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MONETARY REGIMES AND THE CO-ORDINATION OF WAGE SETTING

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Abstract

International comparisons show that countries with co-ordinated wage setting generally have lower unemployment than countries with less co-ordinated wage setting. This paper argues that the monetary regime may affect whether co-ordination among many wage setters is feasible. A strict monetary regime, like a country-specific inflation target, to some extent disciplines wage setters, so that the consequences of uncoordinated wage setting are less detrimental than under a more passive monetary regime (eg a monetary union). Thus, the gains from co-ordination are larger under a passive regime. Under some circumstances a passive regime may induce co-operation in wage setting, and thus lower unemployment, when a stricter regime would not.

Keywords: Wage setting, co-ordination, equilibrium unemployment, monetary regime, monetary union, wage moderation

JEL Classification: E24, J5, E52

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1 Introduction

Over the last decades, explanations of the high European unemployment have increasingly focused on the structure of the labour market. The wage formation system has played a key role in many of the explanations. An important view, advocated by among others Layard, Nickell and Jackman (1991), is that strong unions per se have a negative impact on employment, by increasing wage pressure. Yet if wage setters co-ordinate their wage setting, taking into consideration the negative external effects identified in the literature (cf. surveys in Moene, Wallerstein and Hoel, 1993, and Calmfors, 1993), the negative impact of unions may be mitigated. Indeed, the findings of several international comparisons (e.g. Nickell, 1997, OECD, 1997, Blanchard and Wolfers, 1999; cf. survey in Calmfors, 2000) support the theoretical prediction, showing a marked tendency that countries with a high degree of co-ordination in the wage setting have lower unemployment.

Given the large potential benefits of co-ordination in wage setting, suggested by theory and supported by empirical evidence, a crucial question is: Why are unions in some countries able to co-ordinate their wage setting, while unions in other countries are not? This issue has, however, not received much attention within the economics literature (two exceptions are Holden and Raaum, 1991, and Holden, 1991a). As observed by Flanagan (1999), most studies take the labour market institutions as exogenous.[1] In contrast, this issue has been discussed extensively in the political science literature, cf. e.g. Iversen (1999) and Fajertag and Pochet (2000).

The present paper argues that the monetary regime may be one factor that affects whether co-ordination of wage setting is feasible. The argument builds on a recent literature, including Bratsiotis and Martin (1999), Soskice and Iversen (1998, 2000) and Coricelli, Cukierman and Dalmazzo (2000),[2], where it is shown that a non-accommodating central bank disciplines large wage setters by making employment more sensitive to the real wage. In the present paper, the result of this literature is blended with the analysis of Holden and Raaum (1991) and Holden (1991) on whether co-ordinated wage restraint is feasible. Somewhat simplified, the idea is as follows. Consider an economy with several large wage setters (e.g. industry unions), where uncoordinated wage setting will lead to an adverse outcome with high

[1] Cooper (1999) surveys other types of co-ordination games in macroeconomics.

[2] See also Horn and Persson (1988), Hall and Franzese (1998), Holden (1999), Wibaut (1999), Vartiainen (1999) and Cukierman and Lippi (2001). In a related literature, Cubitt (1992, 1995), Skott (1997), Jensen (1997), Gruner and Hefeker (1999), Cukierman and Lippi (1999), Guzzo and Velasco (1999), Lawler (2000), explore the effects of assuming that unions are also concerned about inflation.

unemployment. Unions have an incentive to co-ordinate their wage setting to achieve lower unemployment. However, any union may deviate from the co-ordination, reaping a short run gain from setting higher wages. Co-ordination is only sustainable if the costs associated with a defection, in the form of reduced likelihood of a mutually beneficial co-ordination in the future, is sufficiently high to outweigh the potential short run gain from deviating.

The monetary regime may influence whether co-ordination is sustainable by affecting the costs of a breakdown of the co-ordination. If wage setting is unionised, but uncoordinated, the monetary regime is important, because a strict central bank may discipline wage setters and thereby dampen the negative consequences of uncoordinated wage setting. The monetary regime is less important if unions co-ordinate their wage setting, because a good equilibrium, with low unemployment, can be achieved in any case.[3] Thus, the gains from co-ordination of wage setting are larger if the central bank is accommodating, providing unions with a greater incentive to co-ordinate.

An important application of the analysis of the paper is the consequences of participation in a monetary union, like the European Monetary Union, EMU. As argued by Soskice and Iversen (1998) and Cukierman and Lippi (2001), monetary policy will not have the same disciplining effect on wage setting in a monetary union as in a country with a country-specific inflation target, implying that equilibrium unemployment will be higher in a monetary union. The intuition is that even if the central bank in the monetary union is a vigorous inflation fighter, the monetary policy response to higher wages in a single country would be small, because the effect on the aggregate price level in the monetary union of higher wages in one single country would be small. In contrast, in a country with a country-specific inflation target, the central bank would respond to higher wages by increasing the interest rate, making a wage increase less attractive for the unions. However, because EMU involve less discipline on the unions, this paper shows that the incentives for unions to voluntary co-ordinate wage setting at the national level are higher in the EMU. If incentives to co-ordinate increase sufficiently to sustain co-ordination, membership in the EMU would lead to lower equilibrium unemployment.

To focus sharply on the effect of the monetary regime on whether co-operation in wage setting is sustainable, the model is kept simple on other accounts. Most importantly, the monetary policy rule is kept exogenous in the main part of the paper. Furthermore, other

[3] This distinction is noted in Bratsiotis and Martin (1999), but without any remarks on the possible implications for whether co-operation is feasible.

possible effects of participation in a monetary union, like increased product market competition (Bean, 1998), a change in the incentives for labour market reform (Calmfors, 1998), or different effects on traded and non-traded sectors (Holden, 1999), are also neglected.

The paper is organised as follows. In section 2, I present the basic economic model. In section 3, I analyse whether co-ordination in wage setting is feasible, drawing upon the theoretical framework in Holden and Raaum (1991). In section 4, I explore whether the key empirical prediction is consistent with data. Section 5 concludes the paper.

2 The model

We consider an economy consisting of k symmetric industries. The workers are organised in $1 < n \leq k$ symmetric unions, so that each union covers the workers in k/n industries. For analytical convenience, n is continuous and the limit case n = 1 is ruled out. The assumption that the economy is symmetric and completely unionised is done to simplify the analysis. The aim is to capture two important elements of European labour markets: (i) There are several fairly large wage setters (typically industry unions). (ii) Most wage earners have their wage set by these large wage setters (bargaining coverage in Western European countries was in 1994 in the interval from 70 to 98 per cent, with two exceptions, UK 47 per cent and Switzerland 50 per cent, see OECD, 1997, table 3.3).

In the model, time horizon is infinite. We first consider behaviour in one time period, which I shall to refer to as a year. To save on notation, time subscript is suppressed whenever possible. Within each industry, there are several firms producing an identical product under constant returns to scale, with labour as the only input $y_f = l_f$, where lower case denotes natural logarithm, y is production, l is labour, and subscript indicates firm. Thus, within each industry there is Bertrand competition, so each firms sets the output price equal to unit costs, that is,

$$p_f = w_f, \tag{1}$$

where w_f is the wage rate for workers in firm f. The demand for products from industry i is

$$y_i = \bar{g} + a(m - p) - \eta(p_i - p) \qquad \alpha, \eta > 0 \tag{2}$$

where $\bar{g}$ is a constant, m is the nominal money stock, p is the log of the aggregate price level defined as

$$(3) \qquad P = \left(\frac{1}{k} \sum_{i=1}^{k} P_i^{1-\eta} \right)^{\frac{1}{1-\eta}}$$

Unions care about the real wages and the employment of their members. The annual loss function of union j is

$$(4) \qquad \Omega_j = \frac{1}{2}(w_j - p - \omega^*)^2 + \frac{\theta}{2}(l_j - l_j^*)^2$$

where $\omega^* > 0$ and $l_j^* = l^* - \ln k > 0$ are the target levels of real wages and employment (identical across unions), l^* is the total labour force, and $\theta > 0$ denotes the union's relative concern for employment. (4) is only meaningful as long as both the real wage and the employment level are below their target values, so that union loss is decreasing in both arguments. However, as will become apparent below, in equilibrium the real wage will be below its target value, which ensures that this condition is fulfilled in the relevant interval.

The central bank sets the nominal money stock according to a predetermined rule

$$(5) \qquad m = \bar{m} + \rho w$$

where $\bar{m}$ is an exogenous component of the money supply, w is the aggregate wage level, and ρ is the rate of accommodation to the wage setting. (5) allows for different interpretations. Coricelli et al (2000) derive a monetary rule like (5) as the optimal monetary policy of a central bank with a loss function that is increasing in inflation and unemployment. Cukierman, Rodriguez and Webb (1998) provide empirical evidence of monetary tightening in response to high wage growth (ie. a negative ρ) in countries like Germany and Austria (which had strict monetary regimes before entering EMU). More broadly, (5) can be thought of as a convenient characterisation of the responsiveness of aggregate demand to the wage setting under different monetary regimes. Under such a broad interpretation, a regime where the central bank inflates or devalues so as to wipe out any real effects of the money wage setting of unions may correspond to $\rho = 1$. In a credibly fixed exchange rate regime, or in a small country in a monetary union, the interest rate would not respond to wages, but aggregate

demand may go down due to increased costs of production compared to the competitors, corresponding to a lower value of ρ. A country-specific inflation target would presumably correspond to a negative ρ, as excessive wage growth would be met with higher interest rates, possibly inducing an appreciation of the currency.

All agents have complete knowledge of the model, and are able to perfectly forecast the behaviour of the other agents. Within the year, the sequence of events is as follows. First, all unions simultaneously set the nominal wages (to simplify the analysis, I follow the common practice in this literature and adopt the monopoly union assumption). Second, the central bank sets the nominal money stock according to the monetary rule (5). This sequence is motivated from the fact that most collective agreements are set for one or two years, while monetary policy can be adjusted at any time. Third, firms set prices and employment levels so as to maximise profits, ensuring that prices and employment are given by (1) and (2) above.

Wage setting

We first consider wage setting without co-ordination. The first order condition of union j is

$$(6) \qquad \frac{d\Omega_j}{dw_j} = (w_j - p - \omega^*)\left(1 - \frac{dp}{dw_j}\right) + \theta(l_j - l_j^*)\frac{dl_j}{dw_j} = 0$$

The first order conditions (6) for each union jointly determine a Nash equilibrium in the wage setting game among the unions. From (1)-(3), and (5), we obtain (note that $dw/dw_j = dp/dw_j$ and that in a symmetric equilibrium $dp/dp_j = 1/n$ from (3))

$$(7) \qquad \frac{dp}{dw_j} = \frac{1}{n} \qquad and \quad \frac{dl_j}{dw_j} = -\alpha(1-\rho)\frac{dp}{dw_j} - \eta\left(1 - \frac{dp}{dw_j}\right)$$

The two components of the wage elasticity of labour demand reflect the two channels through which a wage rise affects employment. First, a wage rise leads to higher prices, reducing aggregate demand via a reduction in the real money stock. This effect is stronger the more centralised the wage setting (dp/dw_j large), and the less accommodating the central bank (ρ small). Secondly, a wage rise raises the relative price of the firms covered by the union, so that these firms obtain a smaller share of aggregate demand. This effect is weaker the more centralised the wage setting, and the lower the price elasticity of product demand.

Substituting out in (6), defining the rate of unemployment for workers associated with union j as $u_j = l_j^* - l_j$, and aggregating over industries, we obtain

$$(8) \qquad w - p = \omega^* - (\alpha(1-\rho)\sigma + \eta)\theta u$$

where I have defined $\sigma = (dp/dw_j)/(1-dp/dw_j)$ as an indicator for centralisation of wage setting. Using (7), $\sigma = 1/(n-1)$, so σ can take values in the interval 1/(k-1) (n = k, ie. decentralisation) to infinity (when n converges to unity).

Inspection of (8) shows that a strict central bank, ρ small, makes labour demand more elastic, inducing unions to aim for lower real wages (for given rate of unemployment) (cf. among others Bratsiotis and Martin, 1999, and Soskice and Iversen, 1998, 2000).

The equilibrium rate of unemployment is derived by combining the wage curve (8) with the aggregate price curve implied by (2); p - w = 0. The following Proposition is immediate.

Proposition 1: The equilibrium rate of unemployment is given by

$$(9) \qquad u^* = \frac{\omega^*}{\theta(\alpha(1-\rho)\sigma + \eta)}.$$

u^* is decreasing in θ and η, decreasing in σ for $\rho < 1$, and increasing in ρ and ω^* (and increasing in n, via the effect of σ).

In particular, we observe that equilibrium unemployment is lower, the stricter the central bank (ρ small), and the more centralised the wage setting (σ large). These are standard findings in the literature. A strict central bank disciplines the wage setters, cf. Bratsiotis and Martin (1999), Soskice and Iversen (2000), and Coricelli et al (2000). Centralisation of wage setting leads to internalisation of negative external effects, cf the surveys by Moene et al (1993) and Calmfors (1993). As the aggregate real wage level is given by productivity and price setting, and thus independent of the level of unemployment, union welfare is unambiguously decreasing in the rate of unemployment.

3 Co-ordination of wage setting

While proposition 1 above shows that co-ordination of wage setting is desirable, it does not necessarily ensure that it is accomplished; this is the topic of this section. First, in the real world, it is not realistic that all income earners comply with the co-ordination; eg self-employed and employees not covered by collective agreements. To capture this in a simple way, I assume that $1-\gamma$ of the industries never participate in the co-ordination. In these industries, the money wage is set simultaneously with the wage setting by the co-ordinating unions, and the money wage is set to the value that makes the real wage in these industries equal to the average real wage in the economy (recall that all agents can forecast the equilibrium price level).

A possible way to achieve co-ordination among the remaining γn (assuming $\gamma n > 2$) unions would be joint wage setting, i.e. a nation-wide wage bargaining covering all workers in these unions. However, in practice, this would involve less flexibility on issues other than wages (e.g. manning ratios, working hours). Furthermore, joint negotiations may also reduce wage dispersion (see Wallerstein, 1999, for empirical evidence), which high wage industries may object to. Empirically, nation-wide wage setting does take place occasionally in some countries, however in most European countries this is rarely or never the case.

A second possible way of ensuring co-operation would be for the unions to sign a binding agreement. However, this would involve important legal and other difficulties.[4] In the sequel, I will assume that the actual wage setting is undertaken independently be each union.

Ahead of the wage setting, the leaders of the γn unions are assumed to come together to agree on a common wage level to be chosen in the subsequent industry-wide wage setting.[5] As wage determination takes place simultaneously in all industries, any one union can deviate from this agreement and set a higher wage. This will not be discovered until the other unions have set their wage. Thus, if the wage setting in one year is viewed in isolation, an agreement on wage restraint by the unions will not be credible. Each union prefers a higher wage for itself irrespective of the wage set by the other unions, and the unique one-shot Nash

[4] However, on rare occasions, e.g. in Norway in 1988-89, unions may accept legal restrictions on wage and price growth imposed by the government.

[5] Alternatively, co-ordination may be achieved by one union acting as the wage leader, by being the first to set wages and then choose a low wage that sets a pattern for others to follow. The question would then be if other unions would follow the leader, or deviate by setting a higher wage. By use of a similar formal analysis to the one presented here, the same qualitative results could be derived in this setting.

equilibrium in the wage setting game among the unions is the uncoordinated equilibrium derived above, as given by (8) and (9) above (where $\sigma = 1/(n-1)$), which I denote $w^N(\rho)$.

However, the situation is different if wage setting in one year may affect the outcome in future years. Intuitively, one would expect unions to be more willing to stick to the agreement if other unions have done so in the past. Thus, unions may want to stick to the agreement so as to induce the other unions to co-operate in the future. To explore this idea more formally, we must specify the overall objective of a representative union j, which is to minimise the discounted sum of annual losses

$$(10) \qquad \sum_{t=0}^{\infty} \beta^t \, \Omega_{jt} \qquad 0 < \beta < 1,$$

where β is the discount factor reflecting the rate of time preference.

The game can now be analysed as a repeated game, where the annual wage setting is repeated each year. Consider the following strategy for the unions:

1. Co-operate by setting w^A until some union alone deviates from co-operation.
2. If some union alone has ever deviated from co-operation, then set $w^N(\rho)$ until an exogenous event Q takes place.

For the time being, w^A is any given wage involving restraint relative to the uncoordinated outcome, $w^A < w^N(\rho)$, with associated unemployment $u^A < u^N(\rho)$; w^A is discussed further below. The exogenous event Q can be associated with a macroeconomic shock that makes the unions "forget" a previous defection and resume a co-operative solution (cf. discussion below). Let 1-q be the probability that Q happens, where $0 < q < 1$.

Thus, if one of the unions deviates from the co-ordination, the co-ordination breaks down and the unions revert to the one-shot Nash equilibrium. A unilateral deviation from the co-operative agreement will be disadvantageous for the deviator if it incurs higher (or equal) discounted total loss by deviating from the agreed wage, inducing a reversion to the uncoordinated one-shot Nash equilibrium, than by sticking to the agreement. This condition is equivalent to (cf appendix)

(11) $$\frac{\Omega^D - \Omega^A}{\Omega^A - \Omega^N} \leq \frac{\delta}{1-\delta} \qquad where\ \delta = q\beta, \qquad 0 < \delta < 1,$$

where Ω^D denotes the annual loss of a union that deviates by setting a higher wage than w^A, while the other unions set w^A. Ω^A denotes the associated payoffs of the co-operating unions, while the annual loss of the unions under uncoordinated wage setting is Ω^N. The numerator on the left hand side of (11) indicates the reduced loss for a deviator in the year of deviation, while the denominator indicates the higher annual loss in subsequent years. The appropriate discount factor δ incorporates both unions' time preference β and the probability of co-ordination being resumed after a breakdown, 1-q.

We now consider how the monetary regime, ρ, affects the decision to deviate. When comparing across regimes I treat the unemployment rate associated with the agreement, u^A, as constant; the question is how the monetary regime affects whether an agreement involving a certain unemployment rate is sustainable. Consider first the gain from co-ordination. As the equilibrium real wage is independent of the wage setting (it is given by the productivity level), the difference in union losses $-(\Omega^A - \Omega^N)$ only depends on the difference in the associated equilibrium rates of unemployment. Using (4), the gain from co-operation is

(12) $$-(\Omega^A - \Omega^N) = -\left(\theta(u^A)^2/2 - \theta(u^N)^2/2 \right).$$

A tighter monetary regime (a smaller ρ) reduces the rate of unemployment under uncoordinated wage setting, u^N, thus reducing the loss under uncoordinated wage setting and also reducing the gains from co-ordination.

Then consider the instantaneous gain from a unilateral deviation from a co-operative agreement, ie. $-(\Omega^D - \Omega^A)$. Although the co-operative agreement is non-binding, it seems realistic that it poses some constraints on a deviator. I assume that a deviator sets the wage $\Delta > 0$ above the agreed wage (the value of Δ does not matter for the qualitative results). The reduction in loss from a unilateral marginal increase of the wage above the co-operative wage w^A is (cf. (6) and (7))

(13) $$\frac{d\Omega^D}{dw_j} = -a + b(\rho)u^A \qquad where$$
$$a = -(w^A - p - \omega^*)\frac{n-1}{n} > 0 \quad and \quad b = \theta\left(\alpha(1-\rho)\frac{1}{n} + \eta\frac{n-1}{n}\right) > 0$$

It is apparent from (13) that $d\Omega^D/dw_j < 0$ for $u^A < u^N$ (because $d\Omega^D/dw_j = 0$ for the one-shot Nash equilibrium u^N). This implies that if a union deviates, it will set a higher wage than the agreed w^A. Substituting out for (12) and (13) in (11), using the first order Taylor expansion $(\Omega^D - \Omega^A) \approx \Delta d\Omega^D/dw_j$, we obtain

(14) $$\frac{(-a + b(\rho)u^A)\Delta}{\theta(u^A)^2/2 + \theta(u^N)^2/2} \leq \frac{\delta}{1-\delta}.$$

We have (cf. appendix)

Proposition 2:

(i) There exists a unique critical value $\delta^A(\rho, u^A) \in (0,1)$, given by equality in (14), such that co-operation involving $u^A < u^N$ is sustainable as a subgame perfect equilibrium under the strategy defined above if and only if $\delta \geq \delta^A(\rho, u^A)$.

(ii) The partial derivatives of δ^A satisfy $\partial\delta^A(\rho, u^A)/\partial\rho < 0$ and $\partial\delta^A(\rho, u^A)/\partial u^A < 0$.

(iii) The minimum value for the discount factor that sustains co-operation on wage moderation is $\delta^{Min} \equiv \lim_{u^A \to (u^N)^-} \delta^A(\rho, u^A) = \frac{b^2\Delta}{b^2\Delta + \theta a}$. Moreover, $\partial\delta^{Min}/\partial\rho < 0$.

Proposition 2 (i) says that co-ordination of wage setting is sustainable if unions are sufficiently patient, and/or the probability that co-operation is resumed after a breakdown is not too large. Proposition 2 (ii) can be given two different applications. First, for a given possible agreement involving the unemployment rate u^A, a less strict monetary regime (higher ρ) leads to a lower critical value δ^A, implying that co-ordination is sustainable for less patient unions (β smaller), and/or a higher likelihood that co-operation is resumed after a breakdown (1-q larger). In other words, a less strict monetary regime facilitates co-ordination of wage setting. Secondly, as δ^A is monotonic in u^A and ρ, the function $\delta^A(.)$ can be inverted to give u^A as a function of δ, $u^A(\delta, \rho)$, where $\partial u^A(\delta, \rho)/\partial\delta = 1/(\partial\delta^A(\rho, u^A)/\partial u^A) < 0$, and $\partial u^A(\delta, \rho)/\partial\rho < 0$.

This implies that for a given discount factor δ of the unions, a less strict monetary regime (higher ρ) makes unions able to sustain an agreement involving a lower unemployment.

Part (iii) of Proposition 3 says that the lowest critical value for which any agreement on wage restraint is sustainable, δ^{Min}, is a decreasing function of ρ. Again, a more accommodating monetary regime facilitates co-ordinated wage restraint.

The intuition for these results is a follows. The monetary regime ρ affects both the gain from deviation and the costs of a breakdown. A less strict monetary regime increases the short run gain from a deviation, because the negative effect on employment associated with a wage rise is mitigated. However, a less strict monetary regime increases the costs associated with a breakdown of the agreement, because the rate of unemployment under uncoordinated wage setting is higher. The latter effect dominates the former; so that the overall effect is that a less strict monetary regime makes a deviation less attractive. Intuitively, the effect on the short run gain from deviation is only related to the wage setting of the deviator, whereas the effect on the loss of a breakdown is related to the wage setting of all unions, so that the latter effect is larger. The feature that a less strict monetary regime makes deviation less attractive implies that the same agreement is sustainable under a wider range of circumstances (i.e. a lower δ), and that a more ambitious agreement is sustainable (a lower u^A).

An inherent problem in repeated games is that there typically exist a large or infinite number of equilibria. The multiplicity is related to the choice of initial agreement (see discussion below), as well as to the consequences of a deviation. Concerning the latter, one line of criticism of trigger strategy equilibria has been that the punishment is not "renegotiation proof", in the sense that if a deviation were to occur, the unions would nevertheless have an incentive to co-operate in the following period. If unions were to anticipate that they would co-operate even after a deviation, a deviation would involve no costs, and in this case the co-operation would not be sustainable in the first place (Farrell and Maskin, 1989). Another line of criticism is that even if co-ordination is not sustainable under the punishment associated with a reversion to a one-shot Nash equilibrium, there may exist harsher punishment strategies that sustain co-ordination (Abreu, 1988).

However, these lines of criticisms are probably more relevant in an analysis of perfectly rational players than in a model of union behaviour. Union wage policy is restricted by what can be accepted by the rank and file. It would be very difficult for the leadership of a union to suggest wage moderation if another union had defected the previous year. Arguments like "Last year was a mistake, but they promise that this year…." will probably have trouble

convincing the members of the union.[6] Likewise, complicated punishment profiles would also be difficult to explain and win acceptance for among the members. Thus, I find it more realistic to use a framework where a defection from the co-operative agreement leads to the uncoordinated outcome, and then reduced likelihood that there will be co-ordination in the future. Ideally, one would want a more elaborate model where the distinction between union leaders and membership were explicit, but this is outside the scope of the present study.

Optimal co-ordination

So far, we have only considered the sustainability of an arbitrary agreement on wage restraint. Let $w^C(\rho)$ denote the wage level that minimises the joint loss of the co-operating unions given that they stick to their agreement, which I will refer to as optimal co-ordination. w^C is given by (8) and (9), using $dp/dw_j = \gamma$ so that $\sigma = \gamma/(1-\gamma)$. Let u^C and Ω^C be the associated rate of unemployment and annual loss of the co-operating unions, given by (9) and (4). Considering the optimal agreement involves the additional complexity that the agreement itself depends on the monetary regime. Let δ^* denote the critical value for the discount factor above which an agreement on $w^C(\rho)$ is sustainable, given by equality in (14) where u^A is replaced by u^C. We have the following Proposition.

Proposition 3:

(i) There is a unique value $\rho^* < 1$, such that the gain from co-operation, $-(\Omega^C - \Omega^N)$, has a maximum for ρ^*, is increasing in ρ for $\rho<\rho^*$ and decreasing in ρ for $\rho>\rho^*$.

(ii) The reduction in loss from a marginal deviation from a co-operative agreement $w^C(\rho)$ (i.e. the gain from deviation, $-(d\Omega^D/dw_j)$) is smaller, the greater is ρ.

(iii) For $\rho < \rho^*$, δ^* is decreasing in ρ (as the gain from co-ordination increases and the gain from deviation decrease, both effects reducing δ^*). For $\rho > \rho^*$, a rise in ρ reduces the gain from co-ordination, so there are two opposing effects, and the effect on δ^* is ambiguous.

[6] As an illustration, in the wage settlement in 2000, the LO members in Norway rejected a moderage agreement proposed by their leaders, leading to new negotiations and a revised agreement on a higher wage. High income growth for other groups played an important role in the debate among LO members prior to the ballot.

The difference from the results in Proposition 2 above is a consequence of the agreement itself being affected by the monetary regime. As for part (i) of Proposition 3, the non-monotonicity arises from the monetary regime affecting both the loss under co-ordination and the loss without coordination, and the overall effect depends on which is the more sensitive to the monetary regime. Part (ii) also reflects two opposing effects. As explained above, a higher value of ρ reduces the elasticity of labour demand, which implies that a wage rise has less negative effect on employment; this increases the gain from a deviation. On the other hand, a higher value of ρ increases unemployment under co-ordination, so that unemployment is farther from its target value, which reduces the gain from a deviation. The latter effect is related to the wage setting of all unions, and thus dominates the former that only affects the wage setting of a deviator. Hence a higher ρ reduces the gain from a deviation.

To sum up Propositions 1-3: If $\delta \geq \delta^*$, unions choose the optimal agreement $w^C(\rho)$, as it is sustainable, involving unemployment $u^C(\rho)$. Within this interval, higher ρ leads to higher unemployment ($du^C/d\rho > 0$), as a more accommodating regime makes the unions show less wage moderation (the discipline effect of Proposition 1). If $\delta^{Min} \leq \delta < \delta^*$, unions minimize their loss by choosing the agreement associated with the lowest possible unemployment that is sustainable, $u^A(\delta; \rho) > u^C$. Here, higher ρ leads to lower unemployment ($du^A(\delta; \rho)/d\rho < 0$), as a more accommodating regime makes unions able to sustain a more moderate agreement (greater incentive for co-ordination, cf. Proposition 2). If $\delta < \delta^{Min}$, co-ordinated wage restraint is not sustainable. The outcome will be the uncoordinated equilibrium u^N, and higher ρ leads to lower unemployment, as $du^N/d\rho < 0$ (the discipline effect).

In addition, the monetary regime shifts the positions of the intervals: higher ρ leads to lower δ^* (numerical simulations below indicate that this also holds in the case where the analytical result of Prop 3 (iii) above is ambiguous) and to lower δ^{Min}. This implies that under a more accommodating monetary regime, co-ordination is possible for less patient unions (lower δ), and unions may agree to co-ordination involving lower unemployment.

Numerical simulations of the model are presented in Table 1. Because of the highly stylised nature of the model, the simulations should be treated as illustrations only, and not as estimates with any claim to precision. For the sake of brevity, and to avoid repetition of the results of Propositions 1-3 above, I will only mention two specific examples.

Consider the basis model (the four columns to the left of the Table), and let the actual discount factor, $\delta = 0.3$. Under an accommodative regime, $\rho = 0.5$, optimal co-ordination is sustainable (as $0.3 > \delta^*(0.5) = 0.226$), involving unemployment $u^C(0.5) = 0.038$. A stricter

regime $\rho = 0$ leads to lower equilibrium unemployment, $u^C(0) = 0.020$, as optimal co-ordination is still sustainable. However, if the monetary regime became even stricter, $\rho = -0.5$, co-ordination on $w^C(\rho)$ would no longer be sustainable as $0.3 < \delta^*(-0.5)=0.338$. The lowest possible unemployment that would be sustainable in this case is $u^A(0.3, -0.5) = 0.049$.

If $\delta = 0.2$ in the basis model, optimal co-ordination w^C is sustainable for $\rho= 0.8$ (as $\delta^*(0.8)=0.179 < 0.2$), implying unemployment $u^C(0.8) = 0.077$. For $\rho = 0.5$, optimal co-ordination is not sustainable ($\delta^*(0.5)> 0.2$), and the lowest possible sustainable unemployment is $u^A(0.2, 0.5) = 0.079$. For $\rho = -0.5$, co-ordination is not sustainable, as $\delta^{Min}(-0.5) > 0.2$, and the outcome is the uncoordinated equilibrium $u^N(-0.5) = 0.17$. The overall result that a stricter monetary regime involves less co-ordination of wage setting is still valid.

Endogenous monetary policy

In this subsection I briefly make one observation regarding implications if monetary policy were endogenous. A possible objection to the analysis above is that if co-ordination for some reason breaks down, the central bank will be tempted to switch to a stricter policy, to avoid the high equilibrium unemployment associated with uncoordinated wage setting under accommodating monetary policy. However, this outcome is not obvious. The central bank must also take into consideration that a switch to a stricter policy may prevent co-ordination from being resumed even if the exogenous event Q takes place. In the appendix, I show that under certain circumstances, a central bank that is sufficiently patient may want to remain accommodating if co-ordination breaks down, so as to make co-ordination possible in the future, rather than reaping a gain in the short run by switching to a stricter regime, but precluding future co-ordination.

4 Some empirical evidence

The main empirical prediction of this paper is that wage setting is less likely to be co-ordinated (or with much less ambitious co-ordination) in countries with a strict monetary policy. Now both co-ordination in wage setting and the strictness of monetary policy are in practice rather complex concepts that are difficult to measure empirically. A host of different empirical measures exists. Regarding wage setting, various scholars have focussed on corporatism, centralisation or co-ordination (see discussion of empirical measures in OECD, 1997). Note that the finding in section 3 above that the gain from co-ordination depends on the monetary regime may also be used to explain the degree of centralisation: centralisation

may involve costs in the form of reduced flexibility and independence, but unions may nevertheless prefer centralisation if the costs of uncoordinated wage setting are too large. In addition, combinations may occur where some unions may choose joint negotiations (centralisation), and then co-ordinate with independent unions. A striking feature for both wage setting and monetary regime is that the ranking of countries is often rather sensitive to the operational definition that is chosen.

Due to the large problems associated with empirical measurement, a robust investigation requires an extensive study of the relationship between different specifications of both concepts. This is outside the scope of the present study. It is nevertheless of interest to explore the relationship between the monetary regime and the co-ordination/centralisation of wage setting using some of the indices suggested in the literature. Figure 1 shows the position of 15 OECD countries on centralisation in wage setting (CeTI) and hard currency regimes (HCI), based on data from Iversen (1999). Some countries have a very decentralised wage setting (observations to the left in the figure), often with small union density, and in most of these countries co-ordination of wage setting is not an issue irrespective of monetary regime (UK/Britain, US and Canada are clearly in this category). However, for the observations of countries with medium and high degree of centralisation of wage setting, there is a clear tendency that a softer currency is associated with more centralised wage setting. A linear regression of centralisation of wage setting on the hard currency index omitting UK/Britain, US and Canada reveals a negative but insignificant effect (Table 2, regression 1).[7] However, omitting the five countries with most decentralised wage setting (which statistically is problematic; regression 2), we obtain a negative effect of the hard currency index significant at the ten percent level. This is consistent with the prediction of the present paper, that wage setting is more likely to be co-ordinated in countries with an accommodating monetary policy.

Figure 2, which plots the relationship between co-ordination in wage setting (CoOECD) in a number of OECD - countries, 1990 (from OECD, 1997, table 3.3) and the index of central bank independence (CBI) given by Cukierman and Lippi (1999), provides a less encouraging picture. No clear relationship is identifiable, irrespective of whether one neglects the countries with completely decentralised wage setting (regression 3). On the other hand, Figure 3, which combines Iversen's (1999) hard currency index with the centralisation of wage setting index of Golden, Lange and Wallerstein (1998) (CeGWL), indicates a clear

[7] Cross-country regressions with few observations is statistically highly problematic, so the results should only be interpreted as indicative.

relationship: wage setting is more centralised in countries with weaker currencies (neglecting US, Canada and UK); this is confirmed by a linear regression excluding the same three countries, where the hard currency index has a negative effect significant at the five percent level (regression 4). Figure 4, where Golden, Lange and Wallerstein's centralisation index is combined with Cukierman and Lippi's central bank independence index provides the same picture: centralised wage setting is combined with low central bank independence. The effect is significant at 10 percent level (regressions 5 and 6).

Overall, most of these indexes appear to be consistent with the theoretical prediction of the present paper. Note however, that even if we were to find a strong relationship between co-ordination in wage setting and accommodating monetary policy, the direction of causality would be an open issue. Clearly, the problems associated with the combination of unionised, uncoordinated wage setting and an accommodating monetary regime may also lead to a switch to a stricter monetary regime.

5 Concluding remarks

In this paper I have argued that the monetary regime affects whether co-ordinated wage restraint is feasible.[8] Because of the existence of negative external effects in wage setting, unions have an incentive to agree on wage moderation. However, individual unions may deviate from the co-operative solution, obtaining a short run gain by increasing wages. Co-ordination is only sustainable if the long-run costs associated with a breakdown of co-ordination outweigh the short run gains from a deviation. This depends on unions' discount factor (co-ordination is more likely if unions are patient), but it also depends on the monetary regime. A strict monetary regime disciplines wage setters by increasing the wage elasticity of employment, thus dampening the negative consequences of uncoordinated wage setting. Uncoordinated wage setting has more detrimental effects if the central bank is accommodating, implying that the gains from co-ordination are greater. Thus, co-ordination in wage setting may be sustainable with an accommodating central bank even if unions are not patient enough to ensure co-ordination with a stricter central bank.

The predicted negative relationship between centralisation of wage setting and central bank strictness is apparent from several combinations of empirical indices used in the literature. However, caution is necessary because empirical measurement of systems of wage

setting and monetary regimes is difficult, and because there also exists specifications of co-ordination/centralisation of wage setting and of monetary regimes where there is no relationship. Yet, the broad view appears to be consistent with the prediction that wage setting is less likely to be co-ordinated in countries with a strict monetary policy.

An interesting possible application of the analysis concerns the effects of membership within a Monetary Union, like the European Monetary Union EMU. Within a monetary union, the common monetary policy is only marginally related to the wage setting in an individual country, simply because one country constitutes a too small part of the total union to have a sizeable effect the aggregate variables. As pointed out by Soskice and Iversen (1998) and Cukierman and Lippi (2001), monetary policy will for this reason not have the same discipline effect within a Monetary Union as in a country with a country-specific inflation target. More speculatively, one may also argue that the lack of credibility of many fixed exchange rate regimes to some extent have disciplined wage setters, because high wage increases led to devaluation expectations and higher interest rates (see Holden and Vikøren, 1996, and Bernhardsen, 2000, for supporting empirical evidence for many European countries during the 1980s and early 1990s). On the argument of the present paper, the reduced discipline effect of interest rates being less responsive to wage growth in one country, leading to higher equilibrium unemployment if wage setting remains uncoordinated, may in fact increase wage setters' incentive to co-ordinate. This argument is interesting in view of the recent emergence of social pacts in many European countries over the last decade; Ireland, Italy, Greece, Finland, Belgium, Spain and Portugal are some examples (Pochet and Fajertag, 2000), a tendency not least surprising in light of the movement towards weaker unions and more decentralisation of wage setting that takes place in many countries. While there are clearly several reasons for this evolution (cf. Fajertag and Pochet, 2000), an interesting topic

[8] A broader discussion of the circumstances that may induce co-ordination of wage setting is given in Holden and Raaum (1991).

for future research would be to explore the relationship with the change in monetary regimes at a more detailed basis.[9]

[9] An additional reason for why membership in the EMU may facilitate co-ordination in wage setting is that devaluation is no longer feasible (see also related arguments in Pochet and Fajertag, 2000, and Calmfors, 2000). If money wages are rigid downwards (see Holden, 1994, 2001, for a theoretical justification based on existing labour market laws and regulations, and references to corroborating empirical evidence), excessive real wage costs arising from a breakdown of a co-operative agreement may be more persistent, and thus more costly, within the EMU. This would make defection from a co-operative outcome less beneficial, thus facilitating co-ordination. In the present paper, there are no nominal rigidities, so this effect is not incorporated.

Appendix

Derivation of (11):
The discounted sum of annual losses for a union that sticks to the agreement is $\Omega^A/(1-\beta)$. The discounted, expected sum of annual losses for a deviating union is $\Omega^D + \beta q\, \Omega^N + \beta^2 q^2\, \Omega^N + \beta^3 q^3\, \Omega^N + \ldots + \beta(1-q)\Omega^A + \beta^2(1-q^2)\Omega^A + \beta^3(1-q^3)\Omega^A + \ldots$ which can be rewritten as

$$\text{(A1)} \quad \Omega^D + \frac{\beta q \Omega^N}{1-\beta q} + \frac{\beta(1-q)\Omega^A}{(1-\beta)(1-\beta q)}$$

(11) follows from $\Omega^A/(1-\beta) \leq$ (A1).

Proof of Proposition 2:
(i)The existence of a unique critical value leading to a subgame perfect equilibrium follows directly from the standard analysis of trigger strategy equilibria, cf Friedman (1986).
(ii) To derive the partial derivatives, let

$$\text{(A2)} \quad F(\rho, u^A) \equiv \frac{(-a + b(\rho)u^A)\Delta}{\theta(u^A)^2/2 - \theta(u^N)^2/2}.$$

From (14) it is apparent that $\text{sign}(\partial\delta^A/\partial u^A) = \text{sign}(\partial F/\partial u^A)$, and likewise for ρ. The partial derivative of F with respect to u^A is

$$\text{(A3)} \quad \frac{\partial F(\rho, u^A)}{\partial u^A} \equiv \frac{h(u^A)}{C_1} \quad \text{where } h(u^A) \equiv b((u^A)^2 - (u^N)^2) - 2u^A(-a + b(\rho)u^A)$$

$$C_1 \equiv \left((u^A)^2 - (u^N)^2\right)^2 \theta/(2\Delta) > 0$$

Now, $h(u^A) = 0$ for $u^A = a/b$ (as $u^N = (a/b)$), while $h'(u^A) = 2bu^A + 2a - 4bu^A = 2(a - bu^A) > 0$ for $u^A < (a/b)$, thus $h(u^A) < 0$ and $\partial F/\partial u^A < 0$ for $u^A < a/b$, completing the proof that $\partial\delta^A(\rho, u^A)/\partial u^A < 0$.

To prove that $\partial\delta^A(\rho, u^A)/\partial\rho < 0$, note first that b is a decreasing function of ρ. We take the partial derivative of F with respect to b, using that $u^N = a/b$, to obtain

$$\text{(A4)} \quad \frac{\partial F}{\partial b} \equiv \frac{z}{C_1} \quad \text{where } z \equiv u^A((u^A)^2 - a^2 b^{-2}) + 2a^2 b^{-3}(a - bu^A)$$

Rearranging z , using $(u^A)^2 - (u^N) = (u^A - u^N)(u^A + u^N)$, gives us

$$\text{(A5)} \quad z = (u^N - u^A)[2(u^N)^2 - u^A(u^N + u^A)] > 0$$

thus $\partial F/\partial b > 0$ for $u^A < a/b$, which completes the proof that $\partial\delta^A(\rho, u^A)/\partial\rho < 0$.

(iii) Using l'Hopital's rule, we obtain $\lim_{u^A \to u^N} F(\rho, u^A) = \frac{b^2\Delta}{\theta a}$. Substituting out in (14) and solving for δ, yields (iii).

Proof of Proposition 3:
(i)Using (4), the gain from co-operation is

(A6) $-(\Omega^C - \Omega^N) = -(\theta(u^C)^2/2 - \theta(u^N)^2/2)$.

Substituting out for the associated equilibrium rates of unemployment using (9), simplifying, and differentiating with respect to ρ, we obtain

(A7) $$\frac{d\left((u^N)^2-(u^C)^2\right)}{d\rho} = 2(u^N)^2\frac{\alpha}{\alpha(1-\rho)+\eta(n-1)} - 2(u^C)^2\frac{\alpha}{\alpha(1-\rho)+\eta(1-\gamma)/\gamma}.$$

Straightforward rearrangement of (A7), using (9), shows that

(A8) $$\frac{d\left((u^N)^2-(u^C)^2\right)}{d\rho} \begin{matrix}>\\=\\<\end{matrix} 0 \quad\Leftrightarrow\quad (1-\rho) \begin{matrix}>\\=\\<\end{matrix} \frac{\eta}{\alpha}\frac{\left(\frac{\gamma}{1-\gamma}\right)^{\frac{1}{3}}-\left(\frac{1}{n-1}\right)^{\frac{1}{3}}}{\left(\frac{\gamma}{1-\gamma}\right)^{\frac{1}{3}}\left(\frac{1}{n-1}\right)^{\frac{1}{3}}\left(\left(\frac{\gamma}{1-\gamma}\right)^{\frac{2}{3}}-\left(\frac{1}{n-1}\right)^{\frac{2}{3}}\right)} > 0.$$

and (i) is immediate. (It's straightforward to show that the expression to the right > 0 by invoking γn > 2).

(ii) The effect of the monetary regime on the gain from a marginal deviation is found by differentiation of (13) with respect to ρ

(A9) $$\frac{d\Omega_j{}^2(w^C(\rho))}{dw_j d\rho} = \theta\alpha(1-\rho)\frac{1}{n}\frac{du^C(\rho)}{d\rho} - \theta\alpha\frac{1}{n}u^C(\rho) + \theta\eta\frac{n-1}{n}\frac{du^C(\rho)}{d\rho}$$

Substituting out for u^C from (9) (where $\sigma = \gamma/(1-\gamma)$), using that $du^C/d\rho = u^C\alpha\sigma/(\alpha(1-\rho)\sigma+\eta)$, we obtain

(A10) $$\frac{d\Omega_j{}^2(w^C(\rho))}{dw_j d\rho} = \frac{\theta u^C}{\alpha(1-\rho)\gamma+\eta}\frac{\eta\alpha}{n}\left((n-1)\sigma-1\right) > 0$$

(A10) is greater than zero whenever γ > 1/n, which holds as γn > 2. As $dw^C/dw_j < 0$, the absolute value of dw^C/dw_j is decreasing in ρ. QED
(iii) Follows from (i) and (ii).

Endogenous monetary policy
For simplicity, restrict attention to two different monetary regimes, ρ^S and ρ^A, where $\rho^S < \rho^A$, and $\delta^*(\rho^S) > \delta > \delta^*(\rho^A)$, so that optimal co-ordination is sustainable under ρ^A, while no co-ordination is sustainable under ρ^S. The loss of the central bank under the various outcomes satisfies $L^{NA} > L^{NS} > L^{CA}$, corresponding to the ranking of the associated unemployment rates under non-coordination and co-ordination. Assume that ρ^A prevails, but then co-ordination breaks down and the central bank is tempted to switch to ρ^S so as to avoid very high

equilibrium unemployment (reduce costs from L^{NA} to L^{NS}). I want to show strategies ensuring that a patient central bank will not switch (cf similar analysis in Holden (1991)) (note that there also exists other equilibria).

Unions:
Set w^C if and only if
(i) the central bank has always played ρ^A, and
(ii) no other unions have deviated after an exogenous event Q has taken place.
Set w^N otherwise.

Central bank:
Play ρ^A if and only if the central bank has never before played ρ^S.
Play ρ^S otherwise.

The discounted sum of annual losses for a central bank that switches to ρ^S is $L^{NS}/(1-\lambda)$, where λ is the discount factor. The discounted, expected sum of annual losses for a central bank that maintains ρ^A is $L^{NA} + \beta q\, L^{NA} + \beta^2 q^2\, L^{NA} + + \beta^3 q^3\, L^{NA} + \ldots + \beta(1-q)\, L^{CA} + \beta^2(1-q^2)\, L^{CA} + \beta^3(1-q^3)\, L^{CA} + ..$ which can be rewritten as

$$\text{(A11)} \quad L^{NA} + \frac{\lambda q L^{NA}}{1-\lambda q} + \frac{\lambda(1-q)L^{CA}}{(1-\lambda)(1-\lambda q)}$$

As $L^{CA} < L^{NS}$, we know that (A11) $< L^{NS}/(1-\lambda)$ for λ sufficiently close to unity, ie the central bank will stick to ρ^A if it is sufficiently patient. QED

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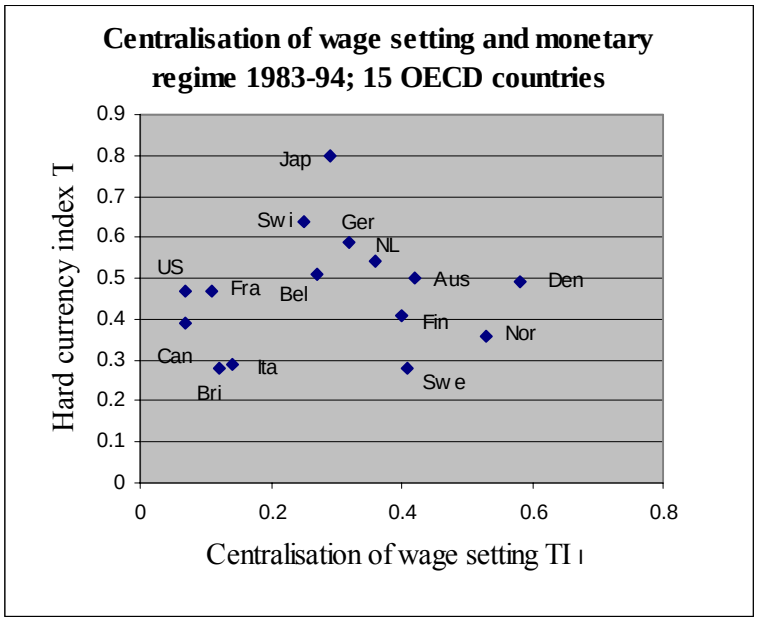

Figure 1: Sources: Iversen (1999), tables 1.2 and 1.3. Aus is Austria, NL the Netherlands, and NZ is New Zealand.

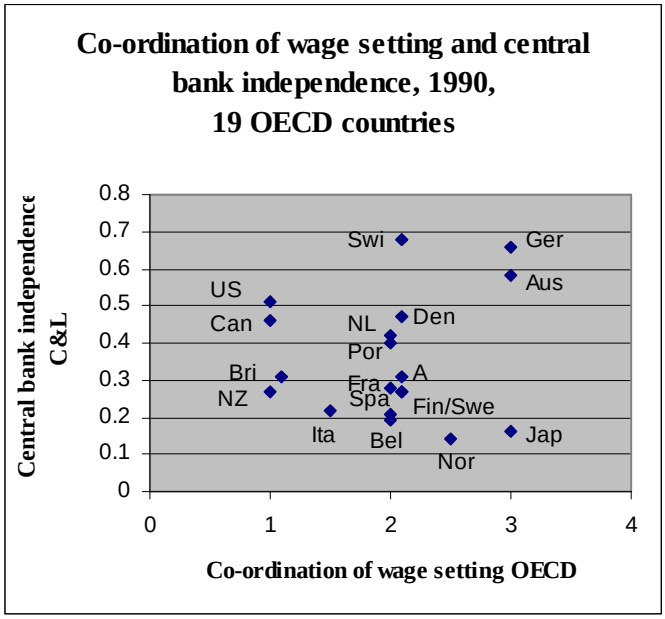

Figure 2: Sources: CBI, Cukierman and Lippi (1999), table 1; co-ordination in wage setting 1990, OECD (1997) table 3.3. A is Australia. Finland and Sweden are at the same data point.

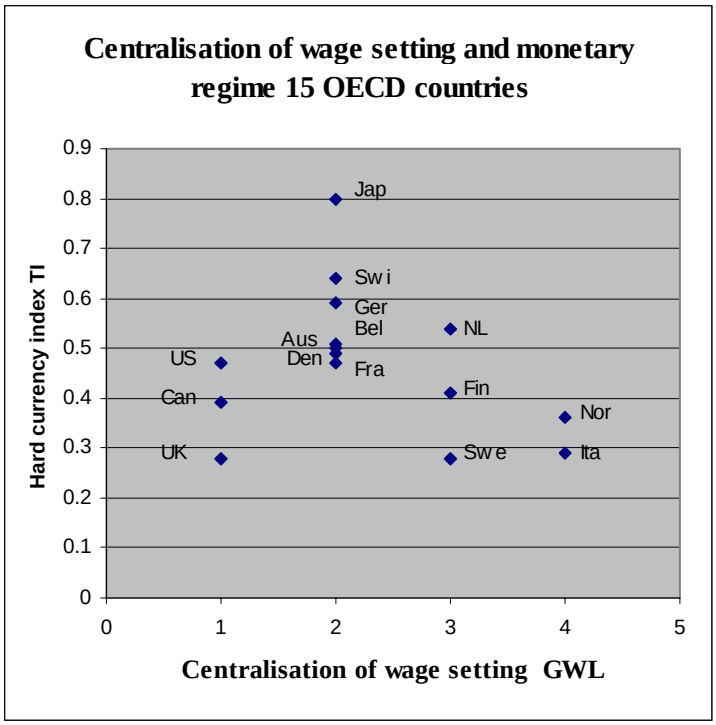

Figure 3: Sources: Wage setting, Golden-Wallerstein-Lange Labor & Political Data. Hard currency index, Iversen (1999), tables 1.3.

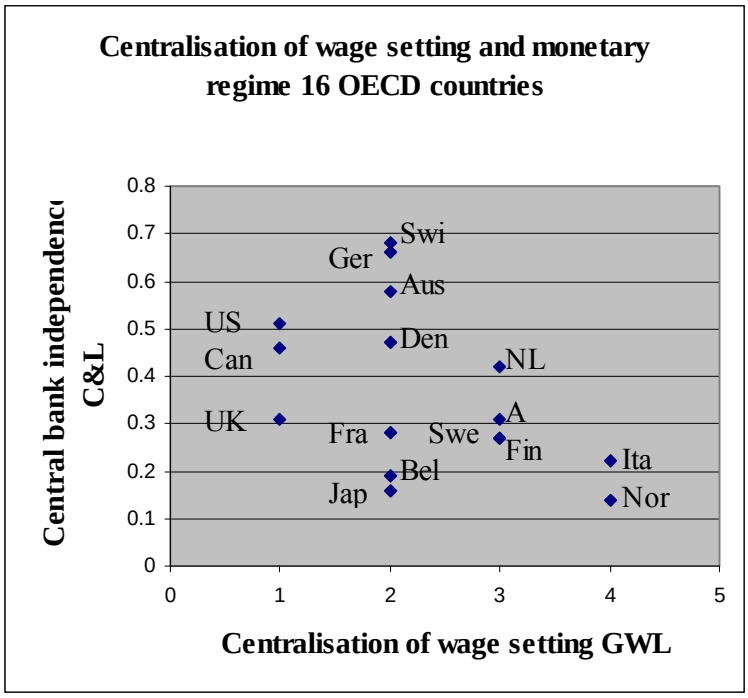

Figure 4: Sources: Wage setting, Golden-Wallerstein-Lange Labor & Political Data. CBI, Cukierman and Lippi (1999), table 1. Finland and Sweden are at the same data point.

	Basis	Basis	Basis	Basis	η=1	η=1	γ = 0.7	γ = 0.7	n=10	n=10
ρ	-0.500	0.000	0.500	0.800	0.000	0.500	0.000	0.500	0.000	0.500
$\delta^*(\rho)$	0.338	0.285	0.226	0.179	0.357	0.296	0.248	0.189	0.255	0.221
$u^C(\rho)$	0.014	0.020	0.038	0.077	0.020	0.036	0.064	0.102	0.020	0.038
$u^N(\rho)$	0.170	0.190	0.216	0.235	0.160	0.178	0.190	0.216	0.220	0.234
$-(\Omega^C-\Omega^N)$	0.014	0.018	0.023	0.025	0.013	0.015	0.016	0.018	0.024	0.027
$-d\Omega(w^C)/dw_j$	0.0073	0.0071	0.0066	0.0054	0.0070	0.0064	0.0053	0.0042	0.0082	0.0075
$u^A(0.2,\rho)$	-	0.146	0.079	-	-	-	0.146	0.079	0.109	0.075
$u^A(0.3,\rho)$	0.049	-	-	-	0.073	-	-	-	-	-
ρ^*	0.775	0.775	0.775	0.775	0.718	0.718	0.510	0.510	0.687	0.687

Table 1: Numerical simulations in Excel showing the effect of the degree of monetary accommodation ρ on the critical value for the discount factor, δ^*, unemployment (u) and union loss (Ω) under uncoordinated (N) and co-ordinated (C) wage setting. $u^A(\delta, \rho)$ is the lowest rate of unemployment associated with co-ordination, cf explanation in the main text. $u^A(\delta, \rho)$ is not calculated for $\delta > \delta^*$, as the optimal agreement w^C then is sustainable, or for $\delta < \delta^{Min}$, when no agreement is sustainable. ρ^* is the value for the monetary regime that maximises the gain from co-operation, as defined in Prop 3. The top row indicates difference from basis model. The simulations are based on equations (9), (13) and (14), where Δ=0.05 (the value of Δ does not matter for the qualitative results)). The basis model has the following parameter values: α=1, θ = 1, γ=0.9, n=5, η=0.8.

Regression	Const	Coef	T- coef	Adj R^2	# Obs	Omitted countries
1: CeTI on HCI	0.40	-0.13	0.42	-0.08	12	UK, US, Can
2: CeTI on HCI	0.60	-0.43	2.05	0.26	10	UK, US, Can, Fra, Ita
3: CoOECD on CBI	1.83	0.95	1.23	0.03	16	UK, US, Can
4: CeGWL on HCI	4.45	-3.76	3.09	0.44	12	UK, US, Can
5: CeGWL on CBI	3.25	-2.53	1.96	0.16	16	
6: CeGWL on CBI	3.36	-2.08	1.95	0.19	13	UK, US, Can

Table 2:
CeTI is the centralisation of wage setting index 1983-94 from Iversen (1999), HCI is the Hard Currency Index 1983-94 from Iversen (1999), CoOECD is the Co-ordination of wage setting index, 1990, of OECD (1997, table 3.3), CBI is the Central Bank Independence index of Cukierman and Lippi (1999), CeGWL is the Centralization of wage setting index, 1990, of Golden, Lange and Wallerstein (1998). Regressions 1 and 2 correspond to fig 1; reg 3 to fig 2; reg 4 to fig 3; and reg 5 and 6 to fig 4.