

THE WAR OF MODELS : DETERMINATION OF WAGES AND EMPLOYMENT IN SWEDISH PRIVATE SECTOR

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1. Introduction

What is the impact of trade unions on employment in Sweden? This crucial question for government policy boils down in defining which wage-employment bargaining model is the most appropriate for describing the Swedish economy. In studying the form of wage contracts, and hence, the relationship between collective bargaining and employment, the central question is that of determining the variables that are subject to negotiation. As there is a consensus with respect to the inclusion of wages as a variable, the controversy is more with respect to employment.

During the period 1956-93, the centralisation of bargaining in Sweden was a direct result of confederate statutes, which state that unions must grant their national committee the right to take all definitive decisions involving collective bargaining. The discussions which took place at the national level produced directives which, in their turn, served as a guide for bargaining at the industry and company levels (Caire, 1992).

Central agreements usually included several pay components like a general pay increase as well as specific increases towards special groups such as low income earners and women. But in addition to the pay agreements other subjects were also negotiated at the central level. They covered for example working hours, working environment and equal opportunities for woman (Hammarström and Nilsson, 1998).

Although unions were highly centralised, this does not mean that were weak or inactive at the local level. For instance, wages were often renegotiated at the plant or workplace level. Furthermore, rules constraint management's decisions over the level of employment. Indeed, on the one hand, from

1974 on, the law made it difficult for employers to dismiss employees and for companies to hire workers on probation without unions approval. On the other hand, the Co-determination Act (MBL) implemented in 1977, ment that the management had to consult the unions before any decision was taken on major changes in the company. For example, in the event of reorganisation or in the case of introduction of a new technology (Hammarström and Nilsson, 1998). To sum up, although wages were definitely the main bargaining topic, in the pre-1993 Swedish collective bargaining system, trade unions also had some bargaining power on employment particularly at the local level.

The aim of this paper is to discriminate among alternative wage-employment bargaining models using annual macro-data from the Swedish private sector covering the period 1960-93. While the majority of research in this field is restricted to testing the usual bargaining models¹, i.e. *right-to-manage* (RMM) and *efficient bargaining* (EBM), we will take a broader look at this question. In other words, bearing in mind the main features of the Swedish collective bargaining system, we found it essential not to test only for the usual bargaining models but also for the *general bargaining* model (GBM). In the latter, wages and employment are negotiated separately.

Our econometric methodology, similar to the one developed by Vannetelbosch (1996), follows first the Engle-Granger's (1987) two-step estimation procedure. Thus, after verifying the order of integration of our variables, we use Phillips-Hansen's (1990) procedure to estimate a long-run employment equation for the RMM and EBM, as well as for the GBM. After having tested the stationarity of the residuals, we estimate, in each case, an ECM (error correction model) representation of a dynamic employment equation. Finally, the use of non-nested tests allows us to select the adequate model for the Swedish private sector.

The paper is structured as follows. In the next section we briefly describe Manning's (1987) GBM. The selection procedure, the data and the results are presented in section 3, 4 and 5. Section 6 provide some concluding remarks.

2. Manning's Model

The GBM, developed by Manning (1987), is a synthetic model in which there is a continuum of possible results between those proposed by the RMM and EBM. Furthermore, with the exception of these two extremes, solutions are situated on neither the labour demand curve nor the contract curve. It is composed of two stages. Negotiations are concerned in the first stage with

¹ For a survey of the literature see for example Booth (1995).

wages, and in the second with employment levels. In contrast to the EBM, the bargaining power of parties is not necessarily the same at each stage.

Formally Manning's model considers a company that is risk-neutral, profit-maximising, and using a technology characterised by the Cobb-Douglas function: $f(L,K)=L^\beta K^\alpha$. The company's profit is given by (1):

$$\Pi(W, L, K) = L^\beta K^\alpha - WL \quad (1)$$

with W , L , and K representing the wage, employment level, and capital stock, respectively. The union members are also assumed to be risk-neutral. The labour supply is a continuum of workers normalised to unity. Consequently, the union's utility function is represented by the following expression:

$$U(W, L, B) = L W + (1-L)B \quad (2)$$

with B representing the reservation wage. The model is solved backwards: the last stage consists in determining the level of employment, given the wage determined in the first stage. The resulting deal is represented by the maximisation of the generalised Nash bargain in which the status quo positions are replaced by the outside options. Thus, the status quo positions of the company, without fixed costs, and of the union members equals respectively zero and B . The generalised Nash bargaining solution associated with this problem can be written in the following manner:

$$\hat{L}(W, \varphi_2, K, B) = \underset{L}{\operatorname{argmax}} [L^\beta K^\alpha - WL]^{1-\varphi_2} [L(W - B)]^{\varphi_2} \quad (3)$$

$\varphi_2 \in [0,1]$ represents the unions' employment-related bargaining power. The first-order condition (FOC) of this problem, which defines the employment level, is represented by (4):

$$[\beta + (1-\beta)\varphi_2]L^{\beta-1}K^\alpha = W \quad \equiv \text{Employment equation.} \quad (4)$$

We observe that, when W , φ_2 , K , and B are given, this equation is compatible with only one level of employment. Moreover, the result of the first stage of negotiation (the wage-related stage) corresponds to the solution of the following generalised Nash bargain:

$$\left\{ \begin{array}{l} \hat{W}(\varphi_1, \varphi_2, K, B) = \underset{W}{\operatorname{argmax}} [L^\beta K^\alpha - WL]^{1-\varphi_1} [L(W-B)]^{\varphi_1} \\ \text{st. } L = \hat{L}(W, \varphi_2, K, B) \end{array} \right. \quad (5)$$

$\varphi_1 \in [0,1]$ represents the union's influence in setting wages. The result of the Nash bargain is given by the FOC:

$$\frac{B}{\beta} (\beta + (1-\beta)\varphi_1) = W \quad \equiv \text{Wage equation} \quad (6)$$

This equation does not directly depend on the parameter φ_2 . Moreover, for φ_1, φ_2, K and B given, the solution is unique. In sum, Manning's model results in the level of employment \hat{L} and the wage \hat{w} , in line with equations (4) and (6). Finally, let us point out that, according to this model, an increase in union influence with respect to wages will reduce employment, whilst an increase of their employment-related bargaining power will reduce the number of unemployed.

3. Selection Procedure

Let us briefly review the procedure developed by Alogoskoufis and Manning (1991) on which we rely to make a choice between the usual bargaining models and the GBM. We begin by noting that equations (4) and (6), log-linear, can be reformulated in the following manner:

$$\left\{ \begin{array}{l} (1-\beta)\log L = \log \delta + \alpha \log K - \log W \\ \log W = \log \vartheta + \log B - \log \beta \end{array} \right. \quad (7)$$

with $\delta = \beta + (1-\beta)\varphi_2$ and $\vartheta = \beta + (1-\beta)\varphi_1$. Assuming that $\log \delta = \delta_0 + \delta_1\varphi_2$, and $\log \vartheta = \vartheta_0 + \vartheta_1\varphi_1$, let us rewrite the system of equations (7) as:

$$\left\{ \begin{array}{l} \log L = \frac{\delta_0 - \vartheta_0 + \log \beta}{1-\beta} + \frac{\alpha}{1-\beta} \log K - \frac{1}{1-\beta} \log B + \frac{\delta_1}{1-\beta} \varphi_2 - \frac{\vartheta_1}{1-\beta} \varphi_1 \\ \log W = \vartheta_0 - \log \beta + \log B + \vartheta_1 \varphi_1 \end{array} \right. \quad (8)$$

Since the unions' relative bargaining power is not directly observable, other variables must be used to approximate it. Thus, let us suppose that:

$$\begin{cases} \varphi_2 = \tau_0 + \tau_1 \log \Phi_1 + \tau_2 \log \Phi_2 \\ \varphi_1 = \nu_0 + \nu_1 \log \Phi_1 + \nu_2 \log \Phi_2 \end{cases} \quad (9)$$

The variables Φ_1 and Φ_2 represent the union's influence during the two stages of the negotiation. These variables do not directly affect the firm's profit function or the level of utility attained by the union. As pointed out by Binmore *et al.* (1986), it is important to capture the asymmetry of the parties' situations, which is independent of their utility functions and their status quo positions. At present, let us replace the variables φ_1 and φ_2 of expression (8) by system (9), and isolate $\log \Phi_2$ from the wage equation. Next, by substituting this expression in the employment expression, we obtain:

$$\begin{aligned} \log L &= \psi_0 + \psi_1 \log K - \psi_2 \log B + \psi_3 \log \Phi_1 + \psi_4 \log W \\ &\equiv \text{GBM employment equation} \end{aligned} \quad (10)$$

$$\text{with } \begin{cases} \psi_1 = \frac{\alpha}{1-\beta}; \psi_2 = \frac{\delta_1 \tau_2}{1-\beta} \frac{1}{\vartheta_1 \nu_2} \\ \psi_3 = \frac{\delta_1 \tau_1}{1-\beta} - \frac{\delta_1 \tau_2}{1-\beta} \frac{\nu_1}{\nu_2}; \psi_4 = \frac{\delta_1 \tau_2 - \vartheta_1 \nu_2}{1-\beta} \frac{1}{\vartheta_1 \nu_2} \end{cases}$$

With the help of this expression, we can establish a procedure involving wages and employment for selecting an appropriate bargaining model. First, if we accept the RMM, the unions have only an indirect influence on employment, through their wage decisions. The parameter φ_2 equals zero and, in conformity with expression (9): $\tau_0 = \tau_1 = \tau_2 = 0$. Consequently, the RMM involves a test of the following restrictions:

$$\begin{cases} H_0 : \psi_2 = 0, \psi_3 = 0 \\ H_1 : \psi_2 \neq 0, \psi_3 \neq 0 \end{cases} \quad (11)$$

Under the null hypothesis, we thus obtain:

$$\begin{aligned} \log L &= \psi_0 + \psi_1 \log K + \psi_4 \log W \\ &\equiv \text{RMM employment equation} \end{aligned} \quad (12)$$

Second, if we choose the EBM, $\varphi_1 = \varphi_2$. According to expression (9), it follows that $\tau_0 = \nu_0$, $\tau_1 = \nu_1$ and $\tau_2 = \nu_2$. Hence, the EBM implies testing the fol-

lowing restriction:

$$\begin{cases} H_0 : \psi_3 = 0 \\ H_1 : \psi_3 \neq 0 \end{cases} \quad (13)$$

Under the null hypothesis, the equation is:

$$\begin{aligned} \log L &= \psi_0 + \psi_1 \log K - \psi_2 \log B + \psi_4 \log W \\ &\equiv \text{EBM employment equation} \end{aligned} \quad (14)$$

Before moving on to the empirical analysis, we should point out that this procedure is only appropriate if we assume that there is no efficiency wage.

4. Data

Our sample consists of annual data from 1960 to 1993 relating to the Swedish private sector. In order to apply the above-discussed tests, we have subdivided our variables into three categories: (a) those that have a direct effect on firms' profit function, (b) those influencing the union's utility function without having any direct impact on firms' profit function, and (c) those impacting the parties' bargaining power without directly influencing their utility and profit functions. The variables grouped in each category are listed in the table 1.

The first category includes the real wage cost, a proxy for the cyclical component of external demand for Swedish production, the real exchange rate, and real import prices weighted for the share of imports in the Swedish GDP. As pointed out by Layard and Nickell (1985, 1986), the last of these, as well as those in categories (b) and (c) constitute push factors.

Indeed, all other things being equal, an increase of $v \log(\text{PM}/\text{P})$ will reduce workers' purchasing power. Consequently, it is likely that workers will demand wage increases to compensate for this reduction. We should thus observe a negative relationship between $v \log(\text{PM}/\text{P})$ and movements in the level of employment.

The replacement ratio (RR) and the tax wedge (TAX) constitute the second category variables. RR describes the evolution in the ratio of the reservation wage (approximated by the average level of unemployment benefits) to the average wage in the Swedish private sector. This variable represents the external opportunity of workers not finding a job. The theory states that an increase in the RR reduces union incentive for wage moderation, and thus exerts

a negative effect on the level of employment. TAX corresponds to the sum of social security contributions and direct and indirect taxes, expressed as a percentage of the hourly wage in the Swedish private sector. All other things being equal, an increase in this variable decreases the real wage received by workers. Consequently, according to the collective bargaining models, unions will push for higher wages to compensate for their members' loss of purchasing power. The level of employment is negatively affected.

Tab. 1 – Variable classification

A. Dependent variable:

log (Lp) log of total employment in the private sector

B. Independent variables:

(a) *Having a direct effect on the profit function*

log (WCP / P) log of the real wage cost in the private sector

WT proxy for the cyclical component of external demand

log (e*PW / P) log of the real exchange rate – competitiveness index

v log (PM / P) log of real import prices, weighted by the share of imports in the GDP

(b) *Having a direct effect on the utility function but not on the profit function*

log (RR) log of the replacement ratio

TAX the private sector tax wedge

(c) *Having a direct effect on the bargaining power but not on the profit and utility functions*

log (DEN) log of the trade union density

log (NSN) log of the number of strikes (both legal and illegal)

* A detailed description of these variables and their sources can be found in appendix A.

The variables grouped in the third category, i.e., the trade union density and the number of strikes, are more subject to criticism. Indeed, there are arguments supporting the notion that the trade union density will affect the unions' utility function, and hence, this variable should be included in the second category. Nonetheless, "it has been conventional to use this variable as a measure of trade union power, and it is difficult to see alternatives" (Alogoskoufis and Manning, 1991). The same holds true for the number of strikes.

Tab. 2 – Average annual growth rates

<i>Period</i>	<i>1960 – 1975</i>	<i>1976 – 1982</i>	<i>1983 – 1990</i>	<i>1991 – 1993</i>
Lp	0.31	-1.24	1.47	-4.77
WCP/P	5.50	-0.08	1.62	-0.52
e * PW / P	-2.59	3.66	-8.56	12.79
v (PM / P)	-0.02	0.80	-1.19	1.27
RR	0.44	4.46	0.20	-0.45
TAX	2.98	2.84	0.86	-1.55
DEN	0.23	1.14	0.42	5.37

* The average annual growth rates for the disaggregated variables can be found in appendix B.

Table 2 presents the average annual growth rates for most of the variables involved in our study. We have chosen a subdivision of time which corresponds to the most characteristic periods of Swedish private sector employment evolutions. During the first period (1960-75), employment remained fairly stable. However, a number of factors contributed to reduced levels of employment in the mid-seventies (Calmfors and Forslund, 1990). These factors included a deterioration in the trade balance, losses of market share for certain exports, a decline in investment and a significant increase in wage costs (provoked by increased prices on imports), all in addition to a weakened growth in productivity. Subsequently, despite real wage cost adjustments, a devaluation of the Swedish Crown and a regain in productivity, it was not until 1983 that employment began to pick up again.

The years 1983-90 correspond to a post-adjustment period. As a result of accommodating economic policy, the level of inflation remained high in comparison to that of other Western European nations. The growth rate of the real wage cost became positive beginning in 1984, and Sweden's competitiveness progressively deteriorated. However, as a result of adjustments made in the preceding period, of strong demand, and of sustained international economic growth, employment continued to grow until the end of the period.

The number of jobs shrank considerably between 1991 and 1993. This reversal is, to a certain extent, the result of an international recession. However, it is likely that the greatest factor is the anti-inflationary policy implemented in Sweden. Indeed, "there was a deliberate attempt to adhere to a non-accommodative policy, in which the fixed exchange rate towards the ECU adopted in 1991 was regarded as the anchor. The consequence was a *collision* between the exchange rate policy and the large wage increases that had already occurred in the preceding boom, which resulted in a serious over-evaluation of the real exchange rate" (Calmfors, 1993). Finally, the upward pressures on the exchange rate between 1991 and 1992 also contributed to the sudden growth in unemployment.

5. Results

Our econometric methodology follows first the Engle-Granger's (1987) two-step estimation procedure. We use Phillips and Hansen's (1990) non-parametric technique to correct OLS estimators of the long-run employment equations of each model, i.e. RMM, EBM and GBM. This method gives optimal and asymptotically normal estimators which permit for statistical inference. After having tested the stationarity of the residuals, we estimate, in each case, an ECM (error correction model) representation of a dynamic employment equation. This pro-

cedure is justified by the fact that the variables are, as we will see, I(1). Besides, it enables us to distinguish between the short and long run impact of the variables on employment. Finally, the use of non-nested tests allows us to select the adequate model for the Swedish private sector.

5.1. Unit root tests

Before moving on to the first step in the co-integration test developed by Engle and Granger (1987), we must verify that all our variables have the same order of integration. To accomplish this, we have used three types of tests: Augmented Dickey-Fuller (ADF), Phillips-Perron (PP) and Durbin-Hausman (DH). In order to determine the number of lags to use in the ADF regression, we relied on the Breusch-Godfrey LM-test. Working with annual data, we chose to test the auto-correlation of residuals to the second order. The results we obtained are presented in table 3.

Tab. 3 – Order of integration of the variables

	Δ	PP	DH	ADF	k	LM	Results
log (Lp)	0	-11.86	16.8	.116	2	.729 / .378	I (1)
	1	-12.83	50.6	.078	1	.496 / .700	
log (WCP / P)	0	-1.10	3.6	.572	0	.513 / .425	I (1)
with dummy	1	-25.48	53.5	.081	1	.446 / .652	
log (WT)	0	-5.39	19.6	.287	1	.335 / .559	I (1)
	1	-16.66	413.0	.003	1	.852 / .774	
log (e*PW/P)	0	-6.16	9.9	.114	1	.319 / .500	I (1)
	1	-17.24	336.1	.020	0	.887 / .317	
v log (PM / P)	0	-7.58	14.3	.495	0	.352 / .673	I (1)
	1	-27.81	19298.6	.001	0	.461 / .775	
log (RR)	0	-1.53	4.2	.766	0	.378 / .546	I (1)
	1	-33.33	741.1	.000	0	.590 / .249	
TAX	0	-1.19	0.3	.589	1	.534 / .346	I (1)
	1	-15.63	48.4	.094	0	.662 / .254	
log (DEN)	0	1.24	2.0	.996	0	.785 / .902	I (1)
	1	-31.77	3816.3	.003	0	.594 / .704	
log (NSN)	0	-5.04	25.7	.525	2	.543 / .674	I (1)
	1	-17.07	4531.7	.000	1	.384 / .585	

* The critical values at 5% for the PP and the DH tests are respectively 12.8 and 32.6.

A dummy variable, made equal to 0 for the years 1960-75 and to 1 for the years 1976-93, was used in the tests concerning real wage cost. The purpose of this variable is to account for a structural break observed in 1975, in the evolution of wage costs. Indeed, the growth rate of this variable was substantially lower in 1976-93 than in the preceding period.

The column Δ indicates whether or not the tests were carried out on variables in level or variables in first differences. The figure in the ADF column corresponds to the p-value. The k parameter represents the number of lags used in the regression relative to the ADF. The LM column indicates the p-values for the Breush-Godfrey test. Finally, the last column shows the order of integration of the variables.

In light of the results of table 3, we can conclude that, at a level of 10%, all of our variables in level are integrated of order one. Moreover, they are stationary in first-order differences. This is also supported graphically.

5.2. Long-run employment equations

The first stage in the Engle-Granger (1987) co-integration test is an estimation of the equilibrium relation between the variables in level. If the variables are co-integrated, then the ordinary least squares method (OLS) supplies super-consistent estimators for the co-integration parameters. However, these estimators do not allow for statistical inference because their distribution is usually not normal and biased in finite samples. This is due to two things : the I(1) structure of the regressors and their potential correlation with the I(0) residuals. Nevertheless, Phillips and Hansen's (1990) estimation procedure corrects for this bias and yields asymptotic normality where such correlation exist. This non-parametric method provides 'fully modified' t-statistics which permit inference to proceed conventionally. It is based upon two non-parametric corrections, i.e. for the auto-correlation of the residuals and the possible correlation between the regressors and the disturbances. The existence of a long-run equilibrium relationship is verified through a stationarity test on the residuals.

Phillips and Hansen's (1990) estimation procedure has been applied to the employment equations of the GBM, the RMM, and the EBM, i.e., to equations (10), (12), and (14). Next, we used the ADF test to determine the order of integration of the residuals from the three regressions. The Breusch-Godfrey LM test allowed us to determine the number of lags to use in the ADF. As recommended by Enders (1995), in order to judge the stationarity of the residuals, we used the critical values supplied by Engle and Yoo (1987). They are available up to N=5, where N corresponds to the number of explanatory I(1) variables in the long-run employment equation. Our estimates are presented in tables 4 and 5.

Tab. 4 - Co-integration tests on the residuals

<i>ADF(k)</i>	<i>k</i>	<i>LM-test</i>	<i>Critical val. at 5 and 10%</i>	<i>Results</i>
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GBM	-5.12	0	.537 / .775	-4.76 / -4.42	I(0)
EBM	-3.99	1	.297 / .516	-4.15 / -3.85	I(0)
RMM	-3.90	1	1.00 / 1.00	-4.15 / -3.85	I(0)

*The critical values figuring in this table come from Engle and Yoo (1987). The parameter "k" corresponds to the number of lags introduced in the ADF.

The results shown in table 4 suggest that the residuals of the three regressions are stationary at a level of 10%, which is supported graphically. Consequently, it appears reasonable for us to affirm that the variables contained in each of these equations form a co-integration vector.

Tab. 5 – Long-run employment equations

<i>log(Lp)</i>	<i>GBM</i>	<i>EBM</i>	<i>RMM</i>
Constant	7.298 (34.4, .00)	6.63 (73.4, .00)	6.547 (73.4, .00)
log (WCP / P)	-.198 (-5.4, .00)	-.143 (-3.2, .00)	-.054 (-1.6, .11)
WT	.188 (1.9, .06)	.524 (5.0, .00)	.462 (3.6, .00)
log (e*PW / P)	-.042 (-1.6, .11)	-.011 (-.4, .73)	-.028 (-.6, .54)
v log (PM / P)	-.682 (-4.2, .00)	-.474 (-2.5, .02)	-.227 (-.9, .35)
log (RR)	-.147 (-4.1, .00)	-.124 (-2.6, .01)	
TAX	.381 (6.2, .00)	.250 (3.7, .00)	
log (DEN)	-.310 (-3.5, .00)		
log (NSN)	.008 (1.9, .05)		
DUM	-.006 (-.9, .36)	-.005 (-.5, .59)	.009 (-.9, .36)
R ² adjusted	.737	.629	.417
SSR	.0011	.0017	.0029
σ of regression	.0067	.0079	.0099
Obs	34	34	34

* t-statistics and p-values are indicated between brackets.

What lessons can be learned from the long-run relationships illustrated in table 5?

- In contrast to the real wage cost, the external demand for Swedish goods has a positive influence on the level of employment at equilibrium.
- Real import prices, weighted by the share of imports in the GDP have a negative influence on employment. This result is not surprising given that "at the time of the first oil shock and the accompanying rise in commodity prices, this was perhaps the most published cause of the rise in unemployment" (Layard and Nickell, 1985). Besides it seems to confirm the notion that a rise in real import prices reduces the purchasing power of workers, thereby pushing real wage costs upward and reducing the level of employment.
- Employment is inversely related to the replacement ratio. In line with the theoretical models an increase in the replacement ratio seems to reduce the unions' incentive to support moderate wages, thereby reducing the level of employment.

- (d) The tax wedge has a positive effect on employment. In order to understand this relationship, let us perform a parallel comparison of the evolutions of real wage cost and the tax wedge, bearing in mind that real wage cost is inversely related to employment. The period 1960-76 was characterised by a significant increase in the tax wedge and the real wage cost. Subsequently, in spite of the continued expansion of the tax wedge, between 1976 and 1982, the increase in real wage cost waned considerably. In the next period (1983-90), the growth rate of real wage cost took off again, in spite of a less vigorous growth in the tax wedge. Finally, a decrease in the tax wedge between 1991 and 1993 was accompanied by a reduction in the real wage cost. This description shows quite clearly that increasing the tax wedge is not always synonymous with employment-reducing wage demands. In reality, “the course of action chosen was instead to try to reach corporatist agreements with trade unions on wage restraints for tax concessions” (Calmfors, 1993). For example, “in the so-called Haga-agreements encompassing 1974-76, the wage earner organisations promised to moderate wage claims in response to increases in payroll taxes” (Calmfors and Forslund, 1990).
- (e) In contrast to the trade union density, the number of strikes has a positive effect on employment. In referring to the underlying theoretical model, these variables can thus be associated with the unions’ bargaining power in terms of wages (φ_1), and of employment, (φ_2) respectively.

5.3. Dynamic employment equations

The second step in the Engle-Granger test (1987) is the estimation of an ECM representation for the RMM, the EBM and the GBM. To do this, we apply the OLS method to the following expression:

$$\Delta Lp_t = \alpha_1 + \alpha_2 \Delta Lp_{t-1} + \alpha_3 \Delta x_t + \alpha_4 \tilde{z}_{t-1} + \varepsilon_t \quad (15)$$

The residuals from the co-integration regression (\tilde{z}_{t-1}) measure deviation with respect to the long-run equilibrium, at time (t-1). The relative coefficient α_4 , captures the speed of adjustment toward long-run equilibrium. It thus represents the part of disequilibrium that is corrected from one period to the next.

Statistical inference based on traditional tests is appropriate, since all the variables involved in equation (15) are stationary. The results of our estimations are presented in table 6. The values in parentheses in table 6 are, respectively, the Student variable and the p-value. NORM corresponds to Jarque-

Bera's test of normality. HET is the White heteroscedasticity test. The Breusch-Godfrey LM test confirms residual auto-correlation to the second order. The F statistic assures the global validity of the model. The p-values associated to NORM, HET and F-tests are indicated between brackets.

The results of the GBM meet theoretical expectations. The evolution of employment is characterised by a certain inertia: an increase of $\Delta(Lp_{-1})$ by 1% provokes an increase by approximately 0.5% of $\Delta(Lp)$. More surprising is the non-significance of the real wage cost regression coefficient. This can be explained, however, if we assume that the production function is of the clay-clay type. In this case, the labour demand equation relies on two perfectly complementary production factors. Hence, in the short term, production factors are not interchangeable. However, as mentioned above, the long-run influence of the real wage cost on employment is significantly negative.

Tab. 6 – Dynamic employment equations

$\Delta \log(Lp)$	GBM	EBM	RMM
Constant	-.002 (-.8, .45)	-.003 (-1.0, .34)	-.004 (-1.2, .25)
$\Delta \log(Lp(-1))$.514 (3.3, .00)	.546 (3.4, .00)	.743 (4.3, .00)
$\Delta \log(WCP/P)$	-.043 (-.4, .72)	.032 (.3, .80)	.202 (1.5, .15)
$\Delta \log(WT)$.065 (.9, .40)	.212 (2.7, .01)	.170 (2.1, .05)
$\Delta \log(e*PW/P)$	-.027 (-1.0, .35)	.008 (.2, .81)	.013 (.4, .70)
$\Delta v \log(PM/P)$	-.357 (-1.6, .12)	-.303 (-1.3, .22)	-.196 (-.8, .44)
$\Delta \log(RR)$	-.053 (-2.1, .05)	-.056 (-2.1, .05)	
$\Delta \log(TAX)$.227 (2.6, .02)	.217 (2.3, .03)	
$\Delta \log(DEN)$	-.070 (-.7, .48)		
$\Delta \log(NSN)$.010 (3.0, .01)		
DUM	.001 (.4, .67)	.002 (.7, .52)	.003 (1.0, .34)
\tilde{z}_{t-1}	-.700 (-3.5, .00)	-.493 (-2.7, .01)	-.475 (-2.9, .01)
R ² adjusted	.653	.590	.517
SSR	.0004	.0006	.0007
σ of regression	.0046	.0050	.0055
LM	.147 / .348	.692 / .862	.294 / .173
NORM	4.76 (.092)	1.79 (.409)	.341 (.843)
HET	21.34 (.448)	13.80 (.681)	16.28 (.234)
F – stat	6.29 (.000)	5.96 (.000)	5.74 (.000)
Obs	32	32	32

* t-statistics and p-values are indicated between brackets.

None of the variables having a direct role in companies' profit function is significantly different from zero at 10 per cent. The replacement ratio, as in the long-run, has a negative – albeit limited – effect on employment. The positive effect of the tax wedge on employment is explained, as mentioned earlier, by the fact that “trade unions accept lower wages under social democratic governments for a *social wage*, i.e., tax and expenditure policies that meet the de-

mands of unions” (Calmfors and Forslund, 1990). Thus, wage moderation is often accompanied by an increase in the tax wedge, which explains the positive relationship between the tax wedge and employment. Moreover, as in the long-run employment equation, the number of strikes has a significant positive influence on employment. Consequently, as suggested by Manning’s model (1987), we are able to assimilate this variable with the parameter (ϕ_2) representing the employment-related bargaining power of the unions.

The results obtained for the EBM and RMM are quite similar to those obtained for the GBM. A noteworthy difference is that in the EBM and RMM, the indicator for external demand for Swedish production becomes significant.

Besides, we remark that the residuals of the long-run employment equations are all significant at a level of 5%. This constitutes additional indication of the existence of co-integration relationships. Moreover, the speed of adjustment towards long-run equilibrium is rather high and this in particular for the GBM.

In the end, what have we found?

- (a) The replacement ratio and the tax wedge have a significant impact on employment both in the short and in the long run. This result can be interpreted as evidence for the rejection of the RMM in favour of the EBM. However, notice that the negative long run coefficient on the real wage cost suggests a downward sloping contract curve which is in contradiction with the assumption of a risk neutral union.
- (b) The variables affecting only the parties’ bargaining power have significant long run estimated coefficients. Moreover, we found that the number of strikes exerts a significant positive influence on employment in the short run. Hence, the GBM seems to be a relevant candidate for describing employment determination in the Swedish private sector.

5.4. Non-nested tests

The Engle-Granger two-step procedure (1987) involves the use of non-nested tests to choose the appropriate wage-employment bargaining model. Indeed, by including the residuals from the co-integration regression, it becomes impossible to write any dynamic employment equation as a specific case of any other.

Tab. 8 – Non-nested tests

$H_0: M_1$, $H_1: M_2$	<i>Encom- passing</i>	<i>N – test</i>	<i>NT – test</i>	<i>W – test</i>	<i>J – test</i>	<i>JA – test</i>
GBM vs RMM	.554 (.466)	-1.108 (.268)	-.463 (.643)	-.665 (.506)	.741 (.468)	.760 (.457)
RMM vs GBM	2.726	-8.395	-2.001	-2.528	4.025	2.963

	(.051)	(.000)	(.045)	(.012)	(.001)	(.007)
GBM vs EBM	.142	-.512	-.266	-.292	.375	.373
	(.711)	(.609)	(.790)	(.770)	(.715)	(.713)
EBM vs GBM	1.952	-4.224	-1.141	-1.451	2.498	1.027
	(.156)	(.000)	(.254)	(.147)	(.021)	(.316)
EBM vs RMM	.145	-.503	-.179	-.284	.375	.370
	(.707)	(.615)	(.858)	(.776)	(.711)	(.759)
RMM vs EBM	2.057	-4.372	-1.323	-1.803	2.601	2.085
	(.137)	(.000)	(.186)	(.071)	(.016)	(.048)

* If the test is not significant, model 1 encompass model 2. When the test is significant, model 1 does not encompass model 2. p-values are indicated between brackets.

A characteristic of the non-nested tests is that they involve two null hypotheses. Thus, there may be no result if the models are simultaneously rejected or accepted. Six kind of tests were applied to discriminate between the three models: the encompassing test (F-test), Davidson and MacKinnon's (1981) J-test, Fisher and MacAleer's (1981) JA-test, Cox's (1962) N-test and finally Godfrey and Pesaran's (1983) NT and W-test. Their performance has been compared by Godfrey and Pesaran (1983) on the basis of Monte Carlo simulations run on small samples.

Results from table 8 are consistent with preceding findings. Indeed, they show that:

- (a) The EBM encompasses the RMM at the level of 10 per cent.
- (b) The RMM and the EBM can be rejected in favour of the GBM respectively at the level of 5 and 15 per cent.

6. Concluding Remarks

The purpose of this paper was to discriminate among alternative wage-employment bargaining models using annual macro-data from the Swedish private sector covering the period 1960-93. While the majority of research in this field is restricted to testing the usual bargaining models, i.e. *right-to-manage* (RMM) and *efficient bargaining* (EBM), we took a broader look at this question. In other words, bearing in mind the main features of the Swedish collective bargaining system, we found it essential not to test only for the usual bargaining models but also for the *general bargaining* model (GBM). Indeed, although wages were unquestionably the main bargaining topic in the pre-1993 Swedish industrial relations system, trade unions also had some bargaining power on employment particularly at the local level (Hammarström and Nilsson, 1998).

Our results, obtained using the Engle-Granger procedure (1987) and non-nested tests, show that the EBM encompasses the RMM. In addition, we found that the RMM and EBM can be rejected in favour of the GBM. This re-

sult may be particularly important for government policy. Indeed, in the latter (i.e. the GBM), an increase in the unions' bargaining power with respect to wages (φ_1) reduces employment. On the other hand, an increase in their influence in the setting of employment levels (φ_2) has the inverse effect. Consequently, a weakening of the unions could potentially lead to a reduction in employment. Among other things, this suggests that the relationship between collective bargaining and employment is considerably more complex than implied by the usual models. Besides, this implies that Pareto inefficiency is not a consequence of the unions' bargaining power, per se, but rather of the difference between φ_1 and φ_2 .

Let us also notice that our findings support Espinosa and Rhee's (1989) predictions. Their theoretical model shows that the equilibria on the labour market are neither as inefficient as the monopoly union model forecasts nor as fully optimal as the efficient bargaining model forecasts. Following Espinosa and Rhee this stems from the fact that the firm-union bargaining relationship is not a one-shot game in nature. Firms and unions are involved in a repeated interaction, so that considerable opportunity exists for the parties to build a long-term relationship that may end up in a nearly efficient outcome. Bargaining over wages and employment thus corresponds to a cooperative strategy that may be sustained in equilibrium if the future consequences of any unilateral deviation are bad enough and if the future matters sufficiently. In other words, they point out that the reason why the monopoly union model fails to result in an efficient outcome in a one-period model is that the problem has a Prisoner's Dilemma structure. This argument seems particularly relevant for a highly corporatist country like Sweden. The concept of corporatism resembles the level of centralisation of collective bargaining as well as the degree of co-ordination among the social partners. In particular, it reflects an intense and repeated firm-union relationship which we believe to be at the root of our findings, i.e. a nearly efficient outcome.

Nevertheless, further research should try to improve the variables representing union bargaining power. This could be done by using data coming from sectors or from individual firms. It would also be interesting to test a modified version of Manning's (1987) model, assuming that the parties' bargaining power is dependent on the degree of centralisation of the negotiations. We could thus account for the fact that the Swedish wage negotiations are relatively less centralised since the 1980's and in particular since SAF's (Swedish Employer's Confederation) 1991 decision to withdraw from the central bargaining process. Finally, additional work is needed on the nature and evolution of trade unions objectives and on how their influence on wages is affected by government policy.

Appendices

A. Sources and Descriptions of Data

Lp: Total employment in the Swedish private sector. Source: Anders Forslund (AF), Department of Economics, Uppsala University, Sweden.

WCP/P: Real wage cost in the Swedish private sector, i.e., (hourly wage per worker + social security contributions) / GDP deflator. Source: AF.

WT: Indicator of the cyclical component of external demand for Swedish production (weighted by the GDP, Hodrick-Prescott filter). Source: AF.

*e*PW/P*: Real exchange rate – competitiveness index.

e: SEK/USD exchange rate. Source: OECD (1998), *Economic Outlook*, Paris : OECD.

PW: USD export price indices for all OECD countries. Source: OECD (1998), *National Accounts – Volume 1*, Paris : OECD.

v: Ratio of imports to the GDP at production cost. Source: OECD (1998), *National Accounts – Volume 1*, Paris : OECD.

PM: Import deflator. Source: OECD (1998), *National Accounts – Volume 1*, Paris : OECD.

TAX: Tax wedge, corresponding to the sum of social contributions, plus direct and indirect taxes in the private sector, as a percentage of the average hourly wage. $TAX = \log(WCP/P) - \log(WN/PC)$.

WN: Average post-tax hourly wage in the private sector, i.e., after deduction of the salary withholding tax and employee social contributions. Source: AF.

PC: Private consumption deflator. Source : OECD (1998), *National Accounts – Volume 1*, Paris : OECD.

RR: Replacement ratio, i.e., W^o/WN .

W^o: Average unemployment benefits, after withholding tax. Source: Arbetslöshetsförsäkringens utveckling 1946-1995, Arbetsmarknadsstyrelsen, Försäkringenheten, AMS, Sweden.

DEN: Trade union density, i.e., total number of union members (including the unemployed, but excluding students, retirees, and the self-employed) / active population. Source: Jelle Visser, University of Amsterdam, Department of Sociology.

NSN: Number of legal and illegal strikes. Source: “Stoppages of work in Sweden, private and public sector”, 1947-1964 and 1965-1996, the Swedish National Conciliation Office, Sweden.

B. Average Annual Growth Rates

<i>Period</i>	<i>1960 – 1975</i>	<i>1976 – 1982</i>	<i>1983 – 1990</i>	<i>1991 – 1993</i>
P	5.82	9.60	7.02	1.89
WCP	11.62	9.50	8.75	1.32
W	9.39	7.80	8.53	5.35
SCR	15.28	2.86	0.28	-4.97
AVTAX	3.43	0.00	1.42	0.74

WN/PC	2.45	-2.84	0.76	1.04
PC	5.51	10.95	6.92	3.98
W ^o	7.49	12.03	8.20	8.02
WN	7.02	7.25	7.99	8.51

* Notation: W corresponds to the hourly wage in the private sector, SCR to the rate used in calculating social contributions, and AVTAX to the average personal income tax, see also appendix A.

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Abstract

The War of Models : Determination of Wages and Employment in Swedish Private Sector

The purpose of this paper is to discriminate between competing models of wage and employment determination (right-to-manage, efficient bargaining and general bargaining models) using annual macro-data from the Swedish private sector covering the period 1960-93. Methodologically, the analysis relies on the Engle-Granger's two-step estimation procedure and on non-nested tests. Phillips-Hansens's non-parametric technique is used to obtain optimal and asymptotically normal long-run estimators. Our results show that the right-to-manage and the efficient bargaining models can be rejected in favour of the general bargaining model. Consequently, they stress the absence of a simple relation between the trade unions bargaining power and employment.

JEL Classification: J50, C22, C52.

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We wish to thank Anders Forslund, Lars Jagren and Jelle Visser for making the data available. We also wish to acknowledge the helpful comments of Maria Jepsen, Joffrey Malek Mansour and Isabelle Terraz.

(Received November 2000)