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Fixed-term contracts and the dynamics of labour demand

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Abstract

We estimate a model of labour demand that accounts for dynamics arising from the relative costs of hiring and firing workers on either indefinite-term contract (ITC) or fixed-term contract (FTC). We use a panel of 1000 French firms, for which we can measure the number of entries and exits for each type of contract between 1988 and 1992. Our estimates suggest that (1) it is much more costly to lay off workers under ITC than to hire them; (2) it is much less costly to adjust the number of FTC than to adjust the number of ITC; (3) the asymmetry between hiring and lay off costs is more important for non-production than for production workers.

JEL classification: J23; J30; D21

Keywords: Fixed-term contracts; Adjustment costs; Dynamic labour demand

Significant firing costs are often pointed out as one of the most important sources of rigidity in continental European labour markets. The presumed negative effect of firing costs on employment is no doubt one of the reasons why most European countries have introduced reforms allowing a wide use of fixed-term labour contracts (see OECD, 1993; Hartog and Theeuwes, 1993).

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De facto, a lot of European employers can now bypass the regulations of dismissals by offering fixed-term instead of indefinite-term contracts. In the early 1990s, about 10% of French and German workers and 30% of Spanish workers were under fixed-term contracts. These contracts have become the most common method of hiring. For instance, in 1992, about 80% of all entries into French private for-profit establishments were made through fixed-term contracts.

Curiously, little work has been devoted to evaluating the effects of the recent promotion of fixed-term contracts in Europe. However, the diffusion of these short-term contracts has given rise to a lot of questions. How do firms choose between temporary and permanent workers? What are the relative costs of hiring a permanent worker instead of a temporary one? What is the cost structure for adjusting the number of permanent workers? What would be the effects of new measures that reduce the relative costs of fixed-term contracts? Would they reduce the number of permanent jobs?

Using a panel of Spanish firms, Bentolila and Saint-Paul (1992) suggest that the cyclical sensitivity of labour demand has increased with the introduction of flexibility measures. However, their data do not allow for the number of permanent workers or for the flows of temporary workers into the different firms to be identified. This data limitation prevents the authors from estimating the structure of adjustment costs. In a recent paper, Abowd and Kramarz (1995) analyse a dataset, which provides some direct measures to the gross adjustment costs for a representative sample of French establishments from 1992. They suggest that the hiring costs are much less important than the firing costs in France. However, their estimates are based on a single cross-section of establishments, and the results may be due to compositional effects rather than to any single firm's cost structure.

In this paper, we try to go a bit further and make some steps towards a better understanding of the dynamic demand for labour when fixed-term contracts are available. We use a sample of French firms, for which we can measure annual worker entries and exits for both fixed-term and unlimited labour contracts.

The paper is organized as follows. In the next section we develop the dynamic model of labour demand, which is the basis of our econometric exercise. The representative firm must take into account the costs of hiring workers on fixed-term contracts (FTC) and indefinite-term contracts (ITC) as well as the costs of terminating workers under either FTC or ITC. In this model, FTC can be transformed into ITC and the hiring of FTC workers represents a means for both temporary and permanent labour adjustments. In Sections 2 and 3, we describe our French data and summarize the relevant features of the French legislation. In Section 4, we present the econometric results, which do not reject our basic labour demand model. They suggest that (1) it is much more costly to layoff workers than to hire them; (2) it is much less costly to adjust the number of FTC than to adjust the number of ITC; (3) the adjustment costs for production

workers have the same basic structure as the adjustment costs for non-production workers. In the last section, we discuss the policy implications for our results.

1. Theoretical considerations

The standard approach to labour demand does not take account of FTC. When employers experience a positive shock to their labour demand, they do not necessarily increase their labour input: such a strategy may indeed imply important firing costs in the following periods, especially if the positive shock turns out to be transitory. The problem is different when employers can use FTC: if they expect the positive shock to be transitory, they can simply choose to hire temporary workers.

In other words, the recent reforms of the European labour markets have modified the basic problem of firms. Their objective is not only to smooth the level of employment over time, it is also to choose between a high- and a low-turnover strategy. The high-turnover strategy consists of a lot of hiring under FTC, which implies a lot of hiring costs while diminishing firing costs. On the contrary, the low-turnover strategy means hiring mostly under ITC, implying minimum hiring costs, but maximum firing costs.

We do not know very much about the mechanisms that explain companies' choices between high-turnover and low-turnover strategies. In particular, we do not know the cost structure associated with the different labour contracts. However, since the early 1980s, research on the dynamic demand for labour has burgeoned. The main advances have come from studying the implications of adjustment costs for the observed path of labour demand. The standard model assumes strictly convex and symmetric adjustment costs. Nickell (1978, 1986) studied the presence of linear adjustment costs while Hamermesh (1989) analysed the presence of fixed costs (see also Holtz-Eakin and Rosen, 1991; Hamermesh, 1992; Caballero et al., 1995). More recently, some authors have found support for asymmetric adjustment costs (see, for instance, Pfann and Verspagen, 1989; Bresson et al., 1992; Schiantarelli and Sembenelli, 1993; Jaramillo et al., 1993; Pfann and Palm, 1993). However, none of the papers regarded as authoritative have studied the structure of adjustment costs when FTC are available (for a survey, see Hamermesh and Pfann, 1996a). Our model is an attempt to make one step in that direction.

1.1. The model

We assume that technology can be represented by a production function F that depends only on labour. To be more specific, we have

$$y_{jt} = F(l_{jt}, \varepsilon_{jt}), \tag{1}$$

where y_{jt} is the output of firm j and l_{jt} its labour input. The ε_{jt} variable represents a productivity shock observed at the beginning of the $[t, t+1]$ period.

Worker entries and exits under ITC are assumed to take place at the beginning of the different periods after the realization of ε_{jt}. We denote by h_{jt} the number of workers hired under ITC at the beginning of $[t, t+1]$, and by f_{jt} the number of ITC workers who are laid off at the beginning of the same period. FTC last only one period, at the end of which they are either terminated or transformed into ITC. We denote by s_{jt} the number of workers hired on FTC at the beginning of $[t, t+1]$, and by t_{jt} (r_{jt}) the number of FTC that are transformed (not transformed) into ITC during the $[t, t+1]$ period. With these notations, we have

$$s_{jt} = r_{jt} + t_{jt}. \tag{2}$$

If x_{jt} represents the number of workers under ITC in firm j at the end of $[t, t+1]$, we also have

$$x_{jt} = x_{jt-1} + h_{jt} + t_{jt} - f_{jt} - q_{jt}, \tag{3}$$

where q_{jt} represents the number of ITC that are terminated at the beginning of $[t, t+1]$, but that do not correspond to layoffs (i.e., voluntary quits, firings for cause, retirements, etc.). We assume that q_{jt} is not under the control of the firm and that it can be considered exogenous.

In the remainder of the paper, we shall assume that when firm j hires s FTC workers at the beginning of a given period, it can transform a maximum of θs FTC into ITC at the end of the period (with $0 \leqslant \theta \leqslant 1$). It yields

$$0 \leqslant t_{jt} \leqslant \theta s_{jt}. \tag{4}$$

The θ parameter corresponds to the retention rate (i.e., one minus the quit rate) for temporary workers. It can also be interpreted as the probability that a worker meets the requirements for long-term employment relationships given that he meets those for short term. The trade-off between direct ITC hiring and FTC transformations depends on this θ parameter: the higher θ is, the easier the selection of ITC workers through FTC hiring.

Now, let us write the firm's programme. The labour input during the $[t, t+1]$ period can be written as

$$l_{jt} = x_{jt} + r_{jt} \tag{5}$$

and the one-period return to labour input is

$$R_{jt} = F(x_{jt} + r_{jt}, \varepsilon_{jt}) - w_{\mathrm{I}jt}(x_{jt} - t_{jt}) - w_{\mathrm{D}jt}(r_{jt} + t_{jt}), \tag{6}$$

where $w_{\mathrm{I}jt}$ denotes the wage paid to ITC workers and $w_{\mathrm{D}jt}$ the wage paid to FTC workers.

With this notation, the firms' objective function can be written as

$$V_{jt} = \mathrm{E}_t\left\{\sum_{k=t}^{\infty} \delta^{k-t}(R_{jk} - C_H(h_{jk}) - C_S(r_{jk} + t_{jk}) - C_F(f_{jk}) - C_R(r_{jk}))\right\}$$

$$\text{subject to } h_{jk} \geqslant 0, \quad r_{jk} \geqslant 0, \quad f_{jk} \geqslant 0, \quad t_{jk} \geqslant 0,$$

$$\theta\, r_{jk} - (1-\theta)t_{jk} \geqslant 0,$$

$$x_{jk} = x_{jk-1} + h_{jk} + t_{jk} - f_{jk} - q_{jk}, \tag{7}$$

where the δ parameter represents the real discount rate while $C_H(h)$ represents the cost of hiring h ITC workers, $C_S(s)$ the cost of hiring s FTC worker and $C_F(f)$ the cost of terminating f ITC workers for economic reasons (i.e., layoffs). Lastly, the $C_R(r)$ function represents the cost of terminating r FTC workers.

For each $K \in \{H, S, F, R\}$, the C_K function is assumed differentiable and strictly convex. We also assume $C'_H(0) = C'_F(0)$ so that the cost of adjusting the number of ITC workers is differentiable at zero.

The problem of firm j is to maximize V_{jt}. We give a detailed analysis of this problem in Goux et al. (1999). In the following subsection, we only present the main results and conditions to be used in subsequent econometric analysis.

1.2. The Euler conditions

Since the C_F function is strictly increasing with f_{jt} and C_H strictly increasing with h_{jt}, the firm never chooses both f_{jt} and h_{jt} positive. There is no hiring (layoffs) of ITC workers when layoffs (hiring) occur. Within this framework, the marginal cost of adjusting the number of ITC workers is equal to $C'_H(h_{jt}) - C'_F(f_{jt})$ and the Euler conditions from which the representative firm operates can be written as

$$E_t\{z_{jt} - (C'_H(h_{jt}) - C'_F(f_{jt})) + \delta(C'_H(h_{jt+1}) - C'_F(f_{jt+1}))\} = 0, \tag{8}$$

where $z_{jt} = \partial F(l_{jt}, \varepsilon_{jt})/\partial l - w_{1jt}$ is the gross marginal return to permanent labour.

Condition (8) means that the optimal decision is such that the current marginal return to one supplementary ITC worker (i.e., $z_{jt} - (C'_H(h_{jt}) - C'_F(f_{jt}))$) is equal to the discounted expected marginal cost for this adjustment (i.e., $\delta \mathrm{E}_t(C'_F(f_{jt+1}) - C'_H(h_{jt+1}))$).

The second first-order condition corresponds to the trade-off between direct hiring under ITC on the one hand, and transformations of FTC into ITC, on the other. When a firm chooses to transform some FTC into ITC (i.e., when $t_{jt} > 0$), then t_{jt} is such that the marginal return to one supplementary ITC through FTC transformation is equal to the marginal return to one supplementary ITC through direct adjustment. Since one supplementary transformation and one

supplementary hiring have the same impact on the expected costs and profits,[1] this condition corresponds to the equality between the current one-period marginal returns to FTC transformation and ITC direct hiring. This condition can be written as

$$\begin{aligned}&\text{if } t_{jt} > 0 \text{ then}\\ &z_{jt} - (C'_H(h_{jt}) - C'_F(f_{jt}))\\ &\quad = (z_{jt} - \Delta w_{jt} - C'_S(r_{jt} + t_{jt}))\\ &\qquad + \frac{r_{jt}}{t_{jt}}\,(z_{jt} - \Delta w_{jt} - C'_S(r_{jt} + t_{jt}) - C'_R(r_{jt})),\end{aligned} \tag{9}$$

where Δw_{jt} stands for $(w_{Djt} - w_{Ijt})$.

The left-hand side of Eq. (9) represents the marginal return to one supplementary ITC through direct adjustments (i.e., through variations in either the number of layoffs or hiring) while the right-hand side represents the marginal return to one supplementary ITC through FTC transformation. De facto, in order to perform one supplementary transformation, it is not only necessary to hire and transform one FTC, but also to hire and terminate r_{jt}/t_{jt} other FTC (i.e., those that are not selected). The marginal return of one supplementary ITC through FTC transformation thus corresponds to the return to one transformed FTC (i.e., $(z_{jt} - \Delta w_{jt} - C'_S(r_{jt} + t_{jt}))$) plus the net returns to the r_{jt}/t_{jt} pure FTC (i.e., each of which implies a net return equal to $(z_{jt} - C'_S(r_{jt} + t_{jt}) - C'_R(r_{jt}) - \Delta w_{jt})$).

After multiplying by t_{jt} and some manipulations, Eq. (9) can be rewritten as

$$r_{jt} z_{jt} = s_{jt} C'_S(s_{jt}) + s_{jt}\Delta w_{jt} + r_{jt} C'_R(r_{jt}) - t_{jt}(C'_H(h_{jt}) - C'_F(f_{jt})), \tag{10}$$

while the Euler condition (i.e., Eq. (8)) implies

$$r_{jt} z_{jt} = \mathrm{E}_t\{r_{jt}(C'_H(h_{jt}) - C'_F(f_{jt})) - \delta r_{jt}(C'_H(h_{jt+1}) - C'_F(f_{jt+1}))\}. \tag{11}$$

Combining the two, we thus have

$$\begin{aligned}&s_{jt} C'_S(s_{jt}) + s_{jt}\Delta w_{jt} + r_{jt} C'_R(r_{jt}) - t_{jt}(C'_H(h_{jt}) - C'_F(f_{jt}))\\ &\quad = E_t\{(C'_H(h_{jt}) - C'_F(f_{jt}))r_{jt} - \delta(C'_H(h_{jt+1}) - C'_F(f_{jt+1}))r_{jt}\}.\end{aligned} \tag{12}$$

Basically, Eq. (12) means that – at the optimum – the marginal unit costs for FTC hiring (left-hand side of (12) divided by r_{jt}) are equal to the marginal unit costs for permanent ones (right-hand side divided by r_{jt}). The most interesting feature of this relationship is that it is independent of z_{jt} (i.e., of both F and ε_{jt}) which is why our econometric investigation will focus on this equation.

[1] At the beginning of the next period, the impact of one supplementary ITC does not depend on whether it corresponds to a direct ITC hiring or to an FTC transformation.

For the remainder of the paper, we shall assume that the different adjustment costs are quadratic,

$$C_K(y) = \tfrac{1}{2}c_K y^2 \quad \forall y \geqslant 0 \text{ and } \forall K \in \{H, S, F, R\}.$$

If w_{jt} represents the average wage in firm j, we also suppose that the ITC/FTC wage differential $\Delta w_{jt}/w_{jt}$ is constant. We denote this ratio by ϕ.

Under this assumption, Eq. (12) can be rewritten as follows:

$$\mathrm{E}_t\left\{\widetilde{h_{jt}} - \widetilde{f_{jt}}) - \frac{(c_F - c_H)}{2c}(\widetilde{h_{jt}} + \widetilde{f_{jt}}) - \frac{c_S}{c}s_{jt}^2 - \frac{c_R}{c}r_{jt}^2 - \phi w_{jt}s_{jt}\right\} = 0, \quad (13)$$

where $\widetilde{x_{jt}}$ stands for $(s_{jt}x_{jt} - \delta r_{jt}x_{jt+1})$ and where c stands for $(c_H + c_F)/2$.

The basic interpretation for Eq. (13) is strictly the same as the one given previously for Eq. (12). With this specification, the structure of adjustment costs can be recovered by regressing an adequate measurement of the net flows (i.e., $(\widetilde{h_{jt}} - \widetilde{f_{jt}})$) on adequate measurements of the gross flows.

Indeed, the main purpose of our econometric analysis is to generate consistent estimates for the different parameters in Eq. (13). The ϕ parameter represents the ITC/FTC wage differential. The $(c_F - c_H)/2c$ parameter measures the asymmetry between the hiring and termination costs of ITC workers, while the joint evaluation of c_S/c and c_R/c makes it possible to compare the hiring and termination costs of FTC workers. In order to test $(c_H > 0)$, we only need to test that $(c_F - c_H)/2c = (c_F - c_H)/(c_F + c_H) < 1$.

2. Data and basic facts

In this paper we use a balanced panel of 915 firms from the French manufacturing sector. These firms represent about 5% of the total employment in the French manufacturing sector and about 12% of the total output of this sector. Between 1988 and 1992, they lost about 0.9% of their jobs each year, which is close to the annual average job destruction rate in the French manufacturing industry during this period. This dataset has been constructed by the French National Institute for Statistics and Economic Surveys (INSEE). In the appendix, we give some supplementary information about its construction.

For each firm and each year between 1988 and 1992, we have (i) the number of entries under FTC (i.e., s_{jt}), (ii) the number of entries under ITC (i.e., h_{jt}), (iii) the number of layoffs (i.e., f_{jt}), (iv) the number of FTC terminations (i.e., r_{jt}) and (v) the number of other separations (i.e., q_{jt}, volontary quits, firings for cause, retirements). These variables are available for both production and non-production workers. For each firm and each year between 1988 and 1992, we also have information about the average wage.

Our dataset does not provide direct measurement of the number of FTC that are transformed each year into ITC. Our measurement of t_{jt} is equal to the difference between the number of entries under FTC (s_{jt}) and the number of exits of FTC workers (r_{jt}). In our dataset, the measurement of t_{jt} represents on average 4.4% of total employment which is close to the figures reported in Thiery and Torelli (1994). About one-third of the FTC is transformed into ITC each year.

2.1. Some basic statistics

Generally speaking, the annual firing and hiring rates for our panel of firms are very close to those reported by the INSEE and the French Labour Ministry for the entire population of firms that respond to the DMMO (see Thiery and Torelli, 1994).

The average annual variations in total employment for our panel of firms reflect the sharp changes in the French macroeconomic situation between 1988 and 1992 (see Fig. 1). Indeed, the average growth rate for our firms declined from about $+1.5\%$ in 1989 during the economic boom of the late 1980s to about -3% in 1992 during the last French downturn.

The different categories of hirings all contribute to labour force adjustment across the business cycle: the rate of direct hiring under ITC (h_{jt}) is about 4.4% of total employment in 1989 but only 3.2% in 1992 and the rate of FTC terminations (which corresponds to pure FTC hirings) is about 9.7% in 1989 and 7.2% in 1992. The rate of FTC transformation is even more pro-cyclical: it is about 6.5% of total employment in 1988 and 2.1% in 1992. As it turns out, the hiring of FTC workers represents a means for adjusting both temporary and permanent work force.

Concerning workers' exits, our data suggest that layoffs are the only category of separations that contribute to labour force adjustments. Indeed, the rate of layoffs is strongly contra-cyclical, with 0.5% of total employment in 1989 and 1.8% in 1992. The number of firms that laid off at least one worker represents 21% of the firms in 1989 and 36% in 1992. Layoffs represent a significant means of adjustment across the business cycle even if they only concern a small fraction of the firms. On the contrary, the firing for cause rate is very stable across the business cycle and remains close to 1% of total employment. The rate of voluntary quits is on average much higher than the rate of firing for cause (about 4%). It has, however, the same slightly pro-cyclical pattern.

Table 1 reports the correlation coefficients between the different categories of workers' flows and the employment growth rates across firms. In this analysis, the employment growth rate corresponds to the net flows of workers (i.e., the sum of entries minus the sum of exits). Variables are taken in first differences in order to eliminate the fixed effects of the measurement errors. It turns out that the different hiring rates are all significantly and positively correlated with

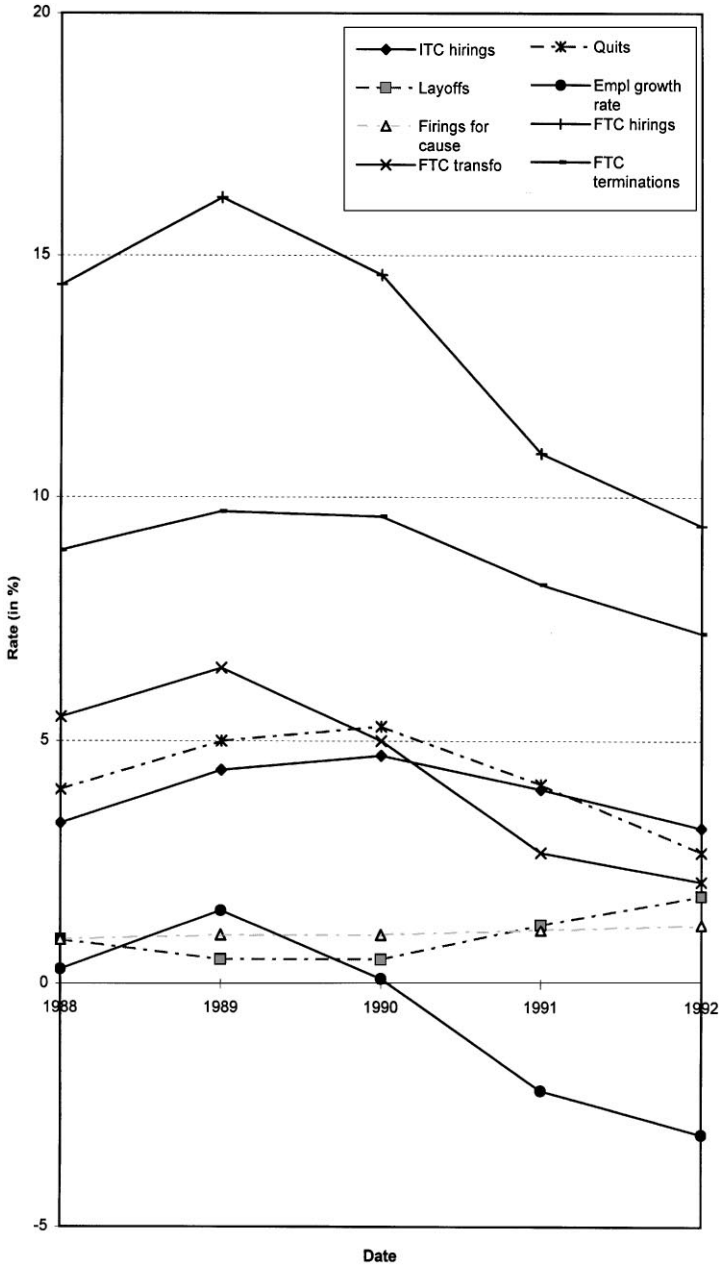

Fig. 1. Hiring and firing rates, 1988–1992.

Table 1
Correlation between hiring and firing rates and employment growth rate[a,b]

Gross flows	Date				Average 1988–1991
	1988	1989	1990	1991	
ITC hiring (h_t)	0.26	0.34	0.30	0.37	0.32
FTC transformations (t_t)	0.71	0.70	0.68	0.59	0.67
Total ITC creations ($h_t + t_t$)	0.66	0.68	0.61	0.58	0.64
FTC hiring (s_t)	0.51	0.46	0.50	0.46	0.49
Layoffs (f_t)	− 0.31	− 0.28	− 0.37	− 0.57	− 0.41
Quits (q_t)	(− 0.04)	− 0.07	− 0.07	− 0.09	(− 0.04)
Firings for cause (f_{ct})	(− 0.07)	− 0.12	− 0.19	− 0.15	− 0.13

[a] *Source*: DMMO-BIC panel, 1988–1992, Insee.
[b] All the variables are taken in first difference. The correlation coefficients are all significant at the 1% level except those in parentheses.

Reading: Let g_t denote the variation in the number of workers during period t. In 1988, the correlation coefficient across firms between h_t and g_t is 0.26.

employment growth. They all contribute to employment adjustments. However, the correlation between FTC transformations and employment growth is stronger than the correlation between ITC direct hirings and employment growth. This result confirms that FTC transformations are at least as important as ITC direct hirings for labour force adjustments. Note that the strength of the correlations between the growth rate and the different hiring rates is rather stable across the business cycle. It is also rather similar among production workers and non-production workers (figures not reported). Generally speaking, the relationship between net and gross flows of workers does not vary much across time or occupations.

Table 1 also reports the correlation coefficients between the different exit rates and the employment growth rates across firms. It turns out that the correlation between layoffs and variations in employment is much higher than the correlation between the other categories of exits and the variations in employment. De facto, the correlation between voluntary quits and employment growth is either not significantly different from zero or very small. The only exit rate that actually contributes to labour force adjusment is the layoff rate. This finding confirms that layoffs are the only category of ITC exits that the firm can actually control and use to adjust its labour force.

What are the preliminary lessons that can be drawn from these basic figures? The different hiring categories are all positively correlated with employment variations. They no doubt represent complementary answers to the various shocks that affect the firms' economic environments each year. On the contrary, there is only one exit category that is negatively correlated with employment variations, which is layoffs. The other types of exits (i.e., voluntary quits and

firing for cause) are much less cyclical than layoffs and cannot be considered as a means of employment adjustment. These exits represent a significant share of the work force each year, however. As it turns out, employers can adapt to most of the variations in their economic environment through variations in their sole hiring rates. Worker layoffs remain a means for large employment contraction.

3. The French institutional setting

In this section, we give some information about the wide variety of French policies and institutions that affect the costs of adjusting labour demand. It could help in understanding and interpreting our estimated structure for adjustment costs.

In France, as in most continental European countries, firms are allowed to hire workers on two types of contracts: indefinite-term contracts (ITC) and fixed-term contracts (FTC). For each hiring, the employer has to fill out an administrative form for the new employee and send it to the necessary government organizations.

The French labour laws stipulate that ITC must represent the normal and general form for an employment contract. De facto, there are significant legal constraints that make it a priori difficult for French employers to justify a large number of workers under FTC. The employer has to prove that their FTC correspond to seasonal activities or temporary activity variations. Otherwise, the employers must prove that their fixed-term workers replace workers who are only temporarily absent from the work place. FTC are also characterized by limited duration as well as limited renewal possibilities. They have a maximum duration of 18 months, including renewals. If employers do not transform the fixed-duration contract into an indefinite-duration contract, they must pay a 6% termination cost of the employment contract's total value.

The termination of an ITC can be either employer initiated or employee initiated. Employer-initiated terminations can themselves take several forms. Firing for cause or for 'serious misconduct' exempts the employer from making a severance payment and from observing a mandatory waiting period (which is the delay between the letter announcing the termination and the actual termination of the contract). For all other types of terminations (layoff, retirement), the employer must observe a mandatory waiting period and make a severance payment.

Concerning layoffs, the mandatory waiting period depends on the seniority of the worker. Only workers with more than six months seniority are given notice. Workers with six months to two years seniority are given one month notice. Workers with more than two years seniority are given two months notice. For high-skilled workers (engineers, professionals and managers), the notice period is three months.

Severance payments also depend on the worker's seniority. Workers with less than two years seniority are not entitled to redundancy pay. For workers with at least two years of seniority, severance payments represent about 10% of a reference monthly wage. This reference wage is the average wage the worker received during his last three months at the firm. An additional 1/15th of a second monthly reference wage must be added for every year of service beyond 10 years. This second reference wage is computed as the maximum of the first reference wage and the average wage over the last 12 months. Some industry collective agreements can promote a more generous formula.

4. Econometric results

We now turn to the econometric estimation of Eq. (13). In order to eliminate the firm-specific effect, we take first differences.[2] Estimations are carried out by the generalized method of moments (GMM) in order to allow for the endogeneity of the regressors. The optimal GMM estimator is obtained with the standard two-stage instrumental variable method introduced by White (1982). The basic set of instrumental variables corresponds to the lagged values of the forcing variables.[3]

The GMM estimates for the adjustment cost parameters are given in Table 2. We present two types of estimations: in the first one, the real discount rate is chosen to equal 0.9, whereas in the second one, it is chosen to equal 0.7. Lastly, for each discount rate, we present three nested regressions: the first one corresponds to the absence of both temporary adjustment costs and inter-contract wage differentials (i.e., $\phi = 0$, $c_S/c = 0$ and $c_R/c = 0$); the second one corresponds to the absence of inter-contract wage differentials (i.e., $\phi = 0$); the last regression does not impose any restriction on the cost structure.

4.1. The estimated structure of adjustment costs

Before analysing the economic meaning for our estimates, let us recall that the instruments must be orthogonal to the disturbances for the GMM to produce consistent estimates. In this paper, this orthogonality condition is tested by the Sargan statistic, which is reported for each estimated model. Basically, this

[2] It is possible to interpret these firm fixed effects as reflecting the impact of measurement errors (see Goux et al., 1999).

[3] For alternative set of instruments and estimation strategy for this type of model, see Blundell and Bond (1998).

Table 2
The structure of adjustment costs (GMM estimates of Eq. (13))[a,b]
(a) All workers (production and non-production)

	$\delta = 0.7$			$\delta = 0.9$		
	(a)	(b)	(c)	(a)	(b)	(c)
$\frac{c_F - c_H}{c}$	0.928*	0.937*	0.949*	0.926*	0.934*	0.942*
	(0.020)	(0.018)	(0.015)	(0.022)	(0.019)	(0.017)
$\frac{c_S}{c}$	—	− 0.003	0.008	—	− 0.005	0.008
		(0.003)	(0.005)		(0.004)	(0.006)
$\frac{c_R}{c}$	—	0.005	0.002	—	0.008	0.004
		(0.008)	(0.009)		(0.010)	(0.011)
ϕ	—	—	-7×10^{-5}*	—	—	-9×10^{-5}*
			(2×10^{-5})			(3×10^{-5})
Number of instruments	6	18	24	6	18	24
Sargan statistic	6.4	14.3	19.6	7.1	14.5	19.3
p-value	0.27	0.50	0.48	0.21	0.49	0.50
Difference-Sargan ($df = 3$)	0.5	0.8		0.7	1.7	0.6

(b) Production workers only

	$\delta = 0.7$			$\delta = 0.9$		
	(a)	(b)	(c)	(a)	(b)	(c)
$\frac{c_F - c_H}{c}$	0.836*	0.852*	0.857*	0.813*	0.841*	0.837*
	(0.044)	(0.039)	(0.029)	(0.053)	(0.044)	(0.032)
$\frac{c_S}{c}$	—	− 0.003	0.003	—	− 0.005	0.001
		(0.004)	(0.005)		(0.004)	(0.006)
$\frac{c_R}{c}$	—	0.005	0.002	—	0.005	0.003
		(0.010)	(0.011)		(0.012)	(0.013)
ϕ	—	—	-3×10^{-5}*	—	—	-3×10^{-5}*
			(2×10^{-5})			(2×10^{-5})
Number of instruments	6	18	24	6	18	24
Sargan statistic	2.3	9.3	13.6	4.5	9.0	12.4
p-value	0.80	0.86	0.85	0.47	0.88	0.90
Difference-Sargan ($df = 3$)	3.9	0.8	1.2	2	1.1	1.3

(c) Non-production workers only

	$\delta = 0.7$			$\delta = 0.9$		
	(a)	(b)	(c)	(a)	(b)	(c)
$\frac{c_F - c_H}{c}$	0.984*	0.986*	0.994*	0.984*	0.987*	0.994*
	(0.016)	(0.007)	(0.004)	(0.011)	(0.007)	(0.004)
$\frac{c_S}{c}$	—	− 0.001	− 0.0004	—	− 0.001	0.000
		(0.001)	− (0.0015)		(0.001)	(0.002)
$\frac{c_R}{c}$	—	0.002	0.002*	—	0.002	0.002*
		(0.001)	(0.001)		(0.014)	(0.001)
ϕ	—	—	-3×10^{-6}	—	—	-5×10^{-6}
			(6×10^{-6})			(6×10^{-6})
Number of instruments	6	18	24	6	18	24
Sargan statistic	4.4	12.5	14.3	4.2	12.2	15.6
p-value	0.50	0.64	0.82	0.52	0.66	0.74
Difference-Sargan ($df = 3$)	8.4	6.4	8.7	8.8	6.3	7.5

[a] *Source:* DMMO-BIC panel, 1988–1992, INSEE.
[b] The instruments are the lagged independent variables. All regressions include three time dummies. Standard errors are in parentheses. The * indicates that the coefficient is significant at the 5% level. Difference-Sargan corresponds to the net increase in the Sargan statistic that we observe when we add dependent variables lagged for two or more periods to the initial set of instruments.

statistic indicates no significant correlation of our basic instruments with the error terms.[4]

Difference-Sargan tests are also reported in the tables. The difference-Sargan statistic corresponds to the net increase in the Sargan statistics that we observe when we add the dependent variable lagged for two or more periods to the basic set of instruments. In the absence of second-order serial correlation in the residuals, the dependent variable lagged for two or more periods is not correlated with the residuals, and the difference-Sargan statistic follows a χ^2 with

[4] There are at least three other sets of instruments that have the same good property: (1) the forcing variables lagged for one or more periods and the dependent variable lagged for two or more periods (which yields $P = 27$ instruments in model (c)); (2) the forcing variables lagged for two or more periods ($P = 12$); (3) both the forcing variables and the dependent variables lagged for two or more periods ($P = 15$). On the contrary, when we add the dependent variable lagged for only *one* period to the lagged forcing variables, we obtain a set of instruments which turns out to be correlated with the residuals.

three degrees of freedom. According to the difference-Sargan for our models, there is no evidence of significant second-order correlations in our residuals series. This result is consistent with the residuals being random expectation errors taken in first-difference. Let us now analyse the results for Eq. (13) and the estimated structure of adjustment costs.

(1) Generally speaking, the estimated parameters have the expected sign and a realistic order of magnitude (see Table 2a). To be more specific, the estimated c_R/c and c_S/c cost parameters are either positive or non-significantly different from zero, while the absolute value of the $(c_F - c_H)/2c$ parameter is less than one. Furthermore, the estimated ϕ parameter is negative, indicating that the wages paid to FTC workers are lower than the wages paid to ITC ones. This finding is consistent with the results obtained in France through standard wage equations (see Colin, 1995). All in all, the econometric exercise does not reject[5] the model of labour demand presented in Section 1.

(2) The estimated $(c_F - c_H)/2c$ is significantly different from zero and positive. It is also significantly less than one, but at the same time very close to one. These results remain stable no matter what the discount rate is. As it turns out, it is costly to hire workers under ITC.[6] However, it is much more costly to terminate ITC workers than to hire them. The costs of hiring a given number of ITC workers only represent about 2.5% of the costs of terminating them.[7] There are very strong asymmetries in the costs of adjusting the number of permanent workers.

Note that when the net change in the level of employment is analysed, the standard asymmetry apparent in the data is not exactly what we find in this paper. In general, employment reductions appear less costly and occur faster than employment increases.[8] Our results are not in line with standard findings because we study the dynamics of hiring and firing decisions, which is a different approach. The difference between the net changes in employment and the net result for hiring/firing decisions comes from the voluntary quits. Since the voluntary quits represent about 4% of the work force each year, most of the labour adjustments can simply be obtained through variations in the hiring rates. When voluntary quits are neglected, the volume of adjustments that are

[5] Generally speaking, the first-step IV estimates for $(c_F - c_H)/2c$ are significant, less than one and very close to the second-step GMM estimates given in the tables, while the first-step IV estimates for c_R/c, c_S/c and ϕ are not significantly different from zero and very poorly estimated.

[6] $(c_F - c_H)/2c = (c_F - c_H)/(c_F + c_H) < 1$ is indeed equivalent to $c_H > 0$.

[7] Note that when $u = (c_F - c_H)/(c_F + c_H)$ is close to one, then $c_H/c_F = (1 - u)/(1 + u)$ is close to $(1 - u)/2$.

[8] See the survey in Hamermesh (1993). Jaramillo et al. (1993) represent an interesting exception. Using a panel of Italian firms, they found that firing costs are higher than hiring costs, reflecting perhaps the strength of institutional restriction in Italy. Their results are however difficult to compare with ours since they do not have information on quits nor on FTC.

obtained through layoffs are overestimated and their costs are underestimated. Using time series on both gross and net adjustments of employment in the US manufacturing industries, Hamermesh and Pfann (1996b) also come to the conclusion that voluntary quits need to be taken into account to identify the structural asymmetries of the adjustment costs.

(3) We have made supplementary analysis taking f_t equal to the total number of firings (i.e., layoffs *and* firings for cause). Within this framework, the estimated $(c_F - c_H)/2c$ remains very high (about 0.85) but somewhat smaller than when f_t is equal to the number of actual layoffs. When layoffs cannot be separated from firings for cause, the costs of terminating ITC and the asymmetry in the costs of adjusting the number of ITC workers are underestimated.

(4) We get similar results when we focus on production workers or non-production workers (see Tables 2b and c). In both cases, $(c_F - c_H)/2c$ remains positive and close to one. Regardless whether we consider production or non-production workers, the termination costs come out to be much higher than the hiring ones. However, the cost differential appears to be more important for non-production workers than for production ones.[9] This result is consistent with non-production workers having on average higher tenure in their firm and with termination costs being higher for high-tenure workers. In particular, the length of the mandatory period increases with tenure in France.

(5) In Table 2a, the estimated c_S/c and c_R/c are non-negative, but much smaller than one and non-significantly different from zero. This result resists to variations in the discount rate.

We get the same findings when we focus on production workers (see Table 2b). There are no significant costs for adjusting the number of FTC production workers. For non-production workers, the estimated c_S/c is non-significantly different from zero at conventional level while the c_R/c parameter can be considered positive at the 10% level (see Table 2c). The estimated parameter remains very small, however (i.e., about 0.2%).

All in all, our basic finding is that it is much less costly to adjust the number of FTC than to adjust the number of ITC. The introduction of FTC at the beginning of the 1980s created very large asymmetries in the structure of adjustment costs.

How does this result compare with what we know about French institutions? In France, the direct severance payments for FTC are about twice as small as the severance payments for ITC. Furthermore, when employers terminate an ITC contract, they have to respect an average two month mandatory period or pay

[9] Using an aggregated employment time series for the UK and the Netherlands, Pfann and Palm (1993) found that firing costs exceed hiring costs of non-production workers whereas hiring costs exceed firing costs of production workers. These results are again difficult to compare with ours since these authors only worked with aggregated data and did not have direct information on quits nor FTC.

the corresponding wages to the worker. This fact alone is no doubt a very important aspect of the relative cost of ITC termination in France. Lastly, the FTC terminations do not imply any control from the administration while the ITC terminations for economic reasons must be justified by the employer. The employer must define 'social plans' in order to increase the likelihood of displaced workers finding new jobs. Our results suggest that an important part of the relative costs of ITC terminations arises from the difficulty in justifying workers' layoffs and in defining 'social plans'.

(6) For production workers, the estimated ϕ parameter is negative and significantly different from zero. When focusing on non-production workers, ϕ is still negative, but it is not significantly different from zero at the conventional level. The ITC wage premium seems more significant for production workers, which is consistent with their having weaker market situations and higher unemployment risks.[10]

4.2. Discussion

Our econometric investigations do not reject the model of dynamic labour demand presented in the first section. We obtained non-negative and realistic estimates for the different cost parameters. These estimates suggest that the introduction of FTC in the early 1980s has created strong asymmetries in the structure of adjustment costs. These results help explain why FTC have become such important means for labour demand adjustments and individual transitions on the labour market. What lessons can we draw from these basic results? What are their policy implications? What would be the effects of new institutional arrangements and/or new variations in the costs of FTC?

There are no simple answers to these questions. The empirical estimates for the adjustment costs have been obtained under rather weak assumptions about the actual technology of the firms or about the actual structure of the stochastic process that affects their production functions. These results could resist a wide range of alternative hypotheses about the technological environment. Nevertheless, the policy implications for these results depend on the actual technology and distribution of the shocks to the economic environment. In Goux et al. (1999), we give some supplementary elements for the resolution of the firms' optimization problem in order to explore these issues. These investigations suggest two supplementary ideas.

(1) First, the introduction of FTC implies a very important modification in the optimal behaviours of firms. When FTC are not available, there are only two basic responses to the variations in the economic context: when the environment

[10] These results are consistent with Colin (1995) who finds that the ITC premium is stronger within low-skilled occupations.

is sufficiently good, the firm hires, when it is not good, the firm fires. With the introduction of FTC, the firm can respond simultaneously to short-term productivity fluctuations on the one hand, and to variations in the long-term productivity parameters on the other. When the firm is in a structurally bad situation (i.e., when the long-term, *expected* marginal returns to labour are negative) it can still find it profitable to hire: only the *current* marginal return needs to be positive. Such temporary increases in the employment of structurally declining firms could not happen in the absence of FTC. Similarly, when the firm is in a structurally good situation (i.e., when the expected marginal return to labour is positive), the availability of FTC creates a wide range of new behaviours, each one corresponding to a specific mix of ITC and FTC hirings as well as FTC transformations. In other words, the introduction of FTC and variations in their costs substantially affect the firms' behaviour and increase the variance of their adjustments.

(2) These changes in the firms' behaviour do not necessarily imply an increase (or a decrease) in the average levels of employment. The net impact of variations in adjustment costs on labour market outcomes depends on the technological environment and the distribution of productivity shocks across time and firms. For instance, when the production function is linear, a decrease in the cost of terminating FTC workers implies (a) an increase in the number of temporary positions created each period, but (b) a decrease in the number of permanent positions created each period. In this special case, the net impact of a decrease in FTC costs on the dynamics for aggregate labour demand is ambiguous. It depends on the distribution of the shocks across the population of firms and on the evolution of this distribution across time.

5. Conclusion

In this paper, we show that very strong asymmetries in the costs of adjusting the number of workers on ITC exist. As it turns out, the displacement of a given number of ITC workers is much more expensive than the costs of hiring them. This type of result is rather different from that reached by the vast majority of studies that did not include the quit rate in their analysis and did not distinguish between fixed-term and indefinite-term contracts. When quits, firing for cause and fixed-term contract terminations are neglected, the incidence of layoffs can be largely overestimated and their costs largely underestimated. We think that the understanding of dynamic labour demand would no doubt be improved if data on contracts and voluntary mobility were more systematically included in econometric analyses.

In this paper, we also find that hiring FTC workers is only slightly less difficult than hiring permanent ones and that the transformation of FTC into ITC is an important means for permanent labour adjustment. All in all, our

model helps explain why FTC represent the vast majority of hirings in France and why the cyclical sensitivity of French labour demand is higher in the 1990s than it was in the early 1980s before the introduction of new legislation on labour contracts. Taking FTC into account no doubt improves our ability to model the dynamic demand for labour. However, in this paper, we only focused on one issue, namely the inter-temporal trade-off between the costs of low-turnover strategies and the costs of high-turnover ones. We have not taken into account that FTC are also a means of testing workers and selecting the best ones. Further research is still needed to improve our understanding of this selection issue. Progress will also come from models that will take into account internal firm mobility.

Appendix

Our panel corresponds to the matching of two datasets. The first one corresponds to the Monthly Workers' Movement Declaration (*Déclaration Mensuelle des Mouvements de Main-d'Oeuvre*, hereafter DMMO). This is an administrative record of workers' movements within French establishments that employ at least 50 employees. It gives the nature of each movement and the type of occupation involved. The dataset used for the construction of the panel consists of the 14,907 establishments that answered each year to the DMMO surveys between 1988 and 1992. The second dataset corresponds to the Survey for Corporate Tax Returns (*Bénéfices Industriels et Commerciaux*, hereafter BIC). This is an administrative record with fiscal information for almost all French firms. Each year, about 20,000 firms of the manufacturing sector are present in the BIC. The dataset used for the construction of the panel consists of the 7,085 firms of the manufacturing sector for which there is information about production, capital, wage bill and employment each year between 1987 and 1992. The matching of the DMMO and BIC datasets (at the firm level) yields a panel of 2,923 firms. In the final file, we kept the 915 firms for which the information about employment coming from the BIC was consistent with the information from the DMMO. A previous version of the panel is described in Dormont and Pauchet (1997).

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