Unions and Workforce Adjustment Costs

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December 2001

Abstract

We present a simple dynamic stochastic game between a wage-setting union and a competitive firm sector which chooses employment. Firms are subject to linear workforce adjustment costs whilst the union, beyond employment and wages, also cares about limiting the number of fired workers during business downturns.

We show that in this context the stringency of employment protection legislation turns out to affect the rate of employment turnover only marginally. Thus, the paper intends to contribute in explaining OECD cross-country evidence whereby turnover rates are surprisingly similar face to large differences in mandated firing costs.

Jel Code

JEL-Code: J23, J51, J63

Keywords: Job Turnover, Union, Firing Costs

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1 Introduction

The effects of employment protection legislation (Epl) on the performance of labour markets represent an issue highly debated by labour market analysts as well as politicians. The beginning of the interest can be traced back to the first half of the '80s when many observers started to blame strict Epl as the main cause for the high European unemployment rate as opposed to that in the United States. Partial equilibrium analyses, however, did not unveil any causal link between large unemployment and high dismissal costs or strict firing procedures. Rather, the main insight of models of dynamic labour demand appeared to be that Epl would only reduce workforce turnover with no clear effect on employment levels (Bentolila and Bertola [1990]).

Workforce stabilisation underscores what is by now a common opinion regarding the main objective of Epl. Namely, reducing the risk of being fired and, when workers are entitled to severance payments, providing an insurance against sharp income reductions following a dismissal . Along this perspective, workers are usually regarded as being risk averse and unable to find an insurer due to obvious problems of asymmetric information. On the other hand, analogous difficulties of conveying objective information to courts also exclude insurance provisions through private arrangements between workers and risk neutral employers. Epl, in summary, is largely regarded as being directed to amend imperfections which prevent risk-sharing through market institutions or private contracts. By restricting the number of workers involved in workforce reductions, employment protection imposes an extra constraint to firms and hinder their productive efficiency but, on the other hand, it also cuts the risk of being fired. Thus, providing it is appropriately designed and administered, employment protection may result in an overall increase in welfare (Bertola [2001], Pissarides [2001]).

The most compelling objection against the conclusions of models of dynamic labour demand is represented by aggregate cross-country evidence whereby the risk of being fired - loosely captured by a measure of job turnover - does not appear to be linked to institutional costs of workforce adjustment. In particular, once one ranks OECD countries on the basis of the stringency of Epl, no clear pattern emerges between the position within the rank and average job turnover[1] (OECD [1996]). Of course, data may not be very reliable whilst conditioning on country-specific composition effects may help to reconcile theory with observations. More fundamentally, however, it may be the case that theory has failed to capture some other aspects of reality that are relevant for turnover decisions. Bertola and Rogerson [1997] provide a first avenue to improve the descriptive performance of models. They notice that countries with loose Epl are also those which present large wage differentials and weak trade unions. By contrast, countries with strict Epl have powerful centralised unions and exhibit narrow wage differentials. Therefore, it may be the case that in countries with weak Epl firms do not need to fire very much, even if firing is not very costly, since wages are flexible and tend to decrease when business conditions worsen. On the other hand, in countries with strict Epl, firms would tend to shed labour at high rates since wages hardly adjust to poor business conditions but they refrain from firing too much due to high institutional costs. Thus, the combination of two institutional features having opposite effect on workforce policy may help to explain the surprising homogeneity of turnover rates across countries face to wide differences in Epl.

The aim of this paper is to contribute to the debate on the apparent irrelevance of Epl for turnover rates by offering some further perspectives. Our contention is that current models of dynamic labour demand fail to capture an important aspect characterising employment relationships. In particular, as in these models labour is exchanged in a competitive setting, workers are by assumption deprived of any active role in affecting turnover outcomes. Yet, in the real world, employees organise more or less formally in unions and bargain with firms over many issues, included their retention in case of a worsening in business conditions. In short, it is possible that workers, even in the absence of Epl, do have some ability to reduce the risk of being dismissed by adopting adequate strategies on wages and/or other aspects of the bargained package. Hence, preferences over retention would represent a major

[1] Computing rank correlation, on a sample of 10 OECD countries for the second half of the '80s, is quite revealing. The rank correlation coefficient (Spearman) between Epl and turnover is unexpectedly positive [$\rho = 0.1152$] but statistically not significant. In short, the ranking on the degree of strictness of Epl is independent from that on average turnover rates. Countries sampled are: USA, Canada, Germany, UK, Italy, France, New Zealand, Finland, Sweden and Denmark (OECD, [1996]).

determinant of observed turnover rates. Of course, introducing Epl would certainly contribute to the goal of employment stability but its *marginal effect* would be smaller than one may expect upon the assumption of workers competitive behavior.

In this paper we study a dynamic game where a union sets wages and firms set employment. The firm sector is subject to costly workforce adjustments, mainly induced by Epl when workers are fired, and to changes in technology and demand conditions in the form of a stochastic alternance of good and bad business states. Labour demand is modeled in a rather standard way as it simply generalises the setting of Bertola [1990] by allowing wages to vary not only over business states but also over time. Labour supply presents instead aspects that may appear novel. In particular, we assume that the union aims at two distinct objectives, the maximisation of rents for those who happen to be employed and their retention in the employment pool over time. In a stable economic environment these two goals would be easy to reach together. But with changing business conditions a conflict emerges in the sense that setting the wage which maximises rents at each point in time generates excessive turnover and deteriorates performance on retention. The optimal strategy of the union is then to sacrifice some current rents in exchange of more employment stability over the planning horizon. In particular, we find that wages are set at a level *too low* in bad times in order to contain job destruction and at a level *too high* in good times in order to contain job creation or, more importantly, the number of future dismissals when business conditions will turn bad.

As Epl becomes more severe, firms are subject to a greater incentive to reduce turnover on their own, i.e. for a given wage policy. From the perspective of the union, this implies a shifting to firms of some of the burden required to stabilise employment and, more generally, an improvement in the dynamic trade-off between current rents and long term retention. In turn, such a trade-off improvement is exploited by the union through a change in the wage policy in the direction of higher current rents. As a consequence, employment fluctuations do not dampen by as much as they would in presence of exogenous (competitive) wages. This may be regarded as the main result of the paper. In short, moderate turnover effects of Epl would arise quite naturally if workers are deeply concerned with their retention and have some power in wage determination.

The paper is organised as follows. In section 2 the firms-union game is formalised and solved. Section 3 studies interactions between Epl and the preference for employment stability in affecting turnover rates and wage dynamics. Section 4 discusses assumptions and provides some assessment on the empirical predictions of the model. Section 5 offers some concluding remarks.

2 A wage-employment game

2.1 The setting

We assume that a single union faces a unit mass of identical firms belonging to the same industry. Firms are competitive and operate with a technology which requires labour as unique input. Their objective is to maximise the present discounted value of a cash flow whose current component cf_t is given by the difference between current revenues and labour costs:

$$cf_t = \pi(\alpha_t, l_t) - w_t l_t - f_t F - h_t H$$

The revenue function $\pi(\alpha_t, l_t)$ exhibits the usual property of decreasing marginal productivity: $\pi_l(\alpha_t, l_t) > 0$ and $\pi_{ll}(\alpha_t, l_t) > 0$. For any level of labour input, revenues also depend on the economic conditions surrounding the industry (indexed by α_t), which may change as a consequence of demand and technological shocks. We assume that revenues increase with α and that α cycles between two values, α_g in good times and $\alpha_b (< \alpha_g)$ in bad times. The cycle is stochastic, if business conditions are currently good, the probability of reverting to the bad state in the next period is given by p, of course $1 - p$ gives the probability that conditions will remain good. By contrast, if business conditions are currently bad, q represents the probability of reverting to the good state next period whilst $1 - q$ represents the probability of persisting in the bad state.

In addition to the wage bill $w_t l_t$, we assume that firms support turnover costs in the form of fixed amounts of money that need to be payed for any recruited or dismissed worker. F and H represent individual costs from firing and hiring whilst f_t and h_t give the number of workers that are fired and hired at time t.

The union maximises a discounted payoff flow with a current component u_t resulting from the sum of two terms:

$$u_t = L_t(w_t - \overline{w}_t) - \frac{\gamma}{2}\mathcal{F}_t^2$$

The first term is traditional in static union models as it represents rents given by the aggregate number of employed workers L_t times the difference between the union wage and some exogenous reference wage $(w_t - \overline{w}_t)$. By contrast, the second term is rather new and intends to convey union aversion towards firings, $\mathcal{F}_t$ represents in fact the aggregate number of fired workers. We argue here that the rent component, taken in isolation, could be rather misleading once one wants to capture what are the relevant objectives of the union in a dynamic context. It implies, for instance, that those who are in charge of making the union policy are equally satisfied if some insiders are substituted by outsiders at unchanged wages. Yet, insiders are likely to have stronger bearing on decisions as compared to outsiders and to oppose resistance to their dismissal by exerting political pressure on those unions officials who ultimately shape the behavior of the union.

We end the description of union objectives by assuming that the exogenous reference wage moves stochastically in accordance with business conditions. Thus, $\overline{w}_g$ and $\overline{w}_b$ represent reference wages respectively with good and bad business conditions.

The sequence of moves is standard. At the beginning of each period nature reveals the state of business conditions, then the union sets the wage and, finally, any firm chooses its own employment level. The game is solved by adopting the notion of Markov-perfect equilibrium (Maskin and Tirole [1988], for instance). This requires identification of wage and employment strategies whereby current decisions are made contingent only on current state variables. In equilibrium, these strategies are mutual best responses and deviations never take place.

Since the union is only concerned with sectorial quantities, current business conditions and lagged aggregate employment are sufficient to describe the state of the game for wage-setting decisions. By contrast, for any single firm the state of the game also includes its own level of lagged employment.

2.2 Employment policy

The aim of this paragraph is to solve the problem faced by a representative firm by identifying an employment policy of the form $l(\alpha_j, l_{t-1}, L_{t-1})$ with $j = g, b$ which needs to be optimal for some given wage policy of the form $w(\alpha_j, L_{t-1})$. For ease of exposition, however, instead of focusing directly on employment we derive, as a first step, optimal hiring and firing policies[2]: $h(\alpha_j, l_{t-1}, L_{t-1})$ and $f(\alpha_j, l_{t-1}, L_{t-1})$.

Assumptions on the dynamics of business conditions and reference wages describe a stochastic but time-stationary environment for both types of agents. This leads quite naturally to represent the problem faced by firms with the following couple of Bellman equation where current firing, hiring and employment are indicated by the triple $\{ f'_j, h'_j, l'_j \}$, $j = g, b$:

$$\begin{aligned} V[g, l_{t-1}, L_{t-1}] &= \max_{h'_g, f'_g} \left[\pi(g, l'_g) - w(g, L_{t-1})\, l'_g - f'_g F - h'_g H\right] + \\ &\quad + \frac{1}{1+r} \left\{pV[b, l'_g, L_t] + (1-p)V[g, l'_g, L_t]\right\} \\ V[b, l_{t-1}, L_{t-1}] &= \max_{h'_b, f'_b} \left[\pi(g, l'_b) - w(b, L_{t-1})\, l'_b - f'_b F - h'_b H\right] + \\ &\quad + \frac{1}{1+r} \left\{qV[g, l'_b, L_{t-1}] + (1-q)V[b, l'_b, L_{t-1}]\right\} \end{aligned}$$

Given that $\quad l(\alpha_j, l_{t-1}, L_{t-1}) = l_{t-1} + h(\alpha_j, l_{t-1}, L_{t-1}) - f(\alpha_j, l_{t-1}, L_{t-1}) \qquad j = g, b$

The value of a single firm depends on current business conditions, lagged own employment and, since it affects current wages, lagged aggregate employment. In particular, the value is given by the current cash-flow plus the expected discounted continuation value.

Due to the linearity of adjustment costs - and for a given wage policy - a solution to above equations does not feature in general positive workforce changes following variations in business conditions. Inaction, in fact, may be a solution when adjustment costs are particularly high to overtake returns from workforce variations. In the real world, however, sectorial employment expands and contracts as a result of demand and productivity changes so that positive adjustments appear to be the

[2] On conceptual grounds, given lagged employment, searching for optimal hiring and firing implies searching for optimal employment.

case empirically relevant. Thus, in the following we focus on an equilibrium which exhibits positive hiring after a reversion from the bad to the good state and positive firing in the opposite case. Later in the section, we examine conditions which guarantee positive workforce adjustments in equilibrium

More formally, since workers are homogeneous, we guess that in equilibrium firms never fire in good times nor hire in bad times: $h_b' = 0$, $f_g' = 0$, $h_g' \geq 0$, $f_b' \geq 0$. And we also guess that firing and hiring take place at positive rates at some point during a bad and a good spell. That is, we guess that the last two inequalities hold strictly in at least one period within a spell of permanently good or bad business conditions.

Let us define $D_h(l_g')$ as the net shadow value of an extra hired worker, i.e. the derivative with respect to h_g' of the present discounted value of cash flows conditional on business conditions being good:

$$D_h(l_g') \equiv \pi_l(g, l_g') - w(g, L_{t-1}) - H + \frac{1}{1+r}\left\{pV_l[b, l_g', L_t] + (1-p)V_l[g, l_g', L_t]\right\}$$

Thus, the net shadow value of hiring increases with current marginal productivity and with the next period discounted shadow value of an extra hired worker and decreases with current wages and hiring costs. Taking account of the non-negative constraint $h_g' \geq 0$, optimality requires

$$D_h(l_g') \leq 0 \qquad h_g' \geq 0 \qquad D_h(l_g')h_g' = 0 \tag{1}$$

In words, if the firm hires at a positive rate, then the net shadow value must be zero. On the other hand, the firm does not hire if the net shadow value is negative.

Analogously, define $D_f(l_b')$ as the net shadow value of an extra fired worker, i.e. the first derivative with respect to f_b':

$$D_f(l_b') \equiv -\pi_l(b, l_b') + w(b, L_{t-1}) - F - \frac{1}{1+r}\left\{qV_l[g, l_b', L_t] + (1-q)V_l[b, l_b', L_t]\right\}$$

This has an interpretation similar to $D_h(l_g')$. Again, taking account of the non-negative constraint $f_b' \geq 0$, we have

$$D_f(l_b') \leq 0 \qquad f_b' \geq 0 \qquad D_f(l_b')\, f_b' = 0 \tag{2}$$

Finally, from the Belmanns we may compute derivatives of continuation values with respect to current employment:

$$V_l[g, l_{t-1}, L_{t-1}] = D_h(l_g') + H \tag{3}$$

and

$$V_l[b, l_{t-1}, L_{t-1}] = -[D_f(l_b') + F] \tag{4}$$

Lemma 1: If $D_f(.) = 0$ holds at all times during a bad spell and if $D_g(.) = 0$ holds at all times during a good spell, then $dD_f(l_b')/dl_b' > 0$ and $dD_g(l_g')/dl_g' < 0$.

Proof: Since $\pi_l(g, l_g')$ decreases with respect to employment, for $dD_g(l_g')/dl_g' < 0)$ to hold is sufficient that derivatives of continuation values with respect to l_g' be constant. This is the case if $D_f(.) = 0$ and $D_g(.) = 0$ at all times, just inspect equations 3 and 4.

The case for $dD_f(l_b')/dl_b' > 0$ is analogous.□

Lemma 2: If there is positive hiring in at least one period during a good spell, then this period is the first in the spell. Also, if there is positive firing in at least one period during a bad spell, then this period is the first in the spell.

Proof: By contradiction. Consider a good spell. If the first period of positive hiring is the second, this means that in the first period the net marginal value of hiring is non-positive. But, since employment and the wage rate do not change from the first period to the second, the net value of hiring also remains constant at the initial non-positive value, i.e. hiring does not take place also in the second period. This represents a contradiction. The proof reiterates for all other periods following the second.

The case of a bad spell is analogous.□

Proposition 1: If $w(g, L_{t-1})$ is non-increasing with respect to past employment and if there is at least a period of positive hiring during a good spell then $D_g(.) = 0$ holds at all times during the spell. If $w[b, L_{t-1}]$ is non-decreasing and if there is at least a period of positive firing during a bad spell then $D_b(.) = 0$ holds at all times during the spell.

Proof: Consider a good spell. If there is at least a period with positive hiring, this must be the first by lemma 2. Thus, $D_g(.) = 0$ holds in the first period. In the second period two cases are possible according to whether the wage decreases or remains constant following the increase in employment. If the wage decreases, positive hiring continues to be convenient, i.e. the net value of marginal hiring $D_g(.)$ tends to become positive and the firm hires until $D_g(.)$ returns back to zero. In fact, by lemma 1, the value of hirings decreases with respect to current employment. If the wage stays constant, then $D_g(.)$ does not change from its previous zero level and the firm does not need to hire any further. Thus, in both cases $D_g(.) = 0$ holds in the second period as well. The proof reiterates for all other periods following the second.

The case for $D_b(.) = 0$ is analogous.□

Proposition 1 and first order conditions 1 and 2 boil down to two labour demand equations - $l(g, L_{t-1}, l_{t-1})$ and $l(b, L_{t-1}, l_{t-1})$ - that are implicitly defined by equations below. One must bear in mind, however, that they hold only if the equilibrium displays positive adjustments after state reversions and if the equilibrium wage policy is consistent with what has been assumed in the proposition:

$$\pi_l(g, l(g, L_{t-1}, l_{t-1})) = w(g, L_{t-1}) + \frac{p}{1+r}F + \frac{1-p}{1+r}H \tag{5}$$

$$\pi_l(b, l(b, L_{t-1}, l_{t-1})) = w(b, L_{t-1}) - \frac{r+q}{1+r}F - \frac{q}{1+r}H \tag{6}$$

These are mere extensions of equations derived by Bertola (1990). Four points deserve attention. First, since firms are small with respect to the market, they take wages as given and do not attempt to use the employment policy to influence wage determination. Second, firing costs increase labour demand in bad times and decrease labour demand in good times. The first effect is rather obvious, if firing becomes more costly, firms will fire less in bad times and employment will be higher. The second is more subtle; if firing costs increase firms become more reluctant to hire since more hirings imply more future firings - and higher firing expenses - when business conditions will turn bad. An analogous explanation hold for the effect of hiring costs. Third, even if in principle employment is made contingent on its lagged value, this does not turn to be the case in the actual policy. The explanation lies in the linearity of adjustment costs with respect to the number of fired and hired workers. Were costs quadratic, for instance, we would observe smoothing, that is dependence on past values. Fourth, aggregate lagged employment affect current employment at the firm level only through wages.

The last two remarks imply that, from the point of view of the union, current labour demand depends only on the current state of technology and on the current wage. Thus, upon aggregation, we have:

$$L(j, w(j, L_{t-1})) = l(j, L_{t-1}, l_{t-1}) \qquad j = b, g.$$

2.3 Wage policy

We derive the policy of the union under a linear specification for the marginal revenue function:

$$\pi_l(j, l) = a_j - \frac{1}{b} l \qquad\qquad \alpha_g > \alpha_b$$

Substitution in 5 and 6 gives the following demand functions:

$$L(g, w(g, L_{t-1})) = b\left[\alpha_g - w(g, L_{t-1}) - \frac{p}{1+r}F - \frac{1-p}{1+r}H\right] \tag{7}$$

$$L(b, w(b, L_{t-1})) = b\left[\alpha_b - w(b, L_{t-1}) + \frac{r+q}{1+r}F + \frac{q}{1+r}H\right] \tag{8}$$

Again, we indicate current decision variable with w'_j, that is $w'_g = w(g, L_{t-1})$ and $w'_b = w(b, L_{t-1})$. Bellmanns for the union are

$$\begin{aligned} W[g, L_{t-1}] \quad &= \quad \max_{w'_g} \left[L(g, w'_g)(w'_g - \overline{w}_g)\right] + \\ &\quad + \frac{1}{1+r}\left\{p\, W\left[b, L(g, w'_g)\right] + (1-p)\, W\left[g, L(g, w'_g)\right]\right\} \end{aligned}$$

and

$$
\begin{aligned}
W[b, L_{t-1}] &= \max_{w_b'} \left[L(b, w_b')(w_b' - \overline{w}_b) - \frac{\gamma}{2}[L_{t-1} - L(b, w_b')]^2 \right] + \\
&\quad + \frac{1}{1+r} \left\{ q\, W\left[g, L(b, w_b')\right] + (1-q)\, W\left[b, L(b, w_b')\right] \right\}
\end{aligned}
$$

Where demand functions $L(j, w_j')$ are given by equations 7 and 8.

Using the envelope theorem for derivatives involving continuation values, we obtain the following f.o.c. for w_g':

$$
-b(w_g' - \overline{w}_g) + L(g, w_g') + \gamma b \frac{p}{1+r} \{ L(g, w_g') - L(b, w(b, L(g, w_g'))) \} = 0 \tag{9}
$$

The latter, together with labor demand equations $L(g, w_g')$ and $L(b, w_b')$ and the wage which would be set next period in case of a state reversion - $w(b, L(g, w_g'))$ - gives the solution $w_g' \equiv w(g, L_{t-1})$. Notice, however, that lagged employment L_{t-1} is absent both in 9 and in labour demands so that, during good business conditions, the wage and employment levels turn out to be unaffected by past employment: $w(g, L_{t-1}) = w_g$ and $L_g = L(g, w_g)$. In particular, we find

$$
w_g = \widetilde{w}_g + \frac{\gamma}{2} \frac{p}{1+r} \left(L_g - L(b, w(b, L_g)) \right) \tag{10}
$$

where $\widetilde{w}_g \equiv \frac{1}{2} \left[\alpha_g + \overline{w}_g - \frac{p}{1+r} F - \frac{r+q}{1+r} H \right]$ represents the wage that the union would set in the absence of firing aversion $[\gamma = 0]$. Thus, being averse to firing plays a role in good times too, when firing does not actually take place. Unions, in fact, behave in a forward looking fashion and add to the wage in good times an extra amount which reflects the concern of containing the number of workforce additions in order to contain the number of dismissals when business condition will worsen. Equation 10 makes clear that such a wage correction increases with the probability of reverting to the bad state and with the parameter which captures aversion to firings and decreases with the interest rate as future events are discounted at a higher rate.

However, the solution for w_g is not yet fully specified as the amount $w(b, L_g)$ - i.e. the function $w(b, .)$ - is still to be found. For this purpose, we use again the enveloppe theorem and derive the f.o.c. for w_b':

$$-b(w_b' - \overline{w}_b) + L(b, w_b') - \gamma b\{L_{t-1} - L(b, w_b')\} + \\ +b\gamma\frac{1-q}{1+r}\{L(b, w_b') - L(b, w(b, L(b, w_b')))\} = 0 \tag{11}$$

It turns out that the function $w(b, L_{t-1})$ that solves equation 11 is linear with respect to lagged employment. Functional parameters may be calculated by adopting the method of undetermined coefficient. This amounts to state the form $w(b, L_{t-1}) = A + BL_{t-1}$ and find the values A and B for which $w(b, L_{t-1})$ solves the equation for any level of lagged employment. After a fair amount of calculus, we find that B must solve a second order equation:

$$b^2\gamma\frac{1-q}{1+r}B^2 + \left[2 + \gamma b + b\gamma\frac{1-q}{1+r}\right]B + \gamma = 0$$

Let B_1 and B_2 - with $B_1 > B_2$ - be the two roots. Since they are both negative, w_b' is a decreasing function of lagged employment and, if business conditions remain bad, an increasing function of the lagged wage rate. More precisely, conditional of persistently bad business conditions, current wages depend on past wages through a multiplier given by $-Bb$. Thus, for convergence, we rule out B_2 and choose B_1 as the latter turns out to be the only root with an absolute value lower than $1/b$.

The corresponding solution for the other undetermined coefficient is $A = \widetilde{w}_b - B_1 L(b, \widetilde{w}_b)$ where $\widetilde{w}_b \equiv \frac{1}{2}\left[\alpha_b + \overline{w}_b + \frac{r+p}{1+r}F + \frac{p}{1+r}H\right]$ represents the wage that the union would set in bad times in the absence of firing aversion. As a consequence, the wage function takes a rather intuitive form:

$$w(b, L_{t-1}) = \widetilde{w}_b + B_1\left[L_{t-1} - L(b, \widetilde{w}_b)\right] \tag{12}$$

which implies the following sequence of employment levels within a spell of low productivity:

$$L(b, w(b, L_{t-1})) - L(b, \widetilde{w}_b) = -bB_1[L_{t-1} - L(b, \widetilde{w}_b)] \tag{13}$$

At any time during the spell the difference between current employment and $L(b, \widetilde{w}_b)$, the level of employment which would arise without firing aversion, is a fraction of its lagged value so that $L(b,\widetilde{w}_b)$ also represents the steady state. Furthermore, employment converges to the steady state from above since the sequence starts with the positive value $L_g - L(b,\widetilde{w}_b)$. Intuitively, since firing aversion increases at the margin, from the point of view of the union optimality requires dismissals to be spread over time instead of being concentrated in only one period. Thus, to induce small per-period workforce dismissals, the union undercuts the steady state level $\widetilde{w}_b$ in the first period of a bad spell and moves gradually upwards in the directions of the steady state as bad conditions persist.

The degree of stickiness in the dynamics of employment and the measure of wage undercutting [for a given difference $L_g - L(b,\widetilde{w}_b)$] are both indexed by $-B_1$, which is an increasing function of γ. Thus, stickiness and wage undercutting increase if large workforce reductions become more costly to the union.

2.4 Equilibrium

We have computed optimal union wages given the employment policy of firms as summarised by equations 7 and 8. However, the latter are optimal only if wages do not increase during a spell of high productivity and do not decrease during a spell of low productivity and if the equilibrium displays positive workforce adjustments. Since the first requirement is satisfied by the wage policy, we are only left to check whether firms actually fire and hire in case of productivity changes, i.e if the inequality $L_g > L(b, w(b, L_g))$ holds in equilibrium.

Let us use L_b and w_b to represent employment and wage levels in the first period of a bad spell [$w_b \equiv w(b, L_g)$ and $L_b \equiv L(b, w_b)$]. For the remainder of the present paragraph we study under what conditions the difference $L_g - L_b$ is positive. In the next section we concentrate on the determinants of $L_g - L_b$ and $w_g - w_b$ which we regard as compact measures of employment and wage dependence upon cyclical business conditions.

Inserting L_g as lagged employment in equations 12 and 13 we obtain an expression for w_b as a function of the difference $(L_g - L_b)$:

$$w_b = \widetilde{w}_b + \frac{B_1}{1 + bB_1}(L_g - L_b) \tag{14}$$

This can be coupled with labour demand equations 7 and 8 and with the condition 10 to obtain a system of four equations with four unknowns (w_g, w_b, L_g and L_b). Solution gives $L_g - L_b$ and $w_g - w_b$:

$$L_g - L_b = \frac{b}{2}\left[1 + b\left(\frac{\gamma}{2}\frac{p}{1+r} - \frac{B_1}{1+bB_1}\right)\right]^{-1}\left[(\alpha_g - \alpha_b) - (\overline{w}_g - \overline{w}_b) - \frac{p+q+r}{1+r}(F+H)\right] \quad (15)$$

$$w_g - w_b = (\widetilde{w}_g - \widetilde{w}_b) + \left(\frac{\gamma}{2}\frac{p}{1+r} - \frac{B_1}{1+bB_1}\right)(L_g - L_b) \quad (16)$$

Thus, conditional on small cyclical variations in reference wages - i.e. a small difference $\overline{w}_g - \overline{w}_b$ - in equilibrium firms hire and fire at positive rates if adjustment costs are not too high with respect to the change in productivity. Further, for given costs and productivity parameters, positive adjustments become more likely if state transition probabilities decrease. Intuitively, incentives to hire and fire increase if changes in business conditions tend to last for longer times.

The condition for positive workforce adjustments also guarantees that equilibrium wages move pro-cyclically.

3 The cyclical behaviour of employment and wages

The aim of this section is to characterise the interaction between workforce adjustment costs and the union preference over employment retention in affecting the cyclical behavior of employment and wages. For this purpose we assign a set of values[3] to structural parameters and provide a graphical representation for the solution of the system composed by equations 7, 8, 10 and 14 under different values of F, H and γ. To present results in compact form, we also assign firing and hiring costs as fixed proportions of a general measure of adjustment costs. In the attempt to catch some aspects of the real world we allow firing costs to be the dominant component: $F = 0.7C$ and $H = 0.3C$.

[3] Values are: $r = 0.05$, $p = q = 0.15$, $\alpha_g = 1$, $\alpha_b = 0.7$, $b = 10$, $\overline{w}_g = 0.5$ and $\overline{w}_b = 0.4$. In the absence of adjustment costs and firing aversion, these values imply $w_g = 0.75$, $w_b = 0.55$, $L_g = 2.5$ and $L_b = 1.5$.

Figure 1 below illustrates percentage wage changes and turnover rates[4] at productivity reversions as a function of adjustment costs and for different measures of firing aversion.

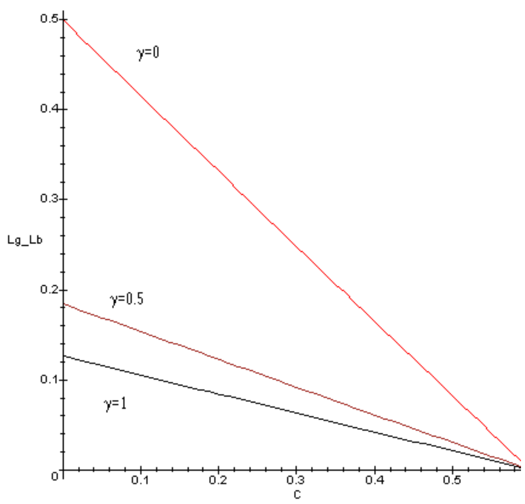

Fig. 1a - Turnover rate

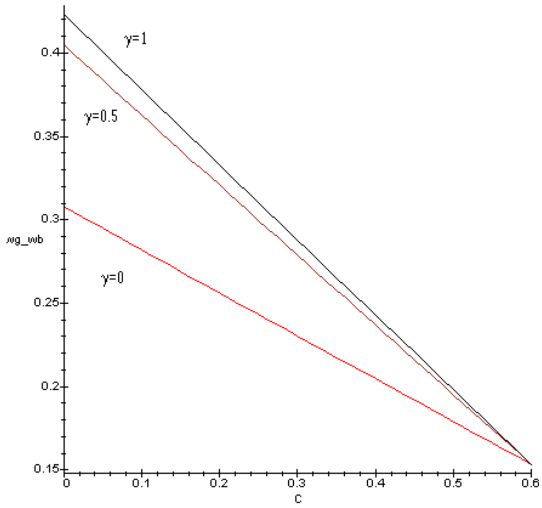

Fig. 1b - Wage change (percentage)

We first observe how the slope of the line corresponding to $\gamma = 0$ in fig. 1a suggests that, in the absence of firing aversion, adjustment costs are particularly effective in reducing turnover. This finding is rather intuitive and, in fact, represents a major result within the theory of dynamic labour demand. Much less intuitive, instead, is the effect of adjustment costs on wage fluctuations. Figure 1a illustrates how, even without firing aversion,fluctuations dampen if costs increase. In line with Bertola (1990), however, we argue that the negative relationship between wage changes and adjustment costs is spurious as it depends on the particular functional forms that have been adopted.

One can easily show, in fact, that with the linear schedules 7 and 8 the elasticity of labour demand increases with adjustment costs when firms hire and decreases when they hire. Thus, monopolistic union wages tend to decrease with adjustment

[4]The rate of turnover is computed as follows:$\frac{L_g - L_g}{0.5(L_g + L_b)}$. This is obviously a shortcut. Since $p = q$, it is true that firms spend half of their time in each state. Nevertheless, employment in the bad state decreases with time so that using the constant L_b implies overstating average employment and understating turnover.

Using "correct" values for the average turnover rate, however, entails only very minor changes in turnover results. This explains why we decided to present the solution in a form which is slighly imprecise but simple.

costs in good times and to increase in bad times. But this is far to be general. If one uses a Cobb-Douglas specification for $\pi(\alpha_t, l_t)$, for instance, adjustment costs affect labour demand elasticity in a fashion which is simply the opposite of what happens in the linear case (see below).

If γ increases, figure 1a indicates that employment turnover decreases proportionally for any regime of workforce adjustment costs. Or, from a reversed perspective, that adjustment costs become less relevant as a determinant of workers turnover. On the other hand, wage changes following reversions in business conditions increase proportionally. Again, from a reversed point of view, this implies that adjustment costs become more relevant in determining wage fluctuations if aversion to firing is higher.

Intuitively, for given adjustment costs, unions choose the best point along a dynamic trade-off whereby small employment fluctuations are paid in terms of excessive wage fluctuations. If adjustment costs increase, the trade-off becomes more favorable, for firms tend to stabilise employment on their own. Unions, in turn, use these more favourable terms to adopt a wage policy featuring less variability. Of course, the strength of these effects depends on union preferences over the conflicting objectives represented by wage optimal variability and employment stability. As γ increases such a conflict becomes more compelling and a given trade-off improvement leads to a large reduction in wage fluctuations. By contrast, if γ decreases, the same trade-off improvement generates a smaller reduction in wage fluctuations. This explains why the relationship between wage changes and adjustment costs becomes steeper as γ increases whilst the relationship between employment changes and adjustment costs becomes flatter.

Cobb Douglas Technology

Here we intend to provide some assessment on the robustness of above conclusions by checking whether they hold under a different specification for the marginal productivity of labour. Thus, in the following, we move from the linear to a log-linear form:

$$\pi_l(j,l) = a_j l^{-\beta} \qquad 0 < \beta < 1 \qquad \alpha_g > \alpha_b \tag{17}$$

Unfortunately, with the new function the model loses the linear-quadratic structure and tractability deteriorates. A simple solution, however, is still available if ones restricts the wage policy to depend uniquely upon the state of productivity[5]. Therefore, in the remainder of the section the vector $[w_g,\ w_b,\ L_g, L_b]$ represents the full solution instead of a simplified characterisation.

The new labour demand schedules are obtained by substituting 17 in 5 and 6. Wage rates, instead, are given by the values w_g and w_b which maximise discounted union payoff flows in good and bad business conditions, W_g and W_b:

$$W_g = L_g(w_g)(w_g - \overline{w}_g) + \frac{p}{1+r}W_b + \frac{1-p}{1+r}W_g$$

$$W_b = L_b(w_b)(w_b - \overline{w}_b) - \frac{\gamma}{2}\left[l_g(w_g) - l_b(w_b)\right]^2 + \frac{q}{1+r}\widetilde{W}_b + \frac{1-q}{1+r}W_g$$

$$\widetilde{W}_b = l_b(w_b)(w_b - \overline{w}_b) + \frac{q}{1+r}\widetilde{W}_b + \frac{1-q}{1+r}W_g$$

These hardly require any comment as their nature of asset evaluation equations is rather clear. We only remark that the discounted value in the first period of a bad spell W_b must be distinct from that of the following periods $\widetilde{W}_b$. For, since the wage has been restricted to be the same all over the spell, firings take place only in the first period and do not affect the payoff of later periods.

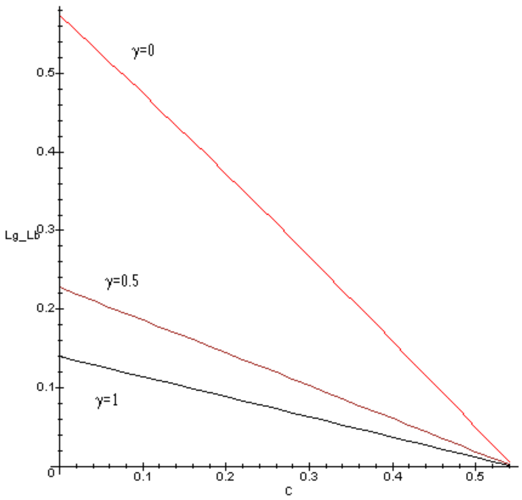

Fig. 2a Turnover rate, CD

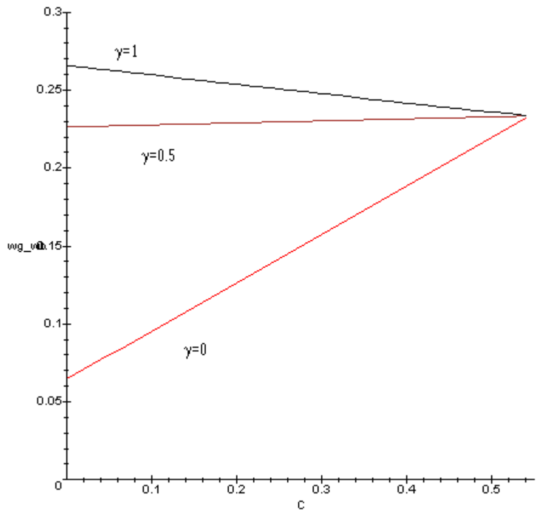

Fig.2b Wage change (percentage), CD

[5]It should be clear, at this point, that such an assumption - restrictive but not implausible - has no bearing on the main argument of the paper.

Figure 2 depicts employment turnover and wage fluctuations for the Cobb-Douglas (CD) case[6]. We notice that, given the choice of parameters, the rate of turnover is remarkably similar to the one in figure 1. Wages, instead, present a pattern completely different. Without firing aversion, and in sharp contrast with figure 1, wages fluctuate *more* if adjustment costs increase. Yet, as argued before, such a positive link is spurious and rests on the effect of adjustment costs on the elasticity of labour demand.

As firing aversion increases, cyclical wage fluctuations may become constant with respect to adjustment costs. This happens because the spurious elasticity effect is exactly counteracted by the incentive to stabilise employment. Of course, for a sufficiently high aversion, employment stabilisation becomes a major concern and the link may turn negative.

In summary, inserting a CD technology in the model proves inconsequential for the above analysis on the determinants of turnover rates. On the other hand, it also warns against the temptation of making any conclusion on the link between turnover costs and wage dynamics.

4 Discussion and Empirical Predictions

Overall, the analysis suggests that firing and hiring costs may not be so relevant in determining labour turnover since the underlying quest for more employment stability can be partly satisfied through union policies leading to more cyclical wages. This may help to explain the stylised fact whereby economies with much different regimes of employment protection exhibit quite similar turnover patterns.

With competitive wages, theoretical predictions are sharply at odds with facts[7]

[6] The figure has been obtained by assigning the following values to parameters: $\alpha_g = 3.2$, $\alpha_b = 2.3$, $\overline{w}_g = 0.8$, $\overline{w}_b = 0.75$, $\beta = 0.45$ and $p = q = 0.1$. Wage and employment levels in the absence of turnover costs and firing aversion are: $w_g = 1.45$, $w_b = 1.36$, $L_g = 5.76$ and $L_b = 3.19$.

[7] The argument made in Bertola and Rogerson (1997), and reviewed in the introduction of the present paper, is appealing. It may contribute to explain evidence from the 6 countries sample considered by the authors, the Anglo-Saxon block (U.S.A., U.K. and Canada) and the Continental Europe block (France, Italy and Germany). Some problems arise, however, if the argument is applied within the European borders. In particular, the sample made by France, Italy, Germany, Finland, Sweden and Denmark exhibits no correlation between turnover rates and Epl strictness but *positive* (and significant) rank correlation between the latter and earnings dispersion (OECD

By contrast, if one allows for uncompetitive wage-setting and firing aversion on the part of those who shape the policy of the union, the link between turnover and costs weakens considerably and may well escape detection in data analysis. Thus, the main concern of this section is to provide some assessment on these relevant assumptions by contrasting our setting with other related papers. Later in the section we also devote some attention to the empirical consistence of those predictions of the model that are peripheral with respect to the relationship between Epl and turnover.

In retrospect, the framework used in this paper may be regarded as a combination of a labour demand setting *à la* Bertola and a dynamic union monopoly model of the kind used by Kennan [1988] or, more recently, Modesto and Thomas [2001]. The main difference with these papers relates to the assumption on the preference for workforce stabilisation in addition to the usual objective represented by some functional combination of employment and wages. This is obtained by summing to a traditional utilitarian function (Oswald [1985]) a quadratic term of the kind frequently used in the hysteresis literature (Blanchard and Summers [1986], Manning [1988]). With the following important change. While in this literature any difference between current employment and membership (i.e. lagged employment) is assumed to be costly to the union, no matter whether it is positive due to new hirings or negative due to firings, in the present paper we only allow for costly workforce reductions[8]. More formally, union indifference curves in the wage-employment space are asymmetric with respect to the locus where current and lagged employment are equal. Akin to Carruth and Oswald [1987], curves flatten in a discontinuous fashion when employment overtakes its lagged level. Nevertheless, it is true that unions also oppose workforce expansions by setting very high wages in good times, but this sort of "hiring aversion" is not imposed from the beginning. Rather, it arises endogenously from the assumption of a two state stochastic cycle coupled with

[1996]).

[8]The union objective function in Blanchard and Summers [1986, 1987] and Manning [1988] is $U = -(n-m)^2$ where n represents current employment and m current membership, which, according to the insider-outsider mechanism, represents some function of lagged employment n_{-1}. An obvious criticism against this formulations concerns its symmetry so that employment above membership turns out to reduce welfare (Sanfey [1995]). In our setting, symmetry is excluded as the hysteresis component is absent when $n > m$ and shows up under the heading of "firing aversion" only when $n < m$.

forward looking behaviour on the part of the union.

If Epl is directed to provide employment insurance, it seems quite natural to introduce some preference for employment retention. Casual observation does in fact suggest that unions use their political influence to maintain and enhance protection. Yet, Modesto and Thomas (2001) provide an argument whereby unions benefit from adjustment costs even in the absence of firing aversion. This happens because, in their framework, workforce adjustment costs are quadratic so that current employment depends on its lagged value. This reduces labour demand elasticity along the adjustment path to a new equilibrium level of employment and, implicitly, enhances monopolistic power in wage-setting. One should notice, however, that empirical investigation on firms data has rejected a quadratic specification of costs[9]. Second, Modesto and Thomas also assume symmetric costs with the consequence that the union, since it is concerned with the welfare of insiders as well as outsiders, benefits from sluggish adjustments when firms move to lower levels of employment following negative shocks but suffer when adjustments are directed to increase employment in the aftermath of a positive shock. In sum, unions should press for higher adjustment costs only if they expect perturbations to be usually negative[10].

Apart from weakening the link between Epl and turnover, we ask whether the model is consistent with available evidence along other dimensions. A first relevant issue appears to be link between Epl and wage fluctuations. In this respect, however, the model, does not predict any specific pattern. On one hand, since employment stability is obtained at the cost of wider wage fluctuations, stricter Epl leads to narrower fluctuations. On the other hand, stricter Epl may affect labour demand elasticity in a way that fluctuations enlarge. As wage changes affect individuals income profiles, a rough indications on the elasticity of wages to business conditions may by grasped from data on individual earnings mobility. In this respect, we notice that, although the Anglo-Saxon countries presents higher earnings dispersion in comparison to the (continental) European countries, when it comes to earnings

[9] See Hamermesh (1989) and Caballero et al. (1997), for instance.

[10] Unions could desire substantial adjustment costs in the transition to higher employment only if concern over the welfare of outsiders is negligeable. In fact, in our model the union benefits from an higher hiring cost H since, in this case, retention increases for given wages. Lindbeck and Snower [1988] come to similar conclusions when they note that insiders may even behave strategically - by refusing to cooperate with newly hired workers, for instance - in order to increase H.

mobility the picture is surprisingly much more homogeneous[11] (OCSE[1996]). This accords with the model once one accept the CD specification as being the most descriptive and assumes that the preference over retention leads to a fairly horizontal line in picture 2b.

Probably, a better avenue to check empirical consistency is to look at more disaggregated evidence on the effect of unionisation on turnover. The issue has not been addressed by many studies. Lucifora (1998), however, provides some interesting results by showing how the presence of local unions reduces job turnover in the Italian metal-mechanical sector. We note that this industry fits rather closely our framework as a centralised union dominates sectorial country-level bargaining while second stage firm-level bargaining affords substantial degrees of freedom in adapting country-level agreements to idiosyncratic contingencies. Hence, as assumed, firms do not act strategically on employment to influence wage decisions while the concern for retention may well operate at the second stage.

5 Concluding Remarks

We have presented a stochastic dynamic framework where wages are decided by a (monopolistic) union and employment by a perfectly competitive firm sector. Firms are subject to linear adjustment costs whilst the union, apart from employment and wages, also cares for retention of those who happen to be employed. The main result of the model is that adjustment costs do affect job turnover rates but the link may be very weak and, in any case, weaker than may be expected on the basis of exogenous (competitive) wages. In this sense, Epl would merely act as a device to make it easier for the union to reach the goal of employment stabilisation.

Although others have argued on the irrelevance of Epl and on its stance to operate a redistribution in favour of those who are employed (Saint-Paul [1996]), we would like to warn against any temptation to draw simple policy indications. Several caveats need to be considered. Above all, one should bear in mind that

[11]"..While the United States has substantially more inequality than other OECD countries, it is not an outlier when it comes to mobility.....Likewise, the more centralised wage setting institutions in Germany and the Nordic countries do not translate into significantly less mobility in those countries than in the United States..." (Gottschalk [1997], p.38).

in many developed economies a substantial fraction of workers, especially at the lower end of the income distribution, present low rates of union density. Of course, our argument loses momentum in a non-unionised contexts where strict Epl may well lead to a welfare improving reduction in the risk of being dismissed. Second, Epl may turn out to have positive welfare effects also through mechanisms that are completely disregarded in models of dynamic labour demand. For instance, Epl may provide firms with a commitment technology capable to overcome the lack of credibility when they announce - in good times - to retain workers also during bad times. In the absence of Epl, in fact, workers would anticipate incentives to renege on promises of retention and, due to the higher firing probability, may withdraw productive effort unless particularly high efficiency wages are paid. Thus, strict Epl may lead to lower efficiency wages and higher employment (Fella [2000]).

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