# The Costs of Hiring and Separations

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**Abstract**

In this article, we estimate the costs of hiring, separation, and retirement of employees for a representative sample of French establishments matched with a representative sample of their employees. The estimates are computed using data from three sources: the Wage Structure Survey (ESS), the Workforce Movement Questionnaire (DMMO), and the Occupational Structure Survey (ESE). We show that the estimated separation costs are increasing and mildly concave functions of the number of exits and include a very large fixed component. Estimated hiring costs are much lower and those associated with short-term contracts are effectively zero. Profit maximizing French firms should adjust employment primarily through hiring changes.

JEL Classifications: J30, D21

# 1 Introduction

We begin at the intersection of dynamic labor demand analysis and the study of the firm's cost functions (initiated in Oi, 1961). The firm's economic problem is the following. Facing economic shocks, the firm must decide to hire or to terminate some workers. To compute the optimal decision, for example the number of terminations, the firm must take into account different types of costs and benefits: past hiring costs, past training costs (both of which are sunk), termination costs, total compensation, and marginal productivity. In the United States the arrival of a negative demand shock causes the establishment to immediately reduce employment through increased separations (Anderson and Meyer, 1994, Davis and Haltiwanger, 1992). The laidoff workers enter unemployment, the existing unemployed workers exit at the same rate as before the shock; hence, the rate of unemployment increases (Abowd and Zellner, 1985, Blanchard and Katz, 1997). Evidently, the cheaper form of adjustment in the US is to fire the employees, even though there are no direct estimates of these costs. In France, the arrival of a negative demand shock causes the establishment to immediately reduce hiring—in particular, to eliminate the hiring of employees on fixed duration contracts (Abowd, Corbel and Kramarz, 1999). The reduction in hiring rates, slows the exit from unemployment without changing the entry rate and, hence, the unemployment rate increases.

Because the set of French employment responses is less familiar to most readers, we summarize the relation between establishment size change (employment growth) and the rates of entry and exit of workers in Figure 1. In Appendix Table A1 we show additional details of the adjustments by type of employment contract. Figure 1 shows that over almost the entire range of employment growth rates, positive and negative, the rate of entry of workers is increasing and the rate of exit of workers is constant. The institution associated with this type of employment mobility in France is the fixed duration employment contract,

which we discuss in detail below. Since more than 70 percent of all employment transactions in 1992, the year of our data analysis, involved short-term contract employees, we believe that the structure of adjustment costs, and the nature of the associated employment institutions, in France must be substantially different from those of the United States. Furthermore, we believe that the French institutions may be more typical of European institutions and, therefore, are of considerable scientific interest because differences in the optimal response to demand shocks arise precisely because of the differences in institutional settings. A reasonable working hypothesis for France, and for much of Europe, is that hiring-related adjustment costs are much lower than separation-related adjustment costs. In this article we directly address this hypothesis by measuring and modeling the costs of adjustment in a cross-section of French establishments.

Once the firm decides to terminate some of its workers or to hire new workers, we observe the associated costs directly. We analyze these costs in terms of both variable and fixed adjustment costs using a cost function in which the explanatory variables are (1) the number of workers that entered or left the firm (variable part) and (2) a fixed cost paid whenever some workers were hired or terminated. In addition, for a sample of terminated workers we directly observe the severance payment or the retirement bonus and individual characteristics. The direct payments to the workers differ from the total termination or retirement costs per separation because of indirect, but measurable, costs associated with restrictive French employment laws. Our ability to measure both types of termination costs allows us to examine the selection process of the terminated workers and the structure of the costs in terms of the individual observables. Finally, we observe the size of the personnel department which gives us a measure of other types of costs induced by human resource management, although we do not have any direct measure of the foregone output component of adjustment costs.

We estimate the costs of hiring, separation, and retirement for a representative sample of French establishments matched with a representative sample of workers employed in those establishments. The data were collected in 1992. We compute establishment-based estimates using French data from three matched sources. The first source is the Wage Structure Survey (ESS), which provides the establishment measures of the hiring and firing costs. It also provides, for some establishments, the employment and the number of new hires and separations. For units where this information is missing, we match data from the Workforce Movement Questionnaire (DMMO) which gives, for every establishment with at least 50 employees, the number of new hires and separations in 1992. Finally, we match data on the establishment personnel department from the Occupational Structure Survey (ESE). Individual-based estimates are computed using the employee part of the Wage Structure Survey, which provides individual-level information on wages, skills, worker characteristics, and severance payments or retirement bonuses for a probability sample of workers in each establishment.

Our results show that the establishment-based adjustment costs of separa-

tions are an increasing and mildly concave function of the number of retirements and an increasing and mildly concave function of the number of terminations. In addition, the fixed cost component is a large part of the total adjustment costs paid when there are separations. Termination or retirement costs act as fixed costs of adjustment for at least two reasons: concavity of the cost function and the fixed cost to be paid when terminations take place. Firms should bunch separations, not do them gradually. Furthermore, the fact that optimal separations are lumpy implies that the sample of establishments with positive observed separations will not be representative of all establishments at risk to separate workers. Our estimated models account for this selection bias. The fixed costs of hiring are of much lower magnitude than those for separations. Except for highly-skilled workers on long-term contracts, there are no variable hiring costs. The working hypothesis is, therefore, confirmed by the data analysis.

We also show that the individual-based estimated retirement or firing costs consist primarily of a fixed component and are only mildly related to the variable part of the legal formula (*i.e.* a proportion of the person's wage that varies linearly with seniority). These results are consistent with the establishment-level results.

In the next section, we give the salient details of the laws and institutions of the French labor market. Section 3 summarizes our data. In section 4, we present the theoretical and statistical models that motivate our specifications. The results of the empirical analysis are in section 5. Finally, we conclude and relate our findings to the growing interface between empirical labor economics and the macroeconomics of employment flows and unemployment.

## 2 Firing: The French Labor Laws

Since 1979, French labor law has recognized two types of regular employment contracts: fixed duration contracts (CDD, contrat à durée déterminée), which contain a specified employment start date, end date and remuneration, but have restricted use (see Abowd, Corbel, and Kramarz, 1999), and indefinite duration contracts (CDI, contrat à durée indéterminée), which are the normal form of contract and which limit the employer's right to terminate the employee as described below. Although their use is formally restricted, CDDs are the more common method of hiring.

Since 1982, employment contracts have all been CDI unless the employee and job qualify for a CDD. Short term employment contracts existed prior to the legal changes in 1982; however, the designation of a contract type was less important because the CDI were not the default contracts. As defined in the text of the law (Article L.122), a CDD cannot be used to fill a job that would exist under normal and permanent business conditions for a given firm. Hence, in principle, a CDD can only be signed for a temporary and precise task (replacement in case of absence, temporary or seasonal demand shock). Such contracts

are also used for youth employment programs. Furthermore, selection and testing of future permanent employees is allowed under such contracts. The contract can only be renewed once and its length, including renewal, cannot exceed 18 months (24 months for youth employment programs). At the termination of the contract, the worker receives a 6 percent severance payment by law. For example, in 1992, 80% of all entries into private for-profit or semi-public establishments were through CDD. On the other hand, at the same point in time more than 90% of the stock of employees in these same establishments were on CDI. For those hired under CDD approximately one in three is eventually converted to CDI (Abowd, Corbel and Kramarz, 1999).

Termination of a CDI is a more complex process. Employer-initiated termination of a CDI employee can take two broad forms–firing (licenciement), for economic reasons or for cause, and early or normal retirement (préretraite and retraite), both of which are considered terminations under French Labor Law (30 July 1987).[1] Firing for cause under French Labor Law can take two forms–firing for "serious reason" or for "very serious misconduct." The latter exempts the employer from paying a severance payment, and we have no information on this type of termination. For all other types of terminations and for retirements, the employer must observe a mandatory waiting notice period and pay a severance payment. An employer can mandatorally retire a worker if that person is currently eligible to receive the full pension paid by the Social Security system; that is, if the worker has been employed in a covered job for at least 37.5 years and is at least 60 years old or if the worker has been employed less time (the exact amount varies) in a covered job but has reached the age of 65, the mandatory retirement age in most industry-level collective agreements (conventions collectives). Retirement timing is, thus, an employer decision or, at the least, a joint employee-employer decision. The mandatory notice period for retirement must be at least as long as that for economic terminations and the severance payment must also be at least equal to the severance payment given in case of economic termination.

Terminations for economic reasons can affect both individual workers and groups of workers. All terminated workers benefit from a reemployment priority within the same firm for one year after the termination date. Valid economic termination reasons include: destruction of the worker's job, transformation of the worker's job, and major modification of the labor contract without a change in the job–leading to termination if the worker refuses to sign the new contract. Major modifications of the job occur when, because of bad business conditions or because of technical change within the firm, existing jobs must be re-engineered to fit the new circumstances. Technical transformations of the job do not necessarily entail a decrease in total employment or the wholesale replacement of workers whose skills are obsolete with new workers whose training is better suited to the re-designed job.

[1] This section heavily borrows from Lamy Social (1992).

Because different rules apply to individual and collective terminations, we discuss both in turn. For individual terminations, the employee must be notified in writing of the termination and its justification. Although the employer need not inform the personnel delegate (elected representative of the employees to the comité d'entreprise), the administrative authority (Direction du Travail) at the Ministry of Labor must be informed. The administrative authority cannot block the termination unless there has been a procedural error. Before the termination, the employee has the right to an exit interview. If a re-training program is offered, the details must be given in the exit interview. This procedure takes at most 3 weeks. Re-training programs may be tailored to individual needs and are arranged jointly by the firm, the semi-governmental agency that administers the unemployment insurance system, and the national government. The firm pays 4,500FF per worker for the re-training program.

There are several types of collective terminations, the first category distinguished by French labor laws is the collective termination of less than 10 workers during a 30 day period. Most steps in this procedure are similar to those described above. The employer must consult the personnel delegate or the union representatives at the firm. The employer must notify the employee and the Ministry of Labor in writing. Each worker has the right to an exit interview at which the employer may offer a re-training program that is the same as the one described above for individual terminations.

The second category of collective terminations concerns the dismissal of at least 10 workers during a 30 day period. The 2 August 1989 law requires that firms with 50 or more employees formulate a "social plan" before implementing a collective termination of this magnitude or greater. This social plan must place a limit on the total number of terminations and lay out plans to facilitate reemployment of terminated workers. The plan may also offer a re-training program, just as the collective terminations noted above did. Union representatives or personnel delegates and the departmental director of the Ministry of Labor must also be informed of the plan. Two public meetings of the works council (comité d'entreprise) must be organized with an interval between the meetings of two to four weeks depending upon the number of terminations proposed. The works council may require the firm to hire a consulting accountant (at the company's expense) to help the council with its analysis. During this period, the departmental director of the Ministry of Labor must be continuously informed of the proceedings, the plan, and the names of the proposed terminated workers. The Ministry is responsible for enforcing the procedure but cannot block the terminations if the correct procedures have been followed. The Minister has one month to confirm the procedural correctness of the collective termination. Besides documenting irregularities, the departmental director may also suggest changes to the social plan. In all other regards the rules governing large-scale collective terminations are the same as those noted above for smaller collective terminations.

For all terminations, regardless of the number of employees involved, the

rules governing the mandatory notification period are as follows. The notification period is the delay between the worker's formal letter announcing the termination and the actual end of the CDI. Workers with less than 6 months seniority are not given notice. For workers with 6 months to 2 years seniority, the notice period is 1 month. The notice period is 2 months for workers with more than two years of seniority. For engineers, professionals, and managers (cadre), the notice period is three months. If the notice period is not respected, the worker must be fully compensated for the difference between the minimum notice period and the delay actually experienced in the termination. There are, however, no punitive damages.

Severance payments are calculated as follows. Unless the sector collective bargaining agreement, the firm-level collective bargaining agreement, or the individual contract specify a more generous formula, the legal minimum severance payment must be paid to workers with at least two years of seniority. For every year of seniority at the firm the employer must pay 20 hours if the worker is paid by the hour or 1/10th of the reference wage if the worker is paid by the month. The reference wage is computed as the average monthly wage over the last three months of service at the firm. Furthermore, for most workers, an additional 1/15 of a second monthly reference wage must be added for every year of service beyond 10. This second reference wage is the maximum of the first reference wage and the average wage over the last twelve months.

When terminated workers would not receive a full-rate retirement pension, early retirement may be an option for the firm in case of the terminations for economic reasons. Early-retired workers must be at least age 55. The candidate worker must agree to the early retirement by signing a convention along with the employer and the French government. The convention requires that, in consideration of early payment of retirement benefits, the worker forfaits the difference between the minimum severance payment as stated in the sector collective bargaining agreement and the legal minimum severance payment. As a part of the early retirement package, the firm must pay a one-time supplement of at least 3% of the daily wage times the number of days the worker would have been paid under the collective bargaining agreement until retirement. Actual supplement rates, again specified in the early retirement agreement, lie between 6 and 8%. The semi-governmental agency that manages the unemployment insurance system (UNEDIC) pays approximately the same supplement to the early-retiree. The early retirement payments end as soon as the worker reaches normal retirement age.

# 3 Data Description

This section describes the three source surveys and our procedure for matching them.

### 3.1 The Wage Structure Survey

The first dataset that we use is based on the most recent wave of the French Wage Structure Survey (Enquête Structure des Salaires, ESS 1992). The survey draws a representative sample of establishments in manufacturing, construction and most service industries. Data were collected on (1) the wage-setting policy of the establishment and (2) wages and characteristics of a representative sample of the individuals employed at this establishment in that year. The Data Appendix gives more details on the sampling procedure and the industries covered by the surveys. In this study, we used most individual-level variables. These individual-level variables, present in the ESS for every sampled worker, are:

- total annual compensation inclusive of all employee- and employer-paid benefits and bonuses but exclusive of non-wage-benefits,
- firm seniority,
- type of contract (CDI or CDD),
- number of days of employment in the establishment in 1992,
- sex,
- age,
- nationality (French or non-French),
- skill-level (in 4 groups),
- bonuses for retirement
- severance payments for workers that retired or were fired in 1992.

The survey distinguishes eight types of bonuses: fixed bonuses; bonuses for personal (not employment-related) events such as a wedding; compensating bonuses such as bonuses for job-difficulty; bonuses based on firm performance; bonuses based on team performance; bonuses based on individual performance; bonuses for firm-specific and exceptional events; and legally-mandated bonuses (primarily severance payments, retirement bonuses and transportation bonuses). To measure the individual severance payment or retirement bonus, we use the legally-mandated bonus category. The transportation bonus cannot exceed a few thousand French Francs in 1992, hence we eliminate all bonuses in the category with an amount less than 5,000FF. To distinguish severance payments from retirement bonuses, we assume, consistent with the law, that all bonuses paid to workers older than age 55 are retirement bonuses. We assume that all payments to workers below age 55 must be severance payments.

The basic research data files for the ESS contain15,858 establishments with 148,976 interviewed employees in 1992. It is also possible to compute, for most of

our establishments, within-establishment statistics on the distribution of wages and seniority. Hence, we computed the first decile, the first quartile, the median, the third quartile and the ninth decile of both the wage and seniority distributions. Even though we do not know the wage or seniority of every retired and separated workers, these fractiles will be another way to capture components of the legally-mandated payments (see section 2).

In addition, we use the following establishment-level variables:

- total employment: the average full-time monthly employment during the year 1992;
- total hiring, CDD: the number of employees hired on fixed duration, short-term contracts;
- total hiring, CDI: the number of employees hired on long-term contracts;
- total retirements: the number of employees retiring or taking early retirement;
- total terminations (economic reasons): the number of employees terminated for economic reasons during 1992 and reported separately for two groups–engineers, professionals, and managers (cadre) and all other workers;
- total terminations (other reasons): the number of employees terminated for cause during 1992 and reported separately for two groups–engineers, professionals, and managers (cadre) and all other workers;
- total terminations (all reasons): the sum of the two categories of terminations defined above;
- retirement costs: the sum of early retirement payments paid directly to employees and regular retirement compensation paid directly to the employees;
- severance payments: legally-mandated separation payments discussed above plus any other payment made by the employer at separation;
- hiring costs: reported employer expenses on job advertising, search firm fees, and compensation of applicants as distinct from employees, explicitly excluding training of newly hired employees.

We also use the following training costs:

- training hours: the total number of hours of training paid by the firm when trainees were directly compensated by the firm, reported separately for engineers, professionals, and managers and for all other workers;

- direct training costs: employer paid training expenditures exclusive of trainee labor costs and inclusive of payroll costs for instructors as well as all other direct material costs, such as the rental of equipment and space;
- trainees' compensation (young): the direct labor costs (total compensation) for young trainees (stagiaires, apprentis, and others);
- trainees' compensation (others): all other trainees' direct labor costs (total compensation).

All costs are reported in 1992 francs. All compensation costs mentioned above are inclusive of employer-paid payroll taxes and employee-paid payroll taxes but exclude employer paid benefits that are not covered by the payroll taxes. We divide the total compensated training time by the number of workers in each of the two skill-groups to get a "training time per new hire" measure. As a measure of the annual full time wage rate, we define average labor costs per employee as the total wage bill reported in the ESS (inclusive of all payroll taxes and all employee and employer paid benefits) by the total employment. Finally, we use the ESS variables that are direct characterizations, asked of the responding manager at every establishment or firm:

- business conditions in that year: good, normal, or bad;
- business conditions during the last 5 years: good, normal, or bad;
- expected change of employment: stable, increasing, decreasing.

## 3.2 The Workforce Movement Questionnaire

Our second data source was the Monthly Worker Movement Report (Déclaration Mensuelle de Mouvement de Main-d'Oeuvre, DMMO), which is an administrative record of all worker movements at all establishments with at least 50 employees. Although this administrative report was created in the 1970s as a part of the government's monitoring of employee terminations, it was first computerized in 1987 for all of France. Each establishment with at least 50 employees must report for each employment movement: (1) the nature of the transaction– (a) hire on a long-term contract (CDI), (b) hire on a short-term contract (CDD), (c) trial hire, (d) transfer in, (e) transfer out, (f) quit, (g) exit for military service , (h) exit for sickness or death, (i) end of short-term contract, (j) end of trial hire, (k) retirement and early retirement, (l) termination for economic reasons, and (m) other terminations including for cause; (2) the skill level of the job involved (two-digit occupational code, CS); and (3) the age and seniority of the employee involved. For this study, we created a working file in which the data were summed to the annual level by skill group aggregates for each establishment. The variables used in our analysis were:

- total hiring on CDI is the number of long-term contract hires;
- total hiring on CDD is the number of short-term contract hires;
- total retirements is the number of regular and early retirements;
- total terminations (economic reasons) is the number of terminations for economic reasons as defined in section 2.

The DMMO working file contains information for 38,592 establishments (private and semi-public) for 1992.

### 3.3 The Occupational Structure Survey

Our third data source is the 1992 Occupational Structure Survey (Enquête sur la Structure des Emplois, ESE), which is an annual administrative data base of the detailed occupational structure for all establishments with at least 20 employees. All establishments from the private or market-oriented public sector (établissement public industriel et commercial, EPIC) with at least 20 employees on December 31, 1991 had to complete a questionnaire. The establishment reports a description of its occupational structure using a 4-digit standardized classification of occupations. From this classification, we defined the following variables:

- clerical worker (personnel department) are all clerical workers (secretaries, assistants, etc.) employed in personnel or legal departments;
- supervisors (personnel department) are all administrative technicians (compensation specialists, benefits specialists, bookkeepers, etc.) and supervisors employed in personnel or legal departments;
- professionals, managers (personnel department) are all professionals (lawyers, MBAs) and managers (human resource managers, personnel directors, compensation managers, benefits managers, etc.) employed in personnel or training departments.

These occupational categories constitute all of the directly identifiable employees in an establishment's personnel or human resource management department. The basic ESE file contains the number of workers employed in these three occupations for 99,904 establishments on December 31, 1991.

It is worth noting that most of the specialized cost and administrative information reported in the ESS is known by the firms because of the legal regulations surrounding the employment relation that we discussed in section 2. The French training laws specify that all firms with ten (twenty in some cases) or more employees must spend a proportion of their wage bill for continuing in-service training (see Delame and Kramarz, 1997). This proportion increased

from 1 percent at the beginning of the 1980s to 1.2 percent at the end of the decade to 1.4 percent in 1992. The flow data on entries and exits must be declared in the DMMO. The hiring and firing costs are regulated by the laws discussed above. Finally, most of these costs are subject to special tax treatment and must, therefore, be accounted separately from other direct costs.

### 3.4 Creation of the Matched Data File

We matched our three source surveys by establishment. In the matched file, we required the establishment to be in both the Wage Structure Survey (ESS) and in the Occupational Structure Survey (ESE). Some establishments do not appear in the DMMO and are missing all items from this survey. With this constraint, there were 7,905 establishments matched. These establishments constitute our analysis file. In this analysis dataset, many variables have missing values (not all establishments report retired workers, terminated or hired employees). We explain here our methods for constructing the analysis variables and for imputing missing data, when required for the statistical analysis.

For those establishments with no data on total employment from the ESS, we used the available information from the DMMO (average of employment on January 1 and employment on December 31). An equivalent procedure was adopted for the following variables: total hires, total separations for economic reasons, and regular or early retirements: if the data were not available in the ESS, then, we used the figures from the DMMO. Furthermore, when total hires, total separations and retirements were available, but their disaggregation by skill—(a) engineers, managers and professionals or (b) all other categories– was missing, we imputed the values by skill-levels by multiplying the aggregate variable by the respective shares in these two skill-levels in the establishment as declared in the DMMO, no missing data. Finally, we used the data on entry by type of contract—short-term (CDD) or long-term (CDI)—only for those establishments with non-missing data. Table 1a shows the number of available observations for each variable from the firm-level data and Table 1b gives the number of observations for each variable from the individual-level data. The number of observations used in the different regressions is shown in our results section.

## 4 Theoretical and Statistical Models

Consider the following labor demand problem for a firm which has profit $\pi_t$ at date $t$ of the following form:

$$\pi(emp_t, s_t, f_t, h_t) = (s_t + p_1)emp_t - \frac{p_2}{2}emp_t^2 - w \times emp_t - C_f(f_t) - C_h(h_t)$$

where $s_t$ is an i.i.d. shock to the firm's revenue function, $p_1$ and $p_2$ are strictly positive coefficients, $emp_t$ is the firm's employment at date $t$, $w$ is the wage rate,

$f_t$ is the number of involuntary separations (early retirements, retirements, and terminations), $h_t$ is the number of new hires, $C_f(.)$ is the firing cost function, and $C_h(.)$ is the hiring cost function. We model these functions as follows:

$$C_f(f_t) = \alpha_{f,0} + \alpha_{f,1} f_t + \frac{\alpha_{f,2}}{2} f_t^2 \tag{1}$$

if $f_t$ is positive, and

$$C_h(h_t) = \alpha_{h,0} + \alpha_{h,1} h_t + \frac{\alpha_{h,2}}{2} h_t^2 \tag{2}$$

if $h_t$ is positive; where $\alpha_{j,k}$ are the coefficients of the cost function for $j = f, h$ and $k = 0, \ldots, 2$. Institutional costs such as severance payments imposed by the collective agreements, for example, are included in the firing costs. Help wanted advertising costs as well as training costs are included in the hiring costs. In both cost functions, we included the fixed costs, $\alpha_{i,0}$ $i = h, f$, which are modeled explicitly in our empirical results.

The firm maximizes the present value of the stream of expected profits, $V$, over an infinite horizon. First, we write $h_t$ and $f_t$ as functions of employment at $t-1$ and $t$.

$$h_t = \max[0, emp_t - (emp_{t-1} - q_{t-1,t})] \tag{3}$$

$$f_t = \max[0, (emp_{t-1} - q_{t-1,t}) - \ emp_t] \tag{4}$$

where $emp_t$ denotes employment at date $t$, and $q_{t-1,t}$ denotes exogenous quits between $t-1$ and $t$. The program becomes

$$V(emp_{t-1}, s_t; \alpha_{f,0}, \alpha_{h,0}) = \max_{emp_t}[\pi(emp_t, s_t, f_t, h_t) + \delta E_t V(emp_t, s_{t+1}; \alpha_{f,0}, \alpha_{h,0})]$$

where $\delta$ is the discount factor and the maximization is carried out subject to equations (3) and (4). We have shown explicitly the dependence of the value function on the fixed adjustment costs to clarify the intramarginal no-adjustment choice that is discussed below. Bentolila and Saint-Paul (1994) solve a version of this model with no fixed adjustment costs in which the following equation gives $emp_t$ when there are terminations (thus, $emp_t < emp_{t-1} - q_{t-1,t}$):

$$s_t + p_1 - p_2 emp_t - w + \alpha_{f,1} + \alpha_{f,2}(emp_t - (emp_{t-1} - q_{t-1,t}))$$

$$+\delta E_t V'(emp_t, s_{t+1}; \alpha_{f,0}, \alpha_{h,0}) = 0,$$

which, in the absence of fixed adjustment costs $(\alpha_{f,0}, \alpha_{h,0})$, would be sufficient when $\pi(emp_t, s_t, f_t, h_t)$ is concave in $emp_t$ given equations (3) and (4). Similarly, when the firm hires workers, they show that the following equation holds:

$$s_t + p_1 - p_2 emp_t - w - \alpha_{h,1} - \alpha_{h,2}((emp_{t-1} - q_{t-1,t}) - emp_t)$$

$$+\delta E_t V'(emp_t, s_{t+1}; \alpha_{f,0}, \alpha_{h,0}) = 0,$$

which, in the absence of fixed adjustment costs, would be sufficient when the profit function is concave in employment. Assuming that the value function exists, the firm does not reduce its level of employment as long as:

$$s_t + p_1 - p_2(emp_{t-1} - q_{t-1,t}) - w + \alpha_{f,1}$$
$$+\delta E_t V'(emp_{t-1} - q_{t-1,t}, s_{t+1}; \alpha_{f,0}, \alpha_{h,0}) > 0 \tag{5}$$

or

$$V(emp_{t-1}, s_t; 0, \alpha_{h,0}) - \pi_t(emp_{t-1} - q_{t-1,t}, s_t, 0, 0)$$
$$-\delta E_t V(emp_{t-1} - q_{t-1,t}, s_{t+1}; \alpha_{f,0}, \alpha_{h,0}) < \alpha_{f,0} \tag{6}$$

The firm does not increase its level of employment as long as:

$$s_t + p_1 - p_2(emp_{t-1} - q_{t-1,t}) - w - \alpha_{h,1}$$
$$+\delta E_t V'((emp_{t-1} - q_{t-1,t}), s_{t+1}; \alpha_{f,0}, \alpha_{h,0}) < 0 \tag{7}$$

or

$$V(emp_{t-1}, s_t; \alpha_{f,0}, 0) - \pi_t(emp_{t-1} - q_{t-1,t}, s_t, 0, 0)$$
$$+\delta E_t V(emp_{t-1} - q_{t-1,t}, s_{t+1}; \alpha_{f,0}, \alpha_{h,0}) < \alpha_{h,0} \tag{8}$$

The condition (5) is the marginal condition for firing and (7) is the marginal condition for hiring. Clearly, these two equations imply that there is a region of inaction $l \leq s_t \leq u$ where the firm makes no employment change (other than exogenous quits). The conditions (6) and (8), which are due to the fixed component of the adjustment cost functions, require that adjustments that satisfy the marginal conditions with equality also increase profits given the payment of the fixed adjustment cost. Hence, necessarily, the region of inaction is larger than the situation with no fixed component of adjustment costs.

Our establishment-level econometric specification can be stated in terms of the economic model above. We consider generalized tobit models. For separations (retirements and terminations), the tobit selection equation is based on equations (5) and (6) with observable characteristics of the establishments replacing the value function. The adjustment cost equation for separations is (1) with observably heterogeneous coefficients in some models. Tables 2 through 6 analyze retirement and termination decisions in this framework. For completeness these tables also report ordinary least squares estimates of the same specifications of equation (1) for those establishments with positive separations. For hiring, the equivalent generalized tobit has a selection equation based on equations (7) and (8) with observable establishment characteristics replacing the value function. The adjustment cost equation for hiring is (2) with observably heterogenous coefficients in some models. Tables 9 through 11 analyze hiring decisions in this framework. We do not report results for the selection equations in any of our tables.

The information collected in the ESS corresponds to the monetary and direct part of hiring or firing costs. Production losses after separations, selection and training of new hires, and delays due to advance notice periods are not quantified in our data sources. However, the analysis of the structure of the personel department constitutes one way to assess these unmeasured adjustment costs. The size of the personnel department is a measure of the willingness of the firm to incur a regular payroll cost in order to smooth, or even eliminate, some of the adjustment costs, both the explicit kind measured in our data and the implicit kind modeled above. The personnel department should have an optimal structure in that the marginal cost of adding one member to the department should equal the marginal gain from reducing employment adjustment costs and production losses associated with hiring or separations. We use this argument to justify the inclusion of the variables characterizing the personnel department structure in the equations determining the hiring/firing regime. Accordingly, in the selection equations we use the following variables: total employment; all training investments—training hours (cadre), training hours (others), direct training costs, trainees' compensation (young), trainees' compensation (others); good business conditions; bad business conditions; average labor costs per employee; and the employment in the personnel department in three skill levels (clerical workers; technicians; professionals and managers). The costs equations are, therefore, identified by the inclusion of these variables in the selection equation but not in the cost equation.

Once the number of terminations, either firing or retirements, is optimally computed, the firm must decide which worker to retire or terminate. This second stage is modeled as follows.

Consider workers indexed by $i$ employed in firm $j(i)$ in 1992. These workers have observed characteristics denoted $x_i$ and are paid $w_i$. First, decompose their wage rates into three parts: returns to observed characteristics, an establishment fixed effect, and a statistical residual, respectively:

$$w_i = x_i\beta + \phi_{j(i)} + \varepsilon_i \tag{9}$$

where the function $j(i)$ indicates the employing establishment $j$ for individual $i$.[2] Given the optimal number of terminations, computed above, the selection of the workers to be fired or retired from the establishment is modeled as follows:

$$\begin{aligned} s_i &= 1 \text{ if } x_i\gamma + \delta w_i + \varepsilon_i + \eta_i > 0 \\ s_i &= 0 \text{ otherwise} \end{aligned} \tag{10}$$

for all $i$ employed at $j(i)$, where $\varepsilon_i$ is the residual of equation (9), and $\eta_i$ is a statistical residual for the selection equation. Those workers that are either

[2] As explained in Abowd, Kramarz, and Margolis (1999), in this formulation $\phi_{j(i)}$ is the average of the person and the firm effects in firm $j(i)$.

fired or retired, for which $s_i = 1$, get a severance payment or a retirement bonus $b_i$ according to the formula:

$$b_i = \tau + \rho w_i \times sen_{i,j(i)} + \nu_i \tag{11}$$

where $\tau$ is the fixed component that the firm pays to the terminated workers, $\rho$ is the coefficient of proportionality that measures the additional severance payment that is collected by terminated workers for each franc of wage and each year of seniority (as described in the legal formula, see 2), is seniority in excess of the legal minimum to receive a severance payment, and $\nu_i$ is a statistical residual, possibly correlated with $\eta_i$. A version of equation (11) in which $\tau$ is decomposed using all individual observables $x_i$ is also be estimated.

Identification of the various effects in equation (11) comes from the presence of $\varepsilon_i$ in the selection equation and its exclusion from the bonus equation. The effect $\varepsilon_i$, the statistical residual in equation (9), measures the deviation of individual $i$ from the wage that prevails in firm $j(i)$ given his or her individual characteristics. The presence of the establishment fixed effect $\phi_{j(i)}$ in the wage equation controls for between-firm differences. Hence, a positive $\varepsilon_i$ measures the deviation of the pay of individual $i$ from the conditional mean within firm $j(i)$. The selection equation includes the estimated establishment wage effects while the bonus equation excludes them. Therefore, in the bonus equation, all effects are due to the interaction of the wage and seniority, as stipulated in the law.

# 5 Estimation Results

Table 1a reports the summary statistics for our sample of establishments. Our first estimate of the different costs is given in this table. The 1992 retirement costs per retired worker, as reported by the estabishments, were 134,011FF. The termination costs reported in the ESS include all severance payments paid for economic reasons and for cause (other than very serious misconduct). However, the number of workers terminated for cause reported in the ESS and the DMMO includes both workers who were terminated for serious reasons (with severance payment) and workers who were terminated for very serious misconduct (without severance payment). Hence, we give two measures of the cost for terminations.[3] The first is the ratio of the termination costs to the number of workers terminated for economic reasons; in 1992, this ratio is equal to 214,828FF. The second is the ratio of termination costs to the total number of terminated workers (either for economic reasons or for cause); in 1992, this ratio is equal to 95,531FF. The first number gives an upper bound on the termination cost whereas the second gives a lower bound since the total number of

[3]However, firing for very serious misconduct is restricted, and the jurisprudence is favorable to the employees.

terminated workers may include terminations for "very serious misconducts," which are exempted from severance payments. The hiring cost per hire were 5,560FF. This last figure does not include the training costs. These training costs are also shown in this table. Since the ESS does not directly ask for the training costs for new hires our reported results are computed as the ratio of the training costs to total employment. This assumption probably underestimates the training costs for the new hires since the establishment total training costs were divided by total establishment employment rather than by the employees at risk to be trained. We also give estimates of the average number of workers entering, retiring from, and terminated from the establishment in 1992. Two versions of these statistics are computed. The first includes establishments with no entries, retirements, or terminations. The second does not include these establishments and, therefore, gives us the average size of the groups entering or leaving the firm in a given year. In establishments with positive entry, 64.8 workers were hired (70 to 80 percent on short-term contracts, see Abowd, Corbel and Kramarz, 1999). In establishments with positive retirements, the average size of the group of retirees is 7.2. Finally, in establishments with positive termination for economic reasons, the average size of the group of workers fired for economic reasons is 20.0 whereas in establishments with positive termination (for economic reasons or for cause) the average size is 15.0.

Table 1b provides summary statistics for our sample of fired or retired workers. The mean age of fired workers is 38 and their average seniority is 10 years. The age of retired workers is close to 59 and their average seniority is 22 years[4]. Our estimate of the mean severance payment is lower than our estimate of the termination cost from the previous table. The same is true for retirement bonuses. Notice, however, that both termination and retirement costs comprise more than the bonuses collected by the workers, as is apparent from the laws.

Table 2 reports our results for the determinants of the cost of retirement and early retirement. Columns (1) and (3) are estimated using least squares on observations with strictly positive retirements and strictly positive retirement costs. Columns (2) and (4) are estimated by maximum likelihood (generalized tobit) using all observations with either positive costs and positive retirements or zero costs and zero retirements. Columns (1) and (2) are estimated on all establishments with at least 50 employees while columns (3) and (4) are estimated on establishments with less than 50 employees. As described above, this size threshold is important in France for all of these questions–in particular, the tradeoff between retirement and termination should depend on the size of the establishment. The least squares and tobit estimates are quite different for the largest establishments. In the least squares estmates, the linear part is very large, the function is strongly concave, and the intercept–a measure of fixed costs–is large and negative.[5] For the tobit estimates, in which the decision to

[4]The reader is reminded that we have no specific indicator for whether a separation is a termination or a retirement. The statistics reported here reflect the definitions above.

[5]All our models are quadratic functions of the number of retirements, separations, or

separate is also modeled, the linear part is small, the function is slightly concave, and the fixed costs, the intercept, are huge: 579,549FF. This difference between the two estimated equations is consistent with our model. Least squares should be downward biased; only those establishments with low costs, all other things being equal, should retire workers. All estimated coefficients for both methods, expressed in francs per retirement, are large and statistically significant. [6]

As we noted above, retirement costs are concave in the number of retired workers. The marginal cost of retiring $N$ workers is estimated at $27,435 - 176N$ (in 1992 FF) in those establishments with at least 50 employees, all other things equal. The cost of setting up the collective retirement agreement is estimated to be 579,549FF.

Table 3, which reports results for retirement costs with the retirees differentiated by skill-levels, shows that the termination costs of retirement stem primarily from retiring engineers, professionals, and managers ("cadres") and not from the retirement of other workers. The cost of retiring workers with other skills seems to be convex although not precisely estimated in Table 3. Therefore, firms should optimally group retirements of their skilled workers (concave adjustment costs) and retire low-skill workers gradually (convex adjustment costs). Notice however that the fixed cost component is also not precisely estimated when compared to the previous table. Indeed, the number of establishements that report the information on retirements by skills is lower than in Table 2.

Table 4a report the results for the costs of firing workers. Our measure of the number of terminated workers is based on the number of all terminated workers rather than just the number of terminations for economic reasons. The structure of the table is similar to that of Table 2 and the results have the same flavor.[7] Fixed costs are huge: 1,138,117FF. The marginal cost of terminating $N$ workers is estimated as $56,299 - 31.2N$. Hence, the separation costs are roughly linear, at least much less concave than those for retirement. As before, the establishments that actually terminate their workers have lower fixed costs which translates into larger proportional costs (see column (1)). Finally, establishments that have less than 50 employees have strongly concave costs, no fixed costs and those which indeed terminate workers do not differ from those which do not. Once again, the largest firms should optimally group the terminations.

hires. Even though the laws seem to imply linear costs, a number of unobserved individual characteristics of the retired or separated workers that matter to determine the retirement or separation costs will be captured by this functional form.

[6] We do not report the estimates from the probit part of the generalized tobit. Most coefficients in the probit equation are significantly different from zero. Surprisingly, the variable "facing bad business conditions" has no impact on the retirement probability. Training investments–hours of training per cadre, hours of training per other type of worker, young trainees' labor costs–decrease the retirement probability whereas the size of the establishment, total labor costs per worker, the number of clerical workers employed in the personnel department, other direct training costs, and all other trainees' labor costs increase the retirement probability.

[7] This is also true for the probit results. However, the variable "facing bad business conditions" strongly increases the probability of terminations.

The distinction between collective and individual terminations is an important element of the French law. One way to address this distinction, not measured in the data, is to assume that any firm that terminates 10 workers or more in 1992 uses the collective termination procedure while those that terminate less than 10 workers necessarily use the individual termination procedure. Results are presented in Table 4b. They are similar to the results presented in Table 4a. Most of the costs come from collective terminations. Estimates for individual terminations may appear surprising in that costs only stem from the fixed part. Identification may be difficult in this case because of a lack of variability in the number of terminations, however, firms that terminate workers, irrespective of the procedure, have much lower fixed costs than those which do not terminate workers in a given year.

Table 5 shows the impact of the skill-level of the terminated workers, distinguishing once more between collective and individual procedures (defined as above since the law does distinguish by skill-level). The cost of collective terminations is an increasing and concave function for engineers, professionals, and managers (cadres) and and a linear function for other skills. The fixed cost part is once more difficult to estimate precisely due to the smaller number of observations. Individual terminations for engineers, professionals and managers are also costly but the structure is convex whereas individual terminations for other workers do not appear to cost anything (but note that the estimates resemble those obtained in Table 4b, also for individual terminations). Such results once more demonstrate that firms should optimally group firings into collective procedures whenever highly skilled workers are involved.

Table 6 tries to decompose the fixed cost component obtained in Table 4b using various information from the survey that should affect these costs. The regression includes data on wages and seniority of the workers employed in the establishment. From the data on individual workers, we have computed fractiles of the within-establishment distributions and used them as regressors. Indeed, we expect to capture elements of the costs of terminations since the law stipulates than the payments have to depend on the wage and the seniority of the terminated workers. Unfortunately, none of these variables have a clear impact on the costs. The size of the firm is the only element that seems to be (positively) correlated with the costs of terminating workers.

Table 7 presents estimates of equations (10, probit part) and (11, tobit part) for the costs of firing based on individual-level data. These equations are estimated by maximum likelihood (first two sets of estimates). The probit equation is estimated using all workers employed in an establishment in which there is at least one individual observation for which the severance payment is known. The continuous part of the tobit is estimated on all workers below age 55 for whom the information on the severance payment is present. To assess the magnitude of the biases involved by selection, we also present least squares estimates of the bonus equation for the sample of terminated workers. The first set of estimates (first two columns) includes a fixed component, an indicator

for collective terminations in the establishment (measured as above, since no individual information is available), and a variable part (annual wage times seniority). All results are consistent with those presented above: tobit estimates differ substantially from least squares estimates, in particular the fixed cost component is much larger when the estimation technique accounts for the bias associated with selection of terminated workers by the firms while the variable part is much smaller. When decomposed using individual characteristics (next two columns), the severance payment (expressed in 1992 FF) is

$$severance\ pay = 56,823 + 776 \times seniority + 555 \times (age - seniority)$$

$$+7,512 \times (manager = 1) + 4,182 \times (blue - collar = 1)$$

and all other coefficients are not significantly different from zero. Notice that the residuals of the two equations are (strongly) negatively correlated which confirms the bias discussed above. The selection equation also shows that clerks, blue-collar workers, high-wage workers, females, senior or aged employees, or French workers are less likely to be selected while overpaid workers (as measured by $\varepsilon_i$, the residual of the wage equation, 9, i.e. workers that are better compensated than workers employed in the same establishment with identical individual characteristics) are more likely to get terminated.

Table 8 presents estimates of the same set of equations for retirement payments. All equations are estimated on workers who are at least age 55 (the first age to benefit from pre-retirement or retirement programs, see 2).[8] All equations have the same structure as described for Table 7. Selection biases are huge and the fixed component is a major part of the retirement bonus. Decomposed in terms of individual observables, the cost is

$$retirement\ bonus = 294,022 - 2,718 \times seniority$$

$$-3,181 \times (age - seniority) + 45,932 \times (manager = 1)$$

Notice that, for all workers, seniority and age coefficients are large, otherwise the workers cannot benefit from retirement programs. As for termination costs, the correlation between the selection and the bonus equations is large and negative. However, age and seniority as well as $\varepsilon_i$ enter positively in the selection equation.

Table 9 presents estimates of the cost of hiring new workers. The table reports least squares results (column 1) as well as generalized tobit estimates (column 2). As above, the two methods give widely different estimates of the fixed cost component while the quadratic part is similar in both columns. Notice, however, that the number of establishments with no hires in 1992 is quite small: 117, the difference between the number of observations in column (2)

[8] We also estimated the same tobit equation with a selection equation run on all potential workers with no changes in the estimated coefficients, albeit more precision in the estimates of the probit equation.

and in column (1). This may explain the high fixed cost of hiring for those 117 establishments.

Table 10 reports the structure of hiring costs when we differentiate the hires by skill-level. The hiring costs are due primarily to entry of engineers, professionals, and managers. Table 11 shows, on a small subsample, that the type of contract matters. Hiring costs are due entirely to entry of highly-skilled workers on long-term contracts (CDI). Once again, the cost function is increasing and concave; thus, firms should group their hiring of engineers, professionals, or managers.

# 6 Conclusions

In this article, we present estimates of the structure of retirement, termination, and hiring costs using, for the first time, representative establishment-level data matched with individual-level information. These costs are directly reported by the sampled establishments. We provide estimates of the magnitude of these costs as well as statistical summaries of their functional shape given the number of movements or the characteristics of the workers. It appears that both retirement and termination costs are increasing and mildly concave in the number of retired or terminated workers. Furthermore, the fixed costs are very large, giving the firm an incentive to group exits instead of adjusting gradually. Termination costs are largest for collective terminations as opposed to individual ones. These costs are largest for highly skilled employees. Hiring costs also exhibit the same structure; concave adjustment costs with a strong fixed component. But these hiring costs do not have the same structure for all skill levels. Only hires of cadres on long-term contracts (CDI) have an increasing and concave impact on the cost. For all other skill levels and types of contract, hiring costs do not depend upon the number of entries. Thus, for hiring costs, the firms have an incentive to group the managerial (cadre) hiring but no adjustment costs for other hiring. The costs of hiring are much less important in France than the costs of separations (retirements and terminations). The structure of the personnel department is also related to all types of entries and exits. We remind the reader that our estimates are based on a single cross-section of establishments and, thus, may be due to compositional effects rather than any single firm's cost structure.

Our results show, for the first time, direct evidence on the shape and structure of firm-level adjustment costs in contrast to the vast amount of indirect evidence based upon estimating dynamic labor demand equations (Hamermesh, 1995). In France, at least, adjustment costs display three sources of lumpiness—the fixed component of the termination or retirement costs (also present in the individual-based estimates), the existence of a personnel department, and the concave shape of these costs, which may explain why firms tend to prefer large adjustments over smaller ones, a feature also found in Caballero, Engel, and

Haltiwanger (1997).

On one hand, wages appear to be rigid in France (see Card, Kramarz, and Lemieux, 1996). On the other hand, Abowd, Corbel, and Kramarz (1999) have shown the existence of a considerable amount of worker turnover in France. Indeed, most of these movements stem from the entry and exit of workers on short-term contracts (CDD). Since the termination or retirement of workers on indefinite duration contracts (CDI) causes adjustment costs in our estimates while the termination of CDD workers does not, the conjunction of rigid wages, high firing costs for workers on CDI, and easy hiring and separation for workers on CDD seems to explain the observed behavior of French firms. In particular, our estimates explain why these firms hire primarily on short term contracts, why they reduce entries in bad times without increasing separations, and why young workers find it difficult to get a job from unemployment.

All of the microeconomic evidence for France has counterparts in the US that are not very different from those observed in France. The turnover levels are quite similar for the two countries.[9] The levels of severance payments incurred by the firms tend to be lower in the US, in particular for low-wage workers, but the difference is less strong than originally supposed: roughly 40% of full-time workers employed at medium or large employers are covered by severance payments while only 20% of those employed at employers with fewer than 100 employees (see BLS, 1993, 1994, 1995). Survey evidence provides even higher severance pay incidence, respectively 90% and 66% (see Lee Hecht Harrison in BNA, 1996). The same private survey reports an average maximum severance of 39 weeks for executives, 32 weeks for exempts, and 30 weeks for non-exempts. In addition, the experience rating in the UI system increases the costs of separations in the U.S. relative to France where there is no such experience rating system.

Like minimum wages, hiring and separation costs induce labor market rigidities. However, the link between these labor market rigidities and the high French unemployment rate is difficult to assess. In particular, as Blanchard and Katz (1997) show, increased flows into and out of unemployment do not necessarily imply a higher unemployment rate. Hence, just because there is a strong incentive to reduce adjustment costs and to increase the flows into and out of employment by the use of CDD employment contracts in France, the equilibrium rate of unemployment is not necessarily higher. Our evidence addresses the way in which adjustment costs interact with economic shocks to affect employment flows but we do not have any direct evidence on the steady state employment consequences of the French labor laws.

[9] See Anderson and Meyer (1994) for the US and Abowd, Corbel and Kramarz (1999) for France.

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**Table 1a:** Summary Statistics for the Establishment-Level Variables

| Variable | Number of Obs. | Mean | Std |
|---|---|---|---|
| Total Employment | 7,905 | 195.8 | 595.6 |
| Total Hiring | 4,255 | 61.8 | 128.9 |
| Total Hiring (excludes zeros) | 4,060 | 64.8 | 131.2 |
| Total Hiring (Eng., Prof., Managers "cadres") | 4,165 | 8.03 | 26.41 |
| Total Hiring (Others) | 4,479 | 40.25 | 103.18 |
| Total Retirements | 3,844 | 3.91 | 12.99 |
| Total Retirements (excludes zeros) | 2,084 | 7.21 | 16.95 |
| Total Retirements (Eng., Prof., Managers) | 3,777 | 0.70 | 3.05 |
| Total Retirements (Others) | 2,749 | 3.86 | 10.92 |
| Total Terminations (All Reasons) | 3,809 | 11.07 | 44.77 |
| Total Terminations (Economic Reasons, excludes zeros) | 1,133 | 19.80 | 66.01 |
| Total Terminations (All, excludes zeros) | 2,845 | 14.96 | 51.27 |
| Total Terminations (All, Eng., Prof., Man.) | 3,668 | 1.90 | 8.36 |
| Total Terminations (All, Others) | 2,215 | 11.11 | 41.28 |
| Clerical Workers (Personnel Dept.) | 7,905 | 0.81 | 6.88 |
| Supervisors (Personnel Dept.) | 7,905 | 0.84 | 5.42 |
| Professionals, Managers (Personnel Dept.) | 7,905 | 0.30 | 3.48 |
| Retirement Costs per Retiree | 1,487 | 134,011 | 1,087,370 |
| Termination Costs per Termination (Eco. Reasons) | 982 | 214,828 | 587,309 |
| Termination Costs per Termination (All) | 2,027 | 95,531 | 233,029 |
| Hiring Costs per Hire | 1,562 | 5560 | 26,240 |
| Training Hours per Eng., Prof., Man. | 7,353 | 86.2 | 2037.2 |
| Training Hours per Others | 7,341 | 68.0 | 2403.6 |
| Direct Training Cost per Worker | 7,896 | 3025.1 | 64686.7 |
| Trainees' Compensation (Young, per Worker) | 7,896 | 458.4 | 11997.5 |
| Trainees' Compensation (Others, per Worker) | 7,896 | 1459.1 | 29427.5 |
| Good Business Conditions (percent) | 7,905 | 4.2 | |
| Bad Business Conditions (percent) | 7,905 | 31.4 | |
| Average Labor Costs | 7,896 | 171,022 | 676,185 |
| Within-Firm Wage Distribution (first decile) | 7,666 | 7.206 | 0.470 |
| Within-Firm Wage Distribution (first quartile) | 7,666 | 7.409 | 0.547 |
| Within-Firm Wage Distribution (median) | 7,666 | 7.901 | 0.693 |
| Within-Firm Wage Distribution (third quartile) | 7,666 | 8.438 | 0.679 |
| Within-Firm Wage Distribution (ninth decile) | 7,666 | 8.716 | 0.598 |
| Within-Firm Seniority Distribution (first decile) | 7,662 | 2.831 | 4.204 |
| Within-Firm Seniority Distribution (first quartile) | 7,662 | 4.612 | 5.055 |
| Within-Firm Seniority Distribution (median) | 7,662 | 8.965 | 6.678 |
| Within-Firm Seniority Distribution (third quartile) | 7,662 | 14.563 | 8.222 |
| Within-Firm Seniority Distribution (ninth decile) | 7,662 | 18.093 | 9.157 |
| Growing Firm (percent) | 7,903 | 45.8 | |
| Shrinking Firm (percent) | 7,903 | 21.2 | |

**Table 1b:** Summary Statistics for Individual-Level Variables

| Variable | Number of Obs. | Mean | Std |
|---|---|---|---|
| Fired Workers: | | | |
| Managers, Engineers, Professionals (percent) | 1,705 | 16.4 | |
| Clerks (percent) | 1,705 | 17.9 | |
| Blue-Collar Workers (percent) | 1,705 | 36.0 | |
| Technicians, Foremen (percent) | 1,705 | 29.7 | |
| Male (percent) | 1,705 | 69.5 | |
| French (percent) | 1,705 | 94.7 | |
| Age | 1,705 | 37.8 | 8.4 |
| Seniority | 1,705 | 10.1 | 8.2 |
| Severance Payment | 1,705 | 18,732 | 28,990 |
| Wage ($10^6$ FF) $\times$ seniority | 1,705 | 1.69 | 1.91 |
| Log of Annual Wage | 1,705 | 12.0 | 0.6 |
| Wage Residual $\varepsilon_i$ | 1,705 | 0.140 | 0.369 |
| Retired Workers: | | | |
| Managers, Engineers, Professionals (percent) | 404 | 16.4 | |
| Clerks (percent) | 404 | 20.8 | |
| Blue-Collar Workers (percent) | 404 | 36.0 | |
| Technicians, Foremen (percent) | 404 | 26.8 | |
| Male (percent) | 404 | 67.5 | |
| French (percent) | 404 | 92.8 | |
| Age | 404 | 59.2 | 2.5 |
| Seniority | 404 | 22.6 | 11.2 |
| Retirement Bonus | 404 | 42,324 | 67,566 |
| Wage ($10^6$ FF) $\times$ seniority | 404 | 4.26 | 4.19 |
| Log of Annual Wage | 404 | 12.2 | 0.8 |
| Wage Residual $\varepsilon_i$ | 404 | 0.272 | 0.521 |

Sources: 1a ESS 1992, ESE 1992, DMMO 1992. 1b ESS 1992.

**Table 2:** The Cost of Retirement and Early Retirement in 1992

| Variable | Mean (Std) | Coef. (St.E) (1) | Coef. (St.E) (2) | Coef. (St.E) (3) | Coef. (St.E) (4) |
|---|---|---|---|---|---|
| Retirement Costs | 956040 | dep. | dep. | dep. | dep. |
| | (5263787) | | | | |
| Total Retirements | 7.72 | 215611 | 27435 | 47729 | 48396 |
| | (16.0) | (17988) | (3468) | (15896) | (16375) |
| Total Retirements | 314.7 | -782.7 | -88.0 | -2887.3 | -3045.3 |
| (squared) | (1860.4) | (153.7) | (28.7) | (987.3) | (1030.1) |
| Intercept | | -464798 | 579549 | 14406 | 80022 |
| | | (169138) | (33242) | (29761) | (58022) |
| Number of Obs. | | 1,370 | 2,554 | 116 | 374 |
| R-Squared | | 0.179 | - | 0.075 | |
| Log-likelihood | | | -14688.2 | | -915.4 |

Sources: ESS 1992, ESE 1992, DMMO 1992.

Notes : Models (1) and (3) give least squares estimates; models (2) and (4) are estimated by maximum-likelihood (generalized tobit model). Models (1) and (3) rely on establishments with strictly positive costs and strictly positive retirements. Columns (1) and (2) give estimates for establishments with 50 or more employees. Columns (3) and (4) give estimates for establishments with less than 50 employees.

**Table 3:** The Cost of Retirement and Early Retirement by Skill-Levels in 1992

| Variable | Mean (Std) | Coef. (St.E) |
|---|---|---|
| Retirement Costs | 1069506 | dep. |
| | (5997983) | |
| Total Retirements | 1.45 | 527761 |
| Eng., Prof., Manag. | (4.78) | (45489) |
| Total Retirements | 24.9 | -6281.6 |
| Eng., Prof., Manag. (squared) | (269.3) | (651.3) |
| Total Retirements | 6.91 | 16633 |
| Other Skills | (12.81) | (21284) |
| Total Retirements | 211.8 | 48.5 |
| Other Skills (squared) | (976.6) | (238.7) |
| Intercept | | -140814 |
| Eng., Prof., Manag. | | (511498) |
| Intercept | | 439008 |
| Other Skills | | (538187) |
| Number of Obs. | | 1,414 |
| Log-Likelihood | | -8080.8 |

Sources: ESS 1992, ESE 1992, DMMO 1992.

Notes : Maximum likelihood estimates on all establishments (generalized tobit).

**Table 4a:** The Cost of Terminations in 1992

| Variable | Means (St.D) | Coef. (St.E) (1) | Coef. (St.E) (2) | Coef. (St.E) (3) | Coef. (St.E) (4) |
|---|---|---|---|---|---|
| Termination Costs | 1619246 | dep. | dep. | dep. | dep. |
| | (6150543) | | | | |
| Terminations | 17.7 | 92086 | 56299 | 40078 | 51660 |
| | (57.0) | (3791.9) | (2771.2) | (9364.0) | (12300) |
| Terminations | 3565 | -18.4 | -15.6 | -662.7 | -1110.4 |
| (squared) | (52417) | (4.12) | (3.04) | (193.2) | (351.1) |
| Intercept | 1.89 | 100080 | 1138117 | -25573 | -31317 |
| | (10.1) | (119827) | (88691) | (53128) | (101641) |
| Number of Obs. | | 1,807 | 2,392 | 175 | 343 |
| R-Squared | | 0.517 | - | 0.101 | - |
| Log-likelihood | | | -18009.5 | | -1433.1 |

Sources: ESS 1992, ESE 1992, DMMO 1992.

Notes : Models (1) and (3) give least squares estimates; models (2) and (4) are estimated by maximum-likelihood (generalized tobit). Models (1) and (3) use only establishments with strictly positive costs and strictly positive terminations for economic reasons. Columns (1) and (2) give estimates for establishments with 50 or more employees. Columns (3) and (4) give estimates for establishments with less than 50 employees.

**Table 4b:** The Cost of Terminations in 1992
(distinguishing collective and individual terminations)

| Variable | Coef. (St.E) |
|---|---|
| Termination Costs | dep. |
| Collective Terminations | 51924 |
| | (3631.6) |
| Collective Terminations | -21.2 |
| (squared) | (3.84) |
| Individual Terminations | -63361 |
| | (143493) |
| Individual Terminations | 4003.0 |
| (squared) | (15700) |
| Intercept for | 1517208 |
| Collective Terminations | (180949) |
| Intercept for | 1668254 |
| Individual Terminations | (267983) |
| Number of Obs. | 2,392 |
| Log-likelihood | -18060.5 |

Sources: ESS 1992, ESE 1992, DMMO 1992.

Notes : Model estimated by maximum-likelihood (generalized tobit) on establishments with 50 or more employees.

**Table 5:** The Cost of Terminations
by Skill-Levels in 1992

| Variable | Coef. (St.E.) |
|---|---|
| Termination Costs | dep. |
| Collective Terminations | 190549 |
| Eng., Prof., Managers | (36299) |
| Collective Terminations | -611.3 |
| Eng., Prof., Managers (squared) | (179.0) |
| Collective Terminations | 24646 |
| Other Skills | (4042.0) |
| Collective Terminations | 1.86 |
| Other Skills (squared) | (5.11) |
| Individual Terminations | -193014 |
| Eng., Prof., Managers | (162096) |
| Individual Terminations | 46645 |
| Eng., Prof., Managers (squared) | (22380) |
| Individual Terminations | -24992 |
| Other Skills | (134020) |
| Individual Terminations | -2074.5 |
| Other Skills (squared) | (14120) |
| Intercept for Collective | 765883 |
| Terminations (Eng., Prof., Man.) | (1178722) |
| Intercept for Collective | 1147132 |
| Terminations (Other Skills) | (865668) |
| Intercept for Individual | 112967 |
| Terminations (Eng., Prof., Man.) | (847105) |
| Intercept for Individual | 1238190 |
| Terminations (Other Skills) | (861563) |
| Number of Observations | 1,365 |
| Log-likelihood | -10282.8 |

Sources: ESS 1992, ESE 1992, DMMO 1992.

Notes :Model estimated by maximum-likelihood (generalized tobit) on establishments with 50 or more employees.

**Table 6:** The Cost of Terminations: decomposing the fixed costs in 1992

| Variable | Coef. (St.E) |
|---|---|
| Termination Costs | dep. |
| Collective Terminations | 76768 |
| | (5133.0) |
| Collective Terminations | -14.7 |
| (squared) | (5.89) |
| Individual Terminations | 39946 |
| | (224692) |
| Individual Terminations | -1425.3 |
| (squared) | (24206) |
| Intercept for Collective Terminations | 5065036 |
| | (2612723) |
| Intercept for Individual Terminations | 4875678 |
| | (2623745) |
| Total Employment | 760497 |
| | (248048) |
| Total Employment | $0.2 \times 10^{-5}$ |
| (squared) | $(2.0 \times 10^{-5})$ |
| Firm in Expansion | -253337 |
| | (258540) |
| Firm in Contraction | 304610 |
| | (300092) |
| Within-Firm Seniority Distribution | 10852 |
| (first decile) | (47246) |
| Within-Firm Seniority Distribution | -46298 |
| (first quartile) | (48711) |
| Within-Firm Seniority Distribution | 26428 |
| (median) | (36599) |
| Within-Firm Seniority Distribution | -4949.3 |
| (third quartile) | (36610) |
| Within-Firm Seniority Distribution | 43106 |
| (ninth decile) | (27096) |

(continues on next page)

**Table 6:** The Cost of Terminations:
decomposing the fixed costs in 1992
(continued)

| | |
|---|---|
| Within-Firm Wage Distribution | 236910 |
| (first decile) | (450680) |
| Within-Firm Wage Distribution | 185695 |
| (first quartile) | (421063) |
| Within-Firm Wage Distribution | 131848 |
| (median) | (270502) |
| Within-Firm Wage Distribution | -268735 |
| (third quartile) | (316103) |
| Within-Firm Wage Distribution | -851607 |
| (ninth decile) | (296576) |
| | |
| Number of Observations | 2,326 |
| Log-likelihood | -17,687.3 |

Sources: ESS 1992, ESE 1992, DMMO 1992.Notes :Model estimated by maximum-likelihood (generalized tobit) on establishments with 50 or more employees.

**Table 7:** Firing Costs and Individual Characteristics

| Variable | Coef. (1) | St.E | Coef. (2) | St.E | Coef. (3) | St.E |
|---|---|---|---|---|---|---|
| Probit (selection): | | | | | | |
| Seniority | -0.011 | 0.001 | -0.015 | 0.002 | | |
| Age-Seniority | -0.007 | 0.001 | -0.012 | 0.002 | | |
| Managers | -0.202 | 0.085 | -0.274 | 0.086 | | |
| Technicians | -0.345 | 0.080 | -0.356 | 0.080 | | |
| Clerks | -0.549 | 0.080 | -0.576 | 0.081 | | |
| Blue-Collar Workers | -0.494 | 0.077 | -0.544 | 0.077 | | |
| Long-Term Contracts (CDI) | 1.352 | 0.091 | 1.363 | 0.090 | | |
| French | -0.071 | 0.042 | -0.106 | 0.051 | | |
| Male | 0.169 | 0.024 | 0.171 | 0.030 | | |
| Log wage | -0.194 | 0.011 | -0.172 | 0.012 | | |
| Residual | 0.738 | 0.033 | 0.743 | 0.033 | | |
| Tobit (severance payment): | | | | | | |
| Intercept | 78,755 | 2193.4 | 56,823 | 4,768.5 | 13,166 | 916.6 |
| Wage (in $10^6$FF) ×Seniority | 2,400.6 | 327.5 | 381.0 | 548.9 | 3,284.6 | 359.5 |
| Collective Termination | 16,220 | 1622.0 | | | | |
| Seniority | | | 776.3 | 130.3 | | |
| Age-Seniority | | | 555.4 | 92.3 | | |
| Manager | | | 7,513.0 | 2,134.4 | | |
| Technician | | | | | | |
| Clerk | | | 1,253.0 | 2,013.0 | | |
| Blue-Collar Worker | | | 4,182.4 | 1,667.0 | | |
| Male | | | -498.0 | 1,545.7 | | |
| French | | | 3,538.5 | 2,824.9 | | |
| $\sigma$ | 39,022 | 975.7 | 39,912 | 996.4 | | |
| Correlation | -0.898 | 0.007 | -0.908 | 0.006 | | |
| Number of Observations | 33,819 | | 33,819 | | | 1,705 |
| Log-Likelihood (or R2) | -25,733.1 | | -25,779.3 | | 0.05 | |

Sources: ESS 1992. Generalized Tobit for the first two models, OLS for model (3).

**Table 8:** Retirement Costs and Individual Characteristics

| Variable | Coef. (1) | St.E | Coef. (2) | St.E | Coef. (3) | St.E |
|---|---|---|---|---|---|---|
| Probit (selection): | | | | | | |
| Seniority | 0.076 | 0.012 | 0.080 | 0.012 | | |
| Age-Seniority | 0.061 | 0.011 | 0.065 | 0.010 | | |
| Managers | 0.056 | 0.189 | -0.147 | 0.195 | | |
| Technicians | -0.054 | 0.181 | -0.144 | 0.187 | | |
| Clerks | -0.155 | 0.188 | -0.232 | 0.194 | | |
| Blue-Collar Workers | -0.273 | 0.176 | -0.341 | 0.182 | | |
| French | -0.113 | 0.113 | -0.085 | 0.120 | | |
| Male | 0.183 | 0.077 | 0.151 | 0.082 | | |
| Log wage | -0.406 | 0.054 | -0.419 | 0.053 | | |
| Residual | 1.632 | 0.093 | 1.623 | 0.107 | | |
| Tobit (retirement bonus): | | | | | | |
| Intercept | 77,554 | 9,166.9 | 294,023 | 17,192 | 12,011 | 4297.6 |
| Wage (in $10^6$FF) ×Seniority | 5,445.6 | 753.4 | 1081.4 | 1810.9 | 7,121.0 | 720.3 |
| Seniority | | | -2,717.9 | 683.7 | | |
| Age-Seniority | | | -3,180.8 | 490.0 | | |
| Manager | | | 45,932 | 17,998 | | |
| Technician | | | | | | |
| Clerk | | | -11,203 | 19,824 | | |
| Blue-Collar Worker | | | -17,682 | 19,275 | | |
| Male | | | 11,117 | 7,702.4 | | |
| French | | | -8,087.3 | 11,876 | | |
| $\sigma$ | 68,738 | 3,396.2 | 73,908 | 4,068.2 | | |
| Correlation | -0.644 | 0.055 | -0.793 | 0.057 | | |
| Number of Observations | 2,636 | | 2,636 | | 404 | |
| Log-Likelihood (or R2) | -5,968.8 | | -5,958.6 | | 0.20 | |

Sources: ESS 1992. Generalized Tobit for the first two models, OLS for model (3).

**Table 9:** The Cost of Hiring in 1992

| Variable | Mean (Std) | Coef. (St.E) (1) | Coef. (St.E) (2) |
|---|---|---|---|
| Hiring Costs | 218475 | dep. | dep. |
| | (2065041) | | |
| Total Hiring | 84.7 | 2908.7 | 2015.0 |
| | (159.9) | (700.5) | (780.9) |
| Total Hiring | 32725 | -1.94 | -1.42 |
| (squared) | (182935) | (0.61) | (0.65) |
| Intercept | 2.10 | 35653 | 385364 |
| | (9.88) | (67193) | (137351) |
| Number of Obs. | | 1,562 | 1,679 |
| R-Squared | | 0.012 | |
| Log-likelihood | | | -13464.8 |

Sources: ESS 1992, ESE 1992, DMMO 1992.

Notes : Model (1) uses least squares estimates on the establishments with strictly positive costs and strictly positive hires. Model (2) is based on maximum-likelihood estimates (generalized tobit).

**Table 10:** The Cost of Hiring by Skill-Levels in 1992

| Variable | Mean (Std) | Coef. (St.E) |
|---|---|---|
| Hiring Costs | 227171 | dep. |
| | (2434239) | |
| Total Hiring | 8.34 | 68174 |
| Eng., Prof., Manag. | (23.06) | (10033) |
| Total Hiring | 601.0 | -188.4 |
| Eng., Prof., Manag. (squared) | (6341) | (37.7) |
| Total Hiring | 73.76 | -1769.2 |
| Other Skills | (156.60) | (1485.1) |
| Total Hiring | 29944 | -0.55 |
| Other Skills (squared) | (184662) | (1.13) |
| Intercept | 2.17 | -100043 |
| Eng., Prof., Manag. | (10.89) | (342521) |
| Intercept | 123.2 | -33044 |
| Other Skills | (1856) | (361702) |
| | | |
| Number of Obs. | | 939 |
| Log-likelihood | | -13710.1 |

Sources: ESS 1992, ESE 1992, DMMO 1992.
Notes : Maximum likelihood estimates (generalized tobit).

**Table 11:** The Cost of Hiring
by Skill-Level and Contract Type in 1992

| Variable | Mean (Std) | Coef. (St.E) |
|---|---|---|
| Hiring Costs | 1438353 | dep. |
| | (8653507) | |
| Total Hiring, CDI, | 15.44 | 270051 |
| Eng., Prof., Manag. | (21.42) | (94536) |
| Total Hiring, CDI, | 691.6 | -1251.2 |
| Eng., Prof., Manag. (squared) | (2677) | (743.3) |
| Total Hiring, CDD, | 6.29 | 82833 |
| Eng., Prof., Manag. | (27.56) | (184684) |
| Total Hiring, CDD, | 790.0 | -344.6 |
| Eng., Prof., Manag. (squared) | (6784) | (748.0) |
| Total Hiring, CDI, | 29.64 | 75669 |
| Other Skills | (60.84) | (56890) |
| Total Hiring, CDI, | 4536 | -168.9 |
| Other Skills (squared) | (23649) | (136.3) |
| Total Hiring, CDD, | 127.8 | -16054 |
| Other Skills | (238.1) | (12788) |
| Total Hiring, CDD, | 72378 | -9.21 |
| Other Skills (squared) | (230965) | (12.35) |
| Intercept | 5.06 | -2224813 |
| | (12.16) | (1581474) |
| | | |
| Number of Obs. | | 86 |
| R-Squared | | 0.187 |

Sources: ESS 1992, ESE 1992, DMMO 1992.

Notes : Least squares estimates. The models use only those establishments with strictly positive costs, with strictly positive hires, and reported data on hires by types of contract and skill-levels.

**Data Appendix**

Appendix Table A1, which is based on the data analysis from Abowd, Corbel and Kramarz (1999), shows the rates of entry and exit of worker of different contract types. The table distinguishes between CDD and CDI workers. The three lines of the table show the rates per 100 employees of growing, shrinking and stable establishments.

The Wage Structure Surveys (Enquête sur la Structure des Salaires, ESS hereafter), conducted jointly by the French National Statistical Institute (INSEE) and the Ministry of Labor, were initiated in 1966 by the European Statistical Office (ESO). However, after the 1966, 1972 and 1978 surveys, the ESS was abandoned by the ESO. INSEE decided to resume this survey given the usefulness and quantity of information collected during each wave. The 1992 ESS collects establishment wage information as well as individual wages (employees sampled within the establishment) for a sample of establishments in the manufacturing, construction, and (some) service industries. The sampling frame has two stages: at the first stage, production units are sampled; at the second stage, individuals employed at these sampled units are sampled. More specifically, the universe to be sampled includes all establishments (manufacturing) or firms (construction and service) with at least ten employees. Agriculture, transportation, telecommunication and the services supplied to households are excluded from the scope of the ESS. Insurance companies, banks, and all other industries where services are supplied to businesses are in the scope of the survey. The universe is derived from the SIRENE system, a unified database recording all existing establishments and firms in France. The sampling rate is stratified according to the industry, region, and the size of the unit. Sampling rates vary from 1 (certainty) for the units above 500 employees to 1/48 for units between 10 and 20 employees.

More detailed technical information on the 1986 version of the ESS is available in Rotbart (1991). The technical report on the 1992 version of the ESS is not yet available.

**Appendix Table A1**
**Rates of Entry/Exit of Workers by Employment Growth Category and Type of Employment Contract or Separation (per 100 Employees)**

| Employment Growth Category | Hired into Long Term Contract | Hired into Short Term Contract | Total Entry | Quits | End of Short Term Contract | Retirement | Terminations | Total Exits |
|---|---|---|---|---|---|---|---|---|
| Establishments with increasing employment in year t (all years) (N=3,465) | 9.8 (83.4) | 26.9 (187.6) | 37.2 (201.4) | 9.6 (62.2) | 17.9 (158.3) | 0.6 (6.9) | 1.9 (21.4) | 30.3 (187.6) |
| Establishments with decreasing employment in year t (all years) (N=3,179) | 5.1 (48.1) | 17.4 (160.5) | 22.7 (170.9) | 8.8 (53.8) | 16.2 (154.0) | 1.2 (12.7) | 2.7 (31.0) | 29.8 (178.5) |
| Establishments with stable employment in year t (all years) (N=371) | 7.1 (61.9) | 15.5 (128.6) | 22.7 (138.6) | 8.5 (65.1) | 12.1 (114.1) | 0.8 (9.6) | 1.6 (13.6) | 23.1 (140.9) |

Sources: Abowd, Corbel and Kramarz (1999) based on Table 8. Original source: DMMO, 1987-1990; weighted by ex post weights.

**Figure 1: Exit and Entry Rates vs. Establishment Growth Rate**