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## ABSTRACT

### Labour Market Institutions and Macroeconomic Shocks\*

Macroeconomic shocks and labour-market institutions jointly determine employment growth and economic performance. The effect of shocks depends on the nature of these institutions, and the effect of institutional change depends on the macroeconomic environment. It follows that a given set of institutions may be appropriate in one epoch and not in another. We derive a dynamic model of labour demand in which the effect of firing costs on labour demand depends on the macroeconomic environment: when the level of macroeconomic activity is expected to drop and/or the trend rate of productivity growth is small, a rise in firing costs affects mainly (and adversely) the hiring decision and not the layoff decision. This makes firing costs harmful to employment when it may appear most appropriate. In contrast, firing costs can raise employment during periods of high growth and positive shocks. Our hypothesis is supported by empirical results using OECD data.

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Labour-market rigidities are often blamed for the European unemployment problem in what is commonly termed “Eurosclerosis<sup>1</sup>”. Recent studies by the OECD link reforms to reduce labour-market rigidities<sup>2</sup> to reductions in unemployment (e.g. Elmeskov, Martin and Scarpetta (1998) and OECD (2000)). This line of argument – according to which rigidities such as firing costs discourage firms from employment – has become increasingly persuasive over the past two decades, as the EU unemployment rate has risen steadily relative to the US rate. However, it then becomes a mystery why the EU unemployment rate was about half the US rate throughout much of the 1950s and 1960s, even though job-security legislation<sup>3</sup> and other impediments to hiring and firing have been more stringent in Europe throughout the postwar period. Thus it appears that there is no simple inverse relation between labour-market rigidities and unemployment. Instead, it seems that these rigidities might promote employment in some circumstances and reduce it in others.

A partial rationale for this possibility is provided by recent work by Phelps (1994), Blanchard and Wolfers (2000), Fitoussi, Jestaz, Phelps and Zoega (2000) and Phelps and Zoega (2001) who show – both theoretically as well as empirically – how a high level of unemployment benefits, a long duration of these benefits, a high density and coverage of labour unions, and employment-protection legislation – which takes the form of a fixed cost of firing – determine the employment effects of macroeconomic shocks. Prominent among these shocks are changes in the rate of productivity growth (Pissarides, 1990; Hoon and Phelps, 1997), changes in real oil prices (Carruth et al., 1998), and changes in world real interest rates (Phelps, 1994). Diaz and Snower (1996) show how the employment effects of firing and hiring costs depend on the persistence of macroeconomic shocks. A recent paper by Ljungqvist and Sargent (1998) shows how an increase in economic turbulence – arising from the restructuring from manufacturing to service industries and the adoption of new technologies – in

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<sup>1</sup> See Giersch (1985).

<sup>2</sup> The actual rules and regulations that affect the relationship between employers and employees in the OECD concern administrative authorizations, minimum-notice periods, severance pay, unfair dismissals and restrictions on layoffs for economic reasons. In our analysis, we will summarise this employment-protection legislation with one summary index of firing costs.

<sup>3</sup> One rationale for these restrictions is that they internalise the social costs of dismissing a worker – hence the cost of reallocating him to a new sector – and therefore cause firms to take these external considerations into account when deciding on a dismissal (Lindbeck and Snower (1988), Booth and

conjunction with high unemployment benefits can contribute to persistently high unemployment.

In this paper, by contrast, we show how the employment effects of firing costs depend on the rate of productivity growth and the likelihood of large-scale recessions (i.e. the probability of adverse demand shocks). In particular, we show that firing costs may have no deleterious employment effects – and might even stimulate employment – if productivity grows sufficiently fast and the likelihood of major recessions is low. These are conditions that, on the whole, prevailed in the 1950s and 1960s. Subsequently, however, in the 1970s and 1980s, productivity growth slowed down and the likelihood of major recessions rose (particularly in conjunction with oil price and other raw material price shocks). We show that under these adverse conditions, firing costs can have a severely contractionary effect on employment, leading to high unemployment.

Our analysis differs from that of Bertola (1990) in that he shows that firms tend to demand less labour in good times and more labour in bad times with the result that employment is more stable where employment protection is more stringent. In contrast, we show how medium-term macroeconomic factors – i.e. the trend rate of growth of labour productivity and the possibility of adverse demand shocks – determine the effectiveness of firing costs which implies that firing costs may raise or lower average employment depending on the macroeconomic environment.

Bertola (1990) and Bentolila and Bertola (1990) demonstrate how the asymmetry of adjustment costs – that is hiring- and firing costs – the rate of time discounting and the expected rate of attrition affect the long-run bias in firms' employment policies. We do not dispute their theoretical insights but we show how the effectiveness of firing costs depends in addition on the stochastic, macroeconomic environment in which firms operate. Thus raising firing costs may raise average employment in one country while reducing it in others. Moreover, Bertola (1990) finds no empirical support for an adverse effect of firing costs on average employment. We show that once the interactions between firing costs and the macroeconomic environment are taken into account, we can detect a significant relationship – positive or negative depending on

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Zoega (1994)). There is the added benefit that to the extent that average tenure becomes longer, both workers and firms may be more willing to invest in general – as well as firm-specific – skills.

the circumstances – between firing costs and average unemployment in a pooled sample of OECD countries.

In Section I we derive a theoretical model of hiring and firing when labour is a quasi-fixed asset (see Oi, 1962) and there are linear, asymmetric costs of hiring and firing. In Section II we show how a change in the macroeconomic environment from high productivity growth and positive expected demand shocks to low growth and negative expected demand shocks will make firing costs harmful to employment. Finally, in Section III, we look at data on unemployment and labour-market institutions for 19 OECD countries and conclude that the predictions of our model are consonant with the data.

## I. Model

We consider the behaviour of a representative firm which finds itself facing stochastic demand for its output and linear costs of hiring and firing workers. We model the firm's hiring and firing decisions by deriving the two thresholds at which hiring and firing become optimal.<sup>4</sup> Both of these decisions may be interpreted as intertemporal investment decisions.

The firm has a linear production technology (1) and faces a linear output demand function (2)

$$Q = gN, \quad (1)$$

$$P = Z - bQ, \quad (2)$$

where  $Q$  denotes production and sales,  $N$  is the size of the firm's workforce,  $g$  is labour productivity,  $P$  is the product price, and  $Z$  is an additive demand parameter. The number of employees quitting is

$$dN = -\mathbf{d} N dt \quad (3)$$

where  $\mathbf{d}$  is the quit rate. Labour productivity grows at the exponential rate  $\mathbf{h}_g$

$$dg = \mathbf{h}_g g dt, \quad (4)$$

and the demand parameter  $Z$  follows a combined geometric Brownian motion and jump process;

$$dZ = \mathbf{h}_z dt + \mathbf{s}_z Z d\mathbf{v} - Zdq_1 + Zdq_2 \quad (5)$$

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<sup>4</sup> For simplicity, we ignore inventories and the possibility of temporary layoffs.

where  $\mathbf{v}$  is a Wiener process;  $dz = \mathbf{e}\sqrt{dt}$  (since  $\mathbf{e}$  is a normally distributed random variable with mean zero and a standard deviation of unity),  $\mathbf{h}_Z$  is the drift parameter and  $\mathbf{s}_Z$  the variance parameter,  $dq_1$  and  $dq_2$  are the increments of Poisson processes (with mean arrival rates  $I_1$  and  $I_2$ ), and  $dq_1$ ,  $dq_2$  and  $d\mathbf{v}$  are independent to each other (so that  $E(d\mathbf{v}dq_1)=0$ ,  $E(d\mathbf{v}dq_2)=0$ , and  $E(dq_1dq_2)=0$ ). It is assumed that if an “event 1” (or “event 2”) occurs,  $q_1$  (or  $q_2$ ) falls (or increases) by some fixed percentage  $f_1$  (or  $f_2$ ) with probability 1. Thus equation (5) implies that product demand will behave as a geometric Brownian motion, but over each time interval  $dt$  there is a small probability  $I_1dt$  (or  $I_2dt$ ) that it will drop (or rise) to  $1-f_1$  (or  $1+f_2$ ) times its original value, and it will then continue fluctuating until another event occurs.

We model expectations about the future through the parameters  $\mathbf{s}_Z$ ,  $I_1$ ,  $I_2$ ,  $f_1$ ,  $f_2$  and  $\eta_Z$ . When  $\mathbf{s}_Z$  is large, there is much uncertainty about the future. When  $I_1$  (or  $I_2$ ) is positive and large, we expect large discrete negative (positive) shocks. We are interested in testing the implications of different parameter configurations for the effect of firing costs on average employment.

Combining (1) and (2) gives

$$P \cdot Q = gZN - bg^2N^2. \quad (6)$$

The firm's revenue function is concave in labour productivity and employment.

The firm faces a hiring cost  $T$  per new employee and a firing cost  $F$  per dismissed worker. If the worker quits, the firm bears no firing cost. We view  $F$  as a summary indicator of the strictness of employment-protection legislation. However, we must note that such restrictions have multiple dimensions that are not captured in our simple framework.<sup>5</sup>

The real wage  $w$  is assumed to grow at the same rate as *productivity*  $\mathbf{h}_g$ . In contrast, we assume that discrete jumps in demand are not reflected in the wage. This assumes the existence of real-wage rigidity which makes labour-demand shocks affect employment and not real wages. Importantly, we do not model the effect of firing costs on wages. In this we are supported by the empirical results of Bertola (1990) who shows – using a cross section of ten OECD countries – that firing costs did not prevent wages from adjusting following the oil-price shocks of the 1970s.

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<sup>5</sup> See footnote 1.



Using Itô's Lemma, the Bellman equation for the value  $V(Z, g, N)$  of the firm's stock of workers at time zero, in the continuation region is

$$\begin{aligned} \mathbf{r}V = & (gZN - bg^2N^2) - wN - \mathbf{d}NV_N + \mathbf{h}_g gV_g \\ & + \mathbf{h}_z ZV_z + \frac{1}{2} \mathbf{s}_z^2 Z^2 V_{zz} - \mathbf{I}_1 \{V - V[(1 - \mathbf{f}_1)Z]\} + \mathbf{I}_2 \{V[(1 + \mathbf{f}_2)Z] - V\}, \end{aligned} \quad (7)$$

where the value of future hires or fires is not taken into account and  $\mathbf{r}$  is the real rate of interest. The first term on the right-hand side is revenue,  $wN$  is the wage bill,  $\mathbf{d}NV_N$  is the loss due to quits,  $\mathbf{h}_g gV_g$  is the gain due to productivity growth, and the last three terms are the change in the value of the firm caused by changes in demand.

To find the value of the marginal employed worker, we take the derivative of (7) with respect to  $N$

$$\begin{aligned} (\mathbf{r} + \mathbf{d})v = & gZ - 2bg^2N - w - \mathbf{d}Nv_N + \mathbf{h}_g gv_g \\ & + \mathbf{h}_z Zv_z + \frac{1}{2} \mathbf{s}_z^2 Z^2 v_{zz} - \mathbf{I}_1 \{v - v[(1 - \mathbf{f}_1)Z]\} + \mathbf{I}_2 \{v[(1 + \mathbf{f}_2)Z] - v\}. \end{aligned} \quad (8)$$

where  $v(Z, g, N)$  is the value of employing the marginal worker. The solution for  $v(Z, g, N)$  consists of the particular integral and the complementary function. The particular integral, which is the expected present value of the marginal employed worker, is<sup>6</sup>

$$v^p(Z, g, N) = K_1 gZ - 2K_2 bg^2N - K_3 w, \quad (9)$$

where

$$\begin{aligned} K_1 = & (\mathbf{r} + \mathbf{d} + \mathbf{I}_1 \mathbf{f}_1 - \mathbf{I}_2 \mathbf{f}_2 - \mathbf{h}_g - \mathbf{h}_z)^{-1}, \\ K_2 = & (\rho + 2\delta - 2\eta_g)^{-1}, \\ K_3 = & (\mathbf{r} + \mathbf{d} - \mathbf{h}_g)^{-1} \end{aligned} \quad (10)$$

are the three discount factors.

The firm's option value of hiring in the future and its option value of firing once the worker is employed are measured by the complementary function:

<sup>6</sup> In particular, the particular integral may be expressed as

$$v(Z, g, N) = E \int_0^{\infty} [g_t Z_t - 2bg_t^2 N_t - w_t] e^{-(\mathbf{r} + \mathbf{d})t} dt$$

which reduces to equation (9) in the absence of hiring and firing.

$$\begin{aligned}
(\mathbf{r} + \mathbf{d})v = & -\mathbf{d}Nv_N + \mathbf{h}_g g v_g + \mathbf{h}_Z Z v_Z + \frac{1}{2} \mathbf{s}_Z^2 Z^2 v_{ZZ} \\
& - I_1 \{v - v[(1 - \mathbf{f}_1)Z]\} + I_2 \{v[(1 + \mathbf{f}_2)Z] - v\}.
\end{aligned} \tag{11}$$

Letting  $v^G$  be the value of the marginal option, the general solutions for the hiring and firing options have the following forms respectively (see Appendix I),

$$v_H^G(Z, g, N) = A_1 (gZ)^{\beta_1}, \tag{12}$$

$$v_F^G(Z, g, N) = A_2 (gZ)^{\beta_2}, \tag{13}$$

where  $\beta_1$  and  $\beta_2$  are the positive and negative roots of the following characteristic equation:

$$\frac{1}{2} \mathbf{s}_Z^2 \mathbf{b}(\mathbf{b} - 1) + \mathbf{h}_Z \mathbf{b} + \mathbf{h}_g \mathbf{b} - I_1 [1 - (1 - \mathbf{f}_1)^{\mathbf{b}}] + I_2 [(1 + \mathbf{f}_2)^{\mathbf{b}} - 1] - (\mathbf{r} + \mathbf{d}) \tag{14}$$

To satisfy the boundary conditions that  $v_H^G(0, g, N) = 0$  and  $v_F^G(\infty, g, N) = 0$ , we use the positive solution for  $v_H^G$  and the negative solution for  $v_F^G$ .

The value of the marginal, employed worker is equal to the sum of  $v^P$  and  $v_F^G$  in the continuation region. In order to derive the two thresholds for hiring and firing, we then compare the value of the worker to the direct and indirect costs of hiring (firing) the workers. The definitions of the hiring and firing barriers,  $Z_H$  and  $Z_F$ , are given by the value-matching and smooth-pasting conditions below. According to the value-matching conditions the firm would find it optimal to exercise its option to hire or fire the marginal worker once  $Z$  hits one of the two barriers:

$$K_1 g Z_H - 2K_2 b g^2 N - K_3 w + A_2 (g Z_H)^{\beta_2} = T + A_1 (g Z_H)^{\beta_1}, \tag{15}$$

$$- [K_1 g Z_F - 2K_2 b g^2 N - K_3 w] + A_1 (g Z_F)^{\beta_1} = F + A_2 (g Z_F)^{\beta_2}, \tag{16}$$

where  $T$  and  $F$  denote hiring and firing costs respectively. The left-hand sides of (15) and (16) show the marginal benefit from hiring/firing a worker and the right-hand sides the marginal costs.

The marginal benefit of hiring a worker is equal to the sum of the present discounted value of his productivity net of wages and the value of the option to fire him. The firm's ability to fire raises the benefit from employing a worker. The marginal cost of hiring is the sum of the direct hiring costs and the sacrificed option to hire him in the future. By hiring a worker today, the opportunity to do so in the future – when conditions may be more favourable – is sacrificed.

Similarly, by firing a worker, the opportunity to do so in the future – when demand conditions may be even more adverse – is sacrificed, and the opportunity to hire him again is gained. The value of the two options depends on expectations about changes in demand. The option to hire is valuable if firms expect demand to increase in the future, while the option to fire is the more important if they expect it to fall.

The smooth-pasting conditions ensure that hiring (firing) is not optimal either before nor after the hiring- (firing) threshold is reached.

$$K_1 g + A_2 \mathbf{b}_2 Z_H^{b_2-1} g^{b_2} = A_1 \mathbf{b}_1 Z_H^{b_1-1} g^{b_1}, \quad (17)$$

$$-K_1 g + A_1 \mathbf{b}_1 Z_H^{b_1-1} g^{b_1} = A_2 \mathbf{b}_2 Z_H^{b_2-1} g^{b_2}. \quad (18)$$

Equations (15), (16), (17) and (18) form a non-linear system of equations with four unknown parameters,  $Z_H$ ,  $Z_F$ ,  $A_1$  and  $A_2$ , and can be solved for numerically once the solutions for  $\beta_1$  and  $\beta_2$  are found from (14). The thresholds for hiring and firing a marginal worker can be found once numerical values for  $Z_H$  and  $Z_F$  are known.

## II. Macroeconomic factors

We now use the model above to examine how the employment effect of firing costs depends on productivity growth and the probability of adverse demand shocks.

According to our stylized account, most OECD countries experienced substantially higher productivity growth and substantially lower probability of adverse demand shocks in the 1950s and 1960s than subsequently in the 1970s and 1980s. We examine whether these secular changes could have affected the role firing costs play in promoting or hampering production and employment activity.

Accordingly, let us consider three scenarios. First, we let productivity grow at 2.5% per annum while the (net) probability of adverse demand shocks is kept at zero. We take this *benchmark scenario* as the analogue to the economic situation in many OECD countries during the 1950s and 1960s. Second, we consider the case of a 20% probability of a large downturn and a 5% probability of a positive jump in demand ( $Z'_H$  and  $Z'_F$ ) – where the size of the jumps is equal – while productivity growth remains at 2.5%. We call this the *downturn scenario*. Finally, we let productivity growth slow down to 1% while ignoring the possibility of demand shocks. This is the *low-productivity-growth* scenario. The last two scenarios – corresponding to low

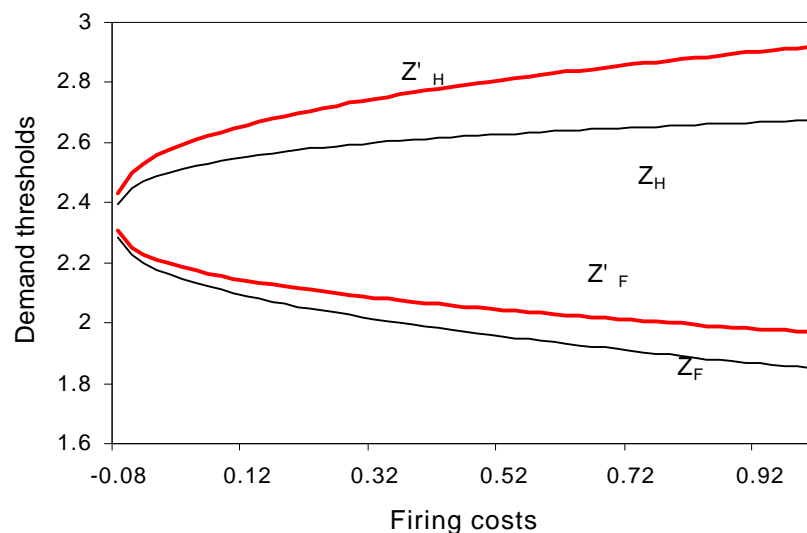
growth and a possibility of adverse demand shocks – are intended to throw light on the effect of changes in the macroeconomic environment between the 1960s, on the one hand, and the 1970s and 1980s, on the other hand.

We want to measure the effectiveness of raising firing costs under the three alternative scenarios. We start by defining what is meant by effectiveness:

**Definition:** The effectiveness of a given change in the level of firing costs is defined as the change in the level of the firing- (and hiring) threshold caused by a change in the level of the firing costs, given the values of the model’s parameters.

Figure 1 illustrates how the employment effects of firing costs depend on anticipations of cyclical downturns. In particular, it shows the effects of firing costs on the hiring- and the firing thresholds under the *benchmark* and *downturn scenarios*.

Note that the thresholds have been normalised to start at the same value.



**Figure 1. The downturn scenario.** The effect of firing costs on the hiring- and firing thresholds with parameters corresponding to a no-supply-shock period ( $\lambda_1 = \lambda_2 = 0$ ,  $\sigma_Z = 0.12$ ) and a supply-shock period ( $\lambda_1 = 0.20$ ,  $\lambda_2 = 0.05$ ,  $\phi_1 = \phi_2 = 0.3$ ,  $\sigma_Z = 0.01$ ). Other parameters:  $\eta_g = 0.025$ ,  $\eta_Z = 0.0$ ,  $\delta = 0.05$ ,  $\rho = 0.05$ ,  $T = 0.083$ , the initial value for  $N = 1$ , the initial value for  $g = 1$ , initial wage = 1. The latter thresholds are distinguished by a prime.

The effect of the expectation of an adverse demand shock makes the hiring threshold steeper and the firing threshold flatter. In the *benchmark scenario*, the hiring threshold is comparatively flat in relation to the firing threshold, whereas in the

*downturn scenario* the firing threshold is comparatively flat. In this way the negative effects of firing costs on hiring are increased in the *downturn scenario* while any beneficial effect on firing is reduced. We conclude that firing costs lose some of their effectiveness under this scenario.

The intuition behind the results is straightforward. When uncertainty primarily takes the form of a constant probability of a net drop in demand – either because a negative shock is more likely or because it is expected to be larger – the ability to change the timing of hiring is worth much less than the ability to change the timing of firing; by waiting, the firm is much more likely to gain valuable information about the optimal timing of firing than about the optimal timing of hiring. For this reason, the firing option is much more valuable than the hiring option.

As firing costs increase, the option value of firing falls as it becomes more expensive to dismiss workers. Firing costs now have only a muted effect on the total cost of firing because the indirect cost of firing – the sacrificed firing option – is reduced which offsets some of the direct effect of the firing costs. As a result, the firing threshold becomes relatively flat.

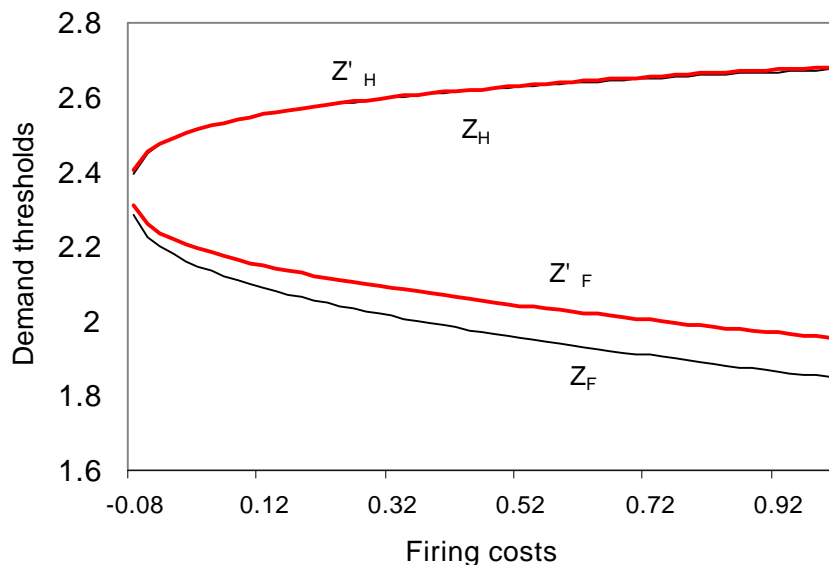
However, the slope of the hiring threshold is affected in the opposite way. When a fall in demand is expected, firms are hesitant to hire a new worker unless they think they will be able to fire him later. Higher firing costs make it difficult to fire workers and this reduces the value of the firing option and hence the benefit from hiring. As a result, the hiring threshold becomes steeper.

In sum, firms hesitate longer before hiring new workers when the level of firing costs is increased because the loss in the event of a bad shock – leading to the dismissal of some workers – is going to be greater. However, when the bad shock hits, firms will not hesitate before firing workers because they put a lower value on the firing option due to the higher costs of firing. It follows that the use of employment-protection legislation is not likely to help since it will primarily reduce incentives to hire workers. Empirical results by Davis et al. (1996) give empirical support for these results; rates of job destruction were not systematically lower in countries with higher employment protection, they were no higher in Europe than in the United States.<sup>7</sup>

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<sup>7</sup> Blanchard and Portugal (1998) compare job flows in Portugal – high employment protection – and the United States – low employment protection. They find that the annual rate of job creation in

Figure 2 describes how the employment effect of firing costs depend on the rate of productivity growth. In particular, it shows the *benchmark* and the *low-productivity-growth* scenarios. Importantly, we let wages grow at the same rate as productivity in both scenarios. The fall in the expected rate of growth of labour productivity also makes the firing threshold flatter but now without visibly affecting the slope of the hiring threshold. Again, firing costs become less effective at deterring layoffs.



**Figure 2. The low-productivity-growth scenario.** The effect of firing costs on the hiring- and firing thresholds with parameters corresponding to high growth of labour productivity ( $\eta_g = 0.025$ ) and low growth ( $\eta_g = 0.01$ ). Other parameters:  $\lambda_1 = \lambda_2 = 0$ ,  $\sigma_z = 0.12$ ,  $\eta_z = 0.0$ ,  $\delta = 0.05$ ,  $\rho = 0.05$ ,  $T = 0.083$ ,  $b = 0.5$ . Initial value for  $N = 1$  and initial value for  $g = 1$ ,  $w = 1$ . The latter thresholds are distinguished by a prime.

The question arises whether wage growth can realistically be expected to respond immediately to changes in the rate of labour productivity growth. One popular macroeconomics textbook discusses the implications of a slow realisation of changes in productivity (Blanchard (1999)). Measures of productivity growth tend to be very volatile and for that reason it may take time for workers and firms to realise that the trend rate of productivity growth has changed. A related argument can be found in a recent paper by Ball and Moffit (2001). Here the rate of technical progress shapes

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manufacturing (adjusted for differences in firm size) is higher in the U.S. while the rate of job destruction is very similar. This is in accordance with our model under the *downturn scenario*.

wage aspirations or wage norms. Workers gradually get used to and as a result learn to expect a given rate of wage increase. As a result, wage growth only adjusts to changes in the rate of productivity growth with a long lag since wage growth depends on the evolution of social norms which give the “fair” rate of wage increases. If these norms only reflect productivity growth with a lag then so do also wages.<sup>8</sup>

Relaxing the assumption that wage growth adjusts to changes in the rate of growth of productivity does not affect our results in Figure 2: the slopes of the two sets of thresholds in the *low-productivity-growth* scenario would remain the same. However, if wages continue to grow at rate 2.5% both the hiring and the firing thresholds will be positioned at a higher level than when they grow at rate 1%. Therefore, firms are less keen to hire and more willing to fire when wages continue to grow at rate 2.5% in spite of a slowdown in the rate of productivity growth. But our measure of the effectiveness of firing cost would be unaffected.

We conclude that at the aggregate level, firing restrictions may have little adverse effects on employment and possibly even a positive effect when productivity is growing and the possibility of large adverse demand shocks remote – provided that these firing restrictions do not lead to a sufficiently large wage increases (and that is a big if!) when workers’ bargaining power is enhanced (see Lindbeck and Snower (1988)). This could possibly explain why many European countries’ relatively stringent job security measures appear not to have had significant adverse employment effects in the first two decades following World War II. But lower growth in the past two decades (Maddison (1987)) and the higher probability of adverse shocks may have turned firing restrictions into a significant obstacle to employment creation and a likely cause of high unemployment.

### **III. Empirics**

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<sup>8</sup> Another rationale for lagged wage responses to productivity is given by Manning (1991). He uses an efficiency wage model to show that higher expected productivity growth – hence higher expected future wage growth – makes workers value their current employment more which then allows firms to pay lower (efficiency) wages. An increase in the rate of productivity will therefore not be followed by an instantaneous rise in the rate of wage growth.

The power of labour-market institutions in explaining cross-country differences in average unemployment has been widely documented.<sup>9</sup> In particular, average unemployment has been found to be positively correlated with measures of the unemployment-benefit replacement ratio, the duration of benefits, the density and the coverage of labour unions and, sometimes, the cost of firing. We include a survey of the literature on the employment effects of firing costs in Appendix II. In contrast, unemployment is inversely correlated with the degree of union- and employer coordination and the level of active labour-market expenditures.

Fitoussi et al. (2000) use measures of labour-market institutions for the period 1983-1988<sup>10</sup> as regressors in an equation explaining the variation in average unemployment in the 1980s in a group of 19 countries.<sup>11</sup> They find significant coefficients for the institutional variables.

Our model implies that the effect of institutions on unemployment depends on the macroeconomic environment – something which is neglected in the empirical studies cited above. In particular, our theoretical model indicates that the adverse effect of employment-protection legislation on employment should be greatest in periods of low growth and a high likelihood of adverse demand shocks.

In order to test this hypothesis, we first estimate an equation relating average unemployment to the institutional variables without taking the macroeconomic environment into account. We estimate the equation using alternatively average unemployment for the 1960s, 1970s, 1980s and 1990s to test for structural stability and report the results in the table below. We use the average value of the institutional variables for 1983-88 in the first three regressions and the average value for 1989-1994 in the last one.<sup>12</sup>

Our results are strongest for the 1980s and the 1970s. For the 1980s, all variables have significant coefficients with the expected sign and the equation explains close to

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<sup>9</sup> See eg. Nicoletti et al. (2001), Fitoussi et al. (2000), Nickell and Layard (1999), Elmeskov et al. (1998), Nickell (1998), Scarpetta (1996), Jackman, Layard and Nickell (1991), and Lazear (1990).

<sup>10</sup> Constructed by Nickell and Layard (1999).

<sup>11</sup> These are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, the U.K., and the U.S.

<sup>12</sup> We acknowledge that the stringency of firing restrictions has not remained constant over time. It increased after the oil-price shock in the mid 1970s (e.g. the U.K., the Netherlands and Sweden) and decreased in the early 1980s in many OECD countries (e.g. Germany, the Netherlands, Sweden, the U.K.). However, the timing of changes has been quite uniform across countries and there is perhaps little reason to believe that these changes have affected the relative rankings.



80% of the variation in unemployment. Most importantly, our measure of firing costs has a significant positive coefficient. The results for the 1970s go in the same direction but are slightly weaker, i.e. the coefficient of firing costs is now insignificant at the 5% level. The results for the 1960s and the 1990s are still weaker. In particular, firing costs do not have a significant coefficient at all in the 1960s. We can also reject the hypothesis that the coefficient has the same value for all four decades.<sup>13</sup>

The analysis in Section II of this paper suggests where to look for an explanation for the varying significance of the firing cost variable. In particular, the adverse effect of firing costs should be greatest in those countries having low rates of growth of productivity and facing large negative shocks to demand. We now pool the data for the four decades and use interactive terms to model the coefficient of firing costs. We first report the results of the pooled estimation without any interactive terms in column (5) where firing costs have an insignificant coefficient. We then let the value of the coefficient  $c$  depend on the level of trend growth of productivity in a given decade and the magnitude of the largest decline in real GDP during the decade,

$$c = c_0 + c_1 g_t + c_2 s_t \quad (19)$$

where  $g$  is the average annual rate of growth of labour productivity<sup>14</sup> during decade  $t$  and  $s$  denotes the largest proportional decline in real GDP during the decade. The results are reported in column (6) of the table.

In column (5) all the institutional variables have statistically insignificant – although correctly signed – coefficients. Allowing for the dependence of the effect of firing costs on trend productivity growth and the possibility of adverse shocks (equation (19)) then improves the equation considerably as can be seen in column (6). The equation now explains close to half the variation in the sample and the coefficients have gained some significance. Most importantly, the coefficients  $c_1$ ,  $c_2$  and  $c_3$  in equation (19) are all correctly signed and significant at the 5% level. Firing costs are positively correlated with unemployment in the absence of productivity growth and negative shocks. When we allow for shocks, we find that the larger was the biggest decadal fall in real GDP, the higher is the value of the coefficient of firing costs; a given level of firing costs

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<sup>13</sup>  $F = 18.90$  for  $H_0$ : The coefficient is the same for all decades. This gives a rejection at the 5% confidence level.

<sup>14</sup> Measured as real GDP per employed worker and smoothed by the Hodrick-Prescott filter (smoothing parameter equal to 100).

causes unemployment to be higher. In contrast, the coefficient of firing costs is inversely related to trend productivity growth. The higher is the growth of labour productivity, the smaller is the (positive) effect of firing costs on unemployment.

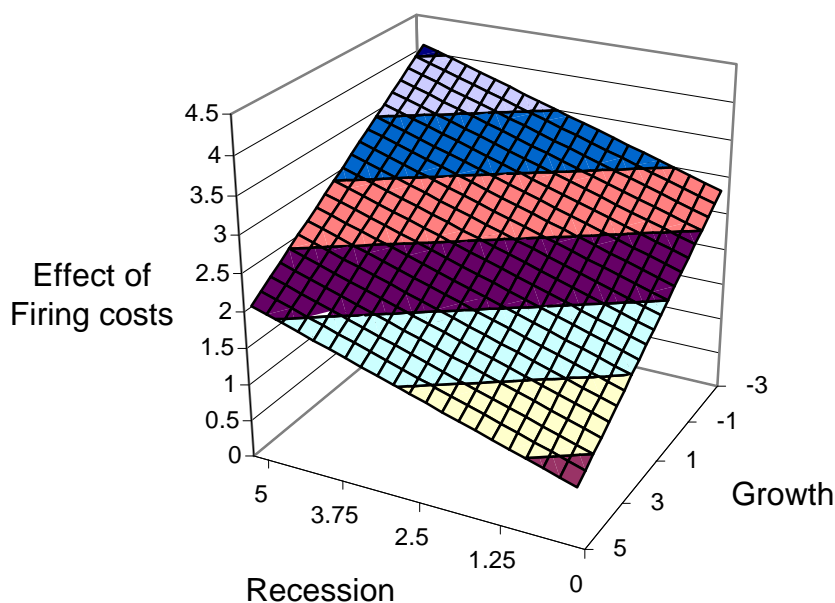
## Average Unemployment and Labour-Market Institutions

	1960-69 (1)	1970-79 (2)	1980-89 (3)	1990-99 (4)	Pooled (5)	Pooled (6)
Constant	4.50* (3.57)	5.31* (3.28)	5.02* (2.00)	2.81 (0.67)	7.15 (3.71)	6.76* (3.98)
Replacement ratio	0.01 (0.99)	0.03* (2.55)	0.12* (2.95)	0.06 (0.86)	0.04 (0.87)	0.04* (1.77)
Duration of benefits	-0.50* (2.53)	-0.34 (1.38)	0.79* (2.13)	1.30* (2.13)	0.13 (0.55)	-0.16 (0.60)
Employer coordination	-0.30 (0.58)	-0.58 (1.02)	-3.95* (3.46)	-2.34 (1.00)	-0.96 (0.57)	-2.17* (2.47)
Union coordination	-1.50* (1.81)	-2.31* (2.70)	-3.06* (2.35)	-2.76 (1.49)	-2.00 (1.32)	-1.13 (1.02)
Union density+union cov.	0.04 (1.67)	0.06* (1.79)	0.08 (1.68)	0.11* (1.75)	0.02 (0.61)	0.03 (0.88)
Labour-market expenditure	-0.04* (2.01)	-0.06* (2.46)	-0.09* (2.14)	-0.07 (1.33)	-0.02 (0.47)	-0.05 (1.16)
<b>Firing costs</b>	0.23 (0.82)	0.43 (1.40)	1.93* (3.28)	2.76 (1.68)	0.54 (1.18)	2.05* (3.31)
<b>Firing costs*growth</b>						-0.25* (2.27)
<b>Firing costs*largest adverse shock</b>						0.26* (3.01)
R <sup>2</sup>	0.62	0.63	0.79	0.48	0.12	0.43
Adjusted R <sup>2</sup>	0.37	0.39	0.65	0.14	0.03	0.35
Observations	19	19	19	19	76	76

\* denotes significance at 5% level. Source: Author's calculations using data supplied by Richard Layard and Stephen Nickell. The table shows regressions of the form;  $u_t = \mathbf{a} + \mathbf{b} Y + \mathbf{e}$ , where  $u_t$  is the average unemployment rate in a given decade and  $Y$  is the set of explanatory variables. The institutional measures<sup>15</sup> are averages for the nineteen countries for the period 1983-1988 – first three columns – and 1989-94 – fourth column. Growth measures average trend growth of labour productivity over a decade – measured as real GDP per employed worker – and the largest adverse shock to GDP is taken to be the largest rate of decline in aggregate real GDP between any two years during the decade.

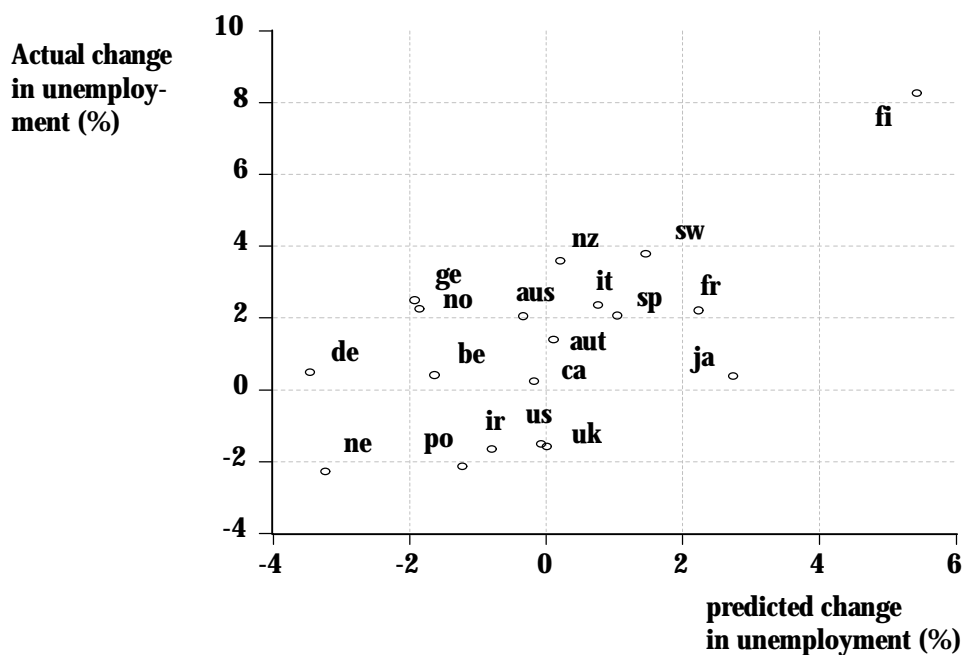
<sup>15</sup> The replacement ratio is defined as the ratio of unemployment benefits to wages; the duration of benefits is the maximum number of months that workers can collect unemployment benefits; union density measures the proportion of the labour force belonging to labour unions; union coverage shows the proportion of the labour force covered by union wage settlements; union- and employer coordination are indices for coordination among different unions and employers during wage bargaining; labour market expenditures is expenditure on active labour market programmes per unemployed person as a percentage of output per person; and, finally; firing costs are measured by the number of months salary that goes into mandatory redundancy payments. Source: Nickell and Layard (1999).

In order to illustrate our results further we plot the coefficient of firing costs as a function of the average rate of growth over the decade and the size of the largest recession in Figure 3.



**Figure 3. The effect of firing costs on unemployment.** The coefficient of firing costs shown as a function of the average rate of growth of productivity and the magnitude of the largest recession – measured as the largest proportional fall in real GDP – over a decade.

The question remains if changes in firing costs, productivity growth and the size of anticipated shocks can account for differences in the change in average unemployment over time across the nineteen countries. We have measures of firing costs for both the period 1983-1988 and 1989-1994. We can use these measures, as well as data on productivity growth and the size of the shocks in the two decades, to predict changes in average unemployment between the 1980s and the 1990s.<sup>16</sup> The results are shown in Figure 4.



**Figure 4. Predicted and actual change in average unemployment 1980-89 to 1990-99.** The prediction is based on the coefficient of firing costs reported in the table above and shown in Figure 3.

The equation does a good job at explaining the rise in unemployment as can be seen from the high correlation between the predicted and the actual rise in unemployment (0.62).

#### IV. Conclusions

Macroeconomic outcomes reflect the interplay of institutions, macroeconomic shocks and policy responses. It follows that one should not study macroeconomic policy without paying attention to the institutional environment: A given set of policies may be appropriate in one country and not in another due to institutional differences. Similarly, institutional reforms – such as those recommended by the OECD – may be sensible in a given macroeconomic environment and not in another. We conclude that a sensible formulation of structural reforms requires understanding of the interplay

<sup>16</sup> The formula is the following where  $g$  denotes productivity growth and  $s$  the size of the largest negative shock,

$$u_{90s} - u_{80s} = 2.05 * (epl_{90s} - epl_{80s}) - 0.25[(g_{90s} - g_{80s})epl_{80s} + g_{80s}(epl_{90s} - epl_{80s})] + 0.26[(s_{90s} - s_{80s})epl_{80s} + s_{80s}(epl_{90s} - epl_{80s})]$$

between institutions, the nature of cyclical shocks and the level of labour productivity growth. We hope this paper contributes to this understanding.

We have found that firing costs have an adverse effect on employment in a macroeconomic environment where the rate of productivity growth is low and large negative shocks are expected. A failure to take this interaction into account may help explain the lack of consensus among authors on the effect of employment protection on unemployment and, much more importantly, lead to incorrect policy recommendations.

## Appendix I

### Derivation of Equations (12) and (13)

The general solution to equation (11) has the same component as the complementary ones. That is, the general solution has the following functional form

$$v = A(gZ)^b. \quad (\text{A1})$$

This gives the following relationships

$$\mathbf{h}_g g v_g = \mathbf{h}_g \mathbf{b} v, \quad (\text{A2})$$

$$dN v_N = 0. \quad (\text{A3})$$

$$\mathbf{h}_Z Z v_Z = \mathbf{h}_Z \mathbf{b} v, \quad (\text{A4})$$

$$\frac{1}{2} \mathbf{s}_Z^2 Z^2 v_{ZZ} = \frac{1}{2} \mathbf{s}_Z^2 \mathbf{b} (\mathbf{b} - 1) v, \quad (\text{A5})$$

$$v[(1 - \mathbf{f}_1)Z] = (1 - \mathbf{f}_1)^b v. \quad (\text{A6})$$

$$v[(1 + \mathbf{f}_2)Z] = (1 + \mathbf{f}_2)^b v. \quad (\text{A7})$$

Substituting (A2), (A3), (A4), (A5) (A6) and (A7) into (10) in the text gives

$$v \left[ \frac{1}{2} \mathbf{s}_Z^2 \mathbf{b} (\mathbf{b} - 1) + \mathbf{h}_Z \mathbf{b} + \mathbf{h}_g \mathbf{b} - I_1 [1 - (1 - \mathbf{f}_1)^b] + I_2 [(1 + \mathbf{f}_2)^b - 1] - (\mathbf{r} + \mathbf{d}) \right] = 0. \quad (\text{A8})$$

Equation (A8) must hold for any value of  $v$ , so that bracketed terms must equal zero:

$$\frac{1}{2} \mathbf{s}_Z^2 \mathbf{b} (\mathbf{b} - 1) + \mathbf{h}_Z \mathbf{b} + \mathbf{h}_g \mathbf{b} - I_1 [1 - (1 - \mathbf{f}_1)^b] + I_2 [(1 + \mathbf{f}_2)^b - 1] - (\mathbf{r} + \mathbf{d}) = 0. \quad (\text{A9})$$

Thus, (A1) becomes

$$v = A_1 (gZ)^{b_1} + A_2 (gZ)^{b_2}. \quad (\text{A10})$$

where  $b_1$  and  $b_2$  are the positive and negative roots of (A8).

The general solutions are equal to the value of the options to fire or hire the marginal worker. When  $Z$  goes to infinity, the value of the option to fire has to go to zero. Hence  $A_1$  is equal to zero for the value of option to fire.<sup>17</sup> Similarly, When  $Z$

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<sup>17</sup> Note that  $\beta_1$  is positive and  $\beta_2$  is negative.

approaches zero, the value of the option to hire has to go to zero. Hence we set  $A_2 = 0$  for the value of option to fire. The general solutions for the hiring and firing options have the following forms respectively,

$$v_H^G(N, Z, g) = A_1(gZ)^{b_1}, \quad (\text{A11})$$

$$v_F^G(N, Z, g) = A_2(gZ)^{b_2}. \quad (\text{A12})$$

## **Appendix II**

### **Literature survey on the effects of employment protection on unemployment**

There is a growing literature – theoretical as well as empirical – on the effects of employment protection legislation on both the variance of unemployment as well as the average level of employment and unemployment.

Bentolila and Bertola (1990), Bertola (1992) and Layard and Nickell (1998) show that firing costs are likely to reduce unemployment turnover and make the unemployment pool more stagnant. Blanchard and Portugal (1998) concur in their comparison of the Portuguese and the US labour markets.<sup>18</sup> However, they claim that the implications of lower turnover for the average unemployment rate are unclear. In an earlier paper, Gavin (1986) finds that the effect depends on the state of demand: Employment is raised when demand is low, but decreased when demand is high. The net effect on average employment is indeterminate. Interestingly, Bentolila and Bertola (1990) give a more definite answer. They show that due to time discounting, the effect of firing costs on the firing decision should dominate their effect on the hiring decision – firms discount the firing costs when making the hiring decision. Holding wages fixed and exogenous, they show that the average level of labour demand is likely to rise when the firing restrictions are made more stringent.

While the effect of EPL on labour turnover appears empirically to be well documented, there is less agreement when it comes to the average level of employment and unemployment. Lazear (1990) studies data on employment protection, employment, unemployment and labour-force participation in 22 countries over a

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<sup>18</sup> However, studies of employment turnover (Bertola and Rogerson (1997) and Boeri (1999) find similar job creation and job destruction rates across countries with different EPL regimes. This may suggest more frequent job-to-job shifts in the rigid labour markets.

period of 29 years.<sup>19</sup> He finds a significantly negative effect of EPL on the employment-population ratio and the labour-force participation rate. Scarpetta (1996) finds an inverse relationship between firing costs and the employment-to-population ratio using a panel of OECD countries. However, Nickell and Layard (1998) claim that this result may be largely caused by low participation rates in southern Europe which also happen to have strict EPL. There is also limited consensus on the effect of EPL on unemployment. While Layard and Nickell (1998) find no such effect, Lazear (1990) found a significant positive effect, as did Elmeskov, Martin and Scarpetta (1998) using the OECD summary index of formal employment protection. However, Addison and Grosso (1996) find no significant evidence when using data similar to those used by Lazear. Moreover, in an earlier paper, Blanchard and Jimeno (1995) point out that the degree of enforcement of employment protection differs significantly between Spain and Portugal despite similar summary indicators of the strictness of the legislation. DiTella and MacCulloch (1998) take this criticism seriously and use data based on surveys of business people over the 1980s and find a positive relationship between EPL regulation and unemployment. Finally, in a recent contribution, Blanchard and Landier (2000) show that limited liberalisation – which makes fixed-term contracts easier to implement – may paradoxically raise average unemployment by raising turnover and unemployment among temporary workers.

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<sup>19</sup> He measures EPL by the number of months of salary given to workers as severance pay upon dismissal after ten years of service and the number of months notice required before termination to workers with ten years of service.



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