average effect has been put at 8 to 10% (Addison and Siebert, 1993; Booth, 1995; Hirsch and Addison, 1986; Metcalf, 1990), but it differs by type of bargaining arrangement, with a strong effect of the closed shop, in particular for semi-skilled manual workers (Stewart, 1987). For Germany, Austria and Norway, the bargaining regime effect has been measured, rather inadequately, as an effect of individual union membership. For Germany, an average gap of 8% has been reported, for Austria 7% (Blanchflower and Freeman, 1992) and for Norway, an effect of 4% (Barth, Naylor and Raaum, 1994). An institutionally more proper estimate for Norway finds that firms under central wage bargaining only, have 7.5% lower wages than firms with additional firm level bargaining; firm level union density is a mediating variable responsable for nonlinearity of this effect (Barth, Naylor and Raaum, 1994). The results suggest that the magnitude of bargaining regime differentials falls if the country is ranked as more corporatist. Canada and the US are commonly ranked as non-corporatist, decentralised countries. On Australia, there is some disagreement, but it is ususally put at the low or very low end of corporatism. Austria is is always put on top of the corporatism scale, Norway is at the high end and so are Germany and the Netherlands, while the UK is ranked closer to the North American non-corporatist countries. The results for just the firm bargaining regime for the Netherlands, with wage differentials between regimes no larger than 4%, neatly fit this emerging relationship: as a highly corporatist country it has small bargaining regime wage effects. However, our more refined estimate of some 12% if we separate out firm bargaining regime and individual coverage, would be somewhat out of step with this relationship.

Many studies have found that the union mark-up differs across worker characteristics and job characteristics (see the surveys in Pencavel, 1991 and Booth, 1995). There is some international evidence that unions flatten experience profiles (Hirsch and Addison (1986) and Freeman (1980) for the US; Christie (1992) for Australia; Robinson and Tomes (1984) for Canada.[15] Our results for the Netherlands are mixed. Within the company bargaining regime and the mandatory extension regime for the firm, we find that covered workers have a larger absolute slope than uncovered workers. If we only look at covered workers in the covered firms, we find that collective bargaining tends to increase the absolute slope relative to uncovered firms. Looking at uncovered workers only, we do not find the workers in uncovered at one end or another of the ranking by absolute slope. Reduction in the returns to education, reported in the studies for the US (Freeman, 1980), Canada (Robinson and Tomes, 1984) and Australia (Christie, 1992), is not found in the Netherlands. The effect of collective bargaining on the returns to education is mostly negligible, with one exception: compared to all the other regimes uncovered workers in the senior management regimes have a substantially higher rate of return. The international evidence on the gender gap does not point unequivocally in one direction. It is reduced by supplementary bargaining in Norway (Barth, Naylor and Raaum, 1994), reduced by union bargaining in the UK (Metcalf, 1982), but increased in Canada (Robinson and Tomes, 1994); the positive effect of unions in Australia is negligible

---

[15] Disentangling the effect of age, experience and tenure is notoriously treacherous, due to selective job mobility patterns. Steepening of tenure wage profiles by unions is reported for the US by Topel (1991) and for Canada by Kuhn and Sweetman (1994); Booth and Frank (1995) find a steepening effect on experience profiles, but they interpret it as an effect on tenure profiles. Hirsch and Addison (1986) conclude in their survey for the US that the union mark-up has a U-shaped relation with age: highest for elderly and young, lowest in the middle, most reliable for the elderly.

(Christie, 1992). We find mostly that collective bargaining reduces the gender gap, in some cases quite substantially; the gap is largest for uncovered workers in firms with industry or company bargaining. The firm size effect is mostly increased by collective bargaining, even for uncovered workers in covered firms. It is only reduced for covered workers in firms covered by industry bargaining. Increased size effect for company bargaining is similar to what is found in the US and Norway (Pearce, 1990; Barth et al, 1994), but not for the UK (Stewart, 1987). To the collection of mixed results in the international literature on the wage structure, we cannot add decisive, unambiguous results. Generally, our results indicate that in corporatist Holland, the wage structure does not differ markedly between firms covered by collective bargaining and firms not covered by it. Instead, if we look at wages by bargaining regime of the firm, irrespective of individual coverage, we find that it's the company bargaining regime that stands out, not the uncovered sector.

We have argued that a distinction of wages only by bargaining regime of the firm is not sufficient: a distinction should also be made between covered and non-covered workers in the firms covered by some type of collective bargaining. The big problem here is unobserved heterogeneity. Workers can be uncovered on both ends of the wage distribution. We tried to acknowledge this by specifying models with endogenous coverage selection, but inference from these results should be very cautious. We now find that for covered workers only, the effect of the firm's bargaining regime may be somewhat higher than we found in the earlier models. Wages are lowest under mandatory extension, highest under company and industry bargaining, spanning an interval of 8 to 15% difference. Thus, wages are **not** lowest in the no-bargaining regime. Depending on the reference worker chosen, wages under industry bargaining may be equal to or higher than under company bargaining, but if higher, the gap is no more than 5%. By separating out covered and uncovered workers, we feel that the bargaining regime effect, measured only for workers who are actually covered if the firm is covered by collective bargaining, has been estimated fairly reliably. We are much less confident about the estimate of the coverage effect, the distinction between covered and uncovered workers within a bargaining regime. This is because of the heterogeneity of the uncovered workers. Our results suggest that for workers with weak attachment to the firm, typically low wage workers, a transition from non-coverage to coverage may substantially increase their wages. If senior management workers would be brought under coverage of collective bargaining, this might substantially reduce their wages. But especially on these latter questions we would like to do more research.

Literature

Addison, J. and W.S. Siebert (1993), The United Kingdom: Labour market institutions, law and performance, in: J. Hartog and J. Theeuwes (eds.), Labour Market Contracts and Institutions, a Cross-National Comparison, Amsterdam: North-Holland

Barth, E., R. Naylor and O. Raaum (1994), Does union density matter?, working paper, Institute for Social Research, Oslo.

Berg, A. van den, and W. Groot (1992), Union membership in the Netherlands: a cross-sectional analysis, Empirical Economics, 17, 537-564.

Berg, A. van den (1995), Explaining union membership in the Netherlands, Ph.D. Thesis, University of Amsterdam.

Blanchflower, D.G. and R. Freeman (1992), Unionism in the United States and other advanced OECD countries, Industrial Relations, 31(1), pp. 56-81.

Booth, A.L. (1995), The economics of the trade union, Cambridge: Cambridge University Press.

Booth, A.L. and J. Frank (1995), Seniority, earnings and the union, ESRC Research Centre on Microsocial Change, University of Essex.

Bruno, M. and J. Sachs (1985), Economics of worldwide stagflation, Cambridge: Harvard University Press.

Brown, C. and J. Medoff (1989), The employer size-wage effect, Journal of Political Economy, 97 (5), 1027-1059

Calmfors, L. and J. Driffill (1988), Centralisation of wage bargaining and economic performance, Economic Policy, pp. 13-61.

Christie, V. (1992), Union wage effects and the probability of union membership, The Economic Record, 68(200), pp. 43-56.

Dell'Aringa, C. and C. Lucifora (1993), Wage dispersion and unionism: are unions egalitarian? Paper presented at the EALE conference, Maastricht

Dickens, W.T. and K. Lang (1985), A test of dual labor market theory, American Economic Review, 75, pp. 792-805.

Flanagan, R. (1993), The United States: Decentralized Heterogeneity, in: Hartog and Theeuwes (1993), pp. 31-75.

Flanagan, R., J. Hartog and J. Theeuwes (1993), Institutions and the labour market: many questions, some answers, in: Hartog and Theeuwes (1993), pp. 415-446.

Freeman, R.B. (1980), Unionism and the dispersion of wages, Industrial and Labor Relations Review, 3(1), pp. 3-23.

Freeman, R.B., J. Hartog and C.N. Teulings (1995), Pulling the Plug, report to OSA, The Hague.

Hartog, J. and J.J.M. Theeuwes, editors (1993), <u>Labour Market Contracts and Institu</u> .ss-
<u>National Comparison</u>, Amsterdam, North-Holland

Hirsch, B.T. and J.T. Addison (1986), <u>The economic analysis of unions</u>, Boston: A! win.

Kuhn, P. and A. Sweetman (1994), Trade unions as discriminating monopolis. / and
evidence, McMaster University, Department of Economics Working Paper)4-95
(forthcoming in <u>Journal of Labor Economics</u>).

Lee, L-F. (1978), Unionism and wage rates: a simultaneous equations model with (, ind
limited dependent variables, <u>International Economic Review</u>, 19(2), pp. 415-433.

Maddala, G. (1983), <u>Limited-Dependent and Qualitative variables in Economieti</u> ridge
University Press.

Metcalf, D. (1982), Unions and the distribution of earnings, <u>British Journal of Indu</u> ins,
20, pp. 163-169.

Metcalf, D. (1990), Trade unions and economic performance: The British evidence, . .etta
and C. Dell'Aringa, eds. <u>Labour relations and economic performance</u>, London, M. 'ress
for International Economic Association.

Mitchell B. and P. Scherer (1993), Australia: the search for fair employment co· ·h
tribunals, in: J. Hartog and J. Theeuwes, eds., <u>Labour market contracts and institu</u>
<u>national comparison</u>, Amsterdam: North-Holland, Chapter 3, pp. 77-114.

Ministerie van Sociale Zaken en Werkgelegenheid (1991), Dienst Collectieve Arbeio
DCA-bevindingen 1990, Een verslag van werkzaamheden en bevindingen van de Die
Arbeidsvoorwaarden over het jaar 1990, Den Haag: VUGA.

Murphy, K.M. and F. Welch (1990), Empirical age-earning profiles, <u>Journal of Lab</u>
8(2), pp. 202-229.

Opstal, R. van, J. Hartog and C. N. Teulings (1997), Inter-industry wage different
effects in the Netherlands and the US, <u>De Economist</u>, 145 (1), 91-99.

Pearce, J.E. (1990), Tenure, unions and the relationship between employer size and w
<u>of Labor Economics</u>, 8(2), pp. 251-269.

Pencavel, J. (1991), <u>Labor markets under trade unionism</u>, Cambridge, Mass., Basil }·

Robinson, C. and N. Tomes (1984), Union wage differentials in the public and pri.
simultaneous equations specification, <u>Journal of Labour Economics</u>, 2(1), pp. 106-12·

Robinson, C. (1989), The joint determination of union status and union wage effects
alternative models, <u>Journal of Political Economy</u>, 97(3), pp. 639-667.

Rosenbaum, S. (1961), Moments of a truncated bivariate normal distribution, <u>Journa</u>
<u>Stistical Society</u> (Series B), 23, pp. 405-408.

Scherer, B., M. and P. (1993), Australia: the search for fair employment contracts through tribunals, in: J. Hartog and J. Theeuwes (eds.), <u>Labour Market Contracts and Institutions, a Cross-National Comparison</u>, Amsterdam: North- Holland.

Stewart, M.B. (1987), Collective bargaining arrangements, closed shops and relative pay, <u>Economic Journal</u>, 97, pp. 140-156.

Teulings, C.N. and J. Hartog (1995), <u>Markets, institutions and wages</u>, paper prepared for the 33rd Biwako Conference on "Employment Adjustment, Incentives and Internal Labour Markets", Biwako, Japan, July 1995 (to be published in the conference volume edited by I. Ohashi and T. Tachibanaki).

Teulings, C.N. and J. Hartog (1997, forthcoming), <u>Corporatism or competition? Labour contracts, institutions and wage structures in international comparison</u>, Cambridge: Cambridge University Press

Topel, R. (1991), Specific Capital, Mobility, and Wages: Wages rise with job seniority, <u>Journal of Political Economy</u>, pp. 145-176.

Voskamp, A. (1992), <u>The structure of Dutch industrial relations and negoriations about the collective labor agreement</u>, working paper, University of Amsterdam.

APPENDIX: Wage equations, OLS

	Industry		Company		Extension		No CLA	
	Coef	S.E.	Coef	S.E.	Coef	S.E.	Coef	S.E.
Covered:								
Constant	1.700	(0.017)	1.225	(0.088)	1.522	(0.087)		
Experience	0.839	(0.013)	0.676	(0.062)	1.248	(0.076)		
Experience**2	-2.786	(0.061)	-2.263	(0.303)	-4.983	(0.423)		
Experience**3	2.931	(0.086)	2.535	(0.442)	6.100	(0.677)		
Education	0.087	(0.001)	0.101	(0.002)	0.103	(0.005)		
Female	-0.130	(0.004)	-0.042	(0.015)	-0.140	(0.021)		
Entrant	-0.057	(0.005)	-0.064	(0.017)	-0.058	(0.026)		
Ln Hours	0.130	(0.004)	0.243	(0.023)	0.076	(0.020)		
Ln Firmsize	0.007	(0.001)	0.029	(0.005)	0.021	(0.006)		
N	14667		982		475			
R-squared	.657		.757		.765			
Std. Error	.203		.189		.203			
Mean log-L	.177749		.249167		.183508			
Non-covered								
Constant	1.589	(0.095)	1.787	(0.163)	1.460	(0.074)	1.783	(0.036)
Experience	0.710	(0.069)	0.569	(0.209)	0.946	(0.056)	0.722	(0.022)
Experience**2	-1.920	(0.300)	-1.550	(1.031)	-2.942	(0.257)	-2.049	(0.103)
Experience**3	1.687	(0.383)	1.619	(1.540)	2.849	(0.343)	1.806	(0.140)
Education	0.092	(0.004)	0.109	(0.009)	0.097	(0.005)	0.094	(0.001)
Female	-0.231	(0.026)	-0.282	(0.090)	-0.134	(0.021)	-0.144	(0.008)
Entrant	-0.063	(0.030)	0.001	(0.052)	-0.096	(0.025)	-0.079	(0.009)
Ln Hours	0.164	(0.020)	-.1	-.-	0.139	(0.018)	0.098	(0.009)
Ln Firmsize	0.042	(0.008)	0.116	(0.020)	0.022	(0.007)	0.020	(0.003)
N	822		193		1044		5006	
R-squared	.675		.688		.629		.689	
Std. Error	.299		.249		.295		.235	
Mean log-L	-.205230		-.0091129		-.194899			
Mean log-L Pr	-.177561		-.342104		-.579766			

A   Switching regressions

The switching regression model we estimated is specified in the following way (Maddala (1983), p.283):

$$\ln w_1 = X_1 \beta_1 + u_1,$$
$$\ln w_2 = X_2 \beta_2 + u_2,$$

the wage equations for the covered and non-covered sector. Sector assignment is determined by the following selection equation:

$$I = Z\gamma - \varepsilon,$$

and regime assignment is as follows:

$$I > 0$$
$$I \leq 0$$

for covered and non-covered respectively. We assume the error terms (u_1, u_2, ε) to have a joint normal distribution $N(0, \Omega)$, with:

$$\Omega = \begin{pmatrix} \sigma_1^2 & * & \sigma_{1\varepsilon} \\ . & \sigma_2^2 & \sigma_{2\varepsilon} \\ . & . & 1 \end{pmatrix}$$

The covariance between the error terms of the wage equations is not identified. The likelihood-function takes the following form:

$$\mathcal{L} = [\Pr(I > 0|u_1) f(u_1)]^d [\Pr(I \leq 0|u_2) f(u_2)]^{(1-d)}$$
$$= \left[\Phi \left(Z\gamma - u_1 \sigma_{1\varepsilon}/\sigma_1^2 \right) \phi(u_1/\sigma_1)/\sigma_1 \right]^d$$
$$\times \left[\left(1 - \Phi \left(Z\gamma - u_2 \sigma_{2\varepsilon}/\sigma_2^2 \right) \right) \phi(u_2/\sigma_2)/\sigma_2 \right]^{(1-d)}$$

Finally, to interpret the covariance matrix, the conditional expected wages are helpful:

$$\begin{aligned} E[\ln w_1 | I > 0] &= X_1 \beta_1 - \sigma_{1\varepsilon} \phi(Z\gamma)/\Phi(Z\gamma) \\ E[\ln w_2 | I \leq 0] &= X_2 \beta_2 + \sigma_{2\varepsilon} \phi(Z\gamma)/(1 - \Phi(Z\gamma)). \end{aligned}$$

B   Estimation of the switching model with partially unobserved sector selection

B.1   The derivation of the likelihood-function

The model in section 3.2 is a mixture of a switching model with unknown regimes as presented in Dickens and Lang (1985), and a ordinary (endogeneous) switching model

(see for example Maddala (1983) p.224). We will repeat it for convenience (dropping individual subscripts):

$$\ln w_1 = X\beta_1 + u_1,$$
$$\ln w_2 = X\beta_2 + u_2,$$
$$\ln w_3 = X\beta_3 + u_3,$$

which are three wage equations. There are two selection equations that govern regime choice:

$$I_1 = Z\gamma_1 - \varepsilon_1,$$
$$I_2 = Z\gamma_2 - \varepsilon_2,$$

and regime assignment is as follows:

$$I_1 > 0 \quad \text{and} \quad I_1 > I_2,$$
$$I_2 > 0 \quad \text{and} \quad I_2 \geq I_1,$$
$$I_1 \leq 0 \quad \text{and} \quad I_2 \leq 0,$$

for regime 1 (non-covered, senior management), 2 (non-covered, weak attachment) and 3 (covered) respectively. Regime 1 and 2 cannot be distuingished from each other; individuals are either observed in regime 3, or not to be in regime 3. It is assumed that the error terms follow a joint normal distribution, with zero expectation and variance-covariance structure for the vector $(u_1, u_2, u_3, \varepsilon_1, \varepsilon_2)$:

$$\Omega = \begin{pmatrix} \sigma_1^2 & * & * & \sigma_{14} & \sigma_{15} \\ . & \sigma_2^2 & * & \sigma_{24} & \sigma_{25} \\ . & . & \sigma_3^2 & \sigma_{34} & \sigma_{35} \\ . & . & . & 1 & \rho \\ . & . & . & . & 1 \end{pmatrix}$$

The covariance of the error terms of the wage equations are not identified. Although we imposed $\sigma_{15} = \sigma_{24} = \rho = 0$ in our estimation procedures, we will derive our results for the unrestricted covariance matrix. The likelihood-function is now:

$$\begin{aligned} \mathcal{L} &= [\Pr(I_1 > 0, I_1 > I_2 | u_1) f(u_1) + \Pr(I_2 > 0, I_2 \geq I_1 | u_2) f(u_2)]^{(1-d)} \\ &\quad \times [\Pr(I_1 \leq 0, I_2 \leq 0 | u_3) f(u_3)]^d \\ &= [\Pr(\varepsilon_1 < Z\gamma_1, \varepsilon_1 - \varepsilon_2 < Z(\gamma_1 - \gamma_2) | u_1) f(u_1) \\ &\quad + \Pr(\varepsilon_2 < Z\gamma_2, \varepsilon_1 - \varepsilon_2 \geq Z(\gamma_1 - \gamma_2) | u_2) f(u_2)]^{(1-d)} \qquad \text{(B.1)} \\ &\quad \times [\Pr(\varepsilon_1 \geq Z\gamma_1, \varepsilon_2 \geq Z\gamma_2 | u_3) f(u_3)]^d. \end{aligned}$$

We assumed normality of the error terms in the wage and selection equations, the distribution of $(\varepsilon_1 - \varepsilon_2, \varepsilon_1 | u_1), (\varepsilon_1 - \varepsilon_2, \varepsilon_2 | u_2)$, and, $(\varepsilon_1, \varepsilon_2 | u_3)$, will be therefore be

normal again,[1] and all we need are the following first and second (central) moments:

$$\mathbf{E}(\varepsilon_1, \varepsilon_1 - \varepsilon_2 | u_1) = \frac{1}{\sigma_1^2} \begin{pmatrix} \sigma_{14} \\ \sigma_{14} - \sigma_{15} \end{pmatrix} u_1,$$

$$\mathbf{V}(\varepsilon_1, \varepsilon_1 - \varepsilon_2 | u_1) = \begin{pmatrix} 1 - \sigma_{14}^2/\sigma_1^2 & (1 - \rho) - (\sigma_{14}^2 - \sigma_{14}\sigma_{15})/\sigma_1^2 \\ (1 - \rho) - (\sigma_{14}^2 - \sigma_{14}\sigma_{15})/\sigma_1^2 & 2(1 - \rho) - (\sigma_{14} - \sigma_{15})^2/\sigma_1^2 \end{pmatrix},$$

$$\mathbf{E}(\varepsilon_2, \varepsilon_1 - \varepsilon_2 | u_2) = \frac{1}{\sigma_2^2} \begin{pmatrix} \sigma_{25} \\ \sigma_{24} - \sigma_{25} \end{pmatrix} u_2,$$

$$\mathbf{V}(\varepsilon_2, \varepsilon_1 - \varepsilon_2 | u_2) = \begin{pmatrix} 1 - \sigma_{25}^2/\sigma_2^2 & -(1 - \rho) - (\sigma_{25}^2 - \sigma_{24}\sigma_{25})/\sigma_2^2 \\ -(1 - \rho) - (\sigma_{25}^2 - \sigma_{24}\sigma_{25})/\sigma_2^2 & 2(1 - \rho) - (\sigma_{24} - \sigma_{25})^2/\sigma_2^2 \end{pmatrix},$$

$$\mathbf{E}(\varepsilon_1, \varepsilon_2 | u_3) = \frac{1}{\sigma_3^2} \begin{pmatrix} \sigma_{34} \\ \sigma_{35} \end{pmatrix} u_3,$$

$$\mathbf{V}(\varepsilon_1, \varepsilon_2 | u_3) = \begin{pmatrix} 1 - \sigma_{34}^2/\sigma_3^2 & \rho - \sigma_{34}\sigma_{35}/\sigma_3^2 \\ \rho - \sigma_{34}\sigma_{35}/\sigma_3^2 & 1 - \sigma_{35}^2/\sigma_3^2 \end{pmatrix}.$$

Using these we can write down the probabilities in (B.1):

$$\Pr(\varepsilon_1 < Z\gamma_1, \varepsilon_1 - \varepsilon_2 < Z(\gamma_1 - \gamma_2) | u_1)$$

$$= \Phi\left(\frac{Z\gamma_1 - u_1\sigma_{14}/\sigma_1^2}{\sqrt{1 - \sigma_{14}^2/\sigma_1^2}}, \frac{Z(\gamma_1 - \gamma_2) - u_1(\sigma_{14} - \sigma_{15})/\sigma_1^2}{\sqrt{2(1 - \rho) - (\sigma_{14} - \sigma_{15})^2/\sigma_1^2}}; r1 \right),$$

$$\Pr(\varepsilon_2 < Z\gamma_2, \varepsilon_1 - \varepsilon_2 \geq Z(\gamma_1 - \gamma_2) | u_2)$$

$$= \Phi\left(\frac{Z\gamma_2 - u_2\sigma_{25}/\sigma_2^2}{\sqrt{1 - \sigma_{25}^2/\sigma_2^2}}, -\frac{Z(\gamma_1 - \gamma_2) - u_2(\sigma_{24} - \sigma_{25})/\sigma_2^2}{\sqrt{2(1 - \rho) - (\sigma_{24} - \sigma_{25})^2/\sigma_2^2}}; -r2 \right),$$

$$\Pr(\varepsilon_1 \geq Z\gamma_1, \varepsilon_2 \geq Z\gamma_2 | u_3)$$

$$= \Phi\left(-\frac{Z\gamma_1 - u_3\sigma_{34}/\sigma_3^2}{\sqrt{1 - \sigma_{34}^2/\sigma_3^2}}, -\frac{Z\gamma_2 - u_3\sigma_{35}/\sigma_3^2}{\sqrt{1 - \sigma_{35}^2/\sigma_3^2}}; r3 \right),$$

where $\Phi(., .; \theta)$ stands for the (normalized) bivariate standard normal cumulative density function with correlation θ, and

$$r1 = \frac{(1 - \rho) - (\sigma_{14}^2 - \sigma_{14}\sigma_{15})/\sigma_1^2}{\sqrt{(1 - \sigma_{14}^2/\sigma_1^2)(2(1 - \rho) - (\sigma_{14} - \sigma_{15})/\sigma_1^2)}},$$

$$r2 = \frac{-(1 - \rho) - (\sigma_{25}^2 - \sigma_{24}\sigma_{25})/\sigma_2^2}{\sqrt{(1 - \sigma_{25}^2/\sigma_2^2)(2(1 - \rho) - (\sigma_{24} - \sigma_{25})/\sigma_2^2)}},$$

$$r3 = \frac{\rho - (\sigma_{14}\sigma_{15})/\sigma_3^2}{\sqrt{(1 - \sigma_{34}^2/\sigma_3^2)(1 - \sigma_{35}^2/\sigma_3^2)}}.$$

---

[1] We use the standard result that if $(x, y) \sim N\left(\begin{pmatrix} \mu_x \\ \mu_y \end{pmatrix}, \begin{pmatrix} V_x & V_{xy} \\ V_{yx} & V_y \end{pmatrix} \right)$ then: $x|y$ has a normal distribution with expectation: $\mathbf{E}(x|y) = \mu_x + V_{xy}V_y^{-1}(y - \mu_y)$, and covariance matrix, $\mathbf{V}(x|y) = V_x - V_{xy}V_y^{-1}V_{yx}$.

3

Using the fact that u_j has a normal distribution with mean: $\ln w_j - X\beta_j$, and variance σ_j, its distribution is ($\phi(.)$ denotes the standard normal probability density function). These results suffice to write out the likelihood (B.1).

B.2 Conditional expected wages

If we want to estimate the expected wage an individual would earn in regime j, calculating $X_i\beta_j$ gives an inconsistent estimate. We need the following expression to make conditional inferences: $\mathbf{E}(u_{ij}|\text{individual } i \text{ is in regime } k)$. It is straightforward to verify that:

$$\mathbf{E}(u_j|\varepsilon_1,\varepsilon_2) = \mathbf{E}(u_j|-\varepsilon_1,\varepsilon_2-\varepsilon_1) = \mathbf{E}(u_j|-\varepsilon_2,\varepsilon_1-\varepsilon_2) =$$
$$(1-\rho^2)^{-1}(\sigma_{j4}(\varepsilon_1-\rho\varepsilon_2)+\sigma_{j5}(\varepsilon_2-\rho\varepsilon_1)),$$

using the result in footnote 2. To derive the conditional expected wages we will used the following result, due to Rosenbaum (1961):

$$\mathbf{E}(x|x>h,y>k) =$$
$$\Phi(-h,-k,\rho)^{-1}\left(\phi(h)\left(1-\Phi\left(\frac{k-\rho h^2}{\sqrt{1-\rho^2}}\right)\right)+\rho\phi(k)\left(1-\Phi\left(\frac{h-\rho k^2}{\sqrt{1-\rho^2}}\right)\right)\right), \tag{B.2}$$

where (x,y) follows a standard bivariate normal distribution, with zero means, unit variances, and correlation coefficient ρ. We will use $\lambda(k,h)+\rho\lambda(h,k)$ to refer to (B.2). Now the expected wage conditional on the regime:

$$\mathbf{E}(\ln w_j|I_1>0,I_1>I_2) = X\beta_j + \mathbf{E}(u_j|-\varepsilon_1>Z\gamma_1,\varepsilon_2-\varepsilon_1>Z(\gamma_2-\gamma_1))$$
$$= X\beta_j - \left(\frac{\sigma_{j4}+\sigma_{j5}}{1+\rho}\right)(\lambda(k',h')+\sqrt{(1-\rho)/2}\lambda(h',k'))$$
$$+ \sqrt{2(1-\rho)}\left(\frac{\sigma_{j5}-\rho\sigma_{j4}}{1-\rho^2}\right)(\lambda(h',k')+\sqrt{(1-\rho)/2}\lambda(k',h'))$$

$$\mathbf{E}(\ln w_j|I_2>0,I_2\geq I_1) = X\beta_j + \mathbf{E}(u_j|-\varepsilon_2>Z\gamma_2,\varepsilon_1-\varepsilon_2\geq Z(\gamma_1-\gamma_2))$$
$$= X\beta_j - \left(\frac{\sigma_{j4}+\sigma_{j5}}{1+\rho}\right)(\lambda(k'',h'')+\sqrt{(1-\rho)/2}\lambda(h'',k''))$$
$$+ \sqrt{2(1-\rho)}\left(\frac{\sigma_{j5}-\rho\sigma_{j4}}{1-\rho^2}\right)(\lambda(h'',k'')+\sqrt{(1-\rho)/2}\lambda(k'',h''))$$

$$\mathbf{E}(\ln w_j|I_1\leq 0,I_2\leq 0) = X\beta_j + \mathbf{E}(u_j|\varepsilon_1\geq Z\gamma_1,\varepsilon_2\geq Z\gamma_2)$$
$$= X\beta_j + \left(\frac{\sigma_{j4}-\rho\sigma_{j5}}{1-\rho^2}\right)(\lambda(k''',h''')+\rho\lambda(h''',k'''))$$
$$+ \left(\frac{\sigma_{j5}-\rho\sigma_{j4}}{1-\rho^2}\right)(\lambda(h''',k''')+\rho\lambda(k''',h''')).$$