Interpreting Wage Bargaining Norms

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.

Summary in Swedish

De kollektiva löneförhandlingarna i Sverige har från och med andra hälften av 1990-talet påverkats av en informell samordning mellan stora fackförbund och förhandlingsorganisationer. Parterna har utgått från en tågordning där industrins förhandlingsresultat sätter en norm för avtalsökningarna i den övriga ekonomin. Denna uppsats presenterar en teoretisk analys av en sådan förhandlingsordning. Två teoretiska tolkningar av det svenska förhandlingssystemet presenteras: (i) Industrin som en Stackelberg-ledare och (ii) industrins avtalsökning som en norm som understöds av antingen ett socialt tryck eller "avundsjuka" fackförbund inom tjänstesektorn. Analysens centrala slutsats är att lönenormering avsevärt kan förbättra såväl produktions- som sysselsättningsnivå jämfört med fallet utan normering. Genom att generalisera en idé som presenterats av Lars Calmfors och Anna Larsson härleds också en enkel teori om varför normen ibland förefaller binda och ibland inte. En jämförelse av modellens prediktioner med avtalsutfallen från de fem senaste avtalsrörelserna visar att modellen i allmänhet är konsistent med empiriska observationer: avtalsökningarna är mer återhållsamma och lönenormen binder bättre när industrins initiala relativlön är låg.

Interpreting wage bargaining norms

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Abstract

From the mid-1990s onwards, Swedish wage bargaining has been characterised by informal co-ordination of the wage claims of big unions and bargaining cartels. In particular, it has been understood that the manufacturing sector should lead by first agreeing on a pay increase, whereafter the service sector and public sector unions choose a similar increase. We analyse this setup with two possible theoretical interpretations: (i) the manufacturing sector as a Stackelberg leader and (ii) a normative role for the manufacturing sector's pay increase, supported either by unmodelled social pressure or a modeled loss aversion (envy) of the sheltered sector unions. The conclusion of the analysis is that the normative or leading role of one sector – in the Swedish case the manufacturing sector – can potentially bring big benefits for employment and output. Generalising an idea suggested by Lars Calmfors and Anna Larsson, our analysis also generates a rudimentary theory of why the wage increase norm sometimes binds and sometimes not. A comparison of the model predictions and the observed outcomes of the last five wage bargaining rounds in Sweden suggests that the model is generally consistent with the empirical observations: wage moderation and norm observance are stronger when the manufacturing industry's initial relative wage is low.

Keywords: wage bargaining, bargaining co-ordination, Sweden. J31, J52.

1 Introduction

Since the demise of the formally centralised wage bargaining procedures in the 1980s, Swedish labour market parties have gradually settled on a system of informal co-ordination. This new bargaining procedure is not completely well-defined, nor accepted by everybody. Yet it is possible to enumerate a few principles and stylised facts that characterise the current institutions:

- The pay increases of most wage earners are still directly or indirectly steered by the collective agreements negotiated by the unions. Centralised, i.e. nationwide union or business federations have no formal role or mandate in wage bargaining. However, they have been replaced by large bargaining cartels and co-ordination between unions and between employer organisations. These bargaining cartels transcend the blue-collar vs. white-collar demarcation line. Instead, they encompass the wage-earners of the manufacturing (mostly) export sector, the public sector or groupings of service sector unions.

- From the late 1990s onwards, it has been generally accepted that the manufacturing industry should play a leading role in pay bargaining. Thus, it is expected that the manufacturing sector organisations are the first to conclude a new collective agreement, and, furthermore, that the remaining bargainers will adopt that level of pay increases in their own pay settlements. This leading role of the manufacturing industry partners is often called "pay increase norm" (lönenormering) in Sweden.

- The leading role of the manufacturing sector is reflected in the organisational structures of the labour market. On the union side, there is an effective organisation, "Manufacturing Unions" (Facken inom Industrin) that establishes a common pay claim for almost the entire manufacturing sector.[1]

- Along with the manufacturing industry cartel, the workers' central organisation LO continues to enforce and sustain the co-ordination efforts of its member unions, even if it is formally cut off from pay bargaining. Employers probably also try to co-ordinate their bargaining efforts within the Swedish Business Confederation (Svenskt Näringsliv). Such organisational co-ordination overlaps with the sectoral bargaining cartels.

- Even if formal centralisation is rejected by all parties, many institutional features support informal co-ordination. Most wage settlements are synchronised, so that bargains occur in the same year, although not simultaneously. The collective agreements of most wage-earners are set for a period of three years. A new government authority, the National Mediation Office, has also been established, with the explicit task of facilitating a common understanding of the "room" for pay increases, ahead of each pay bargaining round. Another government authority,

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[1]This co-operation transcends the traditional demarcation line between hourly paid workers and salaried employees. The manufacturing sector unions and their employers counterparts have also established a network of contacts and agreements on bargaining routines. This co-operation was started in 1997, when the labour market organisations representing manufacturing industry forged an agreement (Industriavtalet) on improving bargaining procedures and basing the pay increases on a shared analysis of macroeconomic conditions and productivity growth.

the National Institute of Economic Research, is charged with the responsibility to publish a yearly report on the preconditions for wage increases.

In the last 10 years, pay bargaining has been conducted more or less according to these principles. When wage contracts are about to expire, the manufacturing sector unions get together and forge an agreement on the proper pace of pay increases. That settlement is then taken as a normative starting point for the other big bargaining cartels, the service sector and public sector ones. Thus, casual observation suggests that informal pay bargaining co-ordination has indeed increased. This period of at least seemingly strengthening co-ordination has coincided with a relatively benign outcome in the labour market. The pace of nominal pay increases has decreased, and the unemployment rate has also been decreasing, at least up to the financial crisis of 2008–2009.

2   Wage increase norms: possible economic interpretations

After the contribution of Calmfors and Driffill (1988), the effects of centralised and decentralised pay bargaining setups have been widely analysed and discussed. Yet it is not clear how the new Swedish bargaining setup should be interpreted in terms of economic theory. The theory literature on wage bargaining usually looks at three well defined bargaining "levels" (firm, union, economywide), whereas the Swedish system clearly looks like something else.

At least three possible interpretations stand out.

1. The new bargaining setup contains so many co-ordinating elements that it might just be interpreted as *centralisation under a new guise*. The pay increase norm procedure and the complicated co-ordination process facilitated by the National Mediation Office could just be a way of implementing centralisation without really saying so. This interpretation is not completely without merit. There are now many new co-ordinating mechanisms in place. The new National Mediation Office facilitates discussions between all main labour market organisations. It is also generally agreed that a jointly agreed economywide (average) level of pay increases should be an important starting point even for the bargains of single unions. Against this interpretation it could be said, however, that nobody in Sweden seems explicitly to acknowledge it – and centralised wage formation is emphatically rejected as a solution of principle.

2. Another interpretation is that the parties now play a *leader – follower (Stackelberg) game* in which one player (the open ("traded") sector cartel) leads by first selecting its pay increase, whereafter the service sector cartels optimise their own pay increase, taking the traded sector pay settlement as given. This interpretation seems in sync with the labour market parties' stated objectives and rules of the game. The manufacturing industry bargaining cartel emphasises its "leading role" for each bargaining round. Service sector and public sector unions, in turn, have widely acknowledged that marching order. Furthermore, it has been the case during the last four bargaining rounds (1998, 2001, 2004, and 2007) that the big manufacturing industry organisations have first committed themselves to a level of pay increases. Against

this interpretation, however, it should be said that a leader-follower game normally presupposes that the follower is completely free to choose its action once the leader has chosen his. In Swedish pay bargaining, however, it has also been a common understanding that the pay increase selected by the manufacturing industry partners should serve as a normative starting point for the service sector and public sector bargainers[2].

3. If we take seriously the idea of the manufacturing sector setting a binding norm for everybody else's pay increase, a third natural interpretation would be that the parties in fact have committed themselves to some appropriate *relative wage* between the different sectors of the economy. This interpretation is vindicated by the observation that the wage bargaining norm is always stated as a percentual increase and never as some level of pay. In other words, the common understanding is that the industry partners first agree on a "room" for pay increases, expressed in percentual terms, and that the other bargainers then take that increase as their norm[3]. If followed to the letter, that would of course imply an unchanged relative wage between the sectors, so that the implicit understanding is about some unchanged relative wage (in fact a real exchange rate, if we interpret the manufacturing sector – service sector distinction in terms of the tradables – nontradables theory).

All three interpretations have some merit. The first interpretation, outright centralisation, has been extensively analysed in labour economics. In this paper, we shall focus on the two other interpretations to shed light on current Swedish pay bargaining institutions.

To assess wage bargaining frameworks, we need a theoretical framework that incorporates the relevant externalities that wage setters must take into account. The motivation for analysing wage bargaining institutions stems from the fact that the incentives of large unions are not compatible with an efficient economic outcome. Unions tend to claim wages that are too high, mainly because they can to some extent pass on the costs of doing so on other agents of the economy. In particular, two channels have been thoroughly investigated in the literature. Firstly, unions in many sectors can affect the prices of their sector by increasing their wages. In that way, they can pass the cost of their wages to consumers and even workers of other sectors, whose room for pay increases diminishes. This is probably the most important externality investigated in the literature on bargaining systems. It was the main mechanism analysed by Calmfors and Driffill (1988) in their celebrated contribution and further analysed by Soskice (1990). Secondly, the pay claims of unions increase unemployment, but the costs of unemployment are not entirely borne by the members of the union. Instead, they are partly borne by taxpayers.

In this paper, we focus on the former mechanism, namely the incentive of a big union to raise wages and thereby affect relative prices.

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[2]This has been acknowledged in the procedural framework agreements of the labour market parties in many other sectors. For example, the Bargaining Protocol of the Municipal Workers (Förhandlingsprotokoll 2000-05-04, Förhandlingar om Kommunal Avtal om Förhandlingsordning) states that "The internationally competing sector has a norm-setting role, so that, when possible, the negotiations of the internationally competing sector should be concluded first, wherever wage negotiations overlap in time."(translation by the author).

[3]A partial exception to this is provided by the blue-collar federation LO's insistence on even providing minimum pay increases defined in krones, not as percentages.

3 A model framework

We adopt a two-player wage bargaining framework, earlier used by Holden (2003) and Vartiainen (2002), as well as, more recently, by Larsson (2007). Consider an economy with two goods: a tradable T-good and a nontradeable S-good (following the terminology of Vartiainen (2002), S for "sheltered" and T for "traded"). Suppose that the economy's labour force is organised in two bargaining cartels (unions), indexed by S and T. This is a simplification of reality, but, for the case of Sweden, where there is big manufacturing bargaining cartel faced with large service sector and public sector unions, the simplification is perhaps not too unrealistic.

Each cartel's preferences can be represented by a an objective function

$$U_i = L_i(W_i/p_i)[\frac{W_i}{P} - \frac{W_r}{P}], \tag{1}$$

where W_i is sector i nominal wage, p_i is the sector i product price, $P = P(p_S, p_T)$ is the consumer price index, $L_i(W_i/p_i)$ is employment in sector i and W_r is the money income of an unemployed person. Thus, the cartel maximises the money surplus of members' incomes in excess of the guaranteed income W_r. The latter can be interpreted as the monetary value of an (unmodelled) unemployment benefit, a low-paid service sector job in the black economy or the value of inefficient home production (growing carrots in the backyard)[4].

Assuming that the cartels can freely set the wage that corresponds to the solution of the optimisation problem, it can be shown by differentiating (1) (see Rama (1994) and Vartiainen (2002) for details) that the optimal real consumption wage w_i of sector i is given by

$$w_i \equiv \frac{W_i}{P_i} = \frac{\varepsilon_{L_i W_i}}{\varepsilon_{L_i W_i} + (1 - \varepsilon_{PW_i})} w_r, \tag{2}$$

in which the expressions ε_{xy} denote the elasticity of variable x with respect to variable y and $w_r = W_r/P$ (we use lowercase letters to denote real variables). Equation (2) illustrates the first-principle tradeoffs that a utilitarian union is interested in: (i) its preferred wage depends on the elasticity of employment with respect to the nominal wage it sets, $\varepsilon_{L_i W_i}$, and (ii) the effect of its wage on the members' purchasing power via the aggregate price index, as captured by the elasticity ε_{PW_i}.

In the paper at hand, we assume that the central bank has a credible inflation target and is able to enforce it completely. Thus, we can set the consumer price index P to unity, so that $\varepsilon_{PW_i} = 0$ and real and nominal magnitudes coincide:

$$P(p_S, p_T) = 1. \tag{3}$$

All the "action" now concerns the cartels' ability to affect their relative price, given an overall price level. Let us define the real product wages $v_i = W_i/p_i$ and decompose the employment – money

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[4]The objective function (1) is very simple: the cartels maximise a wage sum surplus. This implies, inter alia, that increasing the number of a sector's unemployed individuals does not affect the chosen wage. By the same token, we can in principle assume free mobility between the sectors, so that the expected utilities of workers are equalised, and this does not affect the solution either. Such simple utilitarian models are often used in the theory of union wage determination, but their limitations should be kept in mind.

wage elasticity according to

$$\varepsilon_{L_i W_i} = \varepsilon_{L_i v_i}(1 - \varepsilon_{p_i W_i}). \tag{4}$$

The last expression shows that the labour demand elasticity with respect to the "own" nominal wage is a product of the employment elasticity with respect to the real product wage, multiplied by a term that measures the sector's ability to affect its own product price. The former quantity $\varepsilon_{L_i v_i}$ only depends on the production function. Using this notation and (3), the first order condition (2) then becomes

$$\frac{w_r}{w_i} = \frac{W_r}{W_i} = 1 + \frac{1}{\varepsilon_{L_i v_i}(1 - \varepsilon_{p_i W_i})}, \tag{5}$$

which shows the relevant interplay of the bargaining cartels in this model. The (inverse) ratio of a cartel's wage to the "competitive" low income W_r depends both on the technical labour demand elasticity $\varepsilon_{L_i v_i}$ (that only depends on the production function) and the cartel's ability to affect its own product price by increasing its nominal wage, captured by $\varepsilon_{p_i W_i}$. If $\varepsilon_{L_i v_i}$ is high in absolute terms, labour demand is elastic with respect to the product wage. The second term in (5) is then near zero and the preferred wage is near w_r. If the price-influencing power of the cartel is large, then $\varepsilon_{p_i W_i} > 0$ is large, and the second term in (5) is large, so that the preferred wage exceeds w_r by a wide margin.

The elasticities $\varepsilon_{p_i W_i}$ depend on the entire structure of the economy, i.e. preferences and technology. Let us trade away some generality and assume that both sectors are characterised by a Cobb-Douglas production function with the same capital-labour share δ:

$$Y_i = F_i(L_i) = A_i L_i^{\delta}, \tag{6}$$

where A_i reflects technology and the size of the capital stock which is assumed to be fixed. This assumption is of course restrictive but it simplifies the algebra considerably[5]. Furthermore, we assume that the wage share is at least $1/2$.[6]

$$\delta \geq 1/2. \tag{7}$$

In order to close the model, we must specify preferences and technology. Suppose that consumer preferences can be represented by a CES formula so that there is an individual utility index

$$u(x_T, x_S) = (\eta_T x_T^{\frac{\sigma-1}{\sigma}} + \eta_S x_S^{\frac{\sigma-1}{\sigma}})^{\frac{\sigma}{\sigma-1}}, \tag{8}$$

where x_T and x_S are the consumed levels of the two goods and the η_i are positive weights that sum to unity. Parameter σ is the elasticity of substitution between the goods. The ideal price index is then

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[5]Numerical experiments suggest that the qualitative results of the paper would not be significantly affected by allowing for different capital intensities.

[6]The cartels' objectives are linear in real income, and the elasticity of employment with respect to the real product wage depends on the wage share parameter δ. If that parameter is too low, employment is inelastic, which would enable the union to increase the wage bill indefinitely by increasing the wage.

$$P = (\eta_T p_T^{1-\sigma} + \eta_S p_S^{1-\sigma})^{\frac{1}{1-\sigma}}. \tag{9}$$

To close the model, we assume simply that all factor incomes are consumed and equate the supply of either good to the demand of the same good. Implicitly we assume that the economy runs no external surplus of deficit[7]. The goods market equilibrium condition is then

$$(1/\eta_T)p_T^{\sigma}F_T(L_T(W_T/p_T)) = (1/\eta_S)p_S^{\sigma}F_S(L_S(W_S/p_S)). \tag{10}$$

Once the cartels have chosen their wages, the model is closed.

4 Algebraic analysis of the model

4.1 Preliminaries

The Nash equilibrium of the model cannot be solved analytically except for the special cases in which either the elasticity of substitution σ is unity or the sectors are otherwise symmetrical so that $\eta_S = \eta_T$ and $A_S = A_T$. However, the results of Vartiainen (2002) imply that there is a unique Nash equilibrium.

Some wage levels serve as benchmarks that turn up in the algebra of the model. The alternative wage W_r was assumed to represent the value of not working. We call this wage level the *competitive* wage, since this is the wage level where the economy would converge with mobility of interchangeable workers, completely flexible wages and no disutility of working in excess of the eventual disutility associated with W_r.

If a cartel could not at all influence the price of its own product, so that $\varepsilon_{p_i W_i} = 0$ holds, it only considers the employment elasticity of its own sector. The first order conditions (5) then imply that

$$W_i = \frac{W_r}{\delta}. \tag{11}$$

We call this wage W_r/δ the *autonomous* wage since it reflects the absence of any attempt to affect the economy's relative prices.

Let us define the variable "wage surplus in excess of the competitive wage"

$$\tau_i = \frac{W_i - W_r}{W_r}. \tag{12}$$

To ease notation, define the parameter γ as the ratio of the factor shares:

$$\gamma \equiv \frac{\delta}{1-\delta}. \tag{13}$$

Finally, note that the exponential production functions (6) imply that

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[7]This is not a loss of generality as long as one can assume that the pay claims of the unions do not affect the country's external position. In other words, we implicitly assume that the average propensity to save is not affected by the functional distribution of income.

$$\varepsilon_{L_i v_i} = -\frac{1}{1-\delta}. \tag{14}$$

The key magnitudes of the model are the elasticities $\varepsilon_{p_T W_T}$ and $\varepsilon_{p_S W_S}$ which turn up in the cartels' optimal unilateral solution (5) and which capture the cartels' price influencing power and thereby their strategic interaction. We can relate these elasticities to the other endogenous variables of the model by totally differentiating the price level objective (3) (with equation (9) substituted in) and the goods market equilibrium (10) to get[8].

$$\varepsilon_{p_S W_S} = \frac{1}{\frac{\sigma+\gamma}{\gamma}[1 + (\frac{\eta_S}{\eta_T})(\frac{p_S}{p_T})^{1-\sigma}]} \tag{15}$$

and

$$\varepsilon_{p_T W_T} = \frac{1}{\frac{\sigma+\gamma}{\gamma}[1 + (\frac{\eta_T}{\eta_S})(\frac{p_T}{p_S})^{1-\sigma}]}. \tag{16}$$

The assumption $\delta_S = \delta_T$ implies that the goods market equilibrium (10) generates an onto mapping between the wage ratio W_T/W_S and the relative price p_S/p_T:

$$p_S/p_T = C_0 \left(\frac{W_S}{W_T}\right)^{\frac{\gamma}{\sigma+\gamma}}, \tag{17}$$

where

$$C_0 = \left[\frac{\eta_S}{\eta_T}\left(\frac{A_T}{A_S}\right)^{(\frac{1}{1-\delta})}\right]^{\frac{1}{\sigma+\gamma}}. \tag{18}$$

is a positive constant. Equation (17) implies that W_S/W_T determines the relative price p_S/p_T. Expressions (15) and (16) then determine the elasticities $\varepsilon_{p_S W_T}$ and $\varepsilon_{p_S W_S}$. This is illustrated in Figure 1, drawn in the $W_S - W_T$ action space. For each straight line emanating from the origin, the elasticities $\varepsilon_{p_S W_T}$ and $\varepsilon_{p_S W_S}$ are constant and the relative price p_S/p_T is constant[9].

Whether the elasticity of substitution σ is high or low is important for the strategic interaction of the two parties and hence the conclusions of the model. Below, we show that whether σ exceeds unity or not determines the slope of the parties' reaction curves in their bilateral game. Intuition suggests that if σ is high, the cartels' market power is curtailed, since the consumer can then easily substitute one good for the other, so that a cartel's excessive wage claim leads to a shift in the consumption basket and hence unemployment. Conversely, if σ is low, the cartels have a lot of market power and can simply increase their incomes by charging more for their labour services. This intuition is readily confirmed if we analyse the first order conditions of the cartels' optimisation problem and the resulting Nash equilibrium of the model. Expressions (15) and (16) imply that

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[8]To get these results, we use the fact that the Cobb-Douglas production functions in (6) imply that production in each sector i is a function $Q_i(W_i/p_i) = F_i(L_i(W_i/p_i))$ of the real product wage. The expression Q_i'/Q_i that turns up in the differentiated goods market equilibrium can then be equated to $-\gamma_i(p_i/W_i)$.

[9]If we had allowed for different factor shares $\delta_S \neq \delta_T$, the iso-elasticity loci would be nonlinear.

Figure 1 Constant relative wage implies constant price-wage elasticities
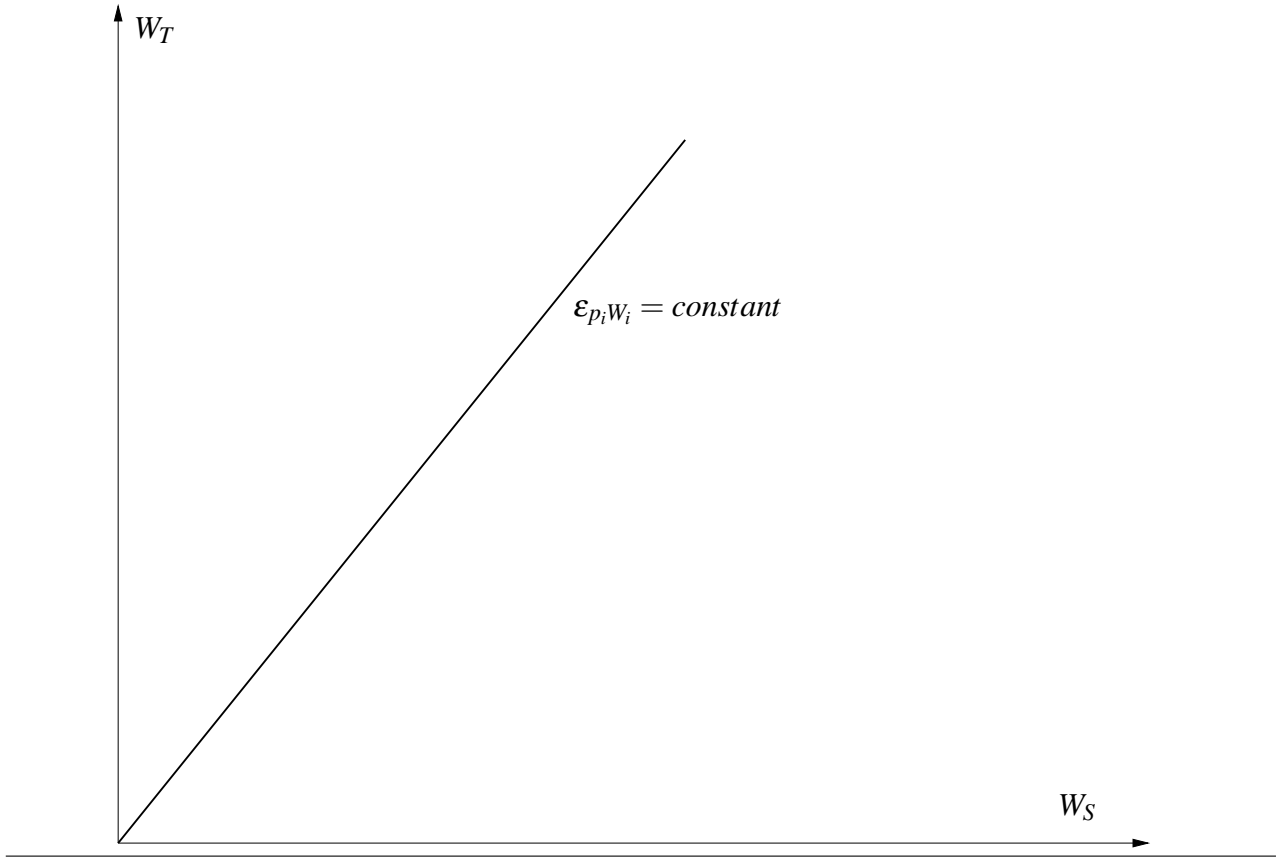
$$\varepsilon_{p_S W_S} + \varepsilon_{p_T W_T} = \frac{\gamma}{\sigma + \gamma}. \qquad (19)$$

Thus, the sum of the own-price elasticities is bound by a term that depends on the substitution elasticity. Recall that, according to (5), the cartels' preferred wages are increasing functions of their own pricing power $\varepsilon_{p_i W_i}$.

Consider the case of perfect symmetry in which the production functions are the same ($A_S = A_T$) and $\eta_S = \eta_T = 1/2$. The highest pay claims occur when there is no substitutability at all, so that $\sigma = 0$ and the consumption function is of the Leontief type. Then equation (19) and symmetry imply that $\varepsilon_{p_i W_i} = 1/2$ so that $W_i = W_r/(2\delta - 1)$. This is the highest possible wage in the symmetric case. If the wage share approaches 0.5, the desired wage approaches infinity. If, on the other hand, $\sigma = \infty$, substitutability is perfect, and $\varepsilon_{p_i W_i} = 0$ because of (19). Then the unions will choose the autonomous wage W_r/δ, which is the lowest possible wage supported by Nash equilibrium in the symmetry case: with perfect substitutability, the cartels have no pricing power.

4.2   Reaction functions, Nash equilibrium versus efficient solutions

The conventional analysis of Nash equilibrium and the efficient locus is summarised in Figure 2. The model equations imply that the cartels have well-defined reaction functions, which may be drawn as shown in Figure 2 for the case $\sigma \leq 1$. The Nash equilibrium is found at the intersection of the reaction curves. The reaction curves are defined by the preference mapping induced by the cartels'

objective function (1). The indifference curves are defined by conditions $U_i = constant$, and the reaction curves are the loci of points where the indifference curves are horisontal for the S-cartel and vertical for the T-cartel. In Vartiainen (2002), it was shown that this model always has a unique Nash equilibrium[10].

Figure 2 Reaction curves, Nash equilibrium, and the efficient locus
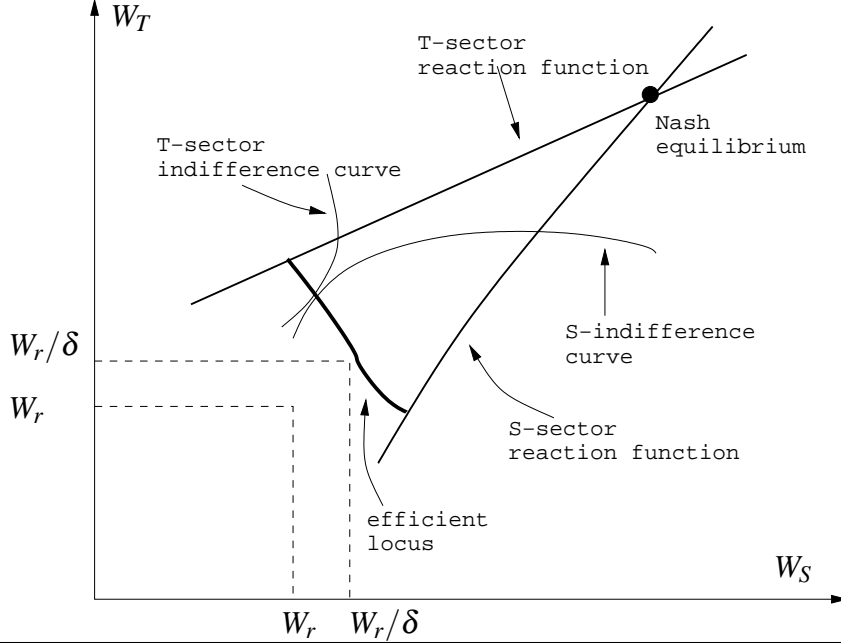
We can derive closed form expressions for the inverses of the reaction functions. Let the best wage response of the T-sector cartel to a given S-sector wage W_S be given by the function $W_T = R_T(W_S)$. The best response function of the T-sector is solved by using (5), in which we have substituted equations (14), (15), (16), (17) and (18). After some manipulations, we can explicitly solve for the inverse of the T-sector reaction function

$$W_S = R_{W_T}^{-1}(W_T) = \left[\left(\frac{\eta_T}{\eta_S} \right)^{\frac{1}{1-\delta}} \frac{A_S}{A_T} \right]^{\frac{1}{1-\delta}} W_T [B(W_T)]^{\frac{1}{\Lambda(1-\sigma)}}, \tag{20}$$

where

$$B(W_T) = \frac{W_T \delta - W_r}{M W_T - \left(\frac{\sigma}{\sigma + \gamma} \right) W_r}, \tag{21}$$

$$\Lambda = \frac{\gamma}{\sigma + \gamma} \in (0, 1) \tag{22}$$

and

$$M = \frac{\sigma}{\sigma + \gamma} + 1 - \delta. \tag{23}$$

The function $B(W_T)$ is bounded in each cartel's action space $[W_r/\delta, \infty)$. It is zero at the lowest possible wage $W_T = W_r/\delta$ and then increases monotonically towards a finite limit of δ/M. The

[10]This result did not require $\delta_S = \delta_T$.

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inverse reaction function can be used to derive the reaction elasticity $\varepsilon_{W_T W_S}$, that is, the relative change in the T-sector wage induced by a relative change in the S-sector wage, according to the T-sector reaction function:

$$\varepsilon_{W_T W_S} = \frac{1}{1 + \frac{B'(W_T)}{B(W_T)} \frac{W_T}{\Lambda(1-\sigma)}}. \tag{24}$$

This elasticity embodies the properties of the reaction function: it is positive if σ is below unity, and, as expected, it is zero if $\sigma = 1$, which is the Cobb-Douglas consumer preferences case with horizontal reaction functions. The expression for the elasticity $\varepsilon_{W_S W_T}$, capturing the effect of the T-sector wage on the S-sector wage along the S-sector reaction curve, is analogous.

That the reaction curves slope upwards when $\sigma < 1$ can also be explained as follows. Consider the T-sector's reaction curve in $W_T - W_S$ -space as depicted in Figure 3. Assume that point A is on the reaction curve, so that it represents the T-cartel's best response to the S-cartel's wage. With that point A is associated some specific level of the relative wage W_T/W_S, represented by the slope of the ray emanating from the origin and passing through A. Consider now some other wage ratio associated with a higher value of the own-price-wage elasticity $\varepsilon_{p_T W_T}$. If σ is below unity, a higher elasticity $\varepsilon_{p_T W_T}$ is associated with a lower (W_T/W_S)-ratio (see equations (15), (16) and (17)). Hence, because of (5), a lower (W_T/W_S)-ratio is associated with a higher best response wage W_T. Hence, point B must be on a lower ray from the origin but must have higher W_T than point A. This is only possible if the T-sector's reaction curve slopes upwards, as is apparent from Figure 3. An analogous argument applies when $\sigma > 1$, in which case a lower (W_T/W_S)-ratio implies a lower $\varepsilon_{p_T W_T}$.

Figure 3 Why the reaction curve slopes upwards when σ is below unity
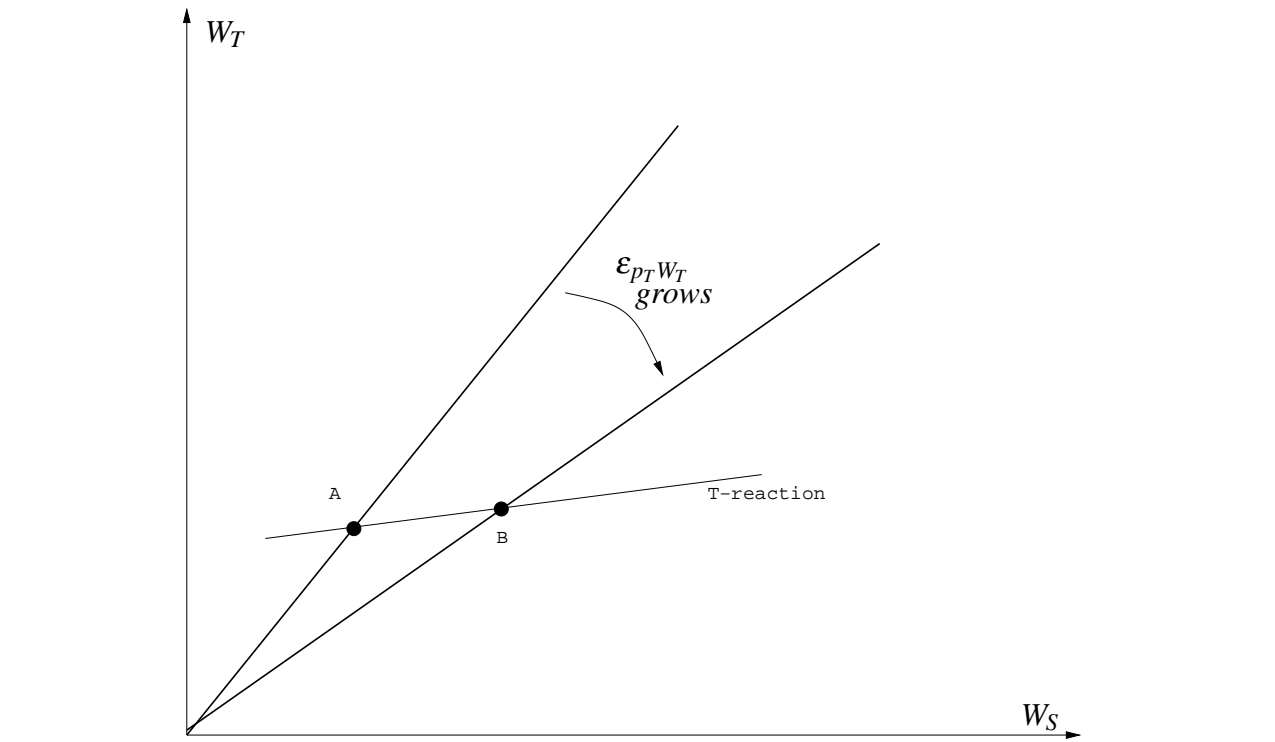
These results can be summarised as follows:

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Result 1. If the elasticity of substitution σ is below unity, the cartels' actions are strategic complements and the reaction curves slope upwards as in Figure 2. If σ is above unity, the cartels are strategic substitutes to each other and the reaction curves slope downwards. If σ is unity, the reaction curves are constants (horizontal and vertical), so that a cartel's preferred wage is independent of the other cartel's wage.

We use the $\sigma < 1$ case as a benchmark, for two reasons. Firstly, one would think that manufacturing industry goods and service sector goods cannot easily be substituted for each other[11]. Secondly, it seems more plausible that the reaction curves slope upwards: if one cartel increases its wage, most observers seem to expect a higher wage claim from other trade unions, too.

There is a locus of efficient solutions in which both nominal wages are lower than at the Nash solution. Along that locus, the indifference curves of both sectors have the same slope. That locus is also depicted in Figure 2. The points of the efficient outcomes are found as the solution to a problem of maximising an objective function that is a weighted sum of their individual objective functions. It is also well known that the parties can attain such an efficient outcome if they bargain on the entire vector of wages (W_T, W_S). If the cartels were to conduct a Nash bargain on the entire vector of wages (W_T, W_S), with the Nash equilibrium as a natural threat point, they would agree on on some point on the efficient curve. This becomes evident if maximises the Nash product

$$\{U_T(W_T, W_S) - U_T(Nash)\} \times \{U_S(W_T, W_S) - U_S(Nash)\}, \tag{25}$$

subject to the goods market equilibrium and price restrictions. The resulting first order condition is then equivalent to the solution of the weighted maximisation problem.

We can derive an analytic expression for the efficient solution curve. Setting the parties objective functions equal to some constant and differentiating (and taking of course into account equations (10) and (3)) yields expressions for the slope of the cartels' indifference curves. Equating them yields, after some manipulations, the condition

$$\tau_T[\varepsilon_{p_T W_T} - \delta] + \tau_S[\varepsilon_{p_S W_S} - \delta] = -(1 - \delta). \tag{26}$$

This defines the efficient contract locus. For each relative wage W_T/W_S there is only one pair of wages that simultaneously satisfies both (26) and the goods market equilibrium (10). Inspection of (26) confirms the intuition that an efficient solution requires lower wages than the Nash equilibrium.

We can get some more information on the position of the efficient curve by substituting one cartel's wage in (26) with the competitive wage W_r. In other words, if the T-sector, say, chooses $W_T = W_r$, so that $\tau_T = 0$, contract efficiency according to equation (26) requires $\tau_S = (1 - \delta)/(\delta - \varepsilon_{p_S W_S})$. The latter condition, however, is the same as the first order condition (5) that defines the

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[11]One may speculate that the formation of trade unions may in fact be related to the grouping of goods in such a way that workers organise themselves within industries whose goods are not easily substituted by other goods. There would be no point in organising a union around the production of a good that is completely substitutable by another good produced in a non-unionised industry. Soskice (1990) emphasizes that the Calmfors-Driffill-type results hinge on the fact that it is easier for the consumer to substitute between goods of the same industry (two motor cars, say) than between the goods of different industries (a motor car for a haircut, say).

Figure 4 The leader-follower outcome
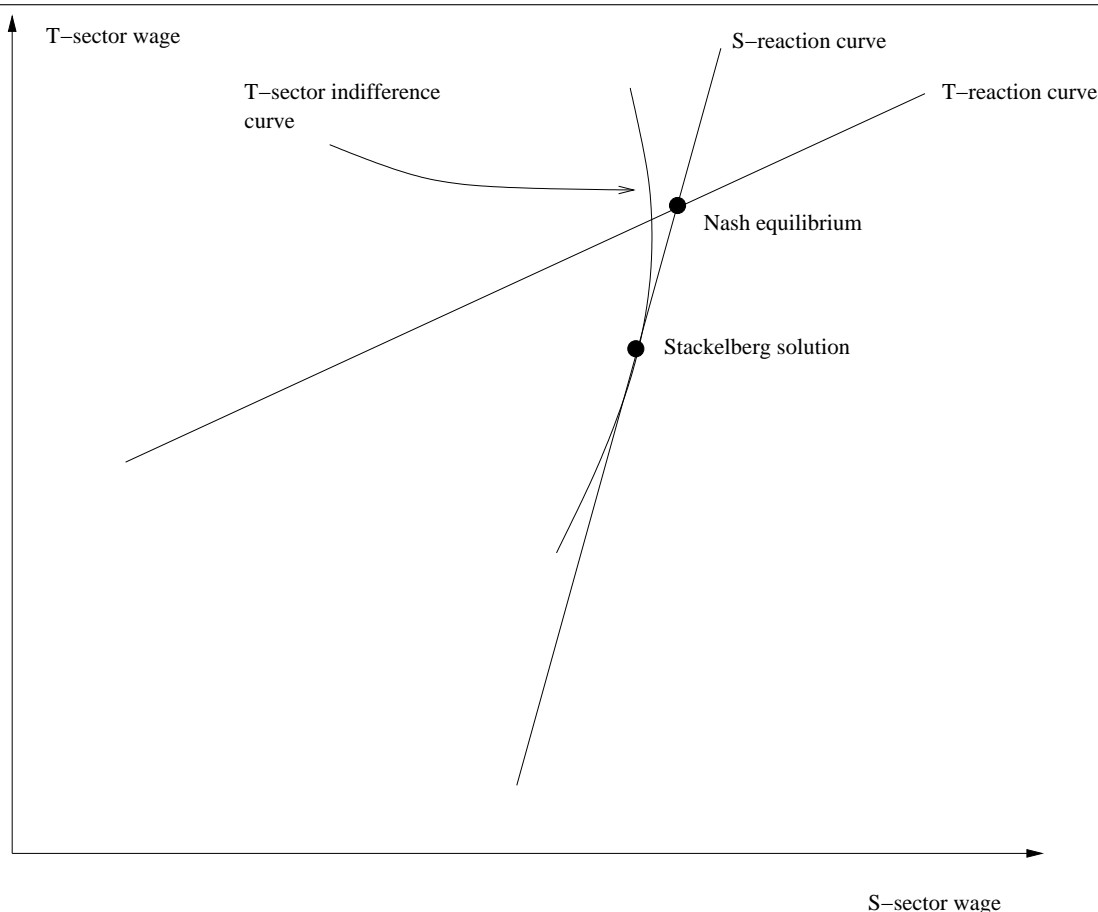
S-sector reaction curve. Thus, we know that the efficient locus joins the reaction curves at the level $W_i = W_r$, as we have depicted them in Figure 2.

If one believes that the Swedish bargaining setup in fact represents complete co-ordination in disguise (our first interpretation in 2), then the Swedish outcome may be some point on the efficient curve.

4.3 The wage norm as a leader-follower outcome

Our second interpretation of the Swedish bargaining regime, a leader – follower game, can with the presented model naturally be interpreted as a Stackelberg equilibrium in which the *T*-sector first selects its wage and the S-sector then optimises its wage claim, taking as given the choice of the *T*-sector. This outcome is illustrated in Figure 4. The *T*-sector cartel knows that the *S*-sector will pick a wage level from its own reaction curve. The *T*-cartel will then select a point from the *S*-sector reaction curve and choose the point which touches the most advantageous *T*-sector indifference curve (see Figure 4).

We see that the outcome differs from the Nash outcome. If the reactions curves are increasing, it is clear from Figure 4 that the outcome implies a lower nominal pay level in both sectors than what the Nash solution would yield. This implies a higher level of employment as well. Note that if this interpretation is correct, this benign effect of the wage norm is generated by the bargaining

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procedure whereby one sector has to move first. It is not necessary that the follower sector selects the same wage increase as the leader sector. The mere fact that the leader (T-sector) knows that the follower will take its decision as given is enough to induce moderation in the behaviour of the leader.

This result can be confirmed algebraically by writing the reaction curve expression of, say, the S-sector $W_S = R(W_T)$ into the goods market equilibrium (10). The resulting expression yields the elasticity $\varepsilon_{P_T W_T}$ that the leading T-sector would use in setting its wage. The elasticity in question is

$$\left(\varepsilon_{P_T W_T}\right)_{leader} = \frac{1 - \varepsilon_{W_S W_T}}{\frac{\sigma + \gamma}{\gamma}[1 + (\frac{\eta_T}{\eta_S})(\frac{p_T}{p_S})^{1-\sigma}]}, \tag{27}$$

in which the cross-wage elasticity $\varepsilon_{W_S W_T}$ represents the effect of the open sector wage on the follower's wage, as internalised by the leading open sector.

Expression (27) should be compared to (16). We see that the strategic complementarity changes: the leading T-sector has to observe that its ability to increase its own price by boosting its own wage is impaired by the fact that a higher own sector wage also implies a higher wage for the other (follower sector). Thus, if the T-sector leads, its ability to influence its own product price is impaired. It internalizes a lower own-price-wage elasticity $\varepsilon_{p_T W_T}$ than in the Nash case, and consequently sets a lower wage. The follower S-sector is on its reaction curve, of course and internalizes the own-wage-price elasticity (15). These results correspond to Figure 4: the T-sector is under its reaction curve and the S-sector is on its reaction curve. The result is summarised:

Result 2. When $\sigma < 1$, the outcome of a bargaining procedure in which one sector leads and the other follows results in lower nominal wages in both sectors and therefore higher employment, as compared to Nash equilibrium.[12].

4.4 The wage norm as a binding relative wage

The third interpretation presented in section 2 was that the leader sector sets a binding norm on the percentual wage increase. If this norm is accepted by the follower, and the leader understands that this is the case, the parties implicitly agree on an unchanged relative wage between the sectors. We argued above that this interpretation comes close to how Swedish labour market organisations themselves interpret the current bargaining setup: the "norm" is always interpreted as a binding percentual increase, which is equivalent to implementing an unchanged relative wage.

Let us first characterise such outcomes and then come back to how, if at all, they may be supported procedurally.

Assume now that both cartels accept that the wage ratio W_S/W_T should be unchanged and that both understand that the other one accepts this. Suppose also, as in the previous section, that the T-sector moves first. The outcome is now as pictured in Figure 5. The T-sector bargaining cartel takes as given that the final outcome will be on the line that embodies the implicit agreement on an unchanged relative wage. The slope of that line is of course determined by the pair of initial wages.

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[12]With Cobb-Douglas consumer preferences, $\sigma = 1$, and the Stackelberg solution obviously coincides with Nash equilibrium. This case is analysed by Calmfors and Larsson (2009).

Thus, whatever pay increase the leader chooses, the S-sector cartel will choose exactly the same increase. As is clear from Figure 5, this setup can induce strong pay moderation. The T-sector can effectively pick a point from the ray that embodies the fixed relative wage. Barring an extremely low initial relative wage W_S/W_T, that line is less steep than the S-sector reaction curve, as depicted in Figure 5.

In this model, there is a strong result:

Result 3. Assume that the leading T-sector cartel believes that the S-sector will choose a the same percentual wage increase as the T-sector. The T-sector cartel then chooses the (low) autonomous wage W_r/δ.

The proof is trivial: the T-sector cartel knows that the relative wage W_S/W_T is given. Hence, even the relative price p_S/p_T is given. This implies that even p_T is given (because of equation (9)). Hence, the T-cartel cannot influence its own price and $\varepsilon_{p_T W_T} = 0$ must hold in the traded sector wage decision. This implies that the autonomous wage W_r/δ is chosen.

Thus, the S-sector can induce substantial wage moderation in the T-cartel just by credibly committing itself to some relative wage target. The remarkable thing is that this relative wage target can be arbitrary, yet the wage moderating effect on the T-*sector* will still be there. Despite its mathematical triviality, I believe this result is potentially important for Swedish pay bargaining. Even if the parties do not agree on a relative wage but the follower sector (sheltered sector) can credibly commit itself to an unchanged relative wage, the threat has big moderating influence on the behaviour of the *leader*. This may help to rationalise the stubborn insistence of many unions in the Nordic countries that everybody should get the same percentual increase.

4.5 Envy as a procedural support for a wage norm

The result of the previous section was based on the assumption that the wage increase norm was binding, which effectively tied down the relative wages of the economy. This took away the leader sector's ability to manipulate the relative wage (price), so that the low autonomous wage was chosen.
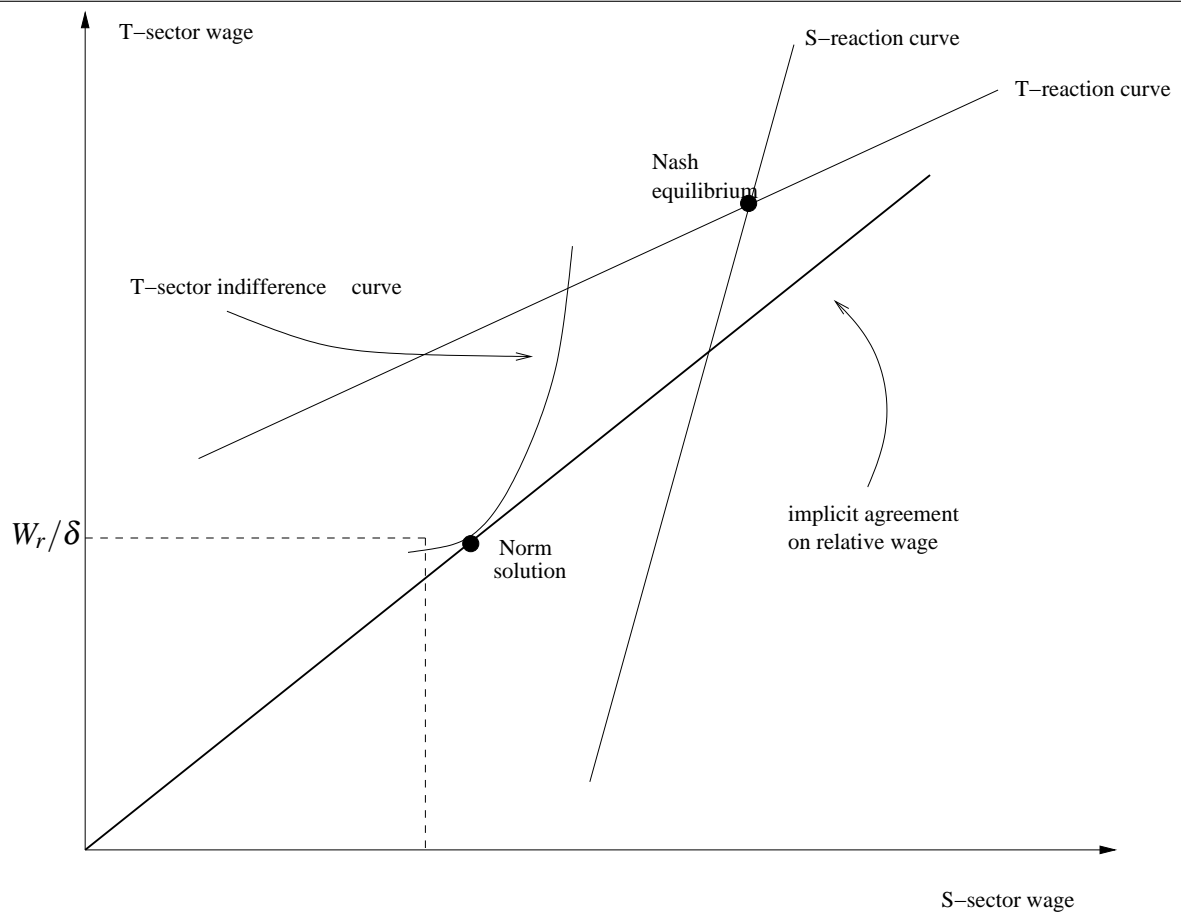
An immediate question is whether such an outcome or a similar outcome can be procedurally supported in a reasonable extension of the model at hand.

Fortunately, a recent paper by Calmfors and Larsson (2009) provides tools that enable one to give a tentative answer to this question. In a related model, they introduce the assumption of an envious follower. Following the ideas of Kahneman and Tversky, they assume that the perceived utility of an employed worker in sector i is

$$\widetilde{w} = \frac{w_i^{1+\alpha_k}}{w_n^{\alpha_k}}, \tag{28}$$

where the loss aversion parameter α_k depends on whether the wage w_i (in their notation) exceeds the "norm" wage, and the norm wage is simply assumed to be the wage of the other union w_n:

Figure 5 The fixed relative wage outcome

T−sector wage

S−reaction curve

T−reaction curve

Nash
equilibrium

T−sector indifference   curve

W_r/δ

Norm
solution

implicit agreement
on relative wage

S−sector wage

$$\alpha_k = \begin{cases} \alpha_1 > 0 & \text{if } w_i \leq w_n \\ 0 & \text{if } w_i > w_n. \end{cases} \tag{29}$$

Thus, the linear utility of the representative follower union member is, in the case in which the other sector has a higher wage, discounted with a term that depends on the ratio of the two wages. Using this setup, Calmfors and Larsson show, in a model that has some similarities with that of this paper, that there may arise corner solutions in which the envy of the follower indeed disciplines the wage decision of the leader sector.

We borrow the Calmfors – Larsson idea but generalise it to fit the assumption of the last section. As is apparent from the last two expressions, Calmfors and Larsson condition the envy-related loss aversion of the follower sector on whether the follower sector gets the same wage *level* as the leader. In my opinion, union leaders are clearly more obsessed with percentual wage *increases*. It is very difficult for a union to explicitly agree on a lower wage increase than that obtained by the other unions. Therefore, we suggest here an alternative specification: that loss aversion be associated with the follower's *lower relative pay increase*. This also implies that the equilibrium of the system becomes dependent on the initial state: some initial wage ratios imply that the envy-related pay norm is effective, whereas other initial ratios lead to outcomes in which the norm of same pay increases is not respected. Thus, this setup generates a rudimentary theory of why the norm sometimes binds and sometimes does not.

Returning to our model, we assumed in equation (1) that the utility of a worker was simply linear in the wage. Instead, assume now that the utility $\widetilde{W}_S$ of a representative member of the follower S-union is a function of the wage that he/she gets, multiplied by a function of the ratio of the percentual pay increases obtained by the two sectors.

$$\widetilde{W}_S = W_S (\frac{\Delta_S}{\Delta_T})^\alpha, \tag{30}$$

where Δ_i is the percentual pay increase of sector i. The effective utility $\widetilde{W}_S$ now replaces W_S in the definition of S-sector utility (1). This transforms the preference map of the S-sector, so that a kink in the indifference curves appears along the "same-increase line", i.e. along the locus of points at which the two cartels obtain the same percentual increase. Observe that the slope of that line depends on the wage ratio W_S/W_T that is in force before the bargain is initiated. This is illustrated in Figure 6. The conventional S-sector indifference curves UU' reflecting preferences (1) are now replaced by the curves EU' which embody the pain due to the wage increase deviation. As long as the S-sector's pay increase is greater or equal to that of the T-sector (i.e. we are to the right of the same-increase line), the preference map is not affected by the envy factor.

We assume that only the "follower" S-sector suffers from envy.

If the parameter α_k is sufficiently large, the resulting S-sector reaction curve will consist of the conventional reaction curve as long as it yields a higher W_S than the same-increase line, and of the same-increase line thereafter. This new reaction curve is drawn in Figure 6 as the thick polyline

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Figure 6 The effect of envy on the S-sectors preference map
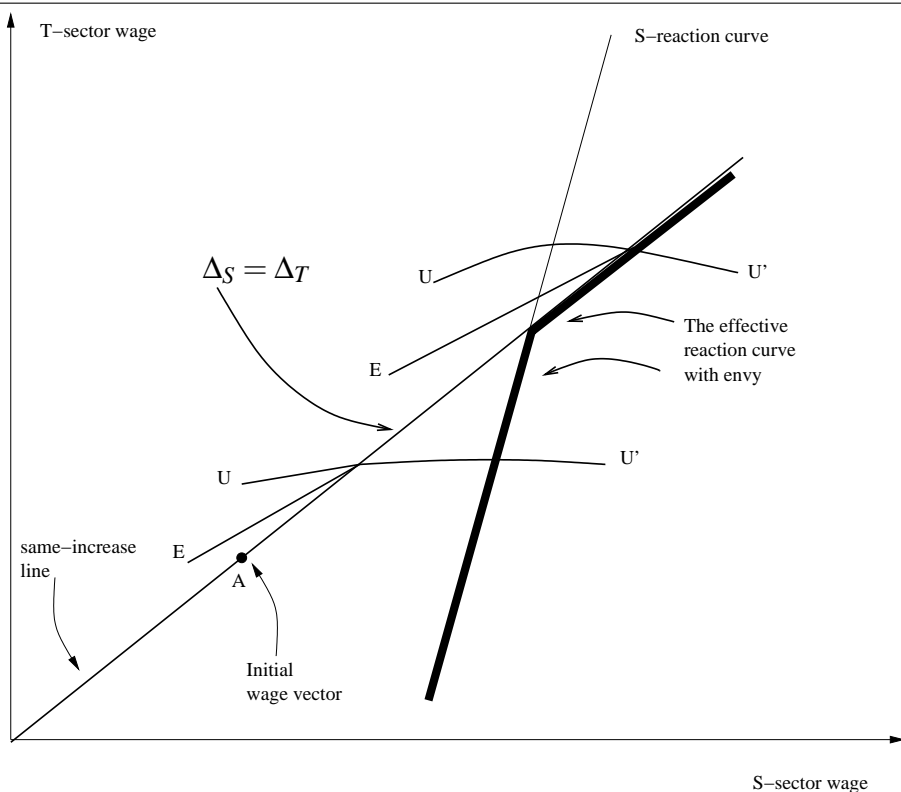

consisting of two segments.[13]

Recall that the slope of the envy restriction curve is a function of the initial wage at the moment of wage bargaining. With the help of this extension, we can build a redimentary theory of why the pay increase norm established by the traded sector sometimes binds and sometimes not.

The preference maps of the cartels obviously depend on productivity. It is reasonable to suppose that, each year, positive productivity growth plus other shocks like local wage drift and structural change move the economy to some point where the wages are too low to satisfy the aspirations of the bargaining cartels. Consider Figure 7. Suppose, for example, that high productivity growth of the economy plus some negative export shock have moved the economy to the initial point A where the wage ratio W_S/W_T is relatively high. The effective reaction curve of the S-sector is now represented by the thick line. The T-sector can then do no better than choose the point B which is a corner solution. At this point, both wages will be lower than at the Stackelberg outcome without envy, which is represented at point C. The economic interpretation is straightforward: the envious "irresponsibility" of sector S disciplines the wage leader, since the leader understands that above some wage increase level the follower will always ask for at least a similar increase. Thus, with a high sheltered sector relative wage to begin with, the norm binds and the sheltered sector follows the increase of the traded sector.

Consider now another initial wage vector, say, according to point A in diagram 8. Now, the relative wage W_S/W_T is low, perhaps because of a transitory export boom that has led to wage drift

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[13]If α_k is low, the upper segment of the reaction curve lies somewhere between the conventional reaction curve without envy and the same-increase line.

Figure 7 Low initial traded sector wage: the same-increase envy restriction generates a corner solution
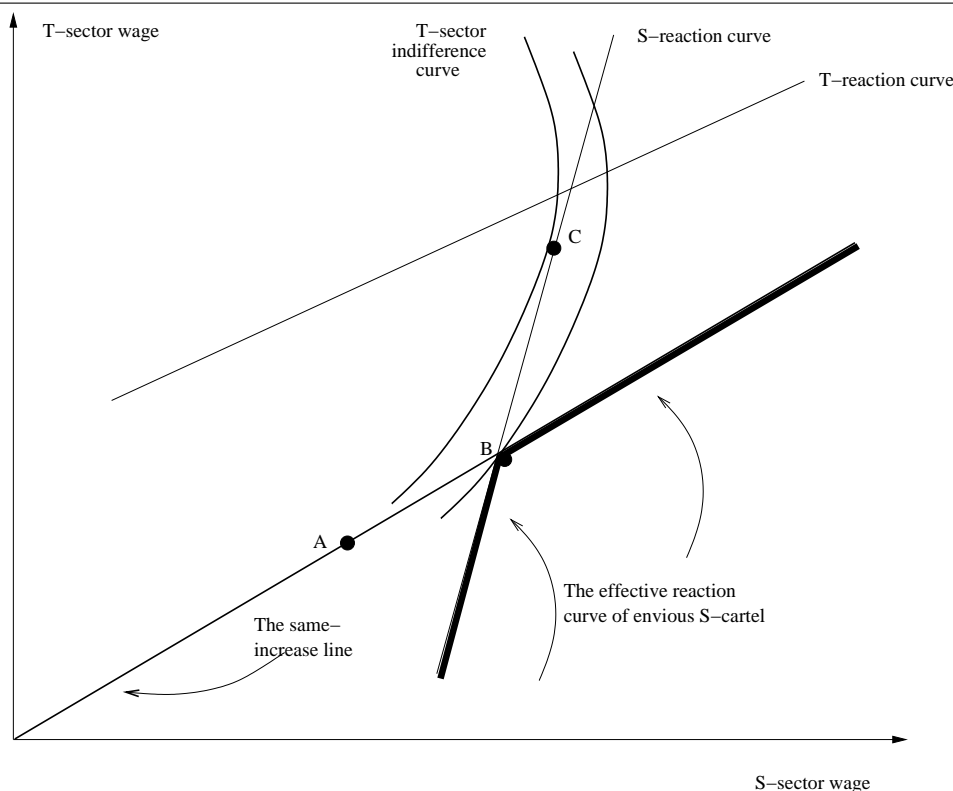
in the open sector. The outcome is now different. The T-sector understands that the other sector is anyway highly likely to deviate from the norm with a higher wage increase. Then the T-cartel can do no better than to choose the most attractive point on that part of S-sector conventional reaction curve that lies to the right of the same-increase line. The T-sector can in this case not hope to remain on the same-increase restriction, because the initial wage ratio is so advantageous for the T-sector: to compel the S-sector to keep that restriction, the T-sector would have to set a very high wage that would lead to high unemployment.

It is clear that the cutoff point between these two cases corresponds to the initial wage ratio that is identical to that implied by the Stackelberg solution.

The previous section argued that the leader will choose the low autonomous wage if it is convinced that the follower will always choose the same wage increase. No procedural support was offered there. Instead, it was simply assumed that a binding norm existed. This section has applied an idea borrowed from Calmfors and Larsson (2009) to investigate whether envy concerning relative wage increases can sustain wage moderation. In a setup in which only the follower is envious, the answer is yes. Yet the outcome depends on the initial wage.

However, note that we haven't provided a procedural support for precisely that outcome that was analysed in the previous section and which was defined as an interior solution of the T-sector's optimisation problem, when the optimisation is carried out under with the constraint that the relative wage is unchanged. As is apparent from the arguments of this section, the case in which the same-

Figure 8 High initial traded sector wage: the same-increase restriction does not bind
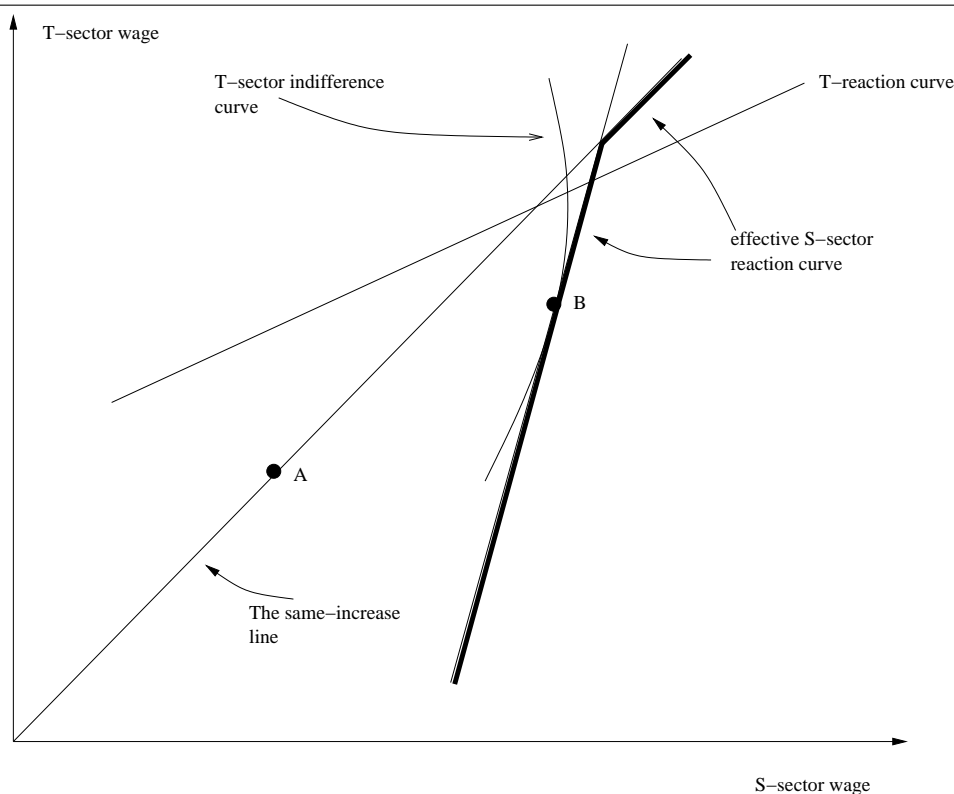
increase line constrains the leader is a corner solution.[14] [15]

We summarise these findings in the following result.

Result 4. If the follower sector feels envy about its relative pay increase, this envy, if intense enough, can amount to a credible commitment that compels the wage leader to set a lower wage than the Stackelberg outcome, provided that the initial wage ratio $(W_S/W_T)_0$ exceeds that implied by the Stackelberg solution without envy. In this case, the observed outcome will appear to satisfy a wage bargaining norm of uniform percentual increases. If the initial wage ratio (W_S/W_T) is lower than that associated with the Stackelberg solution, the latter will be chosen. The norm of uniform increases will then not appear to be respected, and, instead, the follower *S*-sector claims a higher increase.

Thus, whether the norm is respected depends on the initial wage.

4.6 Both sectors envious

We have seen that a binding norm can sustain wage moderation and that something similar can be procedurally sustained by an envious follower sector. The reason is that envy provides a credible

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[14]It may be noted, though, that if the initial traded sector is wage low enough, the T-wage associated with the corner solution analysed in this section can be arbitrarily close to the autonomous wage W_r/δ. This case is perhaps mostly a curiosum.

[15]Larsson and Calmfors derive a similar result, in a model in which the follower's envy is defined as a function of the deviation in wage levels. They show that such a setup can not sustain an outcome in which the leader finds an interior solution under the constraint that the wage levels are identical. Their model is not identical to ours, however, because of the different definition of envy and because they use Cobb-Douglas consumer preferences that imply horizontal and vertical Nash-Cournot reaction curves.

Figure 9 Both cartels are envious: the effect of the initial wage
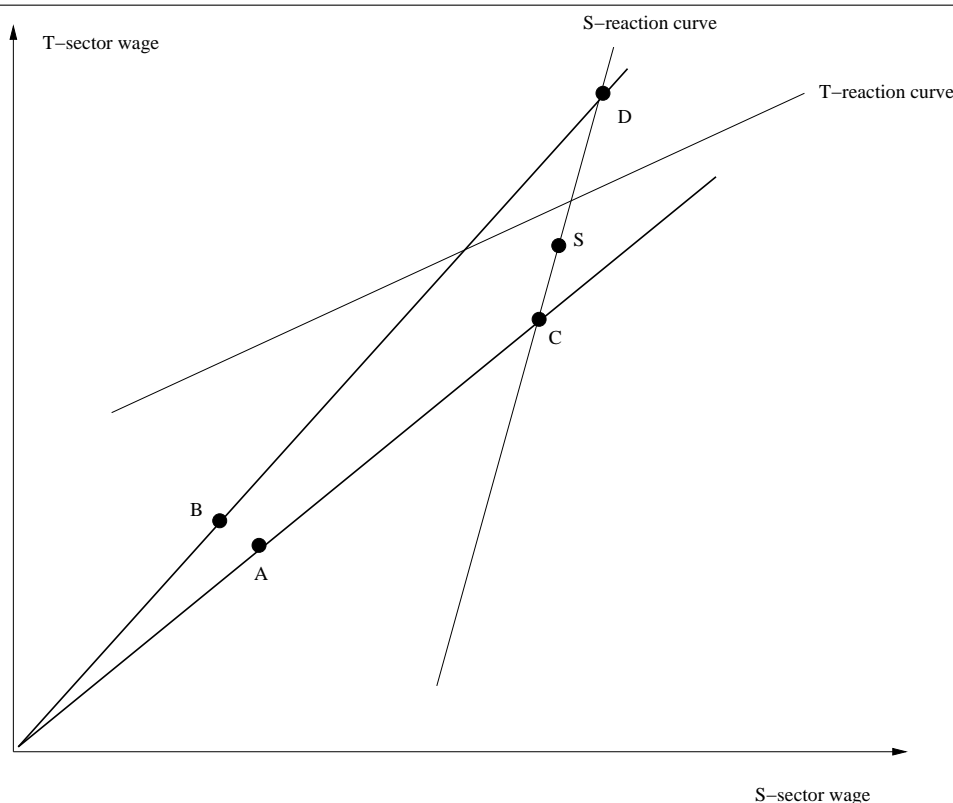
commitment to a high wage claim that matches the relative increase of the leader. This compels the leader to a policy of restraint.

Envy about relative pay increases can be more detrimental to employment, however, if both sectors are envious. If this is the case, the initial relative wage is very important.

Assume now that both cartels are envious and that the envy parameters are so high that none of the cartels will accept a lower percentual increase than the other cartel. Then, given any initial wage and high enough envy parameters, both sectors can simultaneously be satisfied only with similar increases so that the relative wage stays put.

The T-sector cartel leads. To ensure that it gets at least the increase that the S-cartel will enforce, it has to set a wage W_T that is so high that the S-cartel has no incentive to choose a higher wage increase. Consider figure 9, where we have drawn two possible initial wages at points A and B and where it is assumed that the Stackelberg outcome without envy is at point S.

Suppose first that the initial wage vector is at point A. Then the T-cartel wants to select a wage that is at least as high as the one that corresponds to point C. If it chooses anything under that, the no-envy part of the S-cartels reaction curve dictates a higher increase for the S-sector, which the leader wants to avoid. The T-cartel also understands that the follower cartel will not accept anything that lies above the same-increase line that goes through point A. Therefore the T-cartel effectively chooses on the segment of the same-increase line that lies to the right of point C. Point C will then be chosen. However, that point would be chosen by the T-cartel even if it were not envious. In this case, with a low initial traded sector wage, the leader's envy is irrelevant and the follower envy still constrains the solution towards lower wage and higher employment, when compared to the no-envy

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case.

Suppose instead that the initial wage is at point B. A non-envious leader would have preferred point S, which also would have satisfied the envy restriction of the *S*-sector. An envious leader, however, will choose a high wage W_T that meets its own envy restriction. In this case, the leader's envy alters the outcome towards less wage moderation[16]. We summarize these results:

Result 5. If both sectors are envious, the outcome depends on the initial wage. When the *T*-sector's initial relative wage is low, the leader's envy is irrelevant for the outcome which will be driven by the follower *S*-sectors envy which improves employment. If the leader's initial relative wage is high, the leader's envy yields an outcome with higher wages and lower employment, as compared to the case where only the follower in envious. Thus, the leader's envy, given an envious follower, is irrelevant at best and harmful at worst.

We consider the case where only the follower is envious as the benchmark one. We have no stringent motivation for this assumption, but somehow it seems plausible. The leading manufacturing industry sector is the productivity leader, and policymakers have in the Nordic countries always considered the export industry as crucial for the nation's economic well-being.[17] Note, however, that the model of this paper is completely symmetric. There is under a floating exchange rate no asymmetry that would warrant the one of the sectors should have the privilege to lead.

5   An empirical look at wage bargains

Let us summarize the two most important theoretical predictions of the model.

1. *First prediction*. The central conclusion of section 4.3 was that sequential bargaining leads to more wage moderation and higher employment. This was the case in the Stackelberg equilibrium, as compared to Nash equilibrium. It was also the case of the binding norm set by the leader, as analysed in section 4.4. Thus, with the ratification of the Industrial Agreement and the general acceptance of leader–follower bargaining, we should observe lower wage claims.

2. *Second prediction*. The conclusion of section 4.5 was that the wage claims of the leader as well as the observed observance of the norm would depend on the initial wage ratio. With a low traded sector relative wage, we should see more moderate wage claims by that sector and a better observance of the norm by the follower (this corresponds to point B in Figure 7). By contrast, if the traded sector initial relative wage is high, we should see a high wage increase in that sector and an even higher one in the sheltered sector (this corresponds to point B in Figure 8).

Of course, we do not pretend that these predictions can be tested in a very stringent way. But at least it can be illuminating to study whether the wage bargaining outcomes during the last 15 years

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[16]It is easy to work out the case where only the leader is envious. With a low initial W_T/W_S, the leader's envy does not affect the Stackelberg outcome; if initial W_T/W_S is high, the leader's envy increases both wages relative to the Stackelberg solution.

[17]This is also the case considered by Calmfors and Larsson (2009).

Table 1 Information on Swedish pay bargaining rounds

Bargaining round	1995–1997	1998–2000	2001–2003	2004–2006	2007–2009
1. Bargained industry increase (A)	3.3	2.3	2.4	2.0	2.8
2. Bargained service sector increase (B)	3.6	2.8	2.7	2.1	3.1
3. Service sector bargain surplus (B−A)	0.3	0.5	0.3	0.1	0.3
4. Industry increase, outcome (C)	5.5	3.5	3.7	3.1	3.6
5. Service sector increase, outcome (D)	4.6	3.7	3.8	3.1	3.5
6. Service sector outcome surplus (D−C)	-0.9	0.2	0.1	0.0	-0.1
7. Service sector mean-corrected surplus	-0.7	0.4	0.3	0.2	0.1
8. Preceding period industry increase, outcome (E)	3.8	5.5	3.5	3.7	3.1
9. Preceding period service sector increase, outcome (F)	3.4	4.6	3.7	3.8	3.1
10. Preceding period S-surplus (F−E)	-0.4	-0.9	0.2	0.1	0.0
11. Preceding period mean-corrected S-surplus	-0.2	-0.7	0.4	0.3	0.2
12. Expected productivity growth under bargain (G)	1.3	2.2	2.1	2.6	2.1
13. Productivity growth, outcome (H)	3.1	3.0	3.1	4.3	-1.8
14. Expected bargained industry ULC change (A−G)	2.0	0.1	0.3	-0.6	0.7
15. Unemployment under the bargain	10.6	9.8	5.9	7.7	6.1
16. Theoretical interpretation	Nash	Stack.	corner	corner	?

Source: National Institute of Economic Research. The wage increase measures are the ones that are reported monthly in the Swedish Konjunkturlönestatistiken ("Short Term Salary Statistics"). The expected productivity growth is defined as the average productivity growth under the first and second year of the upcoming contract period, as anticipated by the National Institute of Economic Research in its last forecast published under year that preceded the bargain. Thus, for example, for the bargaining round 2001–2003, we take the productivity forecast from the institute's publication Swedish Economy from November 2000, concerning years 2001 and 2002, and average them. Productivity growth forecasts were in general not available for the entire three-year periods and we therefore use the forecast for the first two upcoming years. The productivity growth outcome variable spans the entire three-year-period, by contrast.

at all match these theoretical predictions.

The 1995 bargaining round was a rather uncoordinated one. Since the Industrial Agreement was ratified in 1997, four major bargaining rounds have taken place, influenced by that agreement. Each bargaining round culminated in collective wage agreements, first for the manufacturing industry and then for the the service sector and public sector wage setters. The agreements covered a three-year period, starting with the pay increases in the year of negotiations.

The following table depicts some basic data on these wage settlements. The first two lines tell the collectively agreed pay increase for the manufacturing industry (without construction) and the collectively agreed pay increase for the service sector, respectively. These sectors are here treated as proxies for the paper's T-sector and S-sector.

Line 3 records the surplus of the S-sector, i.e. how much the follower exceeded the norm. Lines 4 through 7 report the outcome of wage increases under each three-year contract period, including those, mostly locally agreed, wage increase components that came on top of the collectively bargained increases. Line 6 records the S-sector surplus in outcome terms.

In the period 1995–2009 we investigate, the S-sector wage surplus outcome is on average negative. In other words, these data show an on average higher industry wage increase over the service sector wage increase, with a difference of about 0.22 per cent per year. This reflects the fact that these statistics do not take into account the changes in the composition of the workforce but only record the difference in pay increases for the given groups of the base year.[18]. We therefore correct the S-surplus figure by subtracting this difference of means, and this is reported in line 7.

The next four lines contain information on the outcome of the increases during the *preceding* contract period. This brings in even the information from the period 1992–1994 that is relevant to judge the circumstances as to the relative wage during the bargain on 1995. It also makes easier to judge relative wage movements under the two contract periods that precede the one one wants to evaluate.

In line 12, we report the expected future productivity growth under the upcoming contract period, as anticipated at the time when collective negotiations were conducted. These productivity forecasts are taken from the National Institute's "Swedish Economy" last report under the year that precedes the the bargaining.[19]

Line 13 reports the productivity outcome of the contract period. Line 14 is a crude measure of "militancy" (inverse moderation): we subtract the anticipated business sector productivity growth from the collectively bargained T-sector pay increase of line 1. This yields a crude measure of militancy: how much would unit labour costs in the Swedish business sector have increased, if the collectively bargained pay increase of the industry would have become the business sector outcome. A low or negative entry in the last line is thus a token of wage moderation. Line 15 is the ILO measure of unemployment.

Finally, the last line is a suggested theoretical interpretation of the bargaining outcome according to the models presented in this paper. Of course, any such interpretation is very speculative.

Out of these data, it is possible to concoct a story that at least does not shout out loudly against the theoretical model. Consider the first two bargains, that of 1995–1997 and that of 1998–2000. The militancy measure of line 14 shrinks markedly between those two, and this coincides with the ratification of the Industrial Agreement in 1997. This is consistent with our *first prediction*: moderation improves when no co-ordination gives way to sequential bargaining.

Note that the bargained S-surplus is still fairly high, 0.5, in 1998–2000 and even 0.3 in 2001–2003 (see line 3). Both of these contract periods were preceded by wage outcomes in which the traded sector wages had increased more than the sheltered sector ones (see lines 10 and 11). Thus, during the bargains of 1998 and 2001, we would rather expect to be in the case of high traded sector initial wage of Figure 8, and this rhymes with the high S-surplus. This is consistent with the *second prediction*.

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[18]These numbers are from the Short Term Salary Statistics (Konjunkturlönestatistiken). In the National Accounts, there is no such systematic tendency of higher industry pay increases. Of course, basic economics suggests that wages of all sectors should in the long run grow at the same pace.

[19]This seems reasonable, since the industry typically conducts its bargains from the turn of the year onwards, and the National Institute's report is published in December. Thus, for example, the industry's bargaining round for the contract period 2004–2006 was conducted from December 2005 to March 2006, and the National Institute's report with its productivity growth forecast for the upcoming years was published in December 2005.

Consider now what happens in the bargain of 2004. In that contract, we see the highest moderation (low militancy), i.e. the lowest bargained unit labour cost increase (see line 14). In the theoretical model, we saw that T-sector wage moderation would be enhanced by a lower initial wage for the T-sector. Thus, increased wage moderation is likely to be preceded by S-sector pay increases that exceed thoses of the T-sector (in Figures 6 through 8, this corresponds to a clockwise rotation of the same-increase line). This is indeed what we observe during the preceding contract period 2001–2003: the S-sector has now started to get compensation for the higher traded sector increases that occurred during the earlier contract periods (see lines 10 and 11). This is also consistent with our *second prediction*.

Finally, the envy model implied that with an improved S-sector relative wage, high moderation would be accompanied by an observed high observancy of the norm. This is also what we observe in 2004: the S-sector bargained surplus measure from line "Service sector bargain surplus" is only 0.1 in 2004–2006. This contrasts with the earlier contract periods 1998–2000 and 2001–2003 when T-sector bargained increases were higher, simultaneously with a higher service sector bargained surplus.

Thus, in broad terms, we see increasing moderation and increasing observance of the norm, once the S-sector starts to catch up. Note that this period of increasing moderation coincides with decreasing unemployment. If there were no institutional changes going on, one would expect that lower unemployment would be associated with higher, not lower wage claims in relation to anticipated productivity growth.

The interpretation of the last contract period 2007–2009 is perhaps less clear cut. Militancy increases, as compared to the earlier contract period (see line 14), although the S-surplus continues to be positive in the preceding period. Note, however that unemployment is now clearly lower than before, which in itself boosts wage claims. It is also true that an unusually large part of the bargained increase in 2007 consisted of *minimum pay level* increases, which in the Swedish wage bargains often seem to be an additive extra component, on top of the generally agreed "room" for pay increases.[20].

These comparisons were based on comparisons of wage increases according to short term Short Term Salary Statistics, so that an S-sector surplus could be interpreted as a clockwise rotation of the same-increase line of Figures 6 through 8. This allowed an interpretation of the data: when the sheltered sector starts to catch up, moderation increases and the enorm is better observed, as is exemplified by the bargaining round of 2004.

The envy model implied that the initial level of relative wages, together with S-sector aversion towards lower wage increases, would determine the economic outcome. In the empirical reasoning above, we used changes in the relative wage outcomes on lines 10 and 11 as an indication of the economy moving from the no-corner solution of Figure 8 to the corner solution of Figure 7.

We did not look at relative wage levels, however. It would be reassuring if even an anlysis of relative wage levels confirmed a similar story. The Business Cycle Wage Statistics do not generate meaningful levels, however, because they are compiled as averages of pay increases for given groups
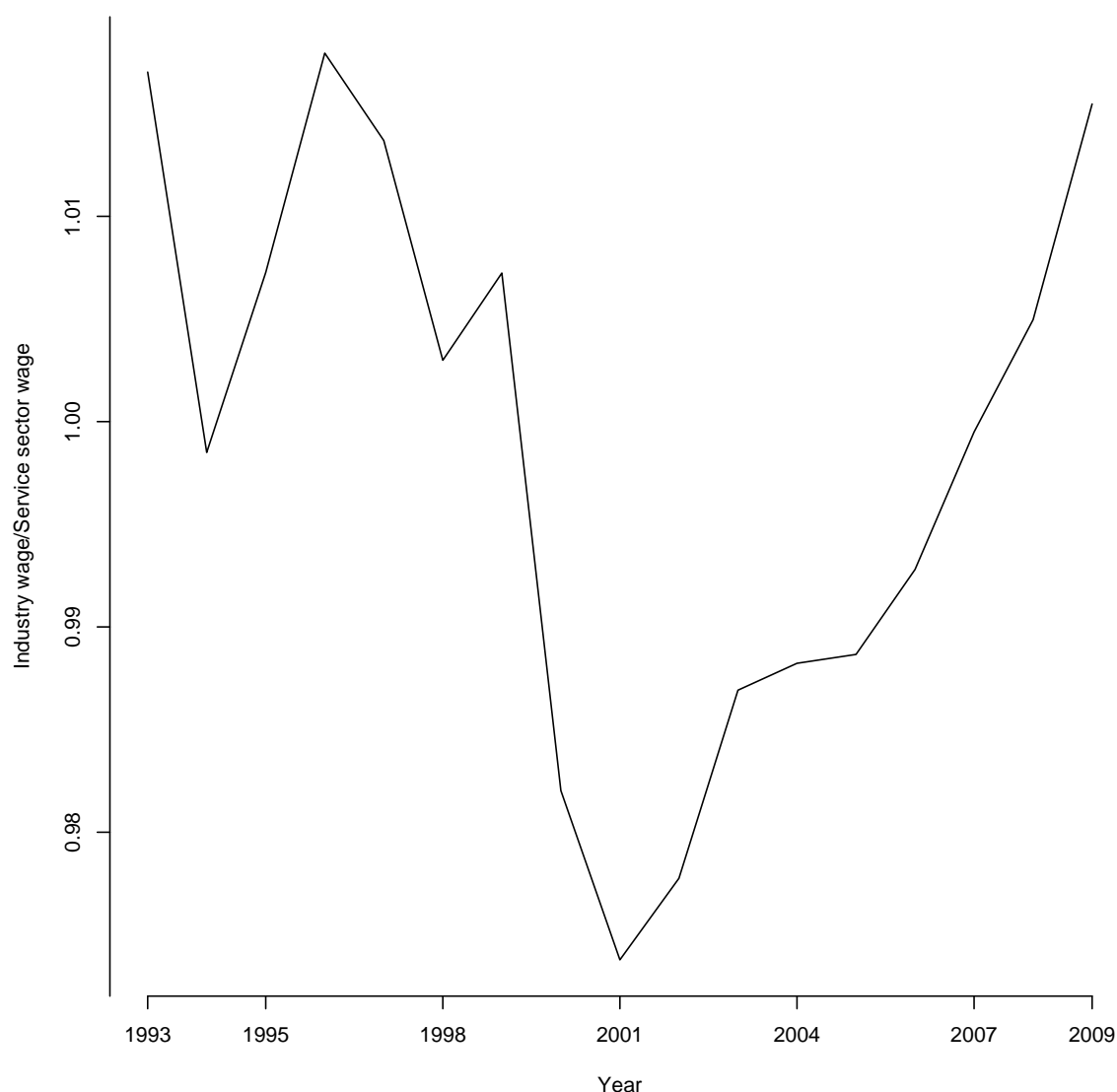
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[20]See the National Institute of Economic Research Wage Formation Report 2008 for an analysis of these minimum pay increases.

Figure 10 The industry/service sector wage ratio from SNA

of white-collar and blue-collar employees in manufacturing industry, construction, services and the local and central government. They do not take into account any changes in the composition of the workforce.

The relative wage level between manufacturing industry and the service sector is reported in the quarterly national accounts, however, and we can use those statistics to check whether we see a similar pattern. To corroborate the story above – increasing moderation and norm observance once the sheltered sector improves its position –, we should see a move from a higher manufaturing industry relative wage in the late 1990's towards a lower one from the turn of the decade onwards. Figure 10 reports that this is indeed the case. The industry's relative wage is higher during the bargain years of 1995 and 1998, and it is lower in 2001 and 2004 when we see wage moderation and norm observance increasing. Even the 2007 figure is under the 1995-1999 level.

Note also that trade union leaders are more likely to look at the Short Term Salary Statistics when making their comparisons. The National Accounts figure is less likely to be weighed in in their wage claims, since it is less easy to relate to collectively agreed pay increases. The National Accounts reading incorporates all structural and compositional changes in the labour force, whereas the Short Term Salary Statistics is far easier to relate to the unions leaders' target variables. Thus, even if the Short Term Salary Statistics does not allow for very meaningful level comparisons, it is likely to be the statistic that the labour market parties will make greater use of.

6   Discussion and conclusions

There is a discussion in Sweden on the merits and drawbacks of the current bargaining regime. Critics argue that the wage norm regime is inefficient, since it imposes a uniform level of pay increases on all sectors. Lars Calmfors (2008), for example, has recently argued that this, together with possible social norms, can lead to employment losses. If demand and employment are high in those sectors which start a bargaining round, it is hard for the follower unions to settle on a lower pay increase, even if the conditions of those sectors would warrant this.

The results of this paper suggest that a system of sequential bargaining, possibly combined with norms on pay increases, can have merits as well. In section 4.3, it was shown that a sequential bargaining procedure is likely to yield a better employment outcome than a simultaneous Nash-Cournot game.

That leader – follower games generically yield more efficient outcomes than Nash equilibria is well known. To understand Nordic and Swedish pay bargaining, the results of section 4.4 and 4.5 may be more interesting and original, despite their mathematical simplicity. If there is a strong norm among large unions that everybody should get the same increase, a powerful incentive for the wage leader to claim high wages is removed: there is no cross wage elasticity (price elasticity) exploit. This insight may make more intelligible the well entrenched attachment of Nordic unions to uniform pay increases across bargaining units. That attitude is often ridiculed, but the results of this paper suggest that it may be a pragmatic way of sustaining wage moderation.

In section 4.4, the existence of a norm on relative wage increases was simply assumed. In section 4.5, we generalised an idea of Calmfors and Larsson to show that the follower's "envy" or loss aversion about pay increases could amount to a procedural support for wage moderation, since that envy created a credible threat that disciplined the wage leader. Whether this outcome occurs, however, depends on the initial relative wages. This also yields an insight on why the norm sometimes binds and sometimes not.

Taking as benchmarks the results of the Stackelberg equilibrium without envy as well as the envy model with an envious follower sector, we investigated the data on wage bargaining outcomes in the last five bargaining rounds. We found that these data were consistent with the model predictions. The establishment of sequential bargaining led to a significant reinforcement of wage moderation. Furthermore, and in accordance with the model, the late 1990's were associated with a higher traded sector relative wage, less wage moderation and a weaker observance of the wage norm by the fol-

lower sector. When the sheltered sector wage caught up, we observed more moderate wage claims and a better observance of the norm. Although these observations do not amount to any stringent test, they suggest that the model is compatible with those few observations that we have on Swedish pay bargaining outcomes.

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