Monetary regimes and the co-ordination of wage setting

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Comments are welcome

Abstract

A recent literature argues that a strict monetary regime may reduce equilibrium unemployment by disciplining wage setters, as wage setters abstain from raising wages to avoid a monetary contraction. However, in this literature the wage setters are assumed not to co-ordinate their wage setting. The present paper argues that precisely because a strict monetary regime may discipline the uncoordinated wage setting, thus lowering unemployment in the uncoordinated outcome, it also reduces wage setters' incentives to co-ordinate. It is shown that an accommodating monetary regime may reduce equilibrium unemployment, via the strengthening of the wage setters' incentives to co-ordinate.

1   Introduction

A recent literature, including Bratsiotis and Martin (1999), Soskice and Iversen (1998, 2000) and Coricelli, Cukierman and Dalmazzo (2000),[1], argues that in an economy with few, large wage setters, a strict central bank may reduce equilibrium unemployment by disciplining wage setting. The key idea is that under a strict monetary regime, employment is more sensitive to the real wage and wage setters will respond by moderating their wage claims, thus lowering equilibrium unemployment. However, a limitation of this literature is that it so far only considers outcomes where wage setters act independently of each other. The aim of the present paper is to extend the literature by exploring to what extent the monetary regime may affect equilibrium unemployment allowing for the possibility that wage setters may co-ordinate their wage setting.

The motivation for this topic derives from the large literature arguing that co-ordination of wage setting is one of the key factors affecting persistent unemployment differentials. The findings of several international comparisons (Nickell, 1997, and Blanchard and Wolfers, 2000) show that countries with a high degree of co-ordination in the wage setting generally have lower unemployment; 5-6 percentage points is the average finding reported in the survey in Calmfors et al (2001).

The key argument of the paper is as follows. In an economy with few, large wage setters (e.g. industry unions), the wage setters have an incentive to co-ordinate their wage setting so as to moderate the wage claims, thus achieving lower equilibrium unemployment. However, each of the wage setters will also be tempted to deviate from the co-ordination, reaping a short run gain from setting higher wages, while at the same time benefiting from the moderation of the others. Co-ordinated wage restraint 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 (as in the analysis of union co-ordination in Holden and Raaum, 1991).

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.[2] 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 Economic and Monetary Union, EMU. As argued by Soskice and Iversen (1998) and Cukierman and Lippi (2001), the disciplining effect on wage setting will be lower in a monetary union than under a strict national monetary regime, simply because the wage setting in one country will have small effect on union-wide inflation, and thus have little effect on union-wide monetary policy. The implication of less discipline of wage setters is higher equilibrium unemployment. The present paper shows that the argument can be reversed: Precisely because a monetary union involves less discipline on wage setters, the incentives for wage setters to voluntary co-ordinate wage setting at the

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[1] Precursors are Horn and Persson (1988) and Holden (1991), while similar results have been derived independently by Hall and Franzese (1998), Holden (2002), Wibaut (1999) and Vartiainen (2002). A related literature, following Cubitt (1992), explores the effects of assuming that unions are also concerned about inflation.
[2] This distinction is noted in Bratsiotis and Martin (1999), but without any remarks on the possible implications for whether co-operation is feasible. In a related paper, Groth and Johansson (2002) explore the relationship between monetary regime and the degree of centralisation of wage setting, focusing on the effects on the choice of contract length.

national level are higher, and the result may be lower equilibrium unemployment. (Clearly, the argument neglects any other effects of a monetary union.)

The paper is organised as follows. Section 2 presents the basic economic model, a simplified version of Bratsiotis and Martin (1999). Section 3 analyses whether co-ordination in wage setting is feasible, drawing upon Holden and Raaum (1991). Section 4 concludes.

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. This setting captures in a simple way the dominating role of large wage setters (typically industry unions) in most Western European labour markets. Bargaining coverage in the market sector is typically about 70-80 percent, with few exceptions (Calmfors et al, 2001, table 4.4).

In the model, time horizon is infinite. We first consider one period in isolation, referred 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, 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, $p_f = w_f$, where w_f is the wage. The demand for products from industry i is

$$(1) \qquad y_i = \bar{g} + \alpha(m - p) - \eta(p_i - p) \qquad\qquad \alpha,\ \eta > 0$$

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

$$(2) \qquad P = \left(\frac{1}{k} \sum\nolimits_{i=1}^{k} P_i^{1-\eta} \right)^{\frac{1}{1-\eta}}$$

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

$$(3) \qquad \Omega_j = \frac{1}{2}(w_j - p - \omega^*)^2 + \frac{\theta}{2}(l_j - l_j^*)^2$$

$\omega^* > 0$ and $l_j^* = l^* - \ln(n) > 0$ are the target levels of real wages and employment (identical across unions), l^* is the total labour force, and $\theta > 0$ denotes unions' relative concern for employment. As will become apparent below, the relevant intervals for both the real wage and the employment level are below their target values, so that union loss is decreasing in both arguments.

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

$$(4) \qquad m = \overline{m} + \rho w$$

where $\overline{m}$ 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. (4) should be interpreted as the central bank reaction function in a reduced form. Coricelli et al (2002) derive a monetary rule like (4) as the optimal monetary policy of a central bank with a loss function that is quadratic in inflation and unemployment. Cukierman, Rodriguez and Webb (1998) provide illuminating empirical evidence for a group of developed countries from mid-seventies to early nineties: central banks with low independence tend to accommodate wage increases by increasing high powered money (corresponding to a positive ρ), while central banks with high independence (e.g. Germany and Austria) tend to tighten monetary policy in response to high wage growth. Coricelli et al (2001) derive a similar monetary rule for a monetary union, where the money

stock depends on the union-wide average wages. For a small member of the union, the effect on union-wide wages is negligible, so this would correspond to ρ being (close to) zero.

All agents are assumed to have complete information. Within the year, the sequence of events is as follows. First, all unions simultaneously set the nominal wages. Second, the central bank sets the nominal money stock according to the monetary rule (4). 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 to maximise profits as derived above, and then supply the demanded output.

Wage setting

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

$$(5) \qquad \frac{d\Omega_j}{dw_j} = (w_j - p - \omega^*)\left(1 - \frac{dp}{dw_j}\right) + \theta(l_j - l_j^{\;*})\frac{dl_j}{dw_j} = 0$$

The first order conditions (5) for each union jointly determine a Nash equilibrium in the wage setting game among the unions. From price setting, (1), (2), (4) and (5), we obtain (note that $dw/dw_j = dp/dw_j$ and that in a symmetric equilibrium $dp/dp_j = 1/n$ from (2))

$$(6) \qquad \text{(i)} \;\; \frac{dp}{dw_j} = \frac{1}{n} \quad \text{(ii)} \;\; \frac{dl_j}{dw_j} = -\alpha(1-\rho)\frac{dp}{dw_j} - \eta(1 - \frac{dp}{dw_j})$$

(i) A wage rise for union j increases consumer prices in proportion with the share of the economy covered by union j. (ii) 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 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.

Substituting out in (5), defining union j unemployment as $u_j = l_j^* - l_j$, invoking symmetry $w_j = w$ and $u_j = u$, we obtain

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

where I have defined $\sigma = (dp/dw_j)/(1-dp/dw_j)$ as an indicator for centralisation of wage setting. Using (6), $\sigma = 1/(n-1)$, so σ can take values in the interval $1/(k-1)$ ($n = k$, ie. decentralisation) to infinity (when n converges to unity).

The equilibrium rate of unemployment under uncoordinated wage setting follows from combining the wage curve (7) with the implication of the price setting, i.e. $p - w = 0$ (see figure 1). The following Proposition is immediate.

Proposition 1: Under uncoordinated wage setting, equilibrium unemployment is given by

(8) $u^N = \dfrac{\omega^*}{\theta(\alpha(1-\rho)\sigma + \eta)}.$

Proposition 1 entails standard properties in the literature (cf e.g. Layard et al, 1991). First, money is neutral so that an increase in the exogenous money stock component $\overline{m}$ does not affect equilibrium unemployment or the real wage, only increases all nominal variables.[3]

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[3] The model can be solved as follows. Unemployment, given by (8), combined with labour supply and the production function, give equilibrium output $y^N = l^* - u^N$. Equilibrium industry output $y_i^N = y^N - \ln(k)$ is inserted in (1), and imposing symmetry $p_i = p$ and $p = w$, and combining with (4), yield $p^N = w^N = \dfrac{1}{\alpha(1-\rho)}\left(\overline{g} + \alpha\overline{m} - l^* + \dfrac{\omega^*}{\theta(\alpha(1-\rho)\sigma + \eta)} - \ln(k)\right)$.

Second, any factor that increases wage pressure (e.g. reduced union concern for employment, i.e. reduced θ), raises equilibrium unemployment. Note that this is the case even if equilibrium real wages are given by productivity and thus unaffected by the wage setting (as there is constant returns to scale and Bertrand price setting).[4] Thus, if all unions were to agree on lower nominal wages, this would reduce unemployment via an increase in the real money stock as prices go down, but with no effect on real wages.[5] However, if one union alone were set lower nominal wages, it would obtain lower wages than others, and thus also lower real wages.

Then turn to the effect of the monetary regime: As previously shown by Bratsiotis and Martin (1999) and Soskice and Iversen (2000), (8) implies that equilibrium unemployment is lower, the stricter the central bank (ρ small). The intuition is that a strict central bank (ρ small) makes labour demand more elastic, inducing unions to set lower nominal wages (cf. fn. 3), shifting the wage curve in figure 1 down, and reducing equilibrium unemployment.

3   Co-ordination of wage setting

The analysis so far shows that wage earners would benefit from wage restraint leading to lower unemployment. Two possible ways to achieve this would be joint wage setting, or the use of binding agreements on moderation. However, while these possibilities are sometimes used, they also involve disadvantages like reduced flexibility on other matters, not included in the model. Thus, in the sequel, the focus is on situations where the wage setting is undertaken

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[4] Although surprising, this is in fact a standard result in the literature, cf. e.g. Layard et al, (1991) page 19. In a previous version of the paper, numerical simulations show that similar results hold also under decreasing returns to scale.
[5] Clearly, this takes the gain from wage moderation to the extreme, as there are no costs in the form of lower real wages. However, even under decreasing returns to scale where wage moderation leads to lower wages, the existence of negative external effects in the wage setting implies that coordinated wage moderation is beneficial for the unions, cf. survey in e.g. Moene, Wallerstein and Hoel (1993).

independently by the unions. The key question is whether unions in advance can agree on wage restraint that leads to reduced unemployment, $u^A < u^N$, and then stick to this agreement.

Clearly, if the wage setting in one year is viewed in isolation, an agreement on wage restraint by the unions will not be credible. As wage setting is simultaneous and each union prefers a higher wage for itself, irrespective of the wage set by the other unions, the unique one-shot Nash equilibrium would involve unemployment u^N.

However, as wage setting takes place repeatedly, unions may want to stick to an agreement on wage moderation in spite of the short run gain from cheating, so as to induce the other unions to co-operate in the future. The intertemporal loss function of a union is $\sum_{t=1}^{\infty} \beta^t \Omega_{jt}$ where $0 < \beta < 1$ is the discount factor reflecting the rate of time preference. Consider the following strategy for the unions:

1. Stick to the agreement until some union alone deviates from the agreement.
2. If some union alone has ever deviated, play uncoordinated until an exogenous event Q takes place.

The exogenous event Q can be associated with a macroeconomic shock that makes unions resume a co-operative solution. Let 1-q be the probability that Q happens, where $0 < q < 1$.

As is well-known (e.g. Friedman, 1986), this type of trigger strategy can sustain voluntary co-operation if any participant would lose from a unilateral deviation, in the sense that sticking to the agreement involves lower or equal discounted total loss than a unilateral deviation involving a short run gain, but inducing a reversion to the uncoordinated equilibrium. Formally, the condition making the agreement sustainable is

$$(9) \quad \frac{-\left(\Omega^{D} - \Omega^{A}\right)}{-\left(\Omega^{A} - \Omega^{N}\right)} \leq \frac{\delta}{1-\delta} \qquad where \quad \delta = q\beta, \qquad 0 < \delta < 1,$$

where $-(\Omega^{D} - \Omega^{A})$ denotes reduced loss for a deviator, while the $-(\Omega^{A} - \Omega^{N})$ is the ensuing loss resulting from a breakdown of the agreement, inducing a reversion to the uncoordinated outcome (both in annual terms). The discount factor δ incorporates both unions' time preference β and the probability of co-ordination being resumed after a breakdown, 1-q.

The gain from co-ordination comes in the form of lower unemployment, in annual terms it is (using (4))

$$(10) \quad -(\Omega^{A} - \Omega^{N}) = - (\theta(u^{A})^{2}/2 - \theta(u^{N})^{2}/2).$$

The gain depends on the monetary regime: 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.

Concerning the gain from a deviation, the reduction in loss from a unilateral marginal increase of the wage above the agreement is (cf. (5) and (6), using that $w - p = 0$)

$$(11) \quad \frac{d\Omega^{D}}{dw_{j}} = -a + b(\rho)u^{A} \qquad where$$

$$a = \omega * \frac{n-1}{n} > 0 \quad and \quad b = \theta\left[\alpha(1-\rho)\frac{1}{n} + \eta\frac{n-1}{n} \right] > 0$$

It is apparent from (9) that $d\Omega^{D}/dw_{j} < 0$ for $u^{A} < u^{N}$ (because $d\Omega^{D}/dw_{j} = 0$ for $u^{A} = u^{N}$). A tighter monetary regime (a smaller ρ) reduces the short run gain from a deviation (the absolute

value of $d\Omega^D/dw_j$ is reduced); the economic intuition is that the negative effect on employment associated with a wage rise is amplified.

A deviator is assumed to raise wages Δ above the agreed wage (the value of Δ does not matter). The condition for an agreement being sustainable, (9), reads (using (9) and (10))

$$(12) \quad F(\rho,u^A) \equiv \frac{(-a+b(\rho)u^A)\Delta}{\theta(u^A)^2/2-\theta(u^N)^2/2} \leq \frac{\delta}{1-\delta}.$$

As is common in repeated games, the optimal outcome (here: zero unemployment) can be achieved if the discount factor δ is sufficiently large (above a critical value δ^H), while no agreement $u^A < u^N$ is sustainable if the discount factor is sufficiently small (below δ^L), cf the proof of Proposition 2 below. Proposition 2 shows how the monetary regime affects the rate of unemployment that can be achieved through an agreement on wage moderation, focussing on the case where co-ordination is possible, but zero unemployment unattainable.

Proposition 2: Let $\delta \in (\delta^L, \delta^H)$. Then

(i) $F(\rho,u^*) = \dfrac{\delta}{1-\delta}$ defines u* =G(ρ, δ) as the lowest possible rate of unemployment

that is sustainable as a subgame perfect equilibrium based on the strategy above.

(ii)   The partial derivates satisfy $G_1 < 0$ and $G_2 < 0$.

(iii) δ^L and δ^H are decreasing in ρ.

Thus, a more accommodating monetary regime, a higher ρ, reduces the minimum rate of unemployment that is sustainable under coordinated wage restraint. The intuition for this result is a follows. As explained above, a less strict monetary regime, higher ρ, increases both the short run gain from a deviation (because the negative effect on employment associated with a wage rise is mitigated) and the costs associated with a breakdown of the agreement (as

the rate of unemployment under uncoordinated wage setting is higher). However, the latter effect dominates, so that the overall effect is that a less strict monetary regime makes a deviation less attractive. The feature that a less strict monetary regime makes deviation less attractive implies that a more ambitious agreement, with lower unemployment, is sustainable.

Result (iii) implies that an accommodating monetary regime facilitates co-ordination by making it possible even for less patient unions, as the critical values δ^L and δ^H are reduced.

As noted above, being a small member of a monetary union corresponds to ρ being close to zero. Proposition 2 implies that in a country where coordinated wage restraint is at work, membership in a monetary union would reduce equilibrium unemployment as compared to having a strict monetary regime (a negative ρ), but increases equilibrium unemployment compared to having an accommodating monetary regime (positive ρ).

If the discount factor is too low for co-ordination to be sustainable (i.e. $\delta < \delta^L$), either because unions are too impatient (β small) or the "environment unstable" (q small), the best achievable outcome is the uncoordinated one, u^N. Here, the disciplining effect prevails and a more monetary accommodating regime (higher ρ) raises the rate of unemployment.

4   Concluding remarks

While international comparisons indicate large potential gains from co-ordinated wage restraint in the form of lower unemployment, co-ordination can only be sustained if individual unions stick to the agreement. In this paper I have shown that a strict monetary regime may make it more difficult to sustain co-ordinated wage restraint, thus leading to higher unemployment in equilibrium. The argument builds on a recent literature showing that a strict monetary regime disciplines wage setters under uncoordinated wage setting, thus reducing unemployment and making this outcome less detrimental. However, precisely because a strict monetary regime is beneficial under uncoordinated wage setting, it implies that the "penalty"

for deviating from co-ordinated wage restraint inducing reversion to uncoordinated wage setting is smaller. The smaller threat from a deviation implies that the agreement must be less ambitious, involving higher unemployment in equilibrium.

An interesting possible application of the analysis concerns the effects of membership within a monetary union, like the Economic and Monetary Union, EMU. As pointed out by Soskice and Iversen (1998) and Cukierman and Lippi (2001), monetary policy will have a smaller discipline effect within a monetary union than in a country with a strict monetary regime. This paper shows that in a country where coordinated wage restraint is at work, membership in a monetary union would reduce equilibrium unemployment as compared to having a strict monetary regime, but increase equilibrium unemployment compared to having an accommodating monetary regime. However, in countries with large wage setters, but where co-ordination of wage setting nevertheless does not work, the general results of Bratsiotis and Martin (1999) and Soskice and Iversen (2000) hold, and a stricter monetary regime involves lower equilibrium unemployment.

Appendix: Proof of Proposition 2:
(i) Follows from standard trigger strategy arguments, cf. e.g. Friedman (1986), noting that F is positive and finite and the RHS of (12) varies from 0 to infinity as δ varies from 0 to unity, so that there always exists a δ given by equality in (12). Furthermore, $\partial F/\partial u^A < 0$ (as shown below), so that if the constraint (12) does not bind, u can be decreased further.

(ii) Consider the partial derivates of F. Noting that $u^N = a/b$, we have

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

(A1) $$C_1 \equiv \left((u^A)^2 - (u^N)^2\right)^2 \theta/(2\Delta) > 0$$

Now, $z(u^A) = 0$ for $u^A = u^N$ while $z'(u^A) = 3(u^A)^3 - 3(u^N)^3 < 0$ for $u^A < u^N = a/b$,

thus $\partial F/\partial b > 0$, and, as b is decreasing in ρ, $\partial F/\partial \rho < 0$ for $u^A < a/b$. The derivative of F wrt u^A

(A2) $\quad \dfrac{\partial F(\rho, u^A)}{\partial u^A} \equiv \dfrac{h(u^A)}{C_1} \quad$ where $\quad h(u^A) \equiv b((u^A)^2 - (u^N)^2) - 2u^A(-a + b(\rho)u^A)$

As above, $h(u^A) = 0$ 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 $u^A < a/b$.

The partial derivatives of $u^* = G(\rho, \delta)$ are found by use of total differentiation of

$$F(\rho, u^*) = \frac{\delta}{1-\delta} : \qquad \partial F/\partial \rho + (\partial F/\partial u)(\partial u/\partial \rho) = 0 \text{, or}$$

(A3) $\quad \dfrac{\partial u}{\partial \rho} = -\dfrac{\partial F/\partial \rho}{\partial F/\partial u} < 0$.

In the same way, we derive $\quad \dfrac{\partial u}{\partial \delta} = \dfrac{\partial \left(\dfrac{\delta}{1-\delta}\right)/\partial \delta}{\partial F/\partial u} < 0$.

The critical values δ^H and δ^L, are given by

(A4) $\quad$ (i) $F(\rho, 0) = \dfrac{\delta^H}{1-\delta^H}$. $\quad$ (ii) $F(\rho, u^N) = \dfrac{\delta^L}{1-\delta^L}$.

which solve for

(A5) (i) $\delta^H \equiv \dfrac{2a\Delta}{2a\Delta + \theta(u^N)^2} \quad$ (ii) $\delta^L \equiv \lim_{u^A \to (u^N)^-} \delta = \dfrac{b^2\Delta}{b^2\Delta + \theta a} = \dfrac{a\Delta}{a\Delta + \theta(u^N)^2} < \delta^H$

(To derive δ^L, we use l'Hopital's rule and obtain $\lim_{u^A \to (u^N)^-} F(\rho, u^A) = \dfrac{b^2\Delta}{\theta a}$. Substituting out in

(A4) and solving for δ, yields (A5ii). The second equality in (A5ii) follows from

straightforward manipulation. It is immediate from (A6) that δ^H and δ^L are both decreasing in

ρ, as u^N is increasing in ρ while the other parameters are independent of ρ. $\qquad$ QED

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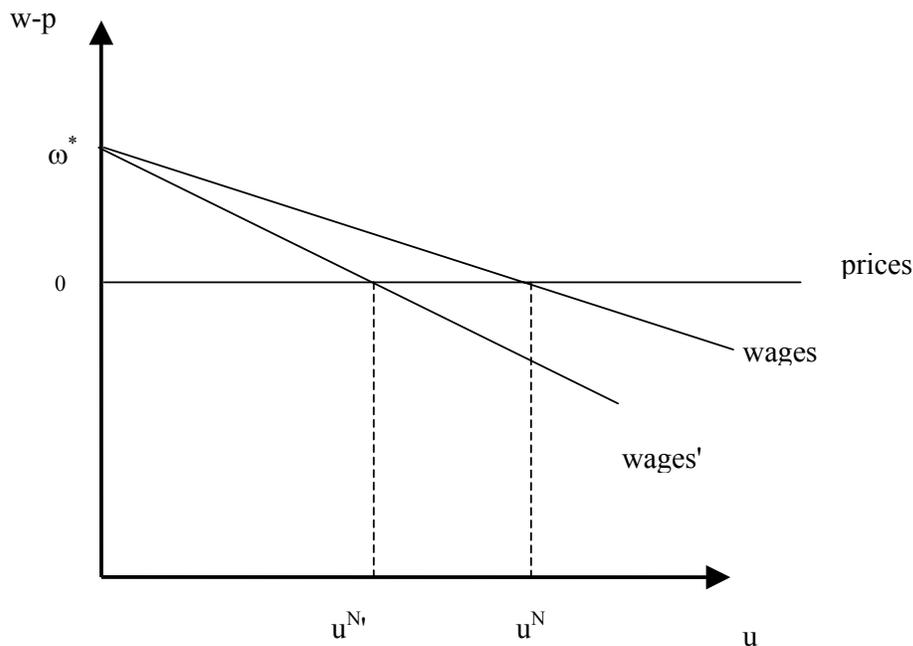
Figure 1: A stricter monetary regime (a lower value of ρ) increases the wage elasticity of employment, shifting the wage curve down and decreasing the equilibrium level of unemployment.