The Impact of the Reason for Layoff on the Subsequent Unemployment Duration*

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Abstract

This paper estimates the impact of the reason for layoff (economic or personal) on the length of the subsequent unemployment spell, exploiting the French Labour Force Survey. In order to control for an eventual endogeneity of the reason for layoff, a joint model of the type of layoff and unemployment duration is proposed. The length of the unemployment spell is estimated to be significantly shorter after a layoff for economic reasons than after a layoff for personal reasons, especially for nonsupervisory workers with less than a high school degree. We interpret these findings as a sign that the type of layoff is used by prospective employers as a signal of unobserved worker's productivity.

Key words: Layoffs, Unemployment Duration, Signals

JEL: J63, J64, C34, C35

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1 Introduction

The way by which observable characteristics and actions of economic agents in the labour market provide information about workers' productive ability, attracts considerable interest of labour economists since the seminal work of Akerlof (1970) and Spence (1973). Riley (2001) in his review of research on screening and signaling mentions, among others, that a signal of worker's productivity may be provided by worker's employment status and its change. As such, not only actions of workers may serve as a source of the signal, but also those of their current employers, if the market believes them to have private information about workers' hidden ability. For example, promotion decisions may provide a signal of worker's higher productivity that have implications for job assignments and turnover (Waldman, 1984, 1990; Milgrom and Oster, 1987; Bernhardt and Scoones, 1993).

Gibbons and Katz (1991) were the first to propose a model with a productivity signal generated by employer's decision that allows an empirical test of its predictions. The model assumes that workers' productivity is known only by their current employer. Prospective employers observe only whether the worker is retained by his employer, and if not, the reason for layoff. They infer that the worker has inferior productivity, if he is laid off while his employer stays on the market. On the contrary, if the firm closes down, no such negative inference is made, as the firm does not choose whom to lay off being obliged to dismiss all its employees. As a result, the model predicts that unemployment durations are longer and re-employment wages are smaller after a layoff without plant closure than after a layoff due to a plant closure. Using data on labour market histories of displaced workers[1], Gibbons and Katz (1991) find empirical evidence in support of the conclusions of their theoretical model.

Other studies inspired by the paper of Gibbons and Katz provide controversial evidence on whether the reason for layoff is perceived as a signal of worker's productivity by potential employers. For Canada, Doiron (1995) finds that white-collar workers displaced at plant closures have higher re-employment wages than those separated for other reasons, while there is no such effect in blue-collar occupations. For France, Margolis (1999, 2002) finds that workers displaced at firm closures have shorter nonemployment durations and higher

[1] January 1984 and January 1986 Displaced Workers Supplements to the US Current Population Survey.

re-employment earnings in comparison with other nonemployed[2]. For Germany, on the contrary, Grund (1999) does not find significant differences in re-employment wages after plant closures and layoffs for other reasons. In another study exploiting North-American data, Krashinsky (2002) argues that all observed difference in wage losses for the two groups of displaced workers is removed once one controls for establishment size.

All the results cited above are obtained by regressing unemployment duration or the re-employment wage on the type of layoff and some set of other relevant observable characteristics (previous tenure, industry, occupation, education, age, region and year-of-dismissal dummies). The estimated impact of the reason for layoff, which is interpreted as the productivity signal, is consequently unbiased only if there is no systematic difference in unobservable (to the econometrician) factors between workers laid off for different reasons.

The most evident reason for which that may not be the case is that worker's ability may influence both the incidence of layoff for a given reason and the subsequent unemployment duration and the re-employment wage. This argument seems to contradict the model of Gibbons and Katz, which says that the new employer does not observe worker's ability and thus uses the reason for layoff to deduce at least if the worker has low productivity or not. However, in reality, it is plausible that worker's ability is multidimensional with some components easily observable by potential employers at interviews and thus remunerated in the starting wage right away and other characteristics, which can be measured only at work.

The work of Lengermann and Vilhuber (2002) questions the very idea that workers displaced at plant closures have a better productivity than those laid off for other reasons. That would be the case if the workers' productivity distribution is the same at a plant that closes down and at a firm that lays some of its workers off but nevertheless survives. Jacobson et al. (1993) show that firms decrease wages before closure (see also Margolis (1999) for France). Consequently, it is probable that high-ability workers are the first to

[2]In these two studies, the group of other nonemployed includes not only people involuntary separated from the job, as the data used provide no information on the reason for nonemployment (separations due to plant closures are determined using firm data). Yet, as the sample is restricted to individuals having been separated from permanent jobs with seniority larger than four years and having fallen to nonemployment, the sample of nonemployed due to reasons other than firm closure seems to include mainly laid-off workers. Voluntary quits are expected to be followed by direct transition to a new job and not by a spell of nonemployment, at least for males. Females might indeed withdraw temporarily from the labour force for reasons such as childbearing.

leave their firm if it is in trouble, so that the workers' productivity distribution at soon-to-close firms is shifted to the left in comparison with the population productivity distribution before the closure really occurs. The studies of Lengermann and Vilhuber (2002) on North-American data and Schwerdt (2008) on an Austrian data set show that high-ability workers do quit their firms before they actually close down, but also low-ability workers are laid off by firms' management in attempt to reduce costs and save the firm. So, it is rather complicated to deduce, first, how the productivity distribution shifts in firms laying people off and, second, what the market (other firms) believes about this shift.

Basing on the above discussion, this paper examines the impact of the reason for layoff on the subsequent unemployment duration, taking into consideration an eventual endogeneity of the reason for layoff. For this purpose, we estimate a joint reduced-form econometric model of the reason for layoff and subsequent unemployment duration. The possibility that the determinants of the reason for layoff may be correlated with factors that influence the unemployment outcomes but are not observable to the econometrician is incorporated by allowing the error term in the equation for unemployment duration to be correlated with the error term in the equation for the type of layoff. The paper uses the *Enquête Emploi* data that allow us to distinguish only two general types of layoffs: layoffs for economic reasons and layoffs for personal reasons. We proceed from the notion that a layoff for personal reasons sends a presumably negative signal about the worker relative to a layoff for economic reasons. This assertion seems plausible as a layoff for personal reasons is always connected to worker's productivity and behaviour that do not satisfy his employer, and a layoff for economic reasons is caused by economic difficulties of the firm that are often beyond the worker's control and are not so correlated with his productivity.

The rest of the paper is organized as follows. Section 2 presents a brief overview of the French legislation concerning layoffs. Section 3 describes the data used. Sections 4 compares unemployment durations after layoffs for economic reasons and layoffs for personal reasons using Kaplan-Meier survival functions. Section 5 estimates standard unemployment duration models treating the reason for layoff as exogenous, i.e. the econometric analysis is made on the assumption that there are no unobservable factors that influence simultaneously the propensity of being laid off for a particular reason and the duration of unemployment spell that follows the involuntary separation from the job. Section 6 proposes a joint model of the reason for layoff and subsequent unemployment duration in order to take into consideration an eventual endogeneity of the reason for layoff. The results of estimation of this joint model suggest that the groups of workers laid off for economic reasons and workers laid off for some personal cause differ not only in observable characteristics but also in unobservable ones. Section 7 concludes.

2 Institutions

The French legislation distinguishes two general classes of layoffs: layoffs for personal reasons and layoffs for economic reasons[3].

The former category includes layoffs for "real and serious cause" (*licenciements pour cause réelle et sérieuse*), for "grave fault" (*licenciements pour faute grave*) and for "severe fault" (*licenciements pour faute lourde*). There exists no legal definition for any of these three motives, though the jurisprudence has defined that the cause is **real** if the claims against the employee are exact, verified and justified, and the cause is **serious** if it is impossible to continue the employment relationship without damages for the firm. It is agreed that a real and serious cause does not necessary mean a fault committed by the employee. Examples of the layoffs for real and serious cause are an employee's refusal of transfer to another position, insufficient performance, refusal of learning a new production technology, altercation with the employer, misconduct, etc. As this list shows, even being laid off for personal reasons is not necessarily a sign of inferior productivity. Repeated and deliberate misconduct, falsification of expenses incurred are examples of the layoffs for grave fault. Severe fault applies in cases when the employee had the intention to damage the employer (theft of materials, peculation). Employees laid off for real and serious cause have almost the same rights in terms of advance notice and receipt of unemployment benefits than those laid off for economic reasons. Those laid off for grave or severe fault have no advance notice and severance pay and have to quit the firm immediately; the difference is that the employee gets his unused vacation pay if the fault is grave and nothing if the fault is severe.

The layoffs for economic reasons subdivide into four groups: individual, fewer than

[3] The information given in this section is partially taken from the website of the Association Law for Everyone (*l'Association Droit pour Tous*): http://sos-net.eu.org/travail/index.htm.

10 employees over 30 days, more than 10 employees over 30 days, and bankruptcy or reorganization. There are also special considerations for large companies that lay off at least 10 people over a 3-month period without passing the 10-people-in-30-day limit. The layoff procedure becomes more and more complicated and long as the number of workers, which the firm wants to lay off, increases: if in the case of individual layoff for economic reasons the management has to organize a “reconciliation” meeting with the worker and only then a notification-of-layoff letter is sent, all with required delay and notice periods, in the case of mass layoff of fewer than 10 employees over 30 days consultations with works council or personnel representatives are also organized and in the case of mass layoff of more than 10 employees over 30 days local labour ministry office also gets involved (though in the last case individual meetings with workers are no longer obligatory)[4]. The time taken by following the legal procedure (prior to the official advance notice that starts running out from the moment the layoff letter is received) takes from approximately one month in the case of an individual layoff to two months in the case of a layoff of more than 10 people in 30 days. After the layoff letters are sent out, the official advance notice period begins. This period is a function of seniority: a minimum of one month for employees with six moths to two years of seniority, and two months for employees with at least two years of seniority. If a collective agreement exists that provides for longer notice periods, the longer periods prevail. However, the employer and employee may agree upon a buy-out of the notice period.

So, while interpreting the results of the econometric analysis presented below, we should keep in mind that workers laid off at mass layoffs have a head start of one month in search of a new job in comparison with workers having the same seniority and being laid off individually. However, one month does not seem to be a so long period taking into consideration that about 40% of unemployed stayed in unemployment for more than one year in 1990s in France (OCDE, 2005).

[4]For more details see Margolis (1999).

3 Data

This paper exploits the 1993-2002 series of the *Enquête Emploi* conducted by the INSEE. During this period, the survey was run annually in March, with one exception in the year 1999 when it was combined with the population census in January. The survey represents a rotating panel of habitations, one third of which is replaced each year.

As a result, each person participates in the survey for at most three consecutive years. The retrospective calendar allows us to observe interviewee's labour market status month by month over the year that passed from the previous survey. Respondents choose the labour market status that they consider to be their principal one from the list proposed in the questionnaire that includes different types of employment (self-employment, indefinite-term work contract, fixed-term work contract, seasonal job, apprenticeship, etc.), unemployment, and a number of reasons for which the person does not participate at the labour market (in school, retirement, military service, housekeeping, etc.)[5]. Demographic characteristics and details about the interviewee's current occupation are also provided.

3.1 Constructing a sample of unemployed

Using retrospective calendars, unemployed people can be identified and the length of their unemployment spells can be calculated. Unemployment durations are measured in months, as only the main activity in each month is reported. Short jobs within a month are not observed and, so, are not counted as interrupting spells of unemployment.

Aggregating all types of wage and salary employment into one category of "employment" and all types of inactivity into "non-participation in the labour force", an unemploy-

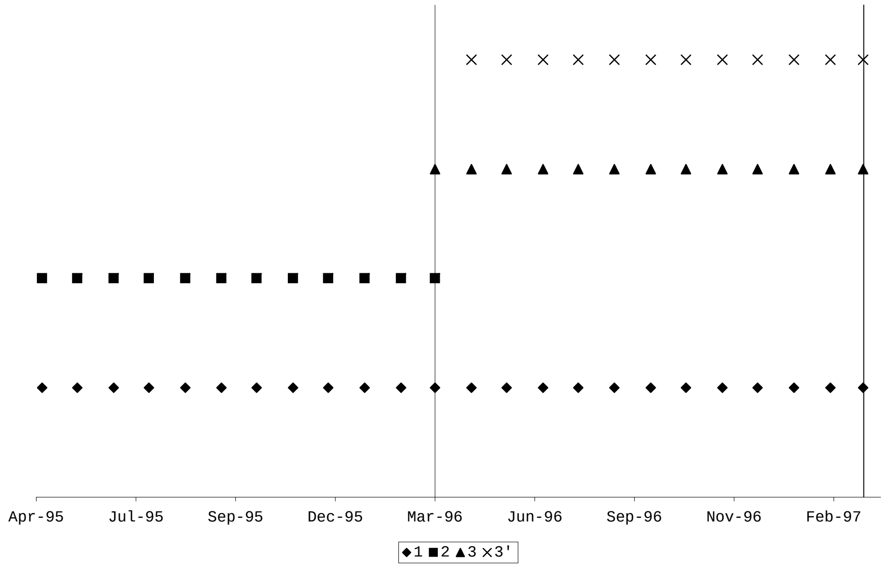
[5]Such auto-declarations seem often not to fit the economic terminology, as far as unemployment is concerned. According to ILO definition, unemployment "relates to all persons not in employment who would have accepted a suitable job or started an enterprise during the reference period if the opportunity arose, and who had actively looked for ways to obtain a job or start an enterprise in the near past". However, people tend to report that they are unemployed even if they do not use active (as defined by ILO) methods of job search. In principle, they have good cause to do that, as there is an important degree of heterogeneity among the group conventionally classified as not-in-the-labour force. For example, nonemployed individuals who are not searching actively because they are waiting for replies from employers have a higher probability of transition to employment than those classified as unemployed by the conventional rule; even people not searching at all but having the desire to work also have a significantly stronger labour force attachment than those who have definitely withdrawn from the labour market (Jones and Riddel, 1999). For more details on the issue of auto-declarations in the *Enquête Emploi* see Chardon and Goux (2003) and Gonzalez-Demichel and Nauze-Fichet (2003).

ment spell is considered to be complete if the respondent managed to find a new job while participating in the survey and right-censored if he stopped searching and left the labour market or failed to find a new job before the survey end. Unemployment spells interrupted by military service or ended with the person becoming self-employed are excluded from the analysis.

Only those unemployment spells that started in the period covered by the survey and immediately after separation from the job are retained. This excludes cases of job search after a period of non-participation and spells that had started more than one year before the person had his first interview. The resulting sample is a sample of newly unemployed, which give a representative picture of the flow into unemployment for each month from April 1992 to March 2002 (with a gap in February-March 1999 as the 1999 survey was conducted in January). This representativity is achieved due to the fact that two consecutive surveys are overlapped in the sense that the person's labour market status in March of each year is reported twice by them. For example, the principal labour market status in March 1996 is reported as the current labour market status in the 1996 survey and in the retrospective calendar of the 1997 questionnaire. If that were not the case and the retrospective calendar in 1997 reconstructed labour market statuses from April 1996 till March 1997, unemployment spells of the survey first-time participants that started in April 1996 would be lost because their previous labour market status would not be observed. Only spells of second- and third-time participants would be retained.

Figure 1 provides an illustration in order to make this concept of overlapping more clear. Individual 1 participates in waves 1996 and 1997 (recall that interviews are run in March). Individual 2 is present in wave 1996 but not in 1997. Individual 3 has his first interview in March 1997. Figure 1 marks months for which individuals' labour market statuses are reported. Individual 3' presents a would-be case if the retrospective calendar were filled from April to March and not from March to March as in the real survey. Suppose that all individuals enter unemployment in April 1996. Without overlapping (that is with individuals 1, 2 and 3'), we would include in the sample of unemployed only the first individual: labour market status of number 2 is unknown because he is not present in 1997, and number 3' is dropped because his spell is left-censored and his previous status is not observed. With overlapping, labour market status of individual 3 in March 1996 is

Figure 1: Overlapping of waves in the French Employment Survey



Note: The figure marks months for which individuals' labour market statuses are reported. Vertical lines mark interview dates (March 1996 and 1997). Without overlapping (that is with individuals 1, 2 and 3'), the final sample of unemployed would include only the first individual: labour market status of number 2 is unknown because he is not present in 1997, and number 3' is dropped because his spell is left-censored and his previous status is not observed. With overlapping, labour market status of individual 3 in March 1996 is known and, so, he is also included in the sample of unemployed.

known and, so, he is also included in the sample of unemployed.

In principle, it is possible to determine even for left-censored spells whether the person is unemployed immediately after an employment spell or began to search for a job after a non-participation one. However, for such left-censored spells, all information that interviewees provide about their previous employment, including hire and quit dates, concerns a too distant period from the interview date. The problem is that such retrospective data are subject to memory errors: the more an event is distant the less recollection is reliable (Magnac and Visser, 1999). Moreover, demographic characteristics that are reported by interviewees at the interview date, such as marital status, number of children, educational level, may be not the same as at the job separation date. Thus, we prefer not to include these left-censored spells in our sample of unemployed.

3.2 Constructing a sample of laid-off workers

After having constructed a representative sample of newly unemployed people, we need to select only those of them who lost their job involuntarily. The *Enquête Emploi* distinguishes[6] the following types of nonemployment:

- expiration of a fixed-term work contract,
- voluntary quit,
- retirement,
- mass layoff or abolition of the position (which we interpret as a "layoff for economic reasons"),
- individual layoff (considered as a "layoff for personal reasons").

Only unemployed reporting the last two reasons for separation from the job are retained for this study.

It should be noted that information about the circumstances of nonemployment is available only for a part of nonemployed. The reason is that the *Enquête Emploi* does not ask for details about nonemployment spells that take place strictly between two interviews. Detailed information about nonemployment spells is available only if the respondent has no job at the interview date, that is in March (January in 1999). If instead he quits/loses his job in April and finds a new one in the following February, nothing is known about his nonemployment spell, except the start and end dates. Such spells are useless for our purpose, as the reason for separation from the job is unknown.

The sample of unemployment spells of laid-off workers constructed from the *Enquête Emploi* data thus includes only spells which cover the month of March (the month of January in 1999). This implies that the shorter is the unemployment spell, the lower is the probability of sampling it. In estimation, this selection bias is treated with a standard procedure of stock sampling correction: each observation is weighted by the inverse probability that the person stays unemployed till the survey date.

The sample of laid-off workers is further restricted to prime-age males (25-55 year old) to have a relatively homogeneous sample of people strongly attached to the labour market. Women are excluded, as the problem of their participation in the labour force is generally

[6] Explicit information on the reason for nonemployment is an advantage of using survey data in comparison with the French administrative Annual Social Data Reports (DADS — Déclarations Annuelles des Données Sociales), which was used by Margolis (1999, 2002). The administrative data set does not contain this information.

acknowledged to be more subtle than that of men. Women withdraw more often than men from the labour market to be engaged in household production, so some of them may decide not to search for a job after being laid off, especially if job search appears to take a lot of time (Swaim and Podgursky, 1994). Omission of young people is usual when the purpose is not to analyse specifically their behaviour, because the young have a particular outside option of resuming their studies. Older people in their turn have an option of retirement (Chan and Stevens, 2001), so they are also excluded from the sample.

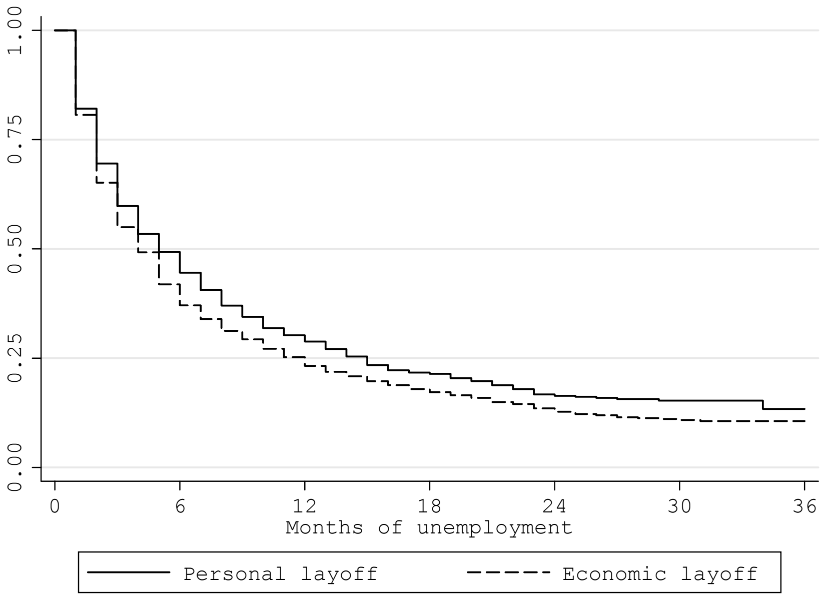
Table A-1 of Appendix presents descriptive statistics of the final estimation sample. It shows that people laid off for economic reasons and those laid off for personal reasons have significantly different characteristics, the former being older, more often non educated, blue-collar workers employed in manufacturing and construction, with longer tenure at the previous job. After separation, they receive more often unemployment benefits, and their unemployment spells are, on average, slightly longer.

4 Nonparametric analysis

To begin with, we calculate the empirical distribution of the duration of unemployment conditional on the reason for layoff. Figure 2 presents Kaplan-Meier survivor functions for workers laid off for economic reasons and for the sample of those laid off for personal reasons. The figure shows that workers who lose their jobs due to personal reasons stay in unemployment longer but the difference between two samples is rather small: one year after involuntary separation from the job, 23.2% of workers laid off for economic reasons and 28.8% of those laid off for personal reasons are unemployed. However, the equality of the two survivor functions is rejected by formal tests at 5% significance level (for example, the log-rank test statistics is 6.35, whereas the 95th percentile of χ^2_1 is 3.84).

Nevertheless, this difference between the survivor functions can not be attributed to the reason for layoff, unless both samples are homogeneous. If that is not the case, the impact of the reason for layoff is mixed with the impact of all other characteristics, in which two samples differ. Given that individuals having lost their jobs due to layoffs for economic reasons more often have characteristics that hamper re-employment in comparison with workers laid off for cause, the nonparametric method used above underestimates the impact

Figure 2: Kaplan-Meier survivor functions, by reason for layoff



of the reason for layoff on unemployment duration.

In principle, one solution is to further divide both categories of laid-off workers into subcategories using other relevant factors until subsamples become homogeneous. However, there exists a risk of getting groups with few observations, especially when using continuous variables, such as age and tenure, and thus a risk of imprecise estimates or even of impossibility to get estimates of survivor functions at some points of time. A large number of groups also does not permit us to have easily interpretable results.

Another solution is to introduce some additional distributional assumptions, which specify explicitly how the probability of leaving unemployment depends on observable and unobservable characteristics. The preference is usually given to semiparametric models, which do not require a full parametrization, but in our case, due to importance of the stock sampling (88.5% of observations are stock sampled), it seems impossible to stay within the bounds of the semiparametric approach when allowing for an endogenous regressor. That's why both semiparametric and fully parametric models are tried in the next section. The estimation of several models also allows us to verify if results are sensible to functional specification.

5 Semi and fully parametric models

5.1 Presentation

The most popular semiparametric duration model is the Cox model, which represents a proportional hazard model estimated using the partial-likelihood approach (Kiefer, 1988). The proportional hazard assumption says that the instant probability of exiting unemployment for the individual i is:

$$\lambda_i(t) = \lambda_0(t)\phi(\mathrm{x}_i, \beta), \tag{1}$$

where $\lambda_0(t)$ is the baseline hazard which is the same for all individuals, x_i is the column vector of observable characteristics of the individual i, and β is the parameter vector[7]. The specification of $\phi(\cdot)$ used in the Cox model is $\phi(\mathrm{x}_i, \beta) = \exp(\mathrm{x}_i'\beta)$. In the partial-likelihood framework, the estimation of β does not require a parametric specification of the baseline hazard.

One of the features of the Cox model is that this is a duration model in continuous time. With our data, this is a hardly realistic assumption given that respondents' occupations are observed once per month and, consequently, only the interval in which the individual leaves unemployment can be determined and not the exact time of exit. The bias in estimation of β resulting from the violation of the continuous time assumption may be significant if the unit of measurement of the duration is not marginal in comparison with the expected duration of unemployment spells.

The complementary log-log model makes it possible to treat the discrete nature of duration data. This model starts with the same proportional hazard hypothesis as the Cox model:

$$\lambda(t) = \lambda_0(t)\exp(\mathrm{x}'\beta). \tag{2}$$

[7]The duration models with hazard functions of the type

$$\lambda(\mathrm{x}, t) = k_1(\mathrm{x})k_2(t)$$

are called "proportional hazard models", because at each point of time t the ratio of hazards of two individuals with observable characteristics x_1 and x_2 is independent of t and is

$$\frac{\lambda(\mathrm{x}_1, t)}{\lambda(\mathrm{x}_2, t)} = \frac{k_1(x_1)}{k_1(x_2)}.$$

In addition to observables characteristics (x), unobserved heterogeneity (V) can be included in the model, so that the instant probability of exiting unemployment becomes

$$\lambda(t) = \lambda_0(t) \exp(\mathrm{x}'\beta + V). \tag{3}$$

It can be shown that if the unemployment spell lasted till $t-1$, the probability to leave unemployment in the period $[t-1, t]$ is

$$\Pr(T \in [t-1, t] | T > t-1) = 1 - \exp(-\exp(\mathrm{x}'\beta + V + c_t)) \tag{4}$$

where c_t equals

$$c_t = \ln \int_{t-1}^{t} \lambda_0(\tau) d\tau. \tag{5}$$

The equivalent of the survivor function is in this case

$$\Pr(T > t) = \prod_{k=1}^{t} \exp(-\exp(\mathrm{x}'\beta + V + c_k)). \tag{6}$$

This model requires explicit parametrization of the baseline hazard. The most flexible functional form of c_t would be a piecewise constant function, which would allow the baseline hazard to vary from month to month without any restriction. However, such specification is not the best choice for our sample, in which 88.5% of observations are stock sampled (only unemployment spells started in March (January in 1999) are flow-sampled). These observations do not contribute to the identification of the baseline hazard in the months of unemployment that precede the interview date, which leads to imprecise results or even non-convergence of the likelihood function maximization procedure[8]. Therefore, we

[8]For example, if the unemployment spell lasted five months and the individual was interviewed in the fourth month of his unemployment spell, his contribution to the likelihood function (given V) is

$$\begin{aligned} L_i &= \frac{\prod_{k=1}^{4} \exp(-\exp(\mathrm{x}'\beta + V + c_k))(1 - \exp(-\exp(\mathrm{x}'\beta + V + c_5)))}{\prod_{k=1}^{3} \exp(-\exp(\mathrm{x}'\beta + V + c_k))} = \\ &= \exp(-\exp(\mathrm{x}'\beta + V + c_4))(1 - \exp(-\exp(\mathrm{x}'\beta + V + c_5))) \end{aligned} \tag{7}$$

so, this spell provides no information about c_1, c_2 and c_3.

approximate c_t with a cubic polynomial of the unemployment duration:

$$c_t = \alpha_1 t + \alpha_2 t^2 + \alpha_3 t^3, \tag{8}$$

the parameters of which α_1, α_2 and α_3 are estimated jointly with β and the distribution of V (Baker and Melino, 2000). We suppose that V is a discrete random variable with two mass points a_1 and a_2 with corresponding probabilities p and $1-p$ (Heckman and Singer, 1984)[9].

Finally, the last specification, the results of which are presented in this section, is a lognormal duration model

$$\ln t = \mathrm{x}'\beta + \varepsilon, \tag{9}$$

where ε is normally distributed with mean 0 and variance σ^2. We choose a lognormal specification because it is characterized by nonmonotonic duration dependence: its hazard function first increases and then decreases. This pattern seems to be realistic in the case of the unemployment duration distribution. It is plausible that the instant probability of exiting unemployment increases in the first months of unemployment, as the person learns about available jobs and approaches the expiration date of unemployment benefits, and then it decreases due to the human capital depreciation and the stigma of being long-term unemployed.

The next subsection presents explanatory variables that we include in estimation of these duration models (as components of the vector x). Their impact is then discussed, as well as the results of the specification tests.

5.2 Results

The set of control variables is the same in all three specifications (Cox, complementary log-log and lognormal). It includes standard variables that are known to affect the length of the unemployment spell, such as age, educational level, family characteristics, as well as characteristics of the previous job (industry, profession and tenure). Characteristics specific to the research question in hand are the reason for layoff and its interactions with education

[9] A distribution with three mass points was also tried, but the data do not support this hypothesis.

and profession, as it is possible that the productivity signal provided by the reason for layoff is not the same for all categories of workers. The models also include indicators for receipt of the unemployment benefits[10] and the minimal income support[11]. Besides personal characteristics of unemployed workers, the models control for local labour market conditions. They are approximated by the city size, the departmental unemployment rate at the separation date and the average monthly percent change of the departmental unemployment rate in the year that follows the layoff[12].

Table 1 contains estimates of the parameter vector β for the three models introduced above. We present the negatives of the coefficients for the Cox and complementary log-log models, so that the coefficients showed the impact of observable variables on the length of the unemployment spell in all models. In view of the fact that the coefficients of observable variables do not have direct and simple interpretations in the Cox and complementary log-log models and thus are not easily comparable, only their signs and significance are commented here.

In principle, the results do not vary much between functional specifications and they are in line with other studies of determinants of the length of the unemployment spell. According to the results, unemployment duration increases with age and is shorter for individuals having a partner. Immigrants from developing countries stay in unemployment longer. No definitive dependence of unemployment durations on educational or skill level as well as on the colour of the collar is found, which can be explained by segmentation of the labour market: people with different education and skills search for a job in different industry and professional segments that do not intersect. The duration of unemployment spells is not monotonically increasing with respect to the tenure at the previous job, but low-tenure workers find new job more quickly. The receipt of unemployment benefits is a very significant factor, and workers receiving them have longer unemployment spells.

[10]The benefit amount depends on the previous wage, so, it is a potentially endogenous variable, as the wage in its turn depends on unobservable worker's ability. As the principal goal of this chapter is to study the dependence of unemployment duration on the reason for layoff, the models presented here control only for the receipt of unemployment benefits and not for its amount in order to make the analysis more simple.

[11]*Revenu minimum d'insertion (RMI).*

[12]Source: the website of the National Institute for Statistics and Economic Studies (l'INSEE) (`http://www.insee.fr/fr/ppp/bases-de-donnees/irweb/eds2004/dd/excel/eds2004_T301.xls`).

Table 1: Impact of the reason for layoff if endogeneity is not taken into account

Variable	Cox Coef. (st.err.)	CLL Coef. (st.err.)	LN Coef. (st.err.)
(ref: layoff for personal reasons)			
Layoff for economic reasons	−0.379***	−0.429**	−0.525***
	(0.137)	(0.174)	(0.172)
(Interactions with education)			
· Junior high school	0.169	0.293*	0.070
	(0.125)	(0.165)	(0.159)
· High school	0.037	0.062	0.319
	(0.302)	(0.383)	(0.351)
· Technical or vocational school	−0.233	−0.268	−0.211
	(0.208)	(0.271)	(0.283)
· Higher education	0.522*	0.820**	0.622*
	(0.271)	(0.363)	(0.319)
(Interactions with profession)			
· Qualified blue collar	−0.019	−0.107	0.110
	(0.155)	(0.196)	(0.198)
· Low-level white collar	0.129	0.108	0.287
	(0.212)	(0.284)	(0.272)
· Middle-level white collar	0.044	−0.056	0.153
	(0.219)	(0.287)	(0.273)
· Line supervisor or technician	0.218	0.286	0.164
	(0.242)	(0.304)	(0.300)
· Supervisor	0.451*	0.562*	0.568*
	(0.232)	(0.300)	(0.297)
Joint significance test of the interactions with the type-of-layoff indicator (χ^2_9)	19.9**	25.1*	17.21**

Note: CLL and LN stand for the complementary log-log and lognormal model respectively. A positive (negative) sign means that the corresponding variable augments (shortens) the unemployment duration. ***, ** and * indicate that the estimate is significantly different from zero at the 99%, 95% and 90% confidence level respectively. Other controls are age, education, ethnic origin, cohabitation, number of children, industry, occupation and tenure at the previous job, indicators of the receipt of unemployment benefits and RMI, city size, departmental unemployment rate at the layoff date and its growth in the year following the layoff (see table A-2 for full results).

As for the impact of the reason for layoff, unemployment spells are, in general, shorter after a layoff for economic reasons than after a layoff for personal reasons. However, the impact is not homogeneous in the population of laid-off workers: the likelihood ratio test shows that the interactions of the type-of-layoff indicator with education and profession levels are jointly significant at the 5% level in the Cox and lognormal models and at the 1% level in the complementary log-log model. If we test whether the length of the unemployment spell is significantly different after two types of layoff for each educational-professional group, the most significant differences are found for blue-collar workers without a high school degree and for those having finished a technical or vocational school. The length of the unemployment spell for people with at least a high school degree does not depend on the reason for layoff significantly, except supervisors with higher education (and line supervisors and technicians in the complementary log-log model), for whom the length of the unemployment spell is significantly shorter after a layoff for personal reasons than after a layoff for economic reasons (see table 2).

Table 2: Joint significance tests in the standard models

Profession	Education				
	Primary education	Junior high school	High school	Vocational school	Higher education
Cox model					
Non qualified blue collar	7.71***	1.96	1.16	7.31***	0.25
Qualified blue collar	13.36***	4.73**	1.44	9.38***	0.21
Low-level white collar	1.87	0.21	0.46	4.11**	0.86
Middle-level white collar	2.87*	0.85	0.94	7.05***	0.48
Line supervisor/technician	0.53	0.00	0.13	2.72*	1.36
Supervisor	0.12	1.45	0.12	0.59	6.83***
Complementary log-log model					
Non qualified blue collar	6.07**	0.52	0.84	5.87**	1.07
Qualified blue collar	14.16***	3.17*	1.55	9.11***	0.62
Low-level white collar	1.63	0.01	0.41	3.36*	1.56
Middle-level white collar	3.35*	0.64	1.18	7.16***	0.91
Line supervisor/technician	0.26	0.32	0.04	1.85	2.80*
Supervisor	0.23	2.63	0.24	0.25	10.33***
Lognormal model					
Non qualified blue collar	9.29***	5.4**	0.31	5.67**	0.08
Qualified blue collar	9.21***	6.27**	0.08	4.96**	0.42
Low-level white collar	1.05	0.55	0.05	2.00	1.22
Middle-level white collar	2.39	1.81	0.02	4.12**	0.60
Line supervisor/technician	1.77	1.32	0.01	3.36*	0.51
Supervisor	0.03	0.19	0.96	0.34	6.11**

Note: The significance of the difference in the length of the unemployment spell after a layoff for economic reasons and a layoff for personal reasons is tested by educational-professional group. The statistic of the corresponding Wald test and its significance level are presented. ***, ** and * indicate that the hypothesis of the equality of unemployment durations is rejected at the 1%, 5% and 10% level respectively.

Specification tests are in favour of the lognormal specification. The global proportional hazard hypothesis is rejected at the 5% significance level using the test based on Schoenfeld residuals (Cleves et al., 2004): the value of the test statistic is $\chi^2_{51} = 70.62$, whereas the 95% critical value for a χ^2_{51} is 68.67. If a flexible gamma duration model is estimated and then its special cases are tested at the 5% level, the exponential and Weibull specifications are rejected ($\chi^2_2 = 109.29$ and $\chi^2_1 = 63.58$ respectively, whereas the corresponding 95% critical values are 5.99 and 3.84), but not the lognormal distribution ($\chi^2_1 = 0.44$).

6 A joint model of the type of layoff and subsequent unemployment duration

6.1 Specification

This section weakens the hypothesis that there are no unobservable factors that influence simultaneously the reason for which the person lost his job and the duration of subsequent unemployment. For this purpose, we model simultaneously the type of layoff that the person undergoes and the length of his unemployment spell. The model thus contains two equations:

$$\begin{cases} D_i = \mathrm{I}(\mathrm{x}'_{1i}\beta_1 + \varepsilon_{1i} > 0) \\ \ln(t_i) = \mathrm{x}'_{2i}\beta_2 + D_i\gamma + \varepsilon_{2i} \end{cases}, \tag{10}$$

where $\mathrm{I}(\cdot)$ is the indicator function, D_i equals 1 if the individual i is laid off for economic reasons and 0 otherwise, x_{1i} and x_{2i} are column vectors of observable characteristics of the individual i, ε_{1i} and ε_{2i} resume unobservable factors, β_1 and β_2 are parameter vectors to estimate, γ represents the impact of the reason for layoff on the subsequent unemployment duration and is estimated jointly with β_1 and β_2.

The final assumption is that ε_{1i} and ε_{2i} have a bivariate normal distribution with zero mean and covariance matrix Σ:

$$\Sigma = \begin{pmatrix} 1 & \sigma_{12} \\ \sigma_{21} & \sigma_{22} \end{pmatrix}. \tag{11}$$

The duration equation includes the same variables as in the previous section. The probit for the type of layoff controls for industry, profession and tenure at the job that the worker lost as well as for his age and ethnic origin. It also controls for local economic conditions in the period when the employer decided to lay off some of his employees. As in the duration equation, these economic conditions are assumed to be well approximated by the local unemployment rate and its dynamics. So, we include in the probit the departmental unemployment rate six months before the layoff and the average percent change of the departmental unemployment rate in the first half of the year preceding the layoff. Such a lag relative to the actual moment of involuntary separation from the job is necessary, as, first, firms decide to conduct a layoff on the ground of a bad economic situation observed for some time, and, second, the legislation on layoffs fixes delays of procedure and advance notice of several months that firms have to respect. From the econometric point of view, this lag is useful in identification of the model, as unanticipated shocks to the unemployment rate with respect to its trend represent an independent source of variation of unemployment durations for a given probability of layoff for economic reasons. Next section discusses this issue in detail.

6.2 Identification

The most natural source of identification for a joint model of the type of layoff and consequent unemployment duration would be characteristics of the employer, as they influence surely the reason for which the employee is laid off but have no direct impact on how the employee is then searching for a new job. However, being a household survey, the *Enquête Emploi* provides no information on employers' characteristics, so this source of exogenous variation of the probability of layoff for economic reasons is not available for us. The idea that there exist personal characteristics of workers that influence the type of separation from the job but do not influence the length of the subsequent unemployment spell seems difficult to justify. So, the only available source of identification of the joint model (besides its nonlinear form) is variations in labour market conditions at the moment when employers decide to lay off their workers and in the period when these workers search for a new job. The rest of this section demonstrates the adequacy of such identification strategy.

Table 3 presents correlations of the local unemployment rate at the layoff date and its lags. It shows that correlations are more and more weaker as the lag order increases. For example, the correlation of the unemployment rate with its one-quarter lag is 0.995, with its one-year lag is 0.94 and its two-year lag is 0.84.

Table 3: Correlation matrix of lagged unemployment rates

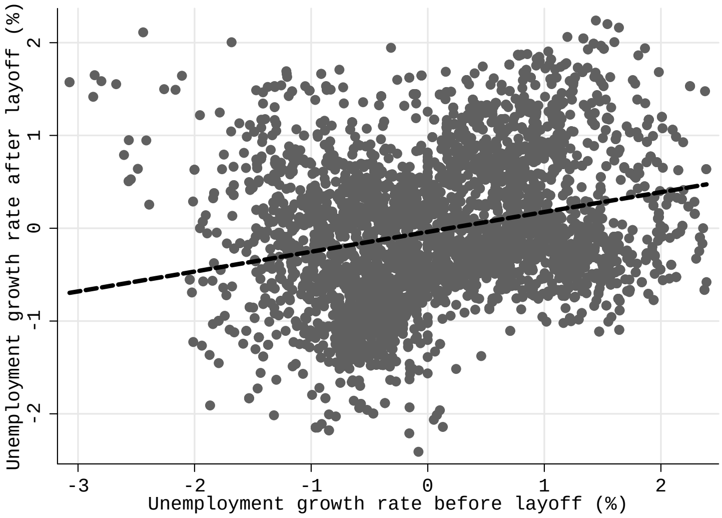
	Lag relative to the layoff date (in months)						
	0	-3	-6	-9	-12	-18	-24
Lag relative to the layoff date 0	1	0.9953	0.9822	0.9628	0.9404	0.8891	0.8357
-3	0.9953	1	0.995	0.9819	0.964	0.9191	0.8695
-6	0.9822	0.995	1	0.995	0.9825	0.9446	0.899
-9	0.9628	0.9819	0.995	1	0.9951	0.9661	0.9256
-12	0.9404	0.964	0.9825	0.9951	1	0.9839	0.9498
-18	0.8891	0.9191	0.9446	0.9661	0.9839	1	0.9855
-24	0.8357	0.8695	0.899	0.9256	0.9498	0.9855	1

Table 4: Correlation matrix of lagged average unemployment growth rates

	Lag relative to the layoff date				
	[0;12]	[-3;0]	[-6;-3]	[-9;-6]	[-12;-6]
Lag relative to the layoff date [0;12]	1	0.6067	0.4624	0.3107	0.1675
[-3;0]	0.6067	1	0.8459	0.8459	0.8459
[-6;-3]	0.4624	0.8459	1	0.816	0.816
[-9;-6]	0.3107	0.6529	0.816	1	0.7736
[-12;-9]	0.1675	0.4693	0.5501	0.7736	1

The correlations of the lagged unemployment growth rates, measured as the average monthly percent changes in the unemployment rates, are much weaker than the correlations of the lagged unemployment rates. Table 4 contains correlations of the average monthly percent change of the unemployment rate during one year after the worker is laid off, which is included as an explanatory variable in the unemployment duration equation, with the average monthly percent change of the unemployment rate over some preceding periods. As in the case of the unemployment rate and its lags, the more distant is the period, the

Figure 3: Unemployment growth rate before and after layoff



Note: "Before layoff" means "in the first half of the year preceding the layoff"; "after layoff" means "in the year that follows the layoff".

weaker is the correlation of unemployment growth rates. For example, the correlation of the unemployment growth rate in the year that follows the layoff with the unemployment growth rate in the last three months preceding the layoff is 0.61, and its correlation with the unemployment growth rate in the first half of the year preceding the layoff, which is included in the type-of-layoff probit, is 0.25. So, the correlation of the unemployment growth rates used in the joint model is sufficiently low for a good identification.

As an additional illustration, Figure 3 shows a scatter plot of the unemployment growth rates used in the probit and in the duration equation. Each point corresponds to an individual of the sample and represents a pair of the unemployment growth rates, the first of which was before the individual was laid off and the second one was observed after this event. The figure demonstrates a high degree of dispersion of observations.

It remains to show that the unemployment rate preceding the layoff has no impact on the length of the unemployment spell. For this purpose, the unemployment duration equation is estimated separately for workers laid off for economic reasons and for workers laid off for personal reasons, controlling for all variables that are expected to influence the duration of unemployment and listed in the beginning of the section 5.2, and also including the unemployment growth rate in the first half of the year preceding the layoff, which is intended to be an exclusion variable in the type-of-layoff equation of the joint model.

Estimation of the duration equation on two subsamples of laid-off workers depending on the reason for separation is necessary in order to avoid the problem of an endogenous regressor: if the equation is estimated on the pooled sample, it should, following our model, control for endogeneity of the reason for layoff. Table 5 presents the results of such reduced-form estimation that concern the impact of the local labour market conditions. They show that the unemployment growth rate before layoff has no impact on the duration of unemployment, while local labour market conditions in the time when the person is searching for a job have significant influence on the length of his unemployment spell.

Table 5: Impact of the departmental unemployment rate on unemployment duration

Variable	Log unemployment duration after a	
	Layoff for economic reasons	Layoff for personal reasons
UR at the separation date	0.0509***	0.0129
	(0.0166)	(0.0196)
UGR after the layoff	0.2819***	0.3679***
	(0.0635)	(0.0750)
UGR before the layoff	−0.0872	−0.0484
	(0.0565)	(0.0703)
Observations	2534	1931

Note: UR stands for the unemployment rate, UGR is the unemployment growth rate. Other controls are age, education, ethnic origin, cohabitation, number of children, industry, occupation and tenure at the previous job, indicators of receipt of unemployment benefits and RMI, and city size. ***, ** and * indicate that the estimate is significantly different from zero at the 99%, 95% and 90% confidence level respectively.

To sum up, this section shows that the unemployment growth rate before layoff has no impact on the consequent unemployment duration (see below for empirical evidence that it increases the probability of layoff for economic reasons). The unemployment rate dynamics before layoff is also shown to be only weakly correlated with the local unemployment rate growth after layoff, which is included in the duration equation and turns out to be a significant factor determining the length of the unemployment spell after involuntary job loss. So, the local unemployment growth rate before layoff appears to be a good continuous exclusion variable for the type-of-layoff probit, which helps us to identify the joint model in addition to its nonlinear form. The estimation results are presented in the next section.

6.3 Joint model estimation results

Table A-3 in Appendix contains full estimation results of the joint model of the reason for layoff and duration of unemployment. The table also provides the marginal effects of explanatory variables on the probability of layoff for economic reasons.

These marginal effects are calculated in the following way. For continuous variables, the first derivative of the probability of layoff for economic reasons with respect to the variable in question is calculated for each observation. For the individual i and the variable k, the estimated first derivative equals $\phi(\mathrm{x}_i'\hat{\beta})\hat{\beta}_k$, where x_i is the column vector of observable characteristics of the individual i, $\hat{\beta}$ is the parameter vector, $\hat{\beta}_k$ is the coefficient on the variable k, and $\phi(\cdot)$ is the standard normal probability density function. Table A-3 presents the sample average of the first derivative. If x_k is a dummy variable, for each observation of the sample we calculate the probability of layoff for economic reasons if x_k equals 0 ($\Phi(\mathrm{x}_i'\hat{\beta}|x_k = 0)$), and the probability of layoff for economic reasons if x_k equals 1 ($\Phi(\mathrm{x}_i'\hat{\beta}|x_k = 1)$), where $\Phi(\cdot)$ is the standard normal cumulative density function. The difference between two probabilities represents the effect of the variable x_k on the probability of layoff for economic reasons. Table A-3 presents the average over the sample effect.

According to the estimation results, the probability of being unemployed due to a layoff for economic reasons increases with age, but at a diminishing rate; after age 49 the quadratic slopes downwards, so that the probability of losing a job for economic reasons slightly decreases after age 49. The probability of being unemployed due to a layoff for economic reasons is higher for blue-collar workers (approximately by 8 percentage points in comparison with white-collar ones) and for those working in manufacturing and construction (by 10 p.p. in comparison with other industries). High-tenure workers are also more likely to be laid off for economic reasons: other things being equal, a person with tenure less than two years has a probability of being unemployed due to a layoff for economic reasons 4 p.p. lower in comparison with a person with tenure between 2 and 8 years and 8 p.p. lower in comparison with a person whose tenure exceeds 8 years. These results are coherent with other studies (Kuhn, 2002). Unfavourable labour market conditions that are approximated by the departmental unemployment growth rate also increase the probability of layoff for economic reasons: if the unemployment growth rate increases by 1 p.p., the probability of layoff for economic reasons increases by 5 p.p.

Table 6: Impact of the reason for layoff if endogeneity is taken into account

Variable	Unemployment duration	
	coef.	st.err.
(ref: layoff for personal reasons)		
Layoff for economic reasons	−1.438**	0.571
Interactions with education		
· Junior high school	0.091	0.160
· High school	0.349	0.352
· Technical or vocational school	−0.191	0.283
· Higher education	0.642**	0.318
Interactions with profession		
· Qualified blue collar	0.104	0.198
· Low-level white collar	0.296	0.271
· Middle-level white collar	0.162	0.273
· Line supervisor/technician	0.167	0.300
· Supervisor	0.576*	0.296
Joint significance test of the interactions with the type-of-layoff indicator (χ^2_9)	18.09**	

Note: ***, ** and * indicate that the estimate is significantly different from zero at the 99%, 95% and 90% confidence level respectively. Other controls are age, education, ethnic origin, cohabitation, number of children, industry, occupation and tenure at the previous job, indicators of receipt of unemployment benefits and RMI, city size, departmental unemployment rate at the layoff date and its growth in the year following the layoff (see table A-3 for full results).

As for the unemployment duration equation, the results are practically the same as when the reason for layoff was treated as exogenous, except the estimated impact of the reason for layoff. Table 6 presents coefficients on the type-of-layoff indicator and its interactions with education and profession. The coefficient of the type-of-layoff dummy is negative and significant as in the simple model, but it is three times larger in absolute value, thus implying that, other (observable as well as unobservable) things being equal, the length of the unemployment spell is four times shorter after a layoff for economic reasons than after a layoff for personal reasons for unskilled blue-collar workers with primary education. If we test whether the difference in unemployment durations is statistically significant for other educational-professional groups (whether the sums of the coefficient on the reason-for-layoff indicator and of those on its interactions with educational and professional levels are significantly different from zero), we find that the length of the unemployment spell does not depend significantly on the reason for layoff only for people with at least a high school degree and for supervisors (see table 7 for the test results).

Following the literature discussed in Introduction, we attribute the difference in unemployment durations after a layoff for economic reasons and a layoff for personal reasons to the productivity signal: potential employers consider that workers laid off for personal reasons have a lower productivity than workers laid off for economic reasons. According to our results, such productivity signal is not the same for all categories of workers: it is significantly weaker for highly educated people and for managers.

Table 7: Joint significance tests in the joint model

Profession	Education				
	Primary education	Junior high school	High school	Vocational school	Higher education
Non qualified blue collar	6.34**	5.76**	2.84*	7.24***	1.58
Qualified blue collar	5.48**	5.08**	2.36	6.48**	1.22
Low-level white collar	3.81*	3.46*	1.54	4.89**	0.63
Middle-level white collar	4.72**	4.42**	2.16	6.25**	1.07
Line supervisor/technician	4.38**	4.1**	1.94	5.82**	0.95
Supervisor	2.08	1.80	0.65	3.23*	0.14

Note: The significance of the difference in the length of the unemployment spell after a layoff for economic reasons and a layoff for personal reasons is tested by educational-professional group. The statistic of the corresponding Wald test and its significance level are presented. ***, ** and * indicate that the hypothesis of the equality of unemployment durations is rejected at the 1%, 5% and 10% level respectively.

The fact that the impact of the reason for layoff estimated in the joint model is much stronger than in the simple model is caused by a positive correlation between unobservable factors in the type-of-layoff and the unemployment duration equations (the estimate of the correlation coefficient between the error terms is equal to 0.44 with standard error 0.23). So, unobservables that increase the probability of layoff for economic reasons also increase the duration of consequent unemployment.

Several explanations of such a result can be devised. First of all, this correlation can be induced by unfavourable labour market conditions that increase the probability of layoff for economic reasons and slow down the re-employment, as we do not measure them perfectly, even if we control for departmental unemployment rate and its dynamics. Second, our results are consistent with the idea of productivity distribution shifts in distressed firms: if high-ability workers quit such firms voluntarily for better jobs before layoffs are actually conducted, then workers who stay until being laid off for economic reasons have a lower ability and are, consequently, less efficient in job search. The third possible explanation lies with reservation wages that workers form when starting their unemployment spells. If workers laid off for economic reasons have a higher quality of the match with their previous employers (and do not quit them voluntarily rather for this reason than because of their lower productivity), then they will have higher reservation wages, which will increase the length of their unemployment spells.

To sum up, this section discussed the impact of the reason for layoff on the duration of unemployment all other observable as well unobservable things being equal. However, the simultaneous equality of observable and unobservable characteristics is actually impossible given endogeneity of the reason for layoff. The fact that people with identical observable characteristics are unemployed following different types of layoff means that they have different values of unobservables having influence on the reason for layoff, which means that they also have different unobservable characteristics having influence on the length of the unemployment spell, given a nonzero correlation between these unobservables. Thus, the impact of the reason for layoff can never be observed alone and is always accompanied by changes in unobservable factors determining the duration of unemployment.

It seems interesting to compare unemployment durations after a layoff for economic reasons and a layoff for personal reasons all observable things being equal but taking into consideration the difference in unobservable factors that leads to different types of layoff for people with the same observable characteristics. The next section presents such comparison.

6.4 Calculation and comparison of the unemployment duration distributions after two types of layoffs

In order to have a more precise idea about the importance of unobservable factors determining the reason for layoff for the length of the subsequent unemployment spell, we calculate for each individual of our sample his expected unemployment duration in the case if he would have been laid off for economic reasons (let us denote it $E(t|ER)$) and his expected unemployment duration if he would have been laid off for personal reasons (denote it $E(t|PR)$). Their ratio allows us to see after which type of layoff the individual can anticipate to find a new job more rapidly. This ratio is calculated twice: first, taking into account only observable variables that determine the length of the unemployment spell, and, second, taking into consideration both observable and unobservable factors. Strictly speaking, the results of the joint model allow us to determine the values of unobservable factors at which the individual would have been laid off for economic reasons and the values at which he would have been dismissed for personal reasons. This information about unobservables is then used to correct the expected length of his unemployment spell after a layoff for economic reasons and after a layoff for personal reasons.

In the first case, $\ln t \rightsquigarrow \mathcal{N}(\mathrm{x}_{2i}\beta_2 + D_i\gamma, \sigma_{22})$ and the available information about ε_1 and its correlation with ε_2 is not used (see Section 6.1 for specification of the model). Then

$$\mathrm{E}(t_i|l) = \exp\left\{\mathrm{x}_{2i}\beta_2 + D_i\gamma + \frac{\sigma_{22}}{2}\right\} \quad l = ER, PR \tag{12}$$

In this case, the ratio $\mathrm{E}(t_i|PR)/\mathrm{E}(t_i|ER)$ does not depend on observable characteristics and is, in fact, a function only of the type-of-layoff indicator and its interactions with the education and profession, so it is the same for all individuals having the same education and skill level. In principle, this ratio represents the productivity signal of the reason for layoff as such, because it compares the length of the unemployment spell after a layoff for economic reasons with its length after a layoff for personal reasons for one and the same person with one and the same characteristics.

In the second case, we use information that $\varepsilon_{1i} > -\mathrm{x}_{1i}\beta_1$ if the person was laid off for economic reasons and $\varepsilon_{1i} < -\mathrm{x}_{1i}\beta_1$ if the person was laid off for economic reasons, and that ε_1 and ε_2 are correlated. Then

$$\mathrm{E}(t_i|l) = \exp\left\{\mathrm{x}_{2i}\beta_2 + D_i\gamma + \sigma_{21}\lambda_l + \frac{\sigma_{22} - \sigma_{21}^2\delta_l}{2}\right\}, \quad l = ER, PR \tag{13}$$

where

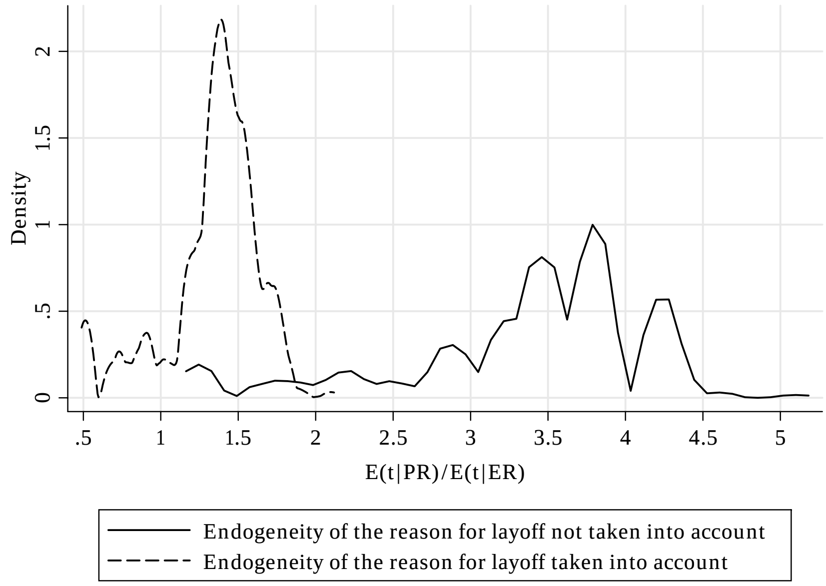
$$\lambda_l = \begin{cases} \phi(-\mathrm{x}_{1i}\beta_1)/[1 - \Phi(-\mathrm{x}_{1i}\beta_1)] & \text{if } l = ER \\ -\phi(-\mathrm{x}_{1i}\beta_1)/\Phi(-\mathrm{x}_{1i}\beta_1) & \text{if } l = PR \end{cases} \tag{14}$$

and

$$\delta_l = \lambda_l(\lambda_l + \mathrm{x}_{1i}\beta_1).^{13} \tag{15}$$

[13]This result is obtained using the following theorem about the moments of the incidentally truncated

Figure 4: Distributions of the ratio of the durations of unemployment spells after a layoff for economic reasons and a layoff for personal reasons



In this case, the ratio $\mathrm{E}(t_i|PR)/\mathrm{E}(t_i|ER)$ also depends on individual observable characteristics included in the vector x_{1i}, as they determine whether the individual is laid off for economic or personal reasons for a given value of unobservables ε_{1i}. Within our model specification, the resulting $\mathrm{E}(\ln t_i|l)$ is a nonlinear function of observable characteristics of the individual i.

Figure 4 presents the distribution of the ratio of the two expected durations $\mathrm{E}(t_i|PR)/\mathrm{E}(t_i|ER)$ in the sample used in this study when the endogeneity of the reason for layoff is ignored and when it is taken into consideration. The difference in the unemployment duration between two types of layoffs is smaller, when we control for existence of unobservable factors that influence simultaneously the reason for layoff and the length of the consequent unemployment spell. The reason is that while the length of the unemployment spell is

bivariate normal distribution: If Y and Z have a bivariate normal distribution with means μ_y and μ_z, standard deviations σ_y and σ_z, and correlation ρ, then

$$\mathrm{E}(Y|Z > a) = \mu_y + \rho\sigma_y\lambda(\alpha_z)$$

$$\mathrm{Var}(Y|Z > a) = \sigma_y^2(1 - \rho^2\delta(\alpha_z)),$$

where $\alpha_z = \dfrac{a - \mu_z}{\sigma_z}$, $\lambda(\alpha_z) = \dfrac{\phi(\alpha_z)}{1 - \Phi(\alpha_z)}$, and $\delta(\alpha_z) = \lambda(\alpha_z)(\lambda(\alpha_z) - \alpha_z)$.

If the truncation is $Z < a$, then $\lambda(\alpha_z) = -\dfrac{\phi(\alpha_z)}{\Phi(\alpha_z)}$.

shorter after a layoff for economic reasons all other things being equal, the unobservables that increase the probability of layoff for economic reasons also increase the duration of the unemployment spell that follows the layoff ($\hat{\sigma}_{21} > 0$).

The figure also shows that the ratio of the expected durations in the case when unobservables are held constant, is rather heterogeneous in our sample: for some people, the length of the unemployment spell after a layoff for personal reasons would be twice as long as after a layoff for economic reasons, and others would have an unemployment spell five times longer if they were laid off for personal reasons and not for economic. The heterogeneity of the ratio of the expected durations is also observed when the endogeneity of the reason for layoff is accounted for; however, the dispersion of the ratio is less in this case.

Table 3 presents the mean and the 1st, 5th and 9th deciles of the two distributions of the ratio $\mathrm{E}(t_i|PR)/\mathrm{E}(t_i|ER)$ for the following four groups of unemployed workers:

1. nonsupervisory workers with a high school degree or less;
2. nonsupervisory workers with at least some college;
3. supervisors with a high school degree or less;
4. supervisors with at least some college.

This choice of categories is justified by the fact that, according to the results of the joint model, the impact of the reason for layoff is significantly different for people with at least some college education and for those who were supervisors at their previous job in comparison with other workers.

Table 8: Distribution of the impact of the reason for layoff

Decile	Ratio $E(t\|PR)/E(t\|ER)$			
	Group 1	Group 2	Group 3	Group 4
Endogeneity of the reason for layoff not taken into account				
1st decile	3.13	1.65	1.67	1.25
5th decile	3.79	1.88	2.16	1.25
9th decile	4.21	2.00	2.87	1.25
Mean	3.63	1.86	2.35	1.25

See next page...

Decile	Ratio $E(t|PR)/E(t|ER)$			
	Group 1	Group 2	Group 3	Group 4
Endogeneity of the reason for layoff taken into account				
1st decile	1.19	0.69	0.71	0.49
5th decile	1.38	0.79	0.93	0.53
9th decile	1.66	0.83	1.23	0.54
Mean	1.40	0.77	0.97	0.52
Number of observations	3774	139	341	211

Note: Group 1 = Nonsupervisory workers with a high school degree or less; Group 2 = Nonsupervisory workers with at least some college; Group 3 = Supervisors with a high school degree or less; Group 4 = Supervisors with at least some college.

Table 3 confirms that the productivity signal varies strongly between educational and skill levels. Other things being equal, low-educated nonsupervisory workers have unemployment spells 3-4 times shorter after a layoff for economic reasons than after a layoff for personal reasons, while the difference in the durations of unemployment spells for supervisors having a college education is much weaker, of the order of 25%. A possible explanation is that being laid off for economic reasons also provides a signal of inferior productivity in the case of supervisors and highly-educated workers: if a supervisor having a college degree is unemployed due to a layoff for economic reasons, he should be responsible, at least partially, for economic difficulties that his firm has.

However, if the endogeneity of the reason for layoff is taken into account, the actual difference in the durations of unemployment spells after a layoff for economic reasons and after a layoff for personal reasons is much less pronounced. Only nonsupervisory workers with a high school degree or less find new jobs more quickly after a layoff for economic reasons than after a layoff for personal reasons. On the contrary, highly-educated workers and supervisors become re-employed more quickly after a layoff for personal reasons, so, their unobservable to the econometrician characteristics not only compensate for the inferior productivity signal provided by a discharge for cause, as in the case of low-educated nonsupervisory workers, but outweigh it.

7 Conclusion

This paper examines how the length of the unemployment spell after a job loss depends on the reason for this involuntary separation. The first conclusion is that when estimating the impact of the reason for layoff on the duration of consequent unemployment spells, one should control for an eventual existence of unobservable to the econometrician factors that influence simultaneously the reason for layoff and unemployment duration. This issue appears to be very important in the data that are used in this study.

We find that the length of the unemployment spell is substantially shorter after a layoff for economic reasons than after a layoff for personal reasons, other things being equal. Following the North-American economic literature on displacements, we consider that the source of this difference is that prospective employers believe that the worker has a lower productivity if he is laid off for personal reasons, while being laid off for economic reasons does not scar unemployed workers so much. However, such productivity signal is not the same for all workers: it is much stronger for nonsupervisory workers with a high school degree or less in comparison with highly educated people and supervisors.

Thus, our results show that the reason for layoff is an important factor affecting the length of the unemployment spell. If the worker is dismissed for cause, he experiences more difficulties in finding a new job, as prospective employers use all available information to deduce unobserved worker's productivity before hiring him, and the circumstances of separating from the previous job represent valuable details. Not knowing the reason for which the worker is unemployed, employers would not make negative inferences about his ability and would be more willing to hire him.

However, a ban against revelation of such information does not seem to be really beneficial in terms of social welfare. As discharges for cause should be justified very well, otherwise the firm that has conducted an unfair layoff for personal reasons might face a lawsuit and bear considerable costs, the fact that the worker is laid off for cause does contain information, though imperfect and incomplete, about unobserved worker's ability useful for prospective employers. Being laid off for personal reasons means that worker's productivity was insufficient to satisfy his previous employer. Under productivity we can understand not only productive ability, but also adequate behaviour, respect for employer's rules and requirements, etc. So, available information on the type of layoff saves firms from costly process of revealing worker's ability by themselves.

This study can not say what is the source of worker's failure to fulfil requirements of his employer, which leads to involuntary separations from the job. On the one hand, this could be worker's fault and unwillingness to properly perform his duties and responsibilities, in which case prospective employers will be warned by the type of layoff that the worker underwent. On the other hand, layoffs for cause might signal worker's insufficient qualification and ability to learn that could be potentially addressed by special training and help in occupational choices.

Finally, according to our estimation results, observable and unobservable factors that increase the probability of layoff for economic reasons also increase the length of the unemployment spell. Consequently, the observed difference in unemployment durations between workers laid off for economic and personal reasons is much smaller than suggested by the productivity signal.

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Appendix

Table A-1: Descriptive statistics

Variable	LfER	LfPR	All layoffs	Equality tests
Age (in years)	40.03	38.39	39.32	6.20***
Cohabitation	0.78	0.73	0.76	10.64***
Number of children				
No children	0.63	0.64	0.63	
1 child	0.18	0.17	0.18	
2 children	0.12	0.12	0.12	3.27
3 children	0.05	0.05	0.05	
More than 3 children	0.02	0.02	0.02	
Ethnic origin				
French	0.83	0.88	0.85	
Maghreb or Vietnam/Laos/Cambodge	0.09	0.07	0.08	24.13***
OECD	0.05	0.03	0.04	
Other foreigner	0.04	0.02	0.03	
Education				
No or primary education	0.45	0.35	0.41	
Junior high school	0.38	0.38	0.38	
High school degree	0.04	0.06	0.05	77.73***
Technical or vocational school	0.07	0.11	0.08	
Higher education	0.06	0.10	0.08	
Sector				
Agriculture	0.02	0.03	0.02	
Manufacturing	0.34	0.27	0.31	
Construction	0.25	0.15	0.21	134.40***
Retail and wholesalers	0.15	0.18	0.16	
Public services	0.02	0.03	0.03	
Services	0.23	0.33	0.27	
Occupation				
Non qualified blue collar	0.19	0.16	0.18	
Qualified blue collar	0.43	0.33	0.39	
Low-level white collar	0.09	0.14	0.11	117.66***
Middle-level white collar	0.09	0.14	0.11	
Line supervisor and technician	0.09	0.08	0.08	
Supervisor	0.10	0.15	0.12	
Tenure (in years)	7.08	5.71	6.48	5.74***
Unemployment				
Unemployment duration (in months)	9.19	8.86	9.05	1.54*
Receipt of the minimum income support	0.02	0.03	0.02	4.37**
Receipt of unemployment benefits	0.84	0.80	0.82	16.01***
Complete spells	907	605	1512	
Number of observations	2534	1931	4465	

Note: LfER and LfPR stand for the layoff for economic and personal reasons respectively. "Equality tests" show if observable characteristics are statistically different for workers laid off for different reasons. They give the statistic of the mean-comparison test if the variable is continuous and the statistic of the Pearson χ^2 independence test if the variable is categorical.

Table A-2: Effects on the unemployment duration in the standard models

Variable	Cox	CLL	LN
	Coef. (st.err.)	Coef. (st.err.)	Coef. (st.err.)
Age/10	-0.850^{***}	-0.952^{**}	-1.223^{***}
	(0.314)	(0.397)	(0.404)
$Age^2/100$	0.147^{***}	0.174^{***}	0.199^{***}
	(0.039)	(0.050)	(0.050)
Ethnic origin (ref: French)			
Maghreb or Vietnam/Cambodge/Laos	0.241^{**}	0.346^{**}	0.335^{**}
	(0.117)	(0.157)	(0.140)
OECD	-0.073	-0.048	-0.058
	(0.136)	(0.178)	(0.183)
Other	0.256	0.347	0.463^{**}
	(0.170)	(0.217)	(0.204)
Cohabitation (ref: single)			
Has a partner	-0.297^{***}	-0.411^{***}	-0.340^{***}
	(0.069)	(0.093)	(0.088)
Number of children less than 18 year old (ref: no children)			
1 child	0.016	0.036	0.054
	(0.074)	(0.095)	(0.096)
2 children	0.220^{**}	0.293^{**}	0.268^{**}
	(0.090)	(0.121)	(0.113)
3 children	0.428^{***}	0.567^{***}	0.539^{***}
	(0.137)	(0.185)	(0.168)
More than 3 children	0.547^{**}	0.555^{*}	0.935^{***}
	(0.246)	(0.321)	(0.278)
Education (ref: no or primary)			
Junior high school	-0.193^{*}	-0.297^{**}	-0.135
	(0.101)	(0.132)	(0.124)
High school	0.234	0.361	0.037
	(0.221)	(0.282)	(0.248)
Technical of vocational school	-0.250	-0.366^{*}	-0.366^{*}
	(0.156)	(0.203)	(0.197)
Higher education	-0.166	-0.337	-0.265
	(0.183)	(0.239)	(0.220)
Sector (ref: manufacturing)			
Agriculture	0.303	0.489^{*}	0.349
	(0.191)	(0.257)	(0.228)
Construction	-0.120	-0.115	-0.170^{*}
	(0.075)	(0.097)	(0.098)
Retail and wholesalers	-0.181^{**}	-0.166	-0.216^{**}
	(0.081)	(0.105)	(0.107)
Public services	-0.355^{**}	-0.287	-0.537^{**}
	(0.173)	(0.243)	(0.236)
Services	-0.107	-0.046	-0.153
	(0.074)	(0.096)	(0.096)
Profession (ref: non qualified blue collar)			
Qualified blue collar	-0.033	0.008	-0.138
	(0.129)	(0.164)	(0.159)
Low-level white collar	0.041	0.142	-0.013
	(0.160)	(0.214)	(0.199)
Middle-level white collar	0.152	0.278	0.157
	(0.171)	(0.217)	(0.207)

See next page...

Variable	Cox Coef. (st.err.)	CLL Coef. (st.err.)	LN Coef. (st.err.)
Line supervisor or technician	0.010	−0.039	0.077
	(0.196)	(0.245)	(0.237)
Supervisor	−0.258	−0.301	−0.248
	(0.175)	(0.224)	(0.218)
Tenure at the previous job (ref: less than 2 years)			
$2 \leq$ Tenure < 4	0.143*	0.223**	0.204**
	(0.079)	(0.109)	(0.101)
$4 \leq$ Tenure < 6	0.028	0.046	0.104
	(0.094)	(0.121)	(0.125)
$6 \leq$ Tenure < 8	0.061	0.049	0.097
	(0.109)	(0.137)	(0.145)
$8 \leq$ Tenure < 10	0.261*	0.421**	0.388**
	(0.138)	(0.182)	(0.171)
10 years or more	0.157**	0.199*	0.241**
	(0.077)	(0.103)	(0.095)
Social welfare (ref: non-receipt of the corresponding benefit)			
Receipt of the minimum income support	0.174	0.364	0.221
	(0.195)	(0.257)	(0.259)
Receipt of unemployment benefits	0.362***	0.719***	0.617***
	(0.077)	(0.106)	(0.084)
Local labour market conditions			
Unemployment rate at the separation date	0.016*	0.023*	0.031**
	(0.010)	(0.012)	(0.012)
Unemployment growth in the year following the separation	0.206***	0.275***	0.289***
	(0.036)	(0.049)	(0.046)
City size (ref: rural area)			
Less than 5,000 residents	0.025	0.043	0.019
	(0.124)	(0.160)	(0.165)
$5{,}000 \leq$ City size $< 10{,}000$	0.120	0.082	0.234
	(0.128)	(0.168)	(0.168)
$10{,}000 \leq$ City size $< 20{,}000$	0.179	0.232	0.245
	(0.127)	(0.169)	(0.166)
$20{,}000 \leq$ City size $< 50{,}000$	0.153	0.249*	0.208
	(0.111)	(0.147)	(0.149)
$50{,}000 \leq$ City size $< 100{,}000$	0.144	0.187	0.215
	(0.119)	(0.162)	(0.151)
$100{,}000 \leq$ City size $< 200{,}000$	0.052	0.040	0.090
	(0.112)	(0.148)	(0.148)
$200{,}000 \leq$ City size $< 2{,}000{,}000$	0.278***	0.304***	0.366***
	(0.081)	(0.105)	(0.106)
Paris and its suburbs	0.310***	0.373***	0.476***
	(0.084)	(0.110)	(0.110)
Reason for layoff and its interactions with education and profession (ref: layoff for personal reasons)			
Layoff for economic reasons	−0.379***	−0.429**	−0.525***
	(0.137)	(0.174)	(0.172)
· Junior high school	0.169	0.293*	0.070
	(0.125)	(0.165)	(0.159)
· High school	0.037	0.062	0.319
	(0.302)	(0.383)	(0.351)
· Technical or vocational school	−0.233	−0.268	−0.211
	(0.208)	(0.271)	(0.283)

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Variable	Cox	CLL	LN
	Coef. (st.err.)	Coef. (st.err.)	Coef. (st.err.)
· Higher education	0.522*	0.820**	0.622*
	(0.271)	(0.363)	(0.319)
· Qualified blue collar	−0.019	−0.107	0.110
	(0.155)	(0.196)	(0.198)
· Low-level white collar	0.129	0.108	0.287
	(0.212)	(0.284)	(0.272)
· Middle-level white collar	0.044	−0.056	0.153
	(0.219)	(0.287)	(0.273)
· Line supervisor or technician	0.218	0.286	0.164
	(0.242)	(0.304)	(0.300)
· Supervisor	0.451*	0.562*	0.568*
	(0.232)	(0.300)	(0.297)
Number of observations	4465	4465	4465
Log-likelihood	-10032.1	-4852.1	-2251.6
Global significance test (χ^2_{51})	315.5***	301.6***	334.8***
Joint significance test of the interactions with the displacement indicator (χ^2_9)	19.9**	25.1*	17.21**

Note: CLL and LN stand for the complementary log-log and lognormal model respectively. A positive (negative) sign means that the corresponding variable augments (shortens) the unemployment duration. ***, ** and * indicate that the estimate is significantly different from zero at the 99%, 95% and 90% confidence level respectively.

Table A-3: Joint model of the type of layoff and the unemployment duration

Variable	Probability of displacement			Unemployment duration (log)	
	coef.	st.err.	m.e.	coef.	st.err.
Age/10	0.611***	0.222	0.227	−1.004**	0.430
$Age^2/100$	−0.063**	0.028	−0.023	0.176***	0.053
Ethnic origin (ref: French)					
Maghreb or Vietnam/Cambodge/Laos	0.043	0.076	0.016	0.344**	0.142
OECD	0.087	0.105	0.032	−0.024	0.189
Other	0.293**	0.116	0.106	0.549**	0.216
Cohabitation (ref: single)					
Has a partner				−0.331***	0.089
Number of children less than 18 years old (ref: no children)					
1 child				0.044	0.096
2 children				0.257**	0.113
3 children				0.525***	0.168
More than 3 children				0.910***	0.278
Education (ref: no or primary)					
Junior high school	−0.066	0.046	−0.025	−0.172	0.127
High school	−0.154	0.096	−0.058	−0.029	0.252
Technical or vocational school	−0.190**	0.081	−0.071	−0.442**	0.204
Higher education	−0.134	0.089	−0.050	−0.322	0.224
Sector (ref: manufacturing)					
Agriculture	−0.401***	0.129	−0.150	0.217	0.246
Construction	0.105*	0.058	0.039	−0.136	0.102
Retail and wholesalers	−0.181***	0.061	−0.068	−0.283**	0.117
Public services	−0.370***	0.130	−0.139	−0.674***	0.253

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Variable	Probability of displacement			Unemployment duration (log)	
	coef.	st.err.	m.e.	coef.	st.err.
Services	-0.240^{***}	0.054	-0.090	-0.239^{**}	0.110
Occupation (ref: non qualified blue collar)					
Qualified blue collar	-0.016	0.058	-0.006	-0.137	0.159
Low-level white collar	-0.194^{**}	0.079	-0.073	-0.085	0.204
Middle-level white collar	-0.286^{***}	0.082	-0.108	0.060	0.216
Line supervisor or technician	0.003	0.086	0.001	0.079	0.237
Supervisor	-0.299^{***}	0.086	-0.113	-0.348	0.227
Tenure at the previous job (ref: less than 2 years)					
$2 \leq$ Tenure < 4	0.065	0.056	0.024	0.226^{**}	0.104
$4 \leq$ Tenure < 6	0.130^{*}	0.071	0.048	0.150	0.131
$6 \leq$ Tenure < 8	0.121	0.086	0.045	0.137	0.150
$8 \leq$ Tenure < 10	0.246^{**}	0.100	0.089	0.464^{**}	0.181
10 years or more	0.214^{***}	0.056	0.079	0.311^{***}	0.105
Social welfare (ref: non-receipt of the corresponding benefit)					
Receipt of RMI				0.204	0.261
Receipt of unemployment benefits				0.622^{***}	0.084
Local labour market conditions					
UR before layoff	0.010	0.007	0.004		
UGR before layoff	0.138^{***}	0.022	0.051		
UR at the separation date				0.038^{***}	0.013
UGR after layoff				0.304^{***}	0.047
City size (ref: rural area)					
Less than 5,000 residents				0.011	0.165
$5{,}000 \leq$ City size $< 10{,}000$				0.243	0.169
$10{,}000 \leq$ City size $< 20{,}000$				0.247	0.166
$20{,}000 \leq$ City size $< 50{,}000$				0.207	0.150
$50{,}000 \leq$ City size $< 100{,}000$				0.206	0.152
$100{,}000 \leq$ City size $< 200{,}000$				0.091	0.148
$200{,}000 \leq$ City size $< 2{,}000{,}000$				0.362^{***}	0.106
Paris and its suburbs				0.482^{***}	0.111
Reason for layoff and its interactions with education and profession (ref: layoff for personal reasons)					
Layoff for economic reasons				-1.438^{**}	0.571
· Junior high school				0.091	0.160
· High school				0.349	0.352
· Technical or vocational school				-0.191	0.283
· Higher education				0.642^{**}	0.318
· Qualified blue collar				0.104	0.198
· Low-level white collar				0.296	0.271
· Middle-level white collar				0.162	0.273
· Line supervisor/technician				0.167	0.300
· Supervisor				0.576^{*}	0.296
Constant	-1.185^{***}	0.437		2.997^{***}	0.820
σ_{21}	0.556^{*}	0.332			
σ_{22}	1.573^{***}	0.237			
$\mathrm{corr}(\varepsilon_1, \varepsilon_2) = \sigma_{21}/\sqrt{\sigma_{22}}$	0.444^{*}	0.233			
Number of observations			4465		
Log-likelihood			-5149.70		
Global significance test (χ^2_{77})			656.77^{***}		
Joint significance test of the interactions with the displacement indicator (χ^2_9)			18.09^{**}		

Note: UR stands for the unemployment rate, UGR is the unemployment growth rate. ***, ** and * indicate that the estimate is significantly different from zero at the 99%, 95% and 90% confidence level respectively. Marginal effect (m.e.) is the average over the sample effect of a discrete change of dummy variable from 0 to 1 or the average derivative with respect to a continuous regressor.