Unions, Job Protection and Employment

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Abstract

We study a stochastic dynamic interaction between a single wage-setting union and a mass of small competitive firms with costly labour shedding. The game is solved both under union commitment on wages as well as under no-commitment.

Firing costs turn out to be neutral for employment both in the commitment and no-commitment equilibrium if the union payoff is linear with respect to the wage rate. By contrast, if the payoff is concave, firing costs decrease employment under no-commitment while neutrality survives under commitment.

We argue that these outcomes shed some light on some ambiguous results from the existing literature.

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1 Introduction

Despite mandated job protection has received great attention by economists over the last fifteen years, there is still a lack of consensus regarding its effect on the level of employment. According to models of dynamic labour demand, firing costs only reduce workforce turnover with no significant impact on average employment (Bentolila and Bertola, 1990). By contrast, the insider-outsider theory explains that these costs reduce employment by contributing to the bargaining power of insiders and, henceforth, by supporting high wage claims (Lindbeck and Snower, 1988).

An obvious way to ascertain which of the two views is closer to the real world is that of comparing the labour market performance of countries with different regimes of employment protection. Empirical research, however, has up to now failed to provide a definitive answer on the issue. Lazear (1990) and, more recently, Djankov *et al.* (2003) are just two examples of empirical works which find that dismissal regulations increase unemployment. By contrast, Bertola (1990), the OECD (1999) and several others find that aggregate employment levels are not affected by the stringency of legal provisions.

In retrospect, the conflict between predictions is a result of differences in models core assumptions. First, in contrast with the insider-outsider theory, models of dynamic labour demand assume wages to be exogenous and, henceforth, rule out any effect of firing costs which operate through the wage-setting mechanism. Second, in contrast with models of dynamic labour demand, the insider-outsider theory is developed within a static economic environment and, henceforth, is deprived of any predictive power regarding the average employment level in an intrinsically dynamic context.

In this paper we offer new theoretical insights on the issue by using a model which removes above special assumptions. On the one hand, in our setting, business conditions change randomly from time to time so that firms and workers are compelled to make decisions in a dynamic stochastic environment. On the other hand, wages are set by a forward looking union instead of being exogenously given. In this respect, we study both the case where the union can commit to future wages and the case where such a commitment is not feasible.

The outcomes of our analysis are the following. First, we find that the equilibrium under commitment presents results that are qualitatively similar to those of models of dynamic labour demand. Firing costs reduce workforce turnover when business conditions change while average employment is hardly and ambiguously affected. Thus, predictions from this class of models appear robust to the introduction of endogenous wages *provided* one assumes wage predetermination. Second, the no-commitment equilibrium presents results that are reminiscent of those from the insider-outsider theory. The union increases the wage by the full amount of firing costs after new workers have been hired in a business upsurge. In turn, firms anticipate the wage increase contain the number of recruits. However, in contrast with the insider-outsider theory, lower employment levels do not necessarily follow. This happens because the union tries to counteract firms reluctance to recruiting by charging particularly low wages at the time of hiring. More specifically, we find that wages at the time of hiring may be set at a level so low that the no-commitment equilibrium exhibits the same level of employment than the equilibrium under commitment. This happens if the union is utilitarian and if the utility function of workers is linear with respect to the wage rate. Thus, predictions from the insider-outsider theory appear robust to a stochastic dynamic extension of the original model *provided* one rules out wage predetermination. In addition, a sufficient *curvature* of the objective function of individuals represents a further necessary conditions for the insider-outsider mechanism to be effective.

Summing up, we show that the conflicting views in the existing literature may be both correct depending on the institutional setting which surrounds the wage bargaining process. By doing so, we implicitly suggest empirical investigators to pay more attention to the interaction between the bargaining context and measures of employment protection. Corporativism, in fact, may favour commitment-like equilibria while a non-cooperative environment may favour no-commitment equilibria. Failing to account for this interaction is bound to bias the coefficient that captures the effect of employment protection on the level of unemployment. We regard these conclusions as the main contribution of the paper.

Works focusing on firms-union strategic interactions in presence of adjustment costs are rare. The closest to the present paper are Kennan (1988), Lockwood and Manning (1989) and Modesto and Thomas (2001). All these papers, however, deal with different issues and, with the exception of Kennan, use a deterministic setting. The first two works investigate whether the speed of adjustment of employment towards its long run equilibrium is slower in a unionised market as opposed to a competitive one. Modesto and Thomas, instead, investigate if the speed of adjustment depends on whether the union is able to make a wage commitment.

The concern on the dynamics of the adjustment path is closely related to the way adjustment costs are modeled. All these papers, in fact, adopt quadratic symmetric costs and, as a consequence, find that workforce changes are spread over long periods of time. Quadratic costs, however, do not square with legal provisions (Nickell, 1986). Further, continuous small variations stand in sharp contrast with empirical analyses conducted on firm micro-data which document that the dominant pattern is made of sporadic discrete adjustments followed by long spells of inaction (Hamermesh, 1989; Caballero *et al.,* 1997). Symmetry appears also problematic as the main component of adjustment costs is very likely to be related to workforce dismissals instead of additions (OECD, 1994).

Finally, Modesto and Thomas also study whether the ability to commit affects wages and employment and reach conclusions that are close to ours. In their framework, however, the shape of workers preferences has no role while quadratic costs are essential for their results to hold. For these reasons, we regard our paper as complementary to theirs.

The plan of the paper is as follows. In section 2 we present the economic environment. In section 3 and 4 we study the firms-union interaction respectively with and without a commitment on wages and under a fairly general union objective function. In section 5 we compare the two equilibria by using an utilitarian objective function and establish under what conditions they are equivalent. Section 6 contains some concluding remarks.

2 The economic environment

2.1 Assumptions

A single wage-setting union and a unit mass of identical competitive firms operate in the same industry. Business conditions, i.e. demand and productivity conditions, are common to all firms and are subject to stochastic changes. Firms maximise the discounted cash flow by adopting an optimal employment policy. In making their decisions, however, they are obliged to pay to a third party a firing cost for any dismissed worker.[1] Production is realised through a labour-only technology, the current cash flow cf_t for the representative firm is given by the difference between current revenues and labour costs:

$$cf_t = (\alpha_t - \frac{d}{2}l_t)l_t - w_t l_t - I_{l_t \leq l_{t-1}} F\left(l_{t-1} - l_t\right)$$

Revenues $(\alpha_t - \frac{d}{2}l_t)l_t$ depend on the level of firm's employment l_t and on the shifter α_t which indexes business conditions during period t. The value of the shifter may change from period t to period $t+1$. We assume that the motion of α is governed by a two-states Markov process, α cycles between an high value α_g and a low value α_b $(< \alpha_g)$ with a constant per-period transition probability q (< 1). Labour costs are given by the wage bill $w_t l_t$ plus total firing costs. F represents the firing cost for a single dismissed worker while $I_{l_t \leq l_{t-1}}\left(l_{t-1} - l_t\right)$ gives the total number (mass) of dismissed workers. The indicator $I_{l_t \leq l_{t-1}}$ switches from 1 to 0 if current employment becomes strictly higher than past employment.

The union maximizes a discounted utility flow by adopting an optimal wage policy (monopoly union). The per-period union payoff $U(w_t, L_t)$ depends on the current wage rate w_t and the current *aggregate* employment L_t. The shape of this payoff is characterised by the following set of properties:

[1] A per-person *hiring* cost could also be fitted into the model with no relevant changes. We decided to abstract from hiring costs to keep the model as simple as possible. Further, in the real world, mandated hiring costs are much lower in size with respect to firing costs (OECD, 1994).

$$U_w, U_L > 0; \quad U_{LL}, U_{ww} \leq 0; \quad U_{wL} > 0 \tag{1}$$

2.2 The optimal hiring and firing policy

Firms choose employment at the beginning of any period and after having observed the current values of the forcing variable and of the wage. Employment decisions also depend on the expectation over future business conditions and wages. The latter are regarded as exhogenous by any (small) firm.

The optimal employment sequence or, equivalently, the optimal hiring and firing sequence, solves the Bellman problem

$$V(\alpha_t, w_t, l_{t-1}) = \max_{l_t} \; (\alpha_t - \tfrac{d}{2} l_t) l_t - w_t l_t - I_{l_t \leq l_{t-1}} F \left(l_{t-1} - l_t \right) + \tfrac{1}{1+r} \; E_t \left[V(\alpha_{t+1}, w_{t+1}, l_t) \right]$$

The value of the firm is given by the current cash flow plus the expected discounted continuation value. This value depends on current wages, current business conditions and, due to the presence of firing costs, on lagged employmend.

To characterise the firm policy in intuitive terms we introduce the notion of the shadow value of labour. We define the shadow value $S(\alpha_t, w_t, l_t)$ as the variation in the current value of the firm V following a marginal upward shift in the employment path $\{l_{-1}, l_t .....\}$. The shift is computed along the optimal hiring and firing policy so that, by the envelope theorem, S also coincides with the derivative of V with respect to l_{t-1}:

$$S(\alpha_t, w_t, l_t) = \alpha_t - d \; l_t - w_t + \frac{1}{1+r} E_t \left[S(\alpha_{t+1}, w_{t+1}, l_{t+1}) \right] \tag{2}$$

The shadow value is given by a recursive relationship. $S(\alpha_t, w_t, l_t)$ equals the current net marginal revenue of labour plus the expected discounted next period shadow value. Thanks to the linearity of firing costs, for a given current employment l_t the shadow value does not depend on lagged employment l_{t-1}. In this sense it is a completely forward looking variable:

$$S(\alpha_t, w_t, l_t) = \sum_j \left(\frac{1}{1+r}\right)^j E_t x_{t+j} \qquad x_{t+j} = \alpha_{t+j} - dl_{t+j} - w_{t+j} \tag{3}$$

Equation 3 has been obtained by running forward the recursive expression in 2 and by applying a *natural transversality condition*. The expression makes it clear that the shadow value is given by the expected discounted sum of net marginal labour products x_t.

Let us use the term *ex ante* shadow value to mean $S(\alpha_t, w_t, l_{t-1})$, i.e. the shadow value before the firm makes a decision on l_t. This definition allows us to characterise the optimal employment policy in simple terms. Since laying off a single worker costs F while a recruit costs nothing, firms choose inaction when the *ex ante* shadow value lies within the interval $[-F, 0]$. In this case, in fact, neither hiring nor firing increases the value of the firm. Workforce adjustments occur only when the *ex ante* shadow value falls outside the inaction interval $[-F, 0]$. If the *ex ante* shadow value is positive, maximisation requires recruiting new workers. Further, hiring must take place up to the point the marginal recruit becomes valueless or, more formally, up to the point the shadow value is brought to the upper boundary of the inaction interval $[S(\alpha_t, w_t, l_t) = 0]$. On the other hand, if the *ex ante* shadow value is lower than $-F$, maximisation requires a reduction in workforce. In particular, this reduction must be such that firing an extra worker entails no net value, this happens when the shadow value is brought to the lower boundary of the inaction interval $[S(\alpha_t, w_t, l_t) = -F]$.

We end this section with a formal representation of the optimal employment policy. Let $\overline{w}(\alpha_t, l_{t-1})$ represent the *maximum* wage consistent with inaction, that is the wage that makes the *ex ante* shadow value equal to $-F$:

$$\overline{w}(\alpha_t, l_{t-1}) = \alpha_t - d\ l_{t-1} + \frac{1}{1+r} E_t \left[S(\alpha_{t+1}, w_{t+1}, l_{t+1})\right] + F \tag{4}$$

As a consequence, $\overline{w}(\alpha_t, l_{t-1}) - F$ gives the *minimum* wage consistent with inaction. The optimal policy can be expressed as follows:

$$I_{w_t \leq \overline{w}(\alpha_t, l_{t-1}) - F} S(\alpha_t, w_t, l_t) = 0 \tag{5}$$

$$I_{w_t \geq \overline{w}(\alpha_t, l_{t-1})} S(\alpha_t, w_t, l_t) = -F \tag{6}$$

$$I_{\overline{w}(\alpha_t, l_{t-1}) - F \leq w_t \leq \overline{w}(\alpha_t, l_{t-1})} (l_{t-1} - l_t) = 0 \tag{7}$$

In these equations the dummy $I_{()}$ equals 1 when the underlying condition is true and 0 otherwise. The first equation gives the optimal condition when firms increase employment. For this reason it is "active" only when the current wage w_t is equal or below $\overline{w}(\alpha_t, l_{t-1}) - F$. If $w_t = \overline{w}(\alpha_t, l_{t-1}) - F$ the condition is satisfied with $l_t = l_{t-1}$. By contrast, if $w_t < \overline{w}(\alpha_t, l_{t-1})$, the condition requires $l_t > l_{t-1}$. The second equation refers to firing while the third to inaction, the interpretation is straightforward.

3 The equilibrium under commitment

3.1 The wage policy

Under commitment, the union announces a wage sequence with the objective of maximising the expected discounted utility flow:

$$\begin{aligned} W(\alpha_0, L_{-1}) = \max \textstyle\sum_t \left(\frac{1}{1+r}\right)^t \{U(w_t, L_t) + \sigma_t I_t^H S_t + \\ + \lambda_t I_t^F (S_t + F) + \gamma_t I_t^I (L_{t-1} - L_t)\} \qquad \alpha_0, L_{-1} \text{ given} \end{aligned} \tag{8}$$

In this program, lagrange multipliers $[\sigma_t, \lambda_t, \gamma_t]$ have been used to embed the constraints ensuing from the optimal employment policy of firms in the form of equations 5-7. For ease of notation, $S(\alpha_t, w_t, L_t)$ has been substituted with S_t while the dummies in constraints 5-7 have been substituted respectively with I_t^H, I_t^F and I_t^I.[2]

[2]Since the mass of firms has a unit measure, aggregation implies $l_t = L_t$. Thus, l_t needs to be substituted with L_t when one writes the constraints arising from the aggregation of the optimal employment policy of single firms.

Despite the appearance, the problem in 8 cannot be solbed through dynamic programming since the shadow value S_t and the three dummies $I_t^{\cdot}$ depend upon (the expected value of) future wages. Equation 3 illustrates the forward nature of S_t while quation 4 illustrates the forward nature of the wage threshold $\overline{w}(\alpha_t, L_{t-1})$ which, in turn, determines the value of the dummies for a given current wage. In words, future wages affect the current union welfare by determining the current value for firms of an extra worker added to the workforce. The latter, in turn, determines wheter firms fire, hire or stay inactive at current time and, in the first two cases, how many workers are involved in the adjustment.

Remark 1: along the optimal policy, the welfare effect of variations in the dummies due to small changes in future wages is null to a first order.

In fact, a marginal change in $\overline{w}(\alpha_t, L_{t-1})$ leads to a non-zero effect on the dummies only when w_t is close to one of the two extremes $\overline{w}(\alpha_t, L_{t-1})$ or $\overline{w}(\alpha_t, L_{t-1}) - F$. Even in this case, however, it is easy to see that the impact is null to a first order. Suppose, for instance, that a small variation in a future wage rate causes a small decrease of $\overline{w}(\alpha_t, L_{t-1})$ and that the latter, as a consequence, moves from the right to the left of w_t. The dummy I_t^F jumps from 1 to 0 while the dummy I_t^I jumps from 0 to 1. The ensuing first order change in the current payoff is given by $\gamma_t \left[L_t - L_{t-1}\right] - \lambda_t(S_t + F)$, which is obviously equal to zero along the optimal policy.

The fact that current constraints contain (the expectation of) future wages causes the optimal wage sequence to be time inconsistent. On technical grounds, program 8 is non-recursive and can not be solved by applying the Bellman approach. For this reason, we transform the program by introducing two Abel state variables[3] which force the planner to implement the optimal policy while behaving in a time consistent fashion (Marcet and Marimon, 1989).

Remark 1 implies that when searching for first order conditions one do not need to take account of variations in the dummies. For this reason, Abel variables are introduced

[3]This is the term adopted by Liumqvist and Sargent (2004, chap 15).

only to account for the forward nature of S_t:

$$W(\alpha_t, L_{t-1}, \Sigma_{t-1}, \Lambda_{t-1}) = \max \left\{ (\Sigma_{t-1} + \Lambda_{t-1})x_t + \sigma_t I_t^H x_t \right.$$

$$\left. \lambda_t I_t^F (x_t + F) + \gamma_t I_t^I (L_{t-1} - L_t) \right\} + \tfrac{1}{1+r} E_t W(\alpha_{t+1}, L_t, \Sigma_t, \Lambda_t) \qquad (9)$$

$$\Sigma_t = \Sigma_{t-1} + \sigma_t I_t^H \qquad \Lambda_{t-1} = \Lambda_{t-1} + \lambda_t I_t^F \quad \Sigma_{-1} = \Lambda_{-1} = 0 \qquad \alpha_0, L_{-1} \text{ given}$$

In the appendix, we derive the focs and the euler conditions for the Bellman problem 9, we also show that these replicate the constraints 5-7. As a consequence, the solution takes the form of a set of time invariant functions of state variables:

$$f_t = f(Y_t) \qquad f = w, L, \sigma, \lambda, \gamma \qquad Y_t = (\alpha_t, L_{t-1}, \Sigma_{t-1}, \Lambda_{t-1}) \qquad (10)$$

The evolution of the state vector Y_t is governed by these policy functions and by the stochastic motion of productivity. Thus, the union can precommit either by announcing the function $w_t = w(Y_t)$ or by anouncing the sequence of history contingent wages $w_t(h_t)$, $h_t \in H_t$, with $h_t = (\alpha_t, \alpha_{t-1}, ...\alpha_0)$ representing the entire history of exhogenous productivity parameters and H_t the set of all possible histories up to time t. In this case, for any history h_t, the union determines $w_t(h_t)$ by applying recursively the optimal policy in 10.

3.2 The equilibrium path

For the purpose of characterising the equilibirum path, we report below the f.o.c. for w_t from program 9 and the combination of the latter with the f.o.c. for L_t:

$$-(\Sigma_{t-1} + \Lambda_{t-1}) + U_w(w_t, L_t) - \lambda_t I_t^F - \sigma_t I_t^H = 0 \qquad (11)$$

$$\gamma_t I_t^I = [U_L(w_t, L_t) - dU_w(w_t, L_t)] + \frac{1}{1+r} E_t \left[\gamma_{t+1} I_{t+1}^I \right] \qquad (12)$$

By inspecting 9, one may term the expression $\gamma_t I_t^I$ as the union shadow value of lagged employment. The presence of I_t^I means that lagged employment is irrelevant for the welfare of the union if employment changes at current time.

Advance the time index in 12, multiply both sides by I^I_{t+1} and notice that $(I^I_{t+1})^2 = I^I_{t+1}$, then run forward the equation and apply the *natural transversality condition*:

$$E_t \gamma_{t+1} I^I_{t+1} =$$
$$= E_t \sum_j \left(\frac{1}{1+r}\right)^j \left[U_L(w_{t+1+j}, L_t) - dU_w(w_{t+1+j}, L_t)\right] \ \prod_{i=0..j} I^I_{t+1+i} \tag{13}$$

In this equation we have applied the property that $\prod_{i=0..j} I^I_{t+1+i}$ is equal to 1 if employment remains constant at level L_t form $t+1$ up to $t+1+j$ and 0 otherwise. The meaning of equation 13 is clear, $U_L - dU_w$ represents the net per-period reward from a marginal increase in employment which is paid with a small decrease in wages. The shadow value coincides with the discounted sum of net rewards until employment remains constant.

Lemma 1

In the commitment equilibrium, if $L_t = L_{t-1}$ then $w_t = w_{t-1}$;

Proof

Inaction at time t implies that the wage w_t lies in the interval $[\overline{w}(\alpha_t, L_{t-1}) - F, \ \overline{w}(\alpha_t, L_{t-1})]$. When the wage is in the interior of the interval, the hiring and firing constraints are not effective [i.e. $I^F_t = I^H_t = 0$]. When the wage coincides with one of the two boundaries the corresponding constraint is non-binding [i.e. $\lambda_t = 0$ if $w_t = \overline{w}$ or $\sigma_t = 0$ if $w_t = \overline{w} - F$]. Thus, in both cases, $\Sigma_t = \Sigma_{t-1}$ and $\Lambda_t = \Lambda_{t-1}$ and, due to equation 11,

$$U_w(w_t, L_t) = U_w(w_{t-1}, L_{t-1})$$

In turn, this equality imply that $L_t = L_{t-1}$ is only possible if $w_t = w_{t-1}$.$\circ$

Lemma 2

In the commitment equilibrium, if employment changes from $t-1$ to t then

$$U_L(w_t, L_t) = dU_w(w_t, L_t) \tag{14}$$

Proof Combine the result in Lemma 1 with equation 13 and observe that, as a consequence of wages being constant,$[U_L(w_t, L_t) - dU_w(w_t, L_t)]$ can be factored out from the summation so that it becomes proportional to $E_t\gamma_{t+1}I^I_{t+1}$. If employment changes, $\gamma_t I^I_t$ is null since the dummy is null. It follows that the optimality condition 12 holds only if the equality in 14 is satisfied.∘

Lemma 3

If $\alpha_t = \alpha_{t-1}$ then, in the commitment equilibrium, inaction at $t-1$ implies inaction at t.

Proof

Inaction at time $t-1$ means $L_{t-1} = L_{t-2}$ and, as noticed in the proof of Lemma 1, $\Sigma_{t-1} = \Sigma_{t-2}$ and $\Lambda_{t-1} = \Lambda_{t-2}$. Since $\alpha_t = \alpha_{t-1}$, the state vector at the beginning of $t-1$ coincides with that at the beginning of t. In turn, if the state does not change, none of the policy variables does. In particular, employment does not change.∘

Proposition 1

If $\alpha_t = \alpha_{t-1}$ then, in the commitment equilibrium, $L_t = L_{t-1}$.

Proof

We only prove, by contraddiction, that hiring is not consistent with equilibrium if business conditions remain stable. The case of firing is similar and, henceforth, omitted.

Suppose firms hire in equilibrium at t. Lemma 3 dictates that, at time $t-1$, firms must hire or fire. Thus, by Lemma 2, the "tangency" conditions 14 holds at $t-1$ and t. In turn, thanks to the properties of the function U, the "tangency" condition dictates that employment and wages must change in the same direction when moving from $t-1$ to t. Thus, consistency with optimal union behaviour requires that an *increase* in employment must be accompanied by an *increase* in the wage rate wage: $w_t > w_{t-1}$.

Let us now consider the demand for labour in the form of equation 2 for periods $t-1$ and t:

$$w_{t-1} = \alpha_{t-1} - dL_{t-1} - S_{t-1} + 1/(1+r)E_{t-1}S_t$$

$$w_t = \alpha_t - dL_t - S_t + 1/(1+r)E_t S_{t+1}$$

Hiring at time t implies $S_t \geq S_{t-1}$. In fact S_t is null under hiring whereas S_{t-1} must lie inside the inaction interval $[-F, 0]$. Further, hiring at t implies $E_t S_{t+1} \leq E_{t-1} S_t$. In fact, firms at the beginning of period $t+1$ inherit higher employment and wages than at the beginning of period t. This reduces the *ex ante* shadow value and makes firing a more likely occurrence. Put togheter these findings and combine with the above labour demand equations. It is not difficult to see that consistency with optimal firm behaviour requires that an *increase* in employment must be accompanied by a *decrease* in the wage rate*:* $w_t < w_{t-1}$.

Thus, hiring at time t with $\alpha_t = \alpha_{t-1}$ can not be part of an equilibirum as it implies that at least one of the two players does not behave optimally.$\circ$

The intuition behind proposition 1 is that with constant business conditions hiring (firing) can only take place if the wage decreases (increases). Convex union preferences, however, rule out wage and employment variations which have opposite directions.

Proposition 1 implies that employment and wages (lemma 1) can only change at the beginning of a spell of constant business conditions. This restricts steady state equilibrium paths to only two cases.[4] The first is an equilibrium where inaction prevails at any time. In this equilibrium, the wage and the employment level are constant while the shadow value cycles between a low and an high value while remaining within the inaction interval at all times. The employment and the wage level depend in general from initial conditions. The second is an equilibrium where employment changes at the beginning of any spell. In particular, hiring takes place at the beginning of good spells and firing at the beginning of bad spells, employment is constant within spells.[5] We regard the latter as the equilibrium which is more plausible from an empirical point of view. Thus, in the next subsection

[4]Depending on initial employment L_{-1} and initial business conditions, a transitional phase of stochastic duration may take place before steady state equilibrium sets in. Since our focus is on long run employment levels, we disregard the transition.

[5]Weird equilibria with hiring at the beginnins of bad spells (as a consequence of very low wages) and

we compute wage and employment levels along such an equilibrium and give a necessary and sufficient condition for its existence in the form of a restriction on parameters. While we proceed, it will be clear that wages and employment levels do not depend on initial conditions.

3.3 Wages and employment with positive adjustments

Constant employment and wages within spells mean that the shadow value of labour S_t is constant too. In particular, it equals $-F$ along a bad spell and 0 along a good spell. Combining these results with equation 2 gives the two demand equations for the two business states. Furthermore, constant wage and employment imply that the tangency condition 14 holds at all times along the spell. We then possess all the elments to write a couple of systems that solve for the two variables in the two states:

$$U_L(w_g^c, L_g^c) = d\ U_w(w_g^c, L_g^c) \tag{15}$$

$$w_g^c = -\frac{q}{1+r}F + \alpha_g - dL_g^c \tag{16}$$

$$U_w(w_b^c, L_b^c) = d\ U_L(w_b^c, L_b^c) \tag{17}$$

$$w_b^c = \frac{r+q}{1+r}F + \alpha_b - dL_b^c \tag{18}$$

L_g^c and w_g^c [c: *committment*] represent the employment and the wage during good spells while L_b^c and w_b^c are the corresponding values during bad spells. The dynamic equilibrium takes the form of a simple collection of purely static equilibria.

At any time along the equilibrium path the union charges the "static" monopolistic wage, corresponding to the tangency between labour demand and the highest indifference

firing at the beginning of good spells (as a consequence of very high wage) can be ruled out by observing that equation 14 implies that employment and wages must move togeter.

curve. In contrast with the static case, however, the position of labour demand in the wage-employment space is endogenous in the sense that depends itself on the wage policy.

We conclude this subsection by stating a proposition which identifies a necessary and sufficient condition for having positive adjustments.

Proposition 2

In the commitment equilibrium, positive adjustments take place if and only if

$$\alpha_g - \alpha_b > \frac{r+2q}{1+r}F \qquad (19)$$

Proof

For positive hiring and firing it must be true that $L_g^c > L_b^c$. Due to the strict convexity of indifference curves (see properties 1) and the linearity of labour demands 16 and 18, the tangency condition implies that wages and employment are "normal goods" for the union. Thus, a necessary and sufficient condition for $L_g^c > L_b^c$ is that labour demand in good times lies above labour demand in bad times. By inspecting schedules 16 and 18, this amounts to impose the restriction in equation 19.$\diamond$

In the remainder of this section we hold the restriction in equation 19 to be true. Intuitively, positive adjustments arise if firing costs are sufficiently low and/or the change in business conditions sufficiently large. Further, notice that firing costs enter the inequality in combination with the transition rate q. An higher transition probability makes business spells less durable and reduce incentives to workforce adjustments. For this reason, given firing costs, the inequality tends to be true for low values of q.

3.4 Workforce stability and employment

Labour demand schedules 16 and 18 convey the main result of models of dynamic labour demand. In fact, these schedules are similar to those usually derived in a context of exogenous wages (Bertola, 1990). Here, we have shown that they hold also if wages are set by a monopoly union *provided* the latter commits to the whole sequence of future wages.

Observe that firing costs insert a wedge between the wage and the marginal labour revenue. The sign of the wedge is positive during bad spells and negative during good spells. In graphical terms, this amounts to say that labour demand is shifted up by firing costs in bad times and down in good times. The first effect is straightforward, the second is due to the expectation of a future reversal in business conditions. In turn, since employment and wages are normal goods for the union, a lower labour demand in good times leads to lower levels of both variables. By contrast, an higher labour demand in bad times leads to higher employment and wage levels. The upshot of these effects is that firing costs tend to dampen wage and employment fluctuations that take place at business turns.

Smaller employment and wage fluctuations, however, are not accompanied by significant and clearcut changes in their average level. These changes, in fact, depend on a "discounting effect" (governed by r) and on a "curvature effect" which is governed by the shape of union indifference curves.

Discounting makes firing costs more relevant for firing decisions than for hiring decisions. Formally, the wedge in equation 16 is smaller in absolute size than the one in equation 18 by an amount which increases with respect to r. As a consequence, the upward shift of the schedule in bad times is more pronounced in comparison to the downward shift in good times. This effect - taken alone - obviously leads to an increase in average employment and wage levels.

Furthermore, the "discounting effect" decreases with respect to the state reversion probability q for any given interest rate. In a highly volatile environment (high q) the chance of being compelled to fire after a short interval from hiring is large and, as a consequence, firing costs have a substantial effect also on the hiring margin.

In contrast with the "discounting effect", the "curvature effect" is not clear-cut. In a stochastic cycle of low and high demand schedules the curvature of indifference curves clearly matters. What is relevant in the present context is that the "curvature effect" could be of any sign depending on the shape of the union utility function. If indifference curves are homothetic, for instance, this effect can be shown to be nil. An increase in firing costs reduces workforce turnover but does not affect average employment. With different preferences, however, an increase in firing costs may lead to higher as well as lower levels in average employment.[6]

Summing up, with wage predetermination - as well as with exogenously fixed wages - the employment effect of firing costs is likely to be negligeable and of uncertain sign.

4 The equilibrium under no-commitment

4.1 The wage policy and the equilibrium path

In this section we analyse the firms-union interaction in the absence of a wage commitment. The optimal policy of each single firm continues to be described by conditions 5-7. As for the union, choosing the wage period by period prevents the chance of applying the policy that is optimal as of at the beginning of the game. Technically, this amounts to assume that the union sets Σ_{t-1} and Λ_{t-1} equal to zero at the beginning of period t so that the state vector collapses from $(\alpha_t, L_{t-1}, \Sigma_{t-1}, \Lambda_{t-1})$ to (α_t, L_{t-1}).

While equation 12 continues to hold, the main difference with respect to the commitment case concerns equation 11. In fact, once one poses $\Sigma_{t-1} + \Lambda_{t-1} = 0$ in the equation, the wage rate does not depend any longer from the past. This mirrors the fact that wages are set without taking account of their effects on past labour demand. Further, since $U_w > 0$, the absence of Σ_{t-1} and Λ_{t-1} dictates that either $\lambda_t I_t^F$ or $\sigma_t I_t^H$ must be positive at all times. Thus, either the firing or the hiring constraint must be binding at all times, even when employment does not change. This feature of the equilibrium path is made more precise in lemma 4.

Lemma 4

If $L_t = L_{t-1}$ then, in a no-commitment equilibrium, $w_t = \overline{w}(\alpha_t, L_{t-1})$.

[6] Abstracting from the "discounting effect" ($r = 0$), if the objective function is, for instance, $U(w, L) = L[\log(w) - \log(\overline{w})]$ an increase in firing costs reduces average employment. By contrast, the function $U(w, L) = w[\log(L) - \log(\overline{L})]$ leads to the opposite conclusion.

Proof

Employment does not change when the union chooses a wage rate within the interval $[\overline{w}(\alpha_t, L_{t-1}) - F, \overline{w}(\alpha_t, L_{t-1})]$. Observe that the continuation value from the game for the union does not depend on the particular wage which is chosen. In fact, the continuation value only depends upon the current state and the latter is not affected by the choice of the wage within the interval. Thus, since the continuation value is unaffected, optimality requires choosing the upper extreme of the interval.○

Intuitively, the meaning of Lemma 4 is that, in a no-commitment equilibrium, the union pushes firms on the firing barrier at all times under inaction. Due to the result in Lemma 4, equation 13 becomes:

$$E_t \gamma_{t+1} I^I_{t+1} =$$

$$= E_t \sum_j \left(\frac{1}{1+r}\right)^j \{U_L [\overline{w}(\alpha_{t+1+j}, L_t), L_t] - dU_w [\overline{w}(\alpha_{t+1+j}, L_t), L_t]\} \prod_{i=0..j} I^I_{t+1+i} \tag{20}$$

In turn, equation 20 implies that the expected shadow value of employment $E_t \gamma_{t+1} I^I_{t+1}$ decreases with respect to current employment. This result is made rigorous in Lemma 5.

Lemma 5

In a no-commitment equilibrium

$$\frac{dE_t \gamma_{t+1} I^I_{t+1}}{dL_t} < 0$$

Proof

Equation 4 implies that $\frac{d\overline{w}(\alpha_{t+1+j}, L_t)}{dL_t} = -d$. Take account of this result, differenciate $dE_t \gamma_{t+1} I^I_{t+1}$ with respect to L_t and observe that any term of the resulting summation contains the negative amount $U_{LL} - 2dU_{wL} + d^2 U_{ww}$.○

Lemma 6

If $\alpha_t = \alpha_{t-1}$, in a no-commitment equilibrium, inaction at time $t-1$ implies inaction at time t.

Proof

Similar to Lemma 3.∘

We are now ready to prove a proposition which states that the equilibrium under no-commitment exhibits inaction if business conditions do not change. In this sense, it is the analogous of proposition 1 for the commitment case.

Proposition 3

If $\alpha_t = \alpha_{t-1}$ then, in the no-commitment equilibrium, $L_t = L_{t-1}$.

Proof

We show that hiring at t brings forth a contraddiction. Firing at t also causes a contraddiction. In this case, however, the proof is amitted as it is identical.

Thus, let us assume that employment increases from $t-1$ to t even if business conditions do not change. As shown in the proof of Proposition 1, this is consistent with firms oprimal behaviour only if the wage rate *decreases*: $w_t < w_{t-1}$.

Let us now consider the union optimal behaviour. Hiring at t implies that $\gamma_t I_t^I$ equals to zero and, as a consequence, that the condition 12 can be written as

$$dU_w(w_t, L_t) = U_L(w_t, L_t) + \frac{1}{1+r} E_t \left[\gamma_{t+1} I_{t+1}^I\right] \tag{21}$$

By Lemma 6, hiring at t means that firms either hire or fire at $t-1$. This means that $\gamma_{t-1} I_{t-1}^I$ is equal to zero and that the above condition 21 holds also with lagged time indexes. Equation 21 is relevant as it implies, in combination with Lemma 5, that employment increases only if the wage does so. That is, consistency with union optimal behaviour requires that hiring must be accompanied by an *increase* in the wage rate: $w_t > w_{t-1}$.

Thus, hiring at time t with $\alpha_t = \alpha_{t-1}$ can not be part of an equilibrium as it implies that at least one of the two players does not behave optimally.∘

To sum up, as in the commitment case, only two types of equilibrium may arise. The first type is an equilibrium where employment does not change across business spells while the shadow value lies on the firing barrier at all times (Lemma 4). In this equilibrium, wages must change when business conditions change in order to peg the shadow value on the firing boundary. The second type is an equilibrium characterised by positive workforce adjustments so that employment levels differ between good and bad spells. In this equilibrium the shadow value lies on the hiring barrier only in the first period of a good spell and on the firing boundary at all other times. Again, due to the empirical relevance of workforce adjustments, we focus on this equilibrium in the next two subsection.

4.2 The equilibrium with positive workforce adjustments

In this section we solve for the wage rates which sustain the no-commitment equilibrium under positive workforce adjustments. Observe that since employment does not change along a spell of constant business conditions, lemma 4 implies that there are at most two wage rates for each spell, one for the first period of the spell and one for all remaining periods.

Throughout the section, L_g^{nc} and L_b^{nc} (nc: no-commitment) represent the employment levels respectively under good and bad business conditions while w_g^{nc} (w_b^{nc}) and $\widehat{w}_g^{nc}$ ($\widehat{w}_b^{nc}$) represent respectively the wage rate in the first and in all subsequent periods of a good (bad) spell.

Proposition 4

a) $\widehat{w}_g^{nc} = w_g^{nc} + F$

b) $\widehat{w}_b^{nc} = w_b^{nc}$

Proof

a) In equilibrium, the shadow value is equal to 0 in the first period of a good spell and to $-F$ in all subsequent periods (lemma 4). Equation 2 delivers the following labour demand schedules respectively for the first and for all other periods of the spell:

$$L_g^{nc} = \frac{1}{d}\left[\alpha_g - \frac{F}{1+r} - w_g^{nc}\right] \tag{22}$$

$$L_g^{nc} = \frac{1}{d}\left[\alpha_g - \frac{F}{1+r} - \widehat{w}_g^{nc} + F\right] \tag{23}$$

To prove part a) just subtract the first from the second equation.

b) In equilibrium, the shadow value is always equal to $-F$ along a bad spell. Equation 2 implies that the labour demand is unique along the spell:

$$L_b^{nc} = \frac{1}{d}\left[\alpha_b - \frac{1-q}{1+r}F - w(b, L_{t-1}) + F\right] \tag{24}$$

The wage must then be the same troughout the spell.○

Employment variations at business changes imply that lagged employment does not affect the discounted welfare flow at the beginning of any given spell: $\gamma_t I_t^I = 0$. In turn, this implies that the union chooses w_g^{nc} and w_b^{nc} so as to maximise the discounted payoff flow only along the corresponding spell.

Thus, at the beginning of a good spell, the union chooses the wage rate w_g^{nc} which solves the problem

$$\max_{w_g^{nc}} U(w_g^{nc}, L_g^{nc}) + \frac{1-q}{r+q} U(w_g^{nc} + F, L_g^{nc}) \tag{25}$$

$s.t.$ labour demand 22

The f.o.c. for this problem can be shown to be equivalent to condition 21:

$$U_l(w_g^{nc}, L_g^{nc}) + \frac{1-q}{r+q} U_l(w_g^{nc} + F, L_g^{nc}) = d \left[U_w(w_g^{nc}, L_g^{nc}) + \frac{1-q}{r+q} U_w(w_g^{nc} + F, L_g^{nc})\right] \tag{26}$$

Solving for w_g^{nc} and L_g^{nc} requires solving the system composed by the optimality condition 26 and the constraint 22. Notice that this system is different from the one that arises under commitment (equations 15 and 16). Thus, the ability to commit leads to different wage and employment levels during spells of good business conditions.

Turning to bad spells, the union chooses the wage rate w_b^{nc} which solves the problem:

$$\max_{w_b^{nc}} U(w_b^{nc}, L_b^{nc}) \tag{27}$$
$$s.t. \text{ labour demand } 24$$

Straightforward differentiation produces the same equations that solve for the wage and the employment levels in the equilibrium under commitment (equations 17 and 18). Thus, wage and employment are the same during bad spells no matter whether the union is able to make a wage commitment. The ability to commit turns out to be relevant only in good times.

Propositions 4 describes an equilibrium which exhibits many elements of the insider-outsider theory. The union increases the wage by the whole amount of firing costs after new workers have been hired and, from the second period onwards, pushes firms onto the firing boundary. Firms, in turn, anticipate the wage increase and hire less workers. Labour demand during the hiring phase (equation 22) lies below the demand in all subsequent periods (equation 23). Obviously, the union is harmed by firms reluctance to hire and, if possible, it would promise not to exploit the protection guaranteed by firing costs. Yet, in the absence of a commitment device, subgame perfection rules out any promise that does not result to be time-consistent. In fact, after new workers have been hired, the union can safely increase the wage by F without paying any cost in terms of dismissed workers.

However, guessing whether the inability to commit leads in general to lower employment as argued by the insider-outsider theory is a difficult task. Firing costs, in fact, not only move labour demand downwards (equation 22) but also bend the shape of union indifference curves in the w_g^{nc}-L_g^{nc} space (equation 25). In particular, F decreases the marginal utility of w_g^{nc} and increases that of L_g^{nc} leading to an incentive to exchange lower wages for higher employment. In turn, this leads the union to counteract the negative effects of firing costs on labour demand by charging a low initial wage. What happens to employment is therefore undetermined as it results from two countervailing effects. In particular, whether firms reluctance to hiring is fully compensated by low initial wages can be assessed only upon a more detailed specification of the objective function $U(.)$. We deal with the issue in the next section.

Finally, we identify a condition for positive adjustments to take place in equilibrium. Since the union is more willing to exchange lower wages for higher employment during the hiring phase, a *sufficient condition* for $L_g^{nc} > L_b^{nc}$ is that labour demand 22 does not lie above labour demand 24:

$$\alpha_g - \alpha_b \geq \frac{1+q+r}{1+r}F \tag{28}$$

As for the equilibrium under commitment, this conditions requires F not to be too high with respect to the change in the marginal revenue of labour.

Since it represents a sufficient but not a necessary condition, the inequality in equation 28 is not comparable with the one stated in equation 19 for the commitment equilibrium. Thus, one can not use the two conditions to assess whether positive adjustments are more likely in the commitment case as opposed to the no-commitment case. In general, positive adjustments in the no-commitment equilibrium depend not only on the position of the labour demand in good and bad spells but also on the shape of the union objective function. For this reason, a more detailed description of U is needed if one wants to know in which equilibrium positive adjustments are more likely to take place.[7]

5 The utilitarian case

The ability to commit is relevant only if there is scope for opportunistic behaviour. In the present context, we have found that this arises during a spell of good business conditions, after new hires become insiders. However, assessing whether the inability to commit

[7]One can show, for instance, that positive adjustments are more likely in the commitment case if - beyond the properties in 1 - the objective function also satisfies two higher order conditions: $U_{lww} \leq 0$ and $U_{www} \geq 0$, with at least one inequality being strict. [Details available from the author upon request]

results in a lower employment level requires some more investigation. On the one hand, firms anticipate the wage increase and hire less. On the other hand, the union tries to counteract low labour demand by charging low *hiring* wages.

In this section we study in some detail the relative strength of these forces and, as a consequence, the net effect of an increase in firing costs on L_g^{nc}. We proceed in our analysis by assuming that the union is utilitarian, i.e. we utilize an objective function U which has been widely used in the union literature:[8]

$$U(w, L) = Lv(w) + (m - L)v(\overline{w})$$

In this expression, m represents union membership, which we assume to be fixed, and $(m - L)$ the number of unemployed members. The utility of each member is given by the function v whose argument is represented by the union wage w for those who happen to be employed and by the "alternative" wage $\overline{w}$ for the unemployed.

We assume that the utility function of each worker may be linear or concave with a non-negative third derivative:[9]

$$v(w) > 0,\ v'(w) > 0,\ v''(w) \leq 0 \text{ and } v'''(w) \geq 0 \tag{29}$$

To solve for $L_{g,c}$ substitute the utilitarian objective function in equation 15 and combine with equation 16. Analogously, to solve for L_g^{nc} substitute the function in equation 26 and combine with equation **??**. Below, we present the expressions that result from these manipulations where, for the sake of simplicity, we have posed $a = \frac{r+q}{1+r}$ and $R = \alpha_g - dL$:

$$\alpha_g - R = \frac{v\left[a\left(-\frac{1}{1+r}F + R\right) + (1-a)\left(\frac{r}{1+r}F + R\right)\right] - v(\overline{w})}{v'\left[a\left(-\frac{1}{1+r}F + R\right) + (1-a)\left(\frac{r}{1+r}F + R\right)\right]} \qquad \text{(for } L_{g,c}\text{)}$$

[8] The obvious reference is Oswald (1985).

[9] Concave utility functions with a positive third derivative are thought to represent a reasonable description of preferences. In an uncertain environment, for instance, these features are both necessary for *prudent* behaviour (Blanchard and Fisher, 1989, Chap. VI).

$$\alpha_g - R = \frac{a\ v\left(-\frac{1}{1+r}F + R\right) + (1-a)\ v\left(\frac{r}{1+r}F + R\right) - v(\overline{w})}{\left[a\ v'\left(-\frac{1}{1+r}F + R\right) + (1-a)\ v'\left(\frac{r}{1+r}F + R\right)\right]} \qquad \text{(for } L_{g,nc}\text{)}$$

Observe first that when v is linear $[v'' = 0]$, the two conditions coincide and the employment level is the same in the two cases no matter whether the union is able to commit or not. This result represents a notable exception to the insider-outsider proposition whereby the opportunistic behaviour of workers reduces the level of employment. Intuitively, when the utility function is linear, the union is not concerned with the actual path of wages but only with the discounted value from the whole wage flow. Thus, the union does not find it costly to charge a particularly low wage in the first period that completely counteracts the reluctance of firms to hiring. The commitment outcome can be replicated at no cost by the union.

Suppose next that the utility function is concave with a positive third derivative. By the Jensen's inequality, the numerator on the RHS of the expression for $L_{g,c}$ is higher than the numerator of the expression for L_g^{nc}. By contrast, the denominator is lower. This means that the RHS of the expression for $L_{g,c}$ is always higher than the RHS of the expression for L_g^{nc}. Further, if one regards the RHSs of the two expressions as functions of R, straightforward differentiation shows that the two RHSs increase and become closer as R increases. In figure 2 we draw the RHS and the LHS of the two expressions as functions of R.

Notice that the marginal revenue R is lower under commitment. Thus, we conclude that the employment level is higher under commitment, a result which is consistent with the insider-outsider mechanism. By the same argument, since firms equate the discounted flow of marginal revenues to the discounted flow of wages plus adjustment costs, wages are on average lower under commitment.[10]

[10] Curves depicted in figure 2 are concave even if concavity is not a general feature as it depends on higher order derivatives of v. The main result of the analysis, however, holds untouched, employment is higher in the commitment equilibrium also with convex curves. The CRRA utility function used to compute numbers in Table 1 below leads to concave curves.

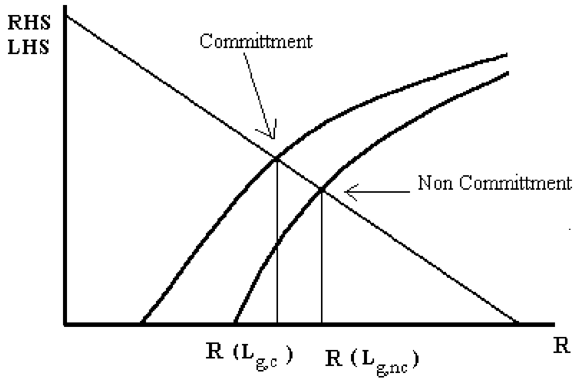

Figure 1: Commitment vs. No-commitment

What happens when the utility function is concave? Concavity implies aversion towards anticipated sharp changes in the wage profile of the type that take place in the no-commitment case. Workers are harmed in that a constant wage profile with equal discounted value is strictly preferred to the actual one, which presents an increase of size F from the second period onwards.

This fact does not explain by itself why the union chooses a lower employment level, and higher wages, in the no-commitment case. It is not difficult to see, however, how this outcome results both from a lower return for the union from the employment level as well as from an higher return from the wage level. The wage shift of size F from the first to the second period reduces the utility of each single employed worker and, henceforth, reduces the gain from being employed as opposed to being unemployed. This means that the union faces a lower benefit from having a large number of employed workers. This effect is captured by the numerators of the expressions above. On the other hand, since the shift is fixed in size it becomes relatively less harmful in terms of utility if wages are particularly high. It follows that the union faces an higher return from a wage increase. This effect is captured by the denominator. Thus, both channels explain why concavity leads to higher wages and lower employment levels in the no-commitment case.[11]

[11] Modesto and Thomas (2001) show that the no-commitment equilibrium exhibits a lower employment level even if they assume $v'' = 0$. Their result, however, is driven by a different mechanism deeply rooted in the assumption of quadratic adjustment costs.

Curvature	$\gamma = 0.1$	$\gamma = 0.5$	$\gamma = 0.7$
Committment	0.01	0	0
Non-Committment	0.01	-3.8	-6

Table 1: Change in average employment (percent) if firing costs increase from F=1 to F=5. Parameters: $\alpha_g = 10$, $\alpha_b = 6$, $q = 0.3$, $r = 0.02$, $d = 2$, $\overline{w} = 4$

In Table 1 we compute the employment effect from an increase in firing costs under a standard parametrisation for the function v. In particular, we assume that the utility of individuals is of the CRRA type: $v(w) = \frac{w^{1-\gamma}}{1-\gamma}$ with $0 < \gamma < 1$, this function satisfies restrictions stated in equation 29. As γ increases the function becomes more concave, i.e. individuals suffer more for given expected jumps in the wage path. In the table we compute the proportional change in average employment $L_i = 0.5L_{i,g} + 0.5L_{i,b}\ \ i = c, nc$ due to an increase in firing cost from $F = 1$ to $F = 5$.[12]

We observe that when the utility function is almost linear [$\gamma = 0.1$] the two equilibria present the same variation in average employment. In spite of the absence of a commitment, the union is capable of replicating (almost) the same employment outcome arising under commitment. In addition, the overall employment effect is close to nil as one should expect from the relatively large reversion probability q on the basis of the previous discussion on the size of the "discounting effect". When the curvature increases, the insider-outsider mechanism becomes more effective. We notice that average employment decreases by 3.8% in the no-commitment equilibrium if $\gamma = 0.5$ and by 6% if $\gamma = 0.7$. No employment reduction takes place in the commitment equilibrium.[13]

In contrast with linear costs, quadratic costs reduce the elasticity of labour demand in the short run but not that in the long run. As a consequence, the union charges higher wages when it deals with the short run labour demand, i.e. in the no-commitment case.

[12]Even if we regard table 1 just as an example we would like to remark that $F = 5$ is below the average wage arising in the no-commitment equilibrium (with $\gamma = 0.7$). In high employment protection countries the amount of firing costs is estimated to be almost equal to the annual wage bill (OECD, 1994).

[13]Notice that $F = 5$ satisfies the necessary and sufficient condition for having positive adjustments in the commitment case (equation 19) but not the sufficient condition for the no-commitment case (equation 28. Nevertheless, positive adjustment arise in the no-commitment case also with such an high level of firing

6 Concluding remarks

We have presented a model characterised by three basic assumptions: a strategic interaction between many firms and a wage setting union, stochastic business conditions and costly labour shedding. Endogenous wages convey the mechanism described by the insider-outsider theory whilst changes in business conditions induce hiring and firing in the spirit of models of dynamic labour demand. Firing costs are shown not to affect employment in the commitment equilibrium and to reduce employment in the no-commitment equilibrium. Thus, predictions from the insider-outsider theory appear to hold also within a stochastic dynamic setting *provided* the focus is on the no-commitment equilibrium. By contrast, predictions from models of dynamic labour demand appear robust to the introduction of endogenous wages *provided* the focus is on the commitment equilibrium.

In the no-commitment equilibrium, we show that the union has an incentive to exploit the insider protection guaranteed by firing costs. This leads to a wage increase after new workers have been hired. In turn, firms anticipate such an opportunistic behaviour and hold up on the number of recruits. By contrast, when the union is able to make a commitment over future wages, the ensuing equilibrium features constant wage and employment levels along any given spell. More importantly, during good spells the wage is on average lower - and the employment level higher - when compared to no-commitment values.

We have also explored the reasons for the two different employment outcomes with and without a commitment and have come to the conclusion that a crucial role is played by the curvature of individual utility functions. This curvature in fact controls for the substitutability of two wage rates received at different points in time. When workers are only concerned with the discounted flow of wages but not with the time profile of this flow, the two outcomes coincide in terms of employment levels and overall union welfare. This happens because the union does not find it costly to charge particularly low wages during the hiring phase so as to buy the same number of jobs that arise under commitment. By

costs. With $\gamma = 0.7$, for instance, $L_{g,nc} = 2.139$ and $L_{b,nc} = 1.889$.

contrast, when workers exhibit aversion towards sharp jumps in the wage path, buying jobs through very low initial wages is costly so that the union opts for an employment level lower than the one which arises under commitment. This conclusion elucidates a further condition for the insider-outsider mechanism to be effective. This mechanism requires wage setters to dislike sharp variations in the wage profile.

In the introduction, we have noticed that empirical research is still inconclusive regarding the relationship between firing costs and employment. What the present paper suggests is that the institutional arrangements which characterise the wage setting process may play an important role in determining such a relationship. Corporativism and cooperative industrial relations, for instance, may help to obtain bargaining outcomes close to those which arise under commitment. The ambiguity of empirical analyses could thus be done, at least in part, to the lack of a proper account of the interaction between employment protection and the bargaining environment.

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