The impact of technological and organizational changes on labor flows. Evidence on French establishments.

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Abstract

This paper investigates the effect of organizational and technological changes on job stability of different occupations in France. We first develop a basic matching model with endogenous job destruction. It provides a structure to the empirical analysis, where we extensively exploit a unique data set on a representative sample of French establishments. The adoption of information technologies is positively correlated to labor flows of blue collar workers while most of the new workplace organizational practices positively influence the managers' turnover.

JEL classification: J23, J41, J63, L23, O33

Keywords: Labor Flows; Information and Communication technologies; Organizational Change

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1 Introduction

The consequences of the information and communication technologies (ICT) revolution have been largely analyzed by the economic literature. While authors like Berman, Bound, and Griliches (1994), Fitz Roy and Funke (1995), Machin, Ryan, and Van Reenen (1998), Krusell et al. (2000) or Moreno-Galbis (2002) claim that the capital-skill complementarity relationship is at the origin of the observed skill-biased technological change, other authors, like Caroli and Van Reenen (2001) argue that it is the internal re-organization of firms following ICT adoption that has been skill-biased. Nowadays, there is an increasing agreement about the existence of a complementary relationship between ICT adoption, inside organizational changes of firms and skills (see Askenazy and Gianella (2000), Bresnahan, Brynjolfsson, and Hitt (2002) Cappelli (1996), Caroli and Van Reenen (2001) and Greenan (1996)). The introduction of ICT is, thus, necessarily associated with changes in the organizational and skill infrastructure of the establishments.

In spite of the rich literature on the effects of the ICT revolution, there is still not much evidence about its consequences for job quality. However, when comparing the scarce available data about the introduction of ICT and high performance workplace organizational (HPWO) practices (such as *delayering*[1], team work, decentralization of decision making within firms, quality control, Total Quality Management) with the also non abundant data concerning the workers' feeling on job stability[2], we observe that, in most European countries, new technologies and innovative organizational practices adoption seems associated with an increased feeling of job instability by workers (see tables 1 and 2). The aim of this paper is to provide an empirical contribution to the recent and scarce, but growing, literature on this topic.

There are numerous works dealing with labor and job flows, e.g., Burgess and Nickell (1990) for the UK, Hamermesh, Hassink, and Van-Ours (1996) for the Netherlands, Burgess, Lane, and

[1]Delegating responsibilities to lower hierarchical levels inside the firm by removing one or more managerial levels.

[2]It would be more interesting to compare the adoption of ICT and HPWO practices with the evolution of job turnover, however the available data on this variable concerns, for most European countries, the average values of job turnover between the mid-eighties and the beginning of the nineties (see OECD (1996) table 5.1 page 176), therefore we cannot analyze its evolution.

Stevens (2000), Neumark, Polsky, and Hansen (1999), Neumark and Reed (2004) or Valletta (1999) for the US, Ilmakunnas and Maliranta (2003) for Finland, Bauer and Bender (2004) for Germany and Abowd and Kramarz (2003) or Givord and Maurin (2004) for France. However, very few analyze the effects that the introduction of ICT and HPWO practices over the last decade may have had on these flows. Some of the papers dealing with this topic are Michelacci and Lopez-Salido (2004), who develop a theoretical approach in which they decompose low-frequency movements in labor productivity into an investment-neutral and investment-specific technology component. They find that, while neutral technology shocks increase job creation and job destruction (reducing aggregate employment), investment specific shocks increase job destruction and have mild effects on job creation (aggregate employment expands).

	ICT[1] investment in OECD countries			**HPWO[2] practices**			
	1980	**1990**	**2000**	**Task rotation**	**Working teams**	**Higher worker implication**	**Reduction in hierarchy**
Belgium	..	..	12	..	..	..	..
France	6.1	8.5	13.1	6	30	44	21
Germany	7.7	13.9	19.2	7	20	19	30
Italy	8.0	14.2	16.7	13	28	24	10
Netherlands	11.2	15.5	20.9	9	9	46	47
Spain	5.6	11.9	10.1	14	34	33	..
United Kingdom	5.6	13.8	22.0	13	33	48	45
United States	15.2	22.5	31.4	..	..	..	..

1. Percentage of non residual gross fixed capital formation, total economy. ICT equipment is defined as computer and office equipment and communication equipment; software includes both purchased and own account software.
2. Percentage of establishments stating in 1996 some of the HPWO practices adopted by their employers during the three previous years (concerning Italy data refers to the three previous months).
.. Unavailable data.
Source concerning ICT: OECD estimates based on national accounts.
Source concerning HPWO: OECD Employment Outlook 1999, table 4.4, page 206.

Table 1: ICT investment and adopted HPWO practices in some OECD countries.

On the empirical side, Bauer and Bender (2004), working with a German employer-employee matched panel data set, examine the impact of ICT and HPWO practices on gross job and

	Feeling[1] of job instability 1996	Evolution[2] of job stability 1985-1995
Belgium	71.5	-6*
France	78.7	-14*
Germany	71.8	-18*
Italy	69.6	-5*
Netherlands	60.3	-12*
Spain	71.2	..
United Kingdom	66.9	-22*
United States	..	..

1. Percentage of workers being in total disagreement with the statement *my job is ensured*.
2. Evolution in percentage points in the proportion of workers considering their job ensured.
.. Unavailable data. * Significant evolution.
Source: OECD Employment Outlook 1997, table 5.2, page 148, and table 5.3, page 149.

Table 2: Job instability in OECD countries.

worker flows. The authors conclude that the organizational change is skill-biased since it leads to higher job destruction and separation rates for low- and medium-skilled workers, while employment patterns of the high-skilled are not affected significantly. They also find that new technologies do not have significant effects on gross job and workers flows. Neumark and Reed (2004), working with US data, estimate a positive link between new economy jobs, defined either as employment in high-tech cities or as industry employment growth, and contingent[3] or alternative[4] employment relationships. Jones, Kato, and Weinberg (2003) implement a case study over ten US manufacturing establishments in order to determine how the quality of jobs is affected by the managerial decision on business strategy. They conclude that in medium sized-establishment located in depressed areas and with workers of low-educational level, the proper adoption of HPWO practices can yield favorable worker outcomes: workers are more empowered, satisfied, committed, trusting, communicative and hardworking. Moreover, on the basis of the European Survey on Working Conditions, Bauer (2004) also finds that higher involvement in

[3]A contingent worker is defined as an individual holding a job that is temporary by its nature.

[4]Alternative employment arrangements are: independent contractors, on-call workers, temporary help agency workers and workers provided by contract firms.

HPWO practices is associated with higher job satisfaction. Finally, Givord and Maurin (2004), using the French Labor Force Survey, develop an econometric analysis that tries to identify the structural factors that have driven the upturn in the risk of involuntary job loss experienced by French workers over the last 20 years. They conclude that technological change seems to be at the origin of the increased job insecurity, but its effect may be mitigated by institutional changes.

Our paper explores the impact of new technologies and new organizational practices on the labor flows of different professional categories in France. The paper is divided in two interrelated parts. The first part develops a simple theoretical model providing a structure that facilitates the comprehension of the empirical analysis developed in the second part. Since we are concerned about the effects of new technologies and innovative organizational practices on the labor flows, we try to embed these features in a basic theoretical setup. The Mortensen and Pissarides (1994) endogenous job destruction model provides an appropriate framework to do so. More particularly, we consider a perfectly segmented labor market where we distinguish between complex jobs, occupied by high-skilled workers and simple jobs, occupied by low-skilled workers. Each type of job is characterized by a constant productivity component which is modified in case of biased technological or organizational changes.

In the second part of the paper we implement an empirical analysis. We use a database resulting from merging two French surveys conducted in 1999 and covering more than twenty-five hundred establishments: the REPONSE survey (RElations PrOfessionnelles et NégociationS d'Entreprise), which describes the use of new technologies and innovative organizational practices by the establishment, and the DMMO survey (Déclaration Mensuelle de Mouvements de main d'Oeuvre), describing the gross labor and job flows (entries, exits, job creations and destructions, etc.) in the establishment by gender, age, professional category, etc. We estimate the effects of ICT and HPWO practices on the labor flows of different categories of workers. Results reveal that the turnover of blue collars is positively affected by ICT adoption and negatively by the introduction of some of the HPWO practices. In contrast, labor flows of white collars are positively related to HPWO practices. Our approach is focused on the total number of movements (entries + exits) by professional categories while the analysis developed in Bauer and

Bender (2004) estimated job creation and destruction patterns for different skill groups inside plants. Findings in both studies can, thus, be considered as complementary.

The paper is organized as follows. Section 2 presents a basic theoretical model providing the structure for our core empirical analysis. The comparative static analysis reveals that the introduction of any technological or organizational change relatively favoring the productivity of white collars stimulates labor flows of blue collars. In contrast any change favoring the relative productivity of blue collar workers increases the turnover of white collars. Section 3 describes both the data surveys and the data itself. Section 4 details the econometric analysis developed in the paper. Results are explained in Section 5 and Section 6 concludes.

2 A simple model

2.1 Assumptions

We develop a simple model giving a theoretical foundation to the effects of ICT and HPWO practices on labor flows. This theoretical setup is inspired from a discrete version of Mortensen and Pissarides (1994), developed in Cahuc and Postel-Vinay (2002) for the case of one firm offering different types of contracts to homogenous workers. Here we assume two types of competitive firms employing labor as a unique input:

- Firms producing complex goods only employ high-skilled workers since the production of these goods involves complex tasks requiring a high-skill qualification.
- Firms producing simple goods only employ low-skilled workers since their production process involves simpler tasks.

We have therefore completely segmented labor markets, where high-skilled workers only occupy complex jobs and low-skilled workers only simple jobs (no job competition). Moreover we assume a one-job-one-firm framework. Both assumptions allow to simplify the theoretical model, which roughly tries to provide an intuitive understanding of the economic mechanisms underlying behind the empirical results. Generalizing the model to the case where job competition is allowed or when the firm offers several jobs, will complicate the analytical results without improving the comprehension of the empirical part.

When the firm opens a vacancy, it can be filled, and the firm starts producing, or it can remain empty and the firm continues searching. Any job that is not producing or searching is destroyed (job destruction). In contrast, a job is created when a firm with a vacant job and a worker meet and both decide to start producing (it is mutually profitable to produce). The number of complex and simple contacts per period (M_t^c and M_t^s) is respectively represented by the following linear homogeneous matching functions:

$$M_t^c = M^c(v_t^c, u_t^h) \qquad \text{and} \qquad M_t^s = M^s(v_t^s, u_t^l)\ , \tag{1}$$

where v_t^c and v_t^s represent the number of complex and simple vacancies and u_t^h and u_t^l the number of high- and low-skilled unemployed.

We denote labor market tensions in the complex and simple segment by ϑ_t^c and ϑ_t^s, where:

$$\vartheta_t^c \equiv \frac{v_t^c}{u_t^h} \qquad \text{and} \qquad \vartheta_t^s \equiv \frac{v_t^s}{u_t^l}. \tag{2}$$

The probabilities of filling a complex and a simple job vacancy are respectively decreasing in ϑ_t^c and ϑ_t^s and they are defined as:

$$\frac{M_t^c}{v_t^c} = q(\vartheta_t^c) \qquad \text{and} \qquad \frac{M_t^s}{v_t^s} = q(\vartheta_t^s). \tag{3}$$

With linear homogeneous matching functions, the probabilities of finding a complex or a simple job can be respectively written as follows:

$$\frac{M_t^c}{u_t^h} = \vartheta_t^c q(\vartheta_t^c) \qquad \text{and} \qquad \frac{M_t^s}{u_t^l} = \vartheta_t^s q(\vartheta_t^s). \tag{4}$$

The complex job is associated to a fixed coefficients technology requiring one high-skilled worker to produce $\varepsilon + h_1$ units of output in period t. The simple job is associated to a fixed coefficients technology requiring one low-skilled worker to produce $\varepsilon + h_2$ units of output in period t. The term ε is a random idiosyncratic productivity parameter that is the same whether we are considering complex or simple jobs. All the values of ε are drawn from the distribution $\phi = \Phi'$ over the interval $[\underline{\varepsilon}, \overline{\varepsilon}]$. The process that changes this idiosyncratic term is the same in the complex and the simple segment, and it follows a Poisson distribution with arrival rate $\lambda \in [0, 1]$. Therefore, there exists a probability λ that the economy is hit by a shock such that a new value of ε has to be drawn from ϕ.

The terms h_1 et h_2 are interpreted as the positive constant productivity component specific to each production sector (complex or simple). We impose them to add up to one ($h_1 + h_2 = 1$) which implies that improvements in the productivity of one sector go against the productivity in the other sector[5]. This assumption can be better justified if we think in terms of the skill-premium. During the last decades the progressive adoption of new technologies and organizational practices has run in parallel with the rise in wage inequalities (see, for example, Davis and Haltiwanger (1991) or Krusell et al. (2000) for the U.S. and Kramarz, Lollivier, and Pelé (1996) for France). The improvement in the high-skilled workers' wage premium is interpreted as an improvement in their relative productivity, which implies a deterioration in the low-skilled relative productivity. Imposing $h_1 + h_2 = 1$ permits to capture this fact and facilitates the analysis of the effects that different biased shocks (favoring the productivity of one type of worker and going against the productivity of the other type of worker) have on the labor flows of each labor market segment.

It is important to notice that all job contacts do not lead to a job creation, since the match may not be productive enough. The initial productivity level $\varepsilon + h_1$ (or $\varepsilon + h_2$) is revealed to the firm and the worker immediately after the match is formed. Because search and hiring activities are costly, the productivity level may be too low to compensate either party for their efforts. Therefore, there exists a productivity level, called reservation productivity and denoted ε^c for the complex segment and ε^s for the simple one, below which it is not in the interest of the firm and the worker to trade.

2.2 Concepts and notation

An open vacancy can remain empty and searching or be filled and start producing. The associated asset value to each of these situations is represented by Π^{v^c} (resp. Π^{v^s}) when the complex (resp. simple) vacancy is empty and by $\Pi^c(\varepsilon)$ (resp. $\Pi^s(\varepsilon)$) when the complex (resp. simple) vacancy is filled. In the same way, the value to the worker in a complex (resp. simple) job is denoted as $V^c(\varepsilon)$ (resp. $V^s(\varepsilon)$). Finally, the average expected return on the high-skilled (resp.

[5] Notice that, the smaller the deterministic productivity component (h_1 or h_2) the more important is the share of the idiosyncratic component (ε) in total productivity, meaning that the agents heterogeneity (represented by ε) will have the prominent role.

low-skilled) worker's human capital when looking for a job is represented by V^{u^h} (V^{u^l}).

Since search and hiring activities are costly, when a match is formed a joint surplus is generated:

$$
\begin{aligned}
S^c(\varepsilon) &= \Pi^c(\varepsilon) - \Pi^{v^c} + V^c(\varepsilon) - V^{u^h} \quad \text{Joint surplus in a complex job.} \\
S^s(\varepsilon) &= \Pi^s(\varepsilon) - \Pi^{v^s} + V^s(\varepsilon) - V^{u^l} \quad \text{Joint surplus in a simple job.}
\end{aligned}
$$

At the beginning of every period the firm and the employee renegotiate wages through a Nash bargaining process, that splits the joint surplus into fixed proportions at all times. Denoting as $\eta \, \epsilon \, [0,1]$ the bargaining power[6] of workers (whether they are in complex or simple positions), we have that:

$$
\Pi^c(\varepsilon) - \Pi^{v^c} = (1-\eta)\, S^c(\varepsilon) \quad \text{or} \quad V^c(\varepsilon) - V^{u^h} = \eta\, S^c(\varepsilon)\ , \tag{5}
$$

$$
\Pi^s(\varepsilon) - \Pi^{v^s} = (1-\eta)\, S^s(\varepsilon) \quad \text{or} \quad V^s(\varepsilon) - V^{u^l} = \eta\, S^s(\varepsilon)\ . \tag{6}
$$

When a firm producing a complex good opens a vacancy it has to support a cost a^c per unit of time. When a firm producing a simple good opens a vacancy it has to support a cost a^s per unit of time. There is a probability $1 - q(\vartheta^c)$ and $1 - q(\vartheta^s)$ that the complex and simple vacancy, respectively, remain empty next period. On the opposite, there is a probability $q(\vartheta^c)$ and $q(\vartheta^s)$ that the complex and the simple vacancies get filled. The asset value associated to a searching vacancy is then:

$$
\Pi^{v^c} = -a^c + \beta\,(1 - q(\vartheta^c))\,\Pi^{v^c} + \beta\, q(\vartheta^c) \int_{\underline{\varepsilon}}^{\overline{\varepsilon}} Max[\Pi^c(x), \Pi^{v^c}]\, d\Phi(x)\ , \tag{7}
$$

$$
\Pi^{v^s} = -a^s + \beta\,(1 - q(\vartheta^s))\,\Pi^{v^s} + \beta\, q(\vartheta^s) \int_{\underline{\varepsilon}}^{\overline{\varepsilon}} Max[\Pi^s(x), \Pi^{v^s}]\, d\Phi(x)\ . \tag{8}
$$

where β is the discount factor.

When the vacancy is filled and actively producing, we know that there is a probability λ that the job is hit by a shock, so that a new value of ε is drawn from the distribution ϕ. The asset values associated to the complex and simple jobs are respectively:

$$
\Pi^c(\varepsilon) = \varepsilon + h_1 - w^c(\varepsilon) + \beta\,(1-\lambda)\, Max[\Pi^c(\varepsilon), \Pi^{v^c}] + \beta\,\lambda \int_{\underline{\varepsilon}}^{\overline{\varepsilon}} Max[\Pi^c(x), \Pi^{v^c}]\, d\Phi(x)\ , \tag{9}
$$

$$
\Pi^s(\varepsilon) = \varepsilon + h_2 - w^s(\varepsilon) + \beta\,(1-\lambda)\, Max[\Pi^s(\varepsilon), \Pi^{v^s}] + \beta\,\lambda \int_{\underline{\varepsilon}}^{\overline{\varepsilon}} Max[\Pi^s(x), \Pi^{v^s}]\, d\Phi(x)\ , \tag{10}
$$

[6]For proofs we will exclude the extreme cases $\eta = 0$ and $\eta = 1$.

where $w^c(\varepsilon)$ and $w^s(\varepsilon)$ represent, respectively, the wages paid to a high- and a low-skilled worker.

Independently of her skills, an unemployed worker receives a flow of earnings w^u including unemployment benefits, leisure, etc. The high-skilled job seeker comes in contact with a complex vacant slot at rate $\vartheta^c q(\vartheta^c)$ while the low-skilled comes in contact with a simple vacancy at rate $\vartheta^s q(\vartheta^s)$. The value to the workers of unemployment is given by:

$$V^{u^h} = w^u + \beta\,(1-\vartheta^c q(\vartheta^c))\,V^{u^h} + \beta\vartheta^c q(\vartheta^c)\int_{\underline{\varepsilon}}^{\overline{\varepsilon}} Max[V^c(x), V^{u^h}]\,d\Phi(x) \tag{11}$$

$$V^{u^l} = w^u + \beta\,(1-\vartheta^s q(\vartheta^s))\,V^{u^l} + \beta\vartheta^s q(\vartheta^s)\int_{\underline{\varepsilon}}^{\overline{\varepsilon}} Max[V^s(x), V^{u^l}]\,d\Phi(x)\ . \tag{12}$$

As just mentioned, a complex job with productivity $\varepsilon + h_1$ pays a wage $w^c(\varepsilon)$ to the worker, while a simple job with productivity $\varepsilon+h_2$ pays $w^s(\varepsilon)$. Both types of jobs are hit by a shock with probability λ (aggregate shock affecting all market segments). The present value of a complex and a simple job to the worker solve:

$$V^c(\varepsilon) = w^c(\varepsilon) + \beta\,(1-\lambda)\,Max[V^c(\varepsilon), V^{u^h}] + \beta\,\lambda\int_{\underline{\varepsilon}}^{\overline{\varepsilon}} Max[V^c(x), V^{u^h}]\,d\Phi(x)\ , \tag{13}$$

$$V^s(\varepsilon) = w^s(\varepsilon) + \beta\,(1-\lambda)\,Max[V^s(\varepsilon), V^{u^l}] + \beta\,\lambda\int_{\underline{\varepsilon}}^{\overline{\varepsilon}} Max[V^s(x), V^{u^l}]\,d\Phi(x)\ . \tag{14}$$

2.3 Job creation and job destruction

We develop in detail the calculus of the steady state in appendix A. This section presents the equilibrium job creation and job destruction rules obtained for each labor market segment. Job creation rules of the complex and simple segments are defined as:

$$\frac{a^c}{\beta(1-\eta)\,q(\vartheta^c)} = \frac{1}{1-\beta(1-\lambda)}\int_{\varepsilon^c}^{\overline{\varepsilon}}(1-\Phi(x))\,dx\ , \tag{15}$$

$$\frac{a^s}{\beta(1-\eta)\,q(\vartheta^s)} = \frac{1}{1-\beta(1-\lambda)}\int_{\varepsilon^s}^{\overline{\varepsilon}}(1-\Phi(x))\,dx\ , \tag{16}$$

where, both equations determine a negative relationship between market tightness and ε, meaning that the job creation curves are negatively sloped in the space $(\vartheta^i, \varepsilon)$ for $i = c, s$.

Complex and simple job destruction rules are given by:

$$\frac{\eta\;a^c\;\vartheta^c}{1-\eta} = \varepsilon^c + h_1 - w^u + \frac{\beta\,\lambda}{1-\beta(1-\lambda)}\int_{\varepsilon^c}^{\overline{\varepsilon}}(1-\Phi(x))\,dx\ , \tag{17}$$

$$\frac{\eta\;a^s\;\vartheta^s}{1-\eta} = \varepsilon^s + h_2 - w^u + \frac{\beta\,\lambda}{1-\beta(1-\lambda)}\int_{\varepsilon^s}^{\overline{\varepsilon}}(1-\Phi(x))\,dx\ . \tag{18}$$

As proved in the appendix both curves are positively sloped in the space $(\vartheta^c, \varepsilon)$ and $(\vartheta^s, \varepsilon)$, respectively.

2.4 Comparative static analysis

We analyze now the variations in job creation and job destruction predicted by the model when some exogenous biased shocks modify the specific productivity component of each sector. Empirical evidence suggests that, technological and organizational changes affect differently the turnover of each professional category. Introducing biased shocks in our theoretical setup seems an appropriate way to investigate the mechanisms underlying behind these empirical findings.

Depending on the values of $h_1, h_2, \vartheta^c, \vartheta^s, a^c$ and a^s, we might have an initial situation where the reservation productivity levels are such that: $\varepsilon^c > \varepsilon^s$ or $\varepsilon^c < \varepsilon^s$ or $\varepsilon^c = \varepsilon^s$. However, since the objective of the static comparative analysis we implement is to determine the variation (increase or decrease) in the turnover of complex and simple jobs, the initial situation is not relevant for the exercise. We focus on the effects of technological and organizational biased changes in each market segment separately.

Let's start the comparative static analysis considering the technological shocks:

- We assume first an exogenous shock consisting in a technological revolution. Evidence has shown that ICT adoption by an economy clearly favors the productivity of high-skilled workers since the efficient use of these new machines requires qualified staff (see Berman, Bound, and Griliches (1994), Fitz Roy and Funke (1995) or Machin, Ryan, and Van Reenen (1998) for evidence on the existence of complementarities between skilled workers and technological capital). Because complex jobs are occupied by high-skilled workers their specific productivity component (h_1) is likely to be improved. In contrast, the productivity in simple jobs (h_2) deteriorates since new technologies cannot be efficiently used. We expect, thus, an upturn in the turnover of simple jobs with respect to the initial situation and the opposite evolution for complex jobs.

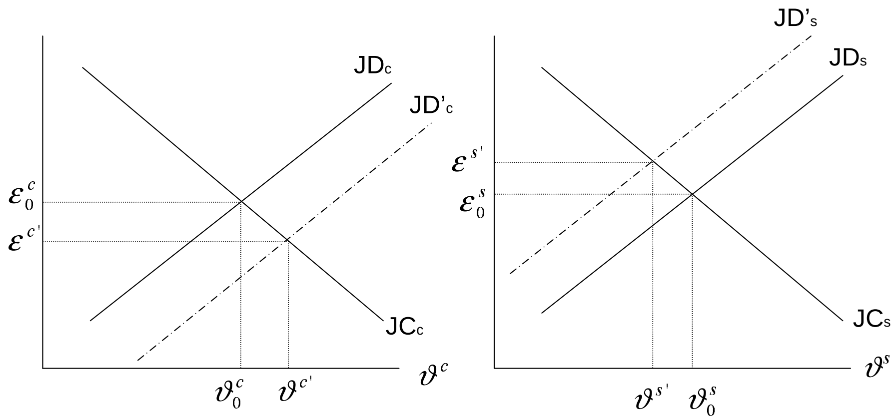


Figure 1: Shock increasing the specific productivity component of complex jobs.

More formally, the complex job destruction curve shifts down[7] (see figure 1) determining a lower reservation equilibrium value[8] $\varepsilon^{c'}$ ($\varepsilon^{c'} < \varepsilon^c$). In the simple sector the evolution is the opposite[9] leading to a higher equilibrium reservation productivity ($\varepsilon^{s'} > \varepsilon^s$). In this new situation, the turnover of complex jobs is necessarily reduced since, in case of an idiosyncratic shock over ε, the new value $\widehat{\varepsilon}$ drawn from the distribution ϕ, might be such that $\varepsilon^{c'} < \widehat{\varepsilon} < \varepsilon^c$. Therefore, some jobs that would have been destroyed in the initial situation, are not destroyed now that the specific productivity component of complex jobs has increased and the reservation productivity decreased. On the contrary, in the simple segment job turnover is stimulated since the reduction of the specific productivity component determines a higher equilibrium reservation productivity (we might have a situation where $\varepsilon^{s'} > \widehat{\varepsilon} > \varepsilon^s$).

- We assume that both economic sectors adopt a traditional *tayloristic* production system. Such a change is likely to improve mainly the marginal productivity of blue collar workers (simple jobs) since they are the users of this kind of technologies. Because white collar workers are non production workers, their productivity is probably not affected by the chain production system. Relative productivity of blue collar workers is thus ameliorated (h_2/h_1). In graphical terms (see figure 2), the job destruction curve of the simple segment

[7] $\left.\frac{\partial \varepsilon^c}{\partial h_1}\right|_{\vartheta^c = Const} = -\frac{1-\beta\,(1-\lambda)}{1-\beta\,(1-\lambda\,\Phi(\varepsilon^c))} < 0.$

[8] Notice that, contrarily to what stated in Cahuc and Postel-Vinay (2002), the movement takes place along the job creation curve, which does not shift.

[9] $\left.\frac{\partial \varepsilon^s}{\partial h_2}\right|_{\vartheta^s = Const} = -\frac{1-\beta\,(1-\lambda)}{1-\beta\,(1-\lambda\,\Phi(\varepsilon^s))} < 0.$

shifts right, determining a lower equilibrium reservation productivity[10] in this market ($\varepsilon^{s'} < \varepsilon^{s}$), while in the complex segment the job destruction curve moves upward leading to a higher reservation productivity ($\varepsilon^{c'} > \varepsilon^{c}$). In this new equilibrium, we require a stronger idiosyncratic shock over ε, with respect to the initial situation, to have simple jobs destroyed. On the contrary the idiosyncratic shock required to destroy complex jobs is now weaker. The turnover of blue collars is, thus, reduced and that of white collars increased.

In sum, technological shocks stimulate turnover in the labor market segment (complex or simple) whose specific productivity component is negatively affected by the shock, while turnover falls in the segment with an improved relative productivity.

The static comparative analysis concerning the introduction of HPWO practices follows the same reasoning. Notice that some of these practices (such as the autonomous teams of production, multidisciplinary or project working groups, *delayering*, etc.) imply the existence of more than one worker inside a firm, whereas we have assumed a one-job-one-firm theoretical setup. However, as far as we manage to determine how the productivity of each type of job (h_1 for complex jobs and h_2 for simple jobs) is affected by the corresponding organizational practice, the theoretical model is able to predict the evolution of the turnover in each sector. This will permit to understand the economic mechanism acting behind the labor flows. We briefly comment the consequences of some HPWO practices on the turnover of complex and simple jobs:

- Most of the innovative organizational practices implemented by firms are targeted to increase the autonomy and the responsibility of production workers, either through the creation of autonomous teams of production and project groups, either through *delayering* (delegating responsibilities to lower hierarchical levels inside the firm by removing one or more managerial levels). As Jones, Kato, and Weinberg (2003) show, these new organizational practices permit low-skilled workers to get more empowered with the firm, more satisfied, more committed and trusting in the managerial structure as well as more hardworking. Moreover, according to Bauer (2004) higher involvement in HPWO practices

[10] Here again the movement takes place along the job creation curve, which does not effectively shift.

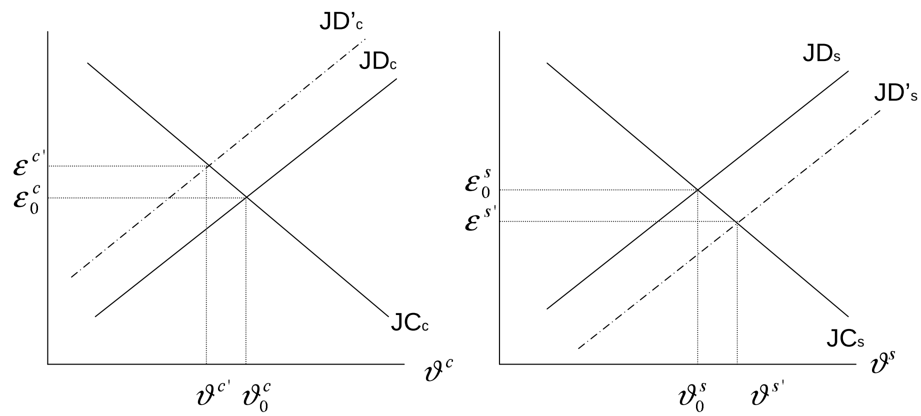


Figure 2: Shock increasing the specific productivity component of simple jobs.

leads to a higher job satisfaction. Existing evidence in the U.S. (e.g., Jones, Kato, and Weinberg (2003)) and Europe (e.g., Bauer (2004)) suggests, thus, that such organizational practices should improve the specific productivity component of low-skilled workers in simple jobs (h_2). Regarding skilled workers, Caroli and Van Reenen (2001) show that, in France, *delayering* has mainly favored skilled manual workers. With respect to high-skilled in complex jobs, Bauer (2004) finds that higher involvement in innovative organizational practices should increase their job satisfaction, however, up to our knowledge, there is no evidence about the effects on their productivity (h_1). Depending on how strong the effect of HPWO practices is on the absolute productivity of high-skilled workers on complex jobs, we may have a situation where the turnover is reduced in the simple segment and augmented in the complex segment (h_1/h_2 decreases. Figure 2) or the opposite (h_1/h_2 increases. Figure 1).

- The rotation of workers among different tasks or the just in time production practices inside firms are more likely to affect production workers (simple sector) rather than managers (complex sector). The main objective of such practices is not simply to form workers with more flexible abilities allowing firms to easily adapt to market demand changes, but also to avoid workers loosing motivation due to repetitive tasks (see Jones, Kato, and Weinberg (2003)). The adoption of the rotation or the just in time production systems is then likely to stimulate the relative specific productivity component of simple jobs, reducing in this way their turnover. On the contrary, the turnover of high-skilled workers should increase (figure 2).

- Another commonly used HPWO practice consists in implementing total quality control procedures. The consequences of this practice over the relative productivity are difficult to predict since these procedures normally require qualified staff to be implemented (h_1/h_2 should increase) but, at the same time, they are targeted to improve the efficiency of the production process: h_2/h_1 should also raise (Evans and Dean (2003)). On the other hand, total quality seems to increase wage inequality, suggesting h_1/h_2 is improved (e.g. Cappelli (1996)).

3 The data

The database used results from merging two French surveys conducted in 1993 and 1999, referring to 1992 and 1998, respectively: the REPONSE survey (RElations PrOfessionnelles et NégociationS d'Entreprise) and the DMMO survey (Déclaration Mensuelle de Mouvements de main d'Oeuvre).

In REPONSE more than twenty-five hundred establishments were surveyed with senior managers being asked about the economic situation of the establishment, its internal organization, technological changes, the wage negotiation with unions and conflicts with workers. Only establishments with 20 or more employees were sampled and no public sector employees were included (except workers in state-owned industries). Concerning ICT and HPWO practices, managers were asked either about their presence in the establishment (1993 and 1999 waves) or about the proportion of workers benefitting from the corresponding technology or workplace practice (1999 wave). The REPONSE survey, which is also used in Caroli and Van Reenen (2001), contains, actually, detailed information on the technological and organizational practices of a representative sample of French establishments.

In the DMMO survey, each establishment with at least 50 employees makes a monthly declaration of the beginning-of-the-month employment, end-of-the-month employment and the total entries and exits within the month. Furthermore, the respondent establishment reports the nature of the employment transaction (type of contract of the new entries and reasons for the exit), as well as the skill level, age and seniority of the employee involved in this transaction.

This paper considers the effects of different technological and organizational variables on the labor flows of different professional categories (managers, intermediary professions, employees and manual workers) as well as on the turnover of all workers, women workers and men workers. Since the REPONSE survey and the DMMO survey were both conducted also in 1993, there does exist a small panel referring to 1992 and 1998. Unfortunately its reduced size and the highly probably presence of a bias leads to meaningless estimations. We use a cross section referred to 1998 that provides the most detailed information concerning ICT and HPWO practices. We explain below the variables used in the econometric analysis.

3.1 Labor flows

The variables capturing the labor flows of different professional categories are defined as follows:

- MANAGERS=(Number of movements of managers in the establishment)/Total number of managers in the establishment. The managers professional category covers all executive and managerial positions inside the establishment.

- INT. PROFES.=(Number of movements of intermediary professionals in the establishment)/Total number of intermediary professionals in the establishment. The intermediary professions refer to technicians and foremen.

- EMPLOYEES=(Number of movements of employees in the establishment)/Total number of employees in the establishment. The employees category includes clerks, office workers and business employees.

- WORKERS=(Number of movements of manual workers in the establishment)/Total number of manual workers in the establishment. This category covers manual workers whether they are qualified or not.

- TOTAL=(Number of movements of all the workers in the establishment)/Total number of workers in the establishment.

- WOMEN=(Number of movements of women in the establishment)/Total number of women in the establishment.

- MEN=(Number of movements of men in the establishment)/Total number of men in the establishment.

Because the number of movements is defined as the sum of entries and exits, the previous variables may adopt values going from 0 to $+\infty$.

3.2 Technological variables

New technologies, specially ICT, are widely spread on French establishments, therefore we consider three technological variables:

- COMPUTER: It is a dummy variable taking the value 1 if 50% or more workers use a computer.

- NET: It is a dummy variable taking the value 1 if between 20 and 50% of the workers use a network system (e.g., intranet).

- INTERNET: Dummy variable taking the value 1 if between 20 and 50% of the workers use the internet.

In addition, automated production is captured by the variable:

- CHAIN: It is a dummy variable taking the value 1 when the establishment still uses *tayloristic* production systems (robots, computer assisted systems, etc.).

3.3 Organizational variables

To measure the effects of HPWO practices we consider six different variables:

- AUTONOMOUS: It is a dummy variable taking the value 1 if between 20 and 50% of the workers participate in autonomous teams of production.

- PROJECT: It is a dummy variable taking the value 1 if between 20 and 50% of the workers participate in multidisciplinary working groups or project groups.

- ROTATION: It is a dummy variable capturing whether the majority of workers rotates among tasks inside the establishment or not.

- QUALITY: It is a dummy variable taking the value 1 when the establishment implements internal total quality control procedures.

- HIERARCHY: It is a dummy variable capturing whether the establishment has reduced the number of hierarchical levels and has adopted organizational practices trying to promote the participation of workers in the internal decisions of the establishment.

- J.I.T.: It is a dummy variable taking the value 1 when the establishment practices just in time production methods.

3.4 Other variables

In the regressions we control for other variables that can affect labor flows, such as the presence of unions in the establishment, the arrival of an important technological change over the last three years, an unusual variation in the economic activity, the size of the establishment, the economic sector, the relative importance of employees, technicians, managers, short term contracts and women in the establishment. Finally, we also consider whether the establishment has already implemented the reduction in the number of working hours (35 hours per week) approved by the French government in the mid nineties. We define these variables as:

- Union: Dummy variable taking the value 1 if the workers have a union representative in the establishment. It seems quite intuitive that the presence of unions promotes job stability inside the establishment as far as the union cares about employment and not only about wages[11].

- Variation: Dummy variable taking the value 1 if the economic activity of the establishment has known an unusual variation (positive or negative) in 1998.

[11] Here we do not refer to the effect of unions on ICT adoption since results seem more ambiguous. Schnabel and Wagner (1992), on the basis of a panel of German industries, find no significant association. Addison and Wagner (1994), using British and German data, conclude the existence of a positive association between unions and R&D in "low tech" industries. Allen (1988) working with U.S. industries finds a negative and significant association between the presence of unions and R&D intensity. Menezes-Filho, Ulph, and Van Reenen (1998) conclude that the relationship between the union density and R&D is non-linear. R&D rises with union density up to a threshold and then falls again (this pattern does not hold when unions bargain only over wages).

- Tech. change: Dummy variable capturing whether the establishment has suffered an important technological change over the last three years.

- The evolution of the economic activity of the establishment during the last three years is captured through the variables: increasing, strongly increasing, decreasing and strongly decreasing. While the effect of a decreasing economic context on job turnover seems quite clear since there are more job destructions and less job creations, the effect of an increasing context risks to be more ambiguous. On the one hand, we can expect less jobs to be destroyed (smaller turnover) and more to be created, however, the number of quits is also likely to increase (bigger turnover) because workers know that they have a higher probability to find another job.

- We control for the size of the establishment through two dummy variables capturing whether the establishment has between 20 and 50 workers (Size 20-50) or more than 500 workers (Size +500).

- P. Employees, P. Technicians and P. Managers are the proportion of employees, technicians and managers in the establishment.

- P. Women is the proportion of women in the establishment.

- P. Contract is the proportion of fixed duration contracts in the establishment.

- Hours: Dummy variable taking the value 1 if the firm has already implemented the reduction in the number of working hours to 35 hours per week.

- We control for 16 economic sectors: agriculture and fishing; agricultural and food industry; consumption industry; automobile industry; equipment industry; intermediary goods industry; energy sector; building sector; trade sector; transport sector; financial activity sector; housing activities; services to firms; services to individuals; education, health and social action; and the public administration.

3.5 Descriptive statistics

Table 24 in appendix C summarizes the means and standard deviations of all variables included in our analysis. The category of workers presenting the relatively most important turnover is the employees, followed by managers, intermediary professionals and manual workers. Even if manual workers are those with the smallest labor flows, they have also the smallest standard deviation, which contrast with the high standard deviation of mangers or employees. Most of these labor flows correspond to women.

With regards to technological variables, notice the high presence of chain production systems and the low degree of penetration of internet in the establishments. Concerning organizational practices, the most commonly used ones are the reduction in the number of hierarchical levels, the just in time production systems and the implementation of quality control procedures.

Table 25 in appendix C presents the correlation matrix between the labor flows, technological variables and organizational variables. The upward part of the table displays the pairwise correlations between labor flows and the technological and organizational variables of the model. The downward part of the table presents the pairwise correlations between the technological and organizational variables.

The first part of the table reveals a positive correlation between the labor flows of manual workers, COMPUTER and NET. This contrast with the systematically negative correlation observed for all professional categories' labor flows and CHAIN. Organizational practices such as the rotation of workers among different tasks, total quality control procedures or the reduction of hierarchical levels are negatively correlated with the turnover of intermediary professionals, employees and manual workers. Besides, AUTONOMOUS and PROJECT are positively related to managers' flows.

From the second part of the table we remark that the use of new technologies and the introduction of new organizational practices are most of the times positively correlated (complementary relationship). However, the rotation of workers among tasks or the just in time production systems are negatively related to COMPUTER and NET. A negative correlation between the autonomous teams of production and COMPUTER is also observed.

4 Econometric strategy

Our structural model provides predictions on the effects of biased shocks on the labor flows of different occupations (no prediction can be drawn when considering all workers together). More particularly, any technological or organizational change improving (deteriorating) the relative productivity of a particular professional category should reduce (increase) its turnover. In this sense, ICT adoption normally stimulates the turnover of production workers (simple jobs) while many HPWO practices increase the turnover of managers (complex jobs). We proceed now to test these results through the estimation of the following econometric model:

$$Y_{iet} = \alpha_1 \, I_{iet} + \alpha_2 \, O_{iet} + \alpha_3 \, X_{iet} + \upsilon_{iet} \ , \tag{19}$$

where the dependent variables are the labor flows of managers, intermediary professions, employees, manual workers, all workers, women workers and men workers. The vector I_{iet} contains all variables measuring the presence of information and communication technologies in the establishment. These variables are COMPUTER, NET, INTERNET and CHAIN. We expect $\alpha_1 > 0$ for intermediary professions, employees and manual workers, and $\alpha_1 < 0$ for managers. The vector O_{iet} includes all variables describing the introduction of HPWO practices by the establishment. It contains: AUTONOMOUS, PROJECT, ROTATION, QUALITY, HIERARCHY and J.I.T.. In this case, we expect $\alpha_2 > 0$ for managers and $\alpha_2 < 0$ for the rest of the occupations. Finally X_{it} is the vector of controls, where we introduce other variables that could affect the labor flows, such as the presence of unions, the evolution of the economic activity of the establishment, its size, the number of hours worked in the establishment, the sector of activity and the proportion of employees, technicians, managers, women and workers with fixed duration contract in the establishment.

Our econometric analysis follows the standard stages for studying the establishments' labor flows:

- We first estimate equation (19) using OLS. For each professional category we estimate three econometric models displayed in appendix A: one including all control variables, model 1; a second one eliminating the variables that are systematically non significant for all professional categories, model 2; and a third model eliminating the least significant variables for the particular professional category under consideration, model 3. For the body of the paper we keep model 2.

- Second, the high degree of intercorrelation among the explicative variables (see table 25) may yield biased coefficients in our estimations. To solve this problem, a traditional approach used in the literature (see Ichniowski, Shaw, and Prennushi (1997)) when only cross-sectional data is available, consists in defining sets of highly correlated practices ("clusters") and re-estimate equation (19) introducing them as explicative variables .

- In a third stage, after implementing a brief descriptive study of the labor flows of each professional category, we proceed to analyze whether the decisions to have or not labor flows and the quantity of these flows, are independent decisions. To do so we use the Heckman two steps model, according to which, in the relationship:

$$FLOWS_{et} = \alpha_1 \, I_{et} + \alpha_2 \, O_{et} + \alpha_3 \, X_{et} + \upsilon_{et} \; , \tag{20}$$

the dependent variable is not always observed. Its observability depends on a certain number of characteristics. Therefore, the Heckman model estimates first:

$$y_t^* = \beta \, Z_t + u_t \; , \tag{21}$$

where y_t^* is the probability to observe labor flows and Z_t a vector containing technological and organizational variables, as well as variables concerning the economic situation of the firm, its size, its labor force composition and its economic sector. Notice that,

$$FLOWS_t = 1 \quad \text{if} \quad y_t^* > 0 \tag{22}$$

$$FLOWS_t = 0 \qquad \text{otherwise} \; . \tag{23}$$

On the basis of this result the relationship (20) is re-estimated. The Heckman selection model estimates, thus, in first place, a probit model (identification model) where the dependent variable is equal to unity if we observe labor flows and zero in case we do not observe them. This phase reveals the determinants of the decision to have or not workers' turnover (equation (21)). In a second step, the Heckman method, considers only establishments having non null flows and estimates the determinants of the quantity of these flows (equation (20)). When $corr(v_t, u_t) = \rho > 0$, that is, when the decisions concerning the presence or absence of labor flows and the amount of labor flows, are correlated, the Heckman selection model provides consistent, asymptotically efficient estimates for all parameters.

The variables included in the identification model (the vector Z_t) are chosen according to the following procedure:

1. First, we estimate a probit model where the dependent variable captures the presence of labor flows. We include in this model all the explicative and control variables defined in sections 3.2 to 3.4.

2. Second, we compare whether some control variables that were non significant in the OLS estimation of model 1 (first column in tables 12-18), become now significant in the probit model. These variables are the identification variables, that is, they affect the decision of the establishments to have or not labor flows but they do not affect the amount of the flows.

3. The vector Z_t contains finally the following variables: COMPUTER, NET, INTERNET, CHAIN, AUTONOMOUS, PROJECT, ROTATION, QUALITY, HIERARCHY, J.I.T., Union, Variation, Tech. change, Strongly increasing, Increasing, Decreasing, Strongly decreasing, Size 20-50, Size +500, Hours, P. Employees, P. Technicians, P. Managers, P. Women, P. Contract and 16 economic sectors. Because the explicative and control variables included in the estimation of equation (20) correspond to our model 2, the identification variables are the following: Union, Tech. change, Increasing, Strongly decreasing, Size 20-50, Size +500 as well as the following sectors: Agriculture, Food industry, Consumption industry, Car industry, Equipment industry and Intermediary industry.

As a final remark, notice that there must be some other technological and organizational practices that affect labor flows and that we are unable to capture due to data limitations. This bias is reflected on the low values of the adjusted R^2.

5 Results

5.1 First estimations

Final estimates from the regressions are reported in appendix B, tables 12-18. For each professional category models 1, 2 and 3 are estimated. Table 3 summarizes model 2 estimated coefficients for all categories. Again, because we work with cross-section data, we only provide correlations that suggest same impacts. They reveal that the potential effects of technological and organizational variables differ, and are even contradictory, depending on the professional category under analysis. The findings are globally consistent with the theoretical predictions. We comment with more detail the obtained results:

- The managers' turnover seems positively influenced by the organizational practices targeting to improve the production workers empowerment and commitment to the firm, such as the autonomous teams of production or project groups. On the contrary, the implementation of total quality control procedures is negatively correlated to the labor flows of managers; an interpretation of this finding is that quality control procedures require qualified staff to be developed more than they improve blue collar's productivity (see section 2.4). Regarding the contribution of each of these practices, table 4 shows that small changes in any of them lead to important effects on the observed labor flows.

- In the intermediary professionals case, the only practice being significant is the reduction in the number of hierarchical levels, which is negatively correlated to their turnover. Moreover, the coefficient associated to this practice is not even very important (an increase by one unit in HIERARCHY "reduces" the intermediary professionals' labor flows by 0.28 units, see table 4).

- The massive use of computers in the establishment is positively related to higher job instability of employees. In contrast, the organizational practice consisting in removing managerial levels is positively associated with the relative productivity, motivation, commitment and empowerment of employees and, therefore, it is negatively correlated to their turnover. When comparing the importance of both correlations on the employees' labor

Table 3: Determinants of labor flows for different professional categories. French establishments 1998.

	Dependent variable: labor flows for						
	MANAGERS	INT.PROFES.	EMPLOYEES	WORKERS	TOTAL	WOMEN	MEN
COMPUTER	0	0	++	0	++	0	0
NET	0	0	0	++	0	0	0
CHAIN	0	0	0	- -	0	0	0
AUTONOMOUS	+	0	0	0	0	0	0
PROJECT	++	0	0	-	0	0	0
ROTATION	0	0	0	0	0	0	0
QUALITY	- -	0	0	0	0	0	0
HIERARCHY	0	-	- -	0	0	0	0
J.I.T.	0	0	0	0	0	0	0
Constant	0	0	++	0	++	+++	0
Observations	1390	1376	1361	1080	1335	1384	1389
Adj R^2	0.043	0.146	0.072	0.085	0.130	0.065	0.124

Lecture: 0 Non significant. + Positive coefficient significant at 10%.++ Positive coefficient significant at 5%.+++ Positive coefficient significant at 1%. - Negative coefficient significant at 10%. - - Negative coefficient significant at 5%. - - - Negative coefficient significant at 1%.
Source: REPONSE and DMMO surveys.

flows (table 4) we observe that the impact of ICT is more than twice bigger than that of HIERARCHY.

- Labor flows of manual workers seem positively influenced by new technologies. More precisely, NET may have a large impact on their turnover (66%). On the opposite, because more traditional chain production systems and project groups improve the relative productivity of manual workers, they are also negatively related to their labor flows.

- The theoretical setup developed in this paper does not provide any prediction when all professional categories are considered together, that is, for TOTAL, WOMEN and MEN. Results in tables 3 and 4 reveal a positive correlation between the massive use of computers and aggregate labor flows (TOTAL). Furthermore, an increase in COMPUTER by 1 unit yields an increase in total labor flows by 0.31 units. When considering separately women or men no significant correlation arises.

To summarize, empirical estimates suggest that, since ICT are skill-requiring, their adoption positively influences turnover of employees and manual workers, who do not have these skills. Probably because these two categories of workers are the most numerous ones, we also observe that aggregate labor flows are positively correlated to the massive use of computers. On the other hand, the fact that most HPWO practices try to stimulate motivation, participation and productivity of blue collar workers (production workers), explains their positive effect on the labor flows of managers and their negative effect on the turnover of intermediary professionals, employees (impact of HIERARCHY) and manual workers (impact of PROJECT). Finally, since ICT adoption is generally accompanied by changes in the internal organization of firms (HPWO practices), we can guess an upturn in the labor flows of all workers categories over the last years, either through the ICT effect for the blue collars, or through the HPWO practices for the white collars. Moreover, the reduction in the use of chain production systems has reinforced job instability of manual workers.

5.2 Dealing with the multicolinearity problem

The high degree of intercorrelation among the explicative variables (see table 25) indicates that the empirical model estimating the impact of ICT and HPWO practices on the labor flows may

Table 4: Contribution of each technological and organizational practice to the observed labor flows of each professional category. French establishments 1998.

	Dependent variable: labor flows for													
	MANAGERS		INT. PROFES.		EMPLOYEES		WORKERS		TOTAL		WOMEN		MEN	
OBSERVED FLOWS	0.741		0.764		0.697		0.921		0.574		1.081		0.845	
	Coef.	%	Coef.	%	Coef.	%	Coef.	%	Coef.	%	Coef.	%	Coef.	%
COMPUTER	-1.277	ns	0.242	ns	0.796	86.38%	0.074	ns	0.228	30.76%	0.274	ns	0.315	ns
NET	-0.277	ns	-0.006	ns	-0.051	ns	0.378	65.83%	-0.107	ns	-0.120	ns	-0.196	ns
CHAIN	-0.524	ns	0.061	ns	-0.186	ns	-0.264	-45.97%	-0.053	ns	-0.205	ns	-0.102	ns
AUTONOMOUS	2.616	342.40%	0.145	ns	-0.124	ns	-0.045	ns	0.055	ns	-0.041	ns	0.219	ns
PROJECT	3.037	397.56%	-0.278	ns	-0.197	ns	-0.296	-51.52%	-0.055	ns	-0.154	ns	-0.090	ns
ROTATION	-1.562	ns	0.185	ns	0.411	ns	-0.134	ns	0.123	ns	0.232	ns	0.173	ns
QUALITY	-2.691	-352.17%	0.175	ns	-0.025	ns	-0.084	ns	-0.080	ns	-0.195	ns	0.195	ns
HIERARCHY	0.974	ns	-0.194	-27.80%	-0.360	-39.04%	0.024	ns	-0.058	ns	-0.019	ns	-0.069	ns
J.I.T.	1.119	ns	-0.039	ns	-0.026	ns	0.073	ns	0.028	ns	0.039	ns	0.021	ns
Observations	1390		1376		1361		1080		1335		1384		1389	
Adj R^2	0.043		0.146		0.072		0.085		0.130		0.065		0.124	

Coef.: Estimated coefficient in the OLS regression

%: Percentage of the observed labor flows explained by the corresponding coefficient.

ns: not significant.

Source: REPONSE and DMMO surveys.

yield biased coefficients. To solve this problem a traditional approach used in the literature (e.g., Ichniowski, Shaw, and Prennushi (1997)) when only cross-sectional data is available, consists in defining sets of highly correlated practices. We consider in this paper two types of clusters differing in their economic interpretation:

- We analyze first the impact of what we will call "incremental organization" or "additive clusters". These sets of practices capture a kind of continuity in the technological and organizational changes.
- Second, we consider the effect of clusters including complementary technological and organizational practices ("multiplicative clusters"). There is an increasing literature (e.g., Ichniowski, Shaw, and Prennushi (1997) or Askenazy and Gianella (2000)) claiming that firms realize the largest gains in productivity by adopting clusters of complementary practices. It seems, thus, relevant to analyze the effect that these sets of interactive practices have on the labor flows.

5.2.1 The incremental organization

The incremental organization can be economically interpreted as measuring a continuity in the process of introduction of technological and organizational changes. We define five sets of variables capturing practices having a similar objective and being highly intercorrelated:

1. TECHNOLOGY: Cluster including the technological variables COMPUTER and NET. The presence of one of these practices is sufficient to guarantee the non nullity of TECHNOLOGY.
2. CHAIN: Dummy variable taking the value 1 when the establishment still uses *tayloristic* production systems (robots, computer assisted systems, etc.).
3. TEAMWORK: Set of organizational variables including all practices tending towards the delegation of responsibilities and the promotion of working teams. The non nullity of TEAMWORK is guaranteed by the presence of any of the following practices: AUTONOMOUS, PROJECT or HIERARCHY.

4. FLEXIBILITY: Cluster covering all organizational practices stimulating a flexible job assignment (ROTATION and J.I.T.).

5. QUALITY: Dummy variable taking the value 1 when the establishment develops a total quality control procedure.

Table 5: Effects of incremental organization on the labor flows of different professional categories. French establishments 1998.

	Dependent variable: labor flows for						
	MANAGERS	INT.PROFES.	EMPLOYEES	WORKERS	TOTAL	WOMEN	MEN
TECHNOLOGY	0	0	+	++	0	0	0
CHAIN	0	0	0	- -	0	0	0
TEAMWORK	+++	-	- -	0	0	0	0
FLEXIBILITY	0	0	0	0	0	0	0
QUALITY	-	0	0	0	0	0	0
Constant	0	0	++	0	++	+++	0
Observations	1390	1376	1361	1080	1335	1384	1389
Adj R^2	0.043	0.146	0.072	0.084	0.129	0.066	0.122

Lecture: 0 Non significant. + Positive coefficient significant at 10%.++ Positive coefficient significant at 5%.+++ Positive coefficient significant at 1%. - Negative coefficient significant at 10%. - - Negative coefficient significant at 5%. - - - Negative coefficient significant at 1%.
Source: REPONSE and DMMO surveys.

Tables 5 and 6 summarize estimations in table 19 (appendix B), and they mainly confirm the results displayed in tables 3 and 4:

- Workplace organizational practices favoring the delegation of responsibilities to lower hierarchical levels as well as the presence of working teams (TEAMWORK) are positively related to the increased turnover observed for the managers. In contrast, quality control procedures continue to have a stabilization effect on their turnover. The latter effect is stronger than the former (see table 6).

- The set of organizational practices included in TEAMWORK is negatively correlated to the intermediary professionals' turnover. Their effect remains, though, quite small (an increase of one unit in TEAMWORK reduces intermediary professionals' labor flows by 0.20 units).

- Regarding employees, ICT and HPWO practices act in opposite sense. While TECHNOLOGY is positively associated with their turnover, TEAMWORK is negatively correlated to the employees' flows. Furthermore, the size of their contribution is quite close (see table 6).

- In the manual workers' case new technologies continue to have a positive influence on labor flows while *tayloristic* production systems negatively affect them, the importance of both effects being similar.

- Finally, when considering all workers, women workers and men workers, no practice appears as significant.

Table 6: Contribution of the incremental organization practices to the observed labor flows of each professional category. French establishments 1998.

	Dependent variable: labor flows for													
	MANAGERS		INT. PROFES.		EMPLOYEES		WORKERS		TOTAL		WOMEN		MEN	
OBSERVED FLOWS	0.741		0.764		0.697		0.921		0.574		1.081		0.845	
	Coef.	%	Coef.	%	Coef.	%	Coef.	%	Coef.	%	Coef.	%	Coef.	%
TECHNOLOGY	-0.687	ns	0.097	ns	0.337	36.55%	0.227	39.63%	0.046	ns	0.056	ns	0.032	ns
CHAIN	-0.448	ns	0.054	ns	-0.203	ns	-0.251	-43.74%	-0.055	ns	-0.210	ns	-0.106	ns
TEAMWORK	1.864	243.98%	-0.143	-20.46%	-0.278	-30.21%	-0.063	ns	-0.035	ns	-0.060	ns	-0.015	ns
FLEXIBILITY	0.466	ns	0.013	ns	0.072	ns	0.024	ns	0.048	ns	0.084	ns	0.054	ns
QUALITY	-2.532	-331.47%	0.162	ns	-0.052	ns	-0.077	ns	-0.087	ns	-0.211	ns	0.181	ns
Observations	1390		1376		1361		1080		1335		1384		1389	
Adj R^2	0.043		0.146		0.072		0.084		0.129		0.066		0.122	

Coef.: Estimated coefficient in the OLS regression

%: Percentage of the observed labor flows explained by the corresponding coefficient.

ns: not significant.

Source: REPONSE and DMMO surveys.

The two general conclusions drawn from the analysis of tables 3 and 4 continue to apply when considering incremental organization. First, ICT adoption has been associated with a higher turnover of employees and manual workers. In the last case, the progressive disappearance of chain production systems has stimulated even more labor flows. Second, HPWO practices consisting in the reduction of hierarchical levels and the promotion of autonomous working groups are positively correlated to the turnover of managers and negatively to that of intermediary professionals and employees. In contrast, because quality control procedures require qualified staff, they promote stability in the manager's flows.

5.2.2 The complementary relationships

Ichniowski, Shaw, and Prennushi (1997) argue that the firms realize the largest gains in productivity by adopting clusters of complementary practices ("multiplicative clusters"). It seems, thus, relevant to analyze the effect that these sets of complementary practices have on the labor flows. We consider two sets of variables[12]:

1. TEAMWORK*: Set of organizational variables including all practices tending towards the delegation of responsibilities and the promotion of working teams. The non nullity of TEAMWORK* is only guaranteed when the HPWO practices AUTONOMOUS, PROJECT and HIERARCHY are simultaneously present in the establishment.

2. ICT FLEXIBILITY: This cluster combines technological and organizational variables. It tries to capture the fact that the massive use of new technologies (COMPUTER) and the introduction of flexible job assignment practices (ROTATION), normally act in the same sense over labor flows.

Results in tables 7 and 8 reveal that labor flows of TOTAL, WOMEN and MEN are positively correlated to the simultaneous introduction of ICT and flexible job assignment practices. The complementary effect of technological and organizational practices captured by the variable ICT FLEXIBILITY is positively related to the upturn in aggregate turnover. Moreover, individual technological and organizational variables are non significant, confirming the key role played by

[12] Alternative clusters of complementary variables have been considered, but they were non significant.

Table 7: Effects of multiplicative clusters on the labor flows of different professional categories. French establishments 1998.

	Dependent variable: labor flows for						
	MANAGERS	INT.PROFES.	EMPLOYEES	WORKERS	TOTAL	WOMEN	MEN
COMPUTER	0	0	0	0	0	0	0
NET	0	0	0	++	0	0	0
CHAIN	0	0	0	- -	0	0	0
AUTONOMOUS	0	0	0	0	0	0	0
PROJECT	0	0	0	0	0	0	0
ROTATION	0	0	0	0	0	0	0
QUALITY	-	0	0	0	0	0	0
HIERARCHY	0	-	- -	0	0	0	0
J.I.T.	0	0	0	0	0	0	0
TEAMWORK*	+++	0	0	0	0	0	0
ICT FLEXIBILITY	0	0	+++	0	+++	+++	++
Observations	1390	1376	1361	1080	1335	1384	1389
Adj R^2	0.049	0.145	0.080	0.084	0.137	0.066	0.126

Lecture: 0 Non significant. + Positive coefficient significant at 10%.++ Positive coefficient significant at 5%.+++ Positive coefficient significant at 1%. - Negative coefficient significant at 10%. - - Negative coefficient significant at 5%. - - - Negative coefficient significant at 1%.

Source: REPONSE and DMMO surveys.

complementarities (see table 8 to get an idea on the importance of their impact). The detailed analysis of the different professional categories leads to the following results:

- Regarding managers, the individual variables AUTONOMOUS, PROJECT and HIERARCHY loose their significance, while the variable capturing their interactions (TEAMWORK*) becomes significant and positive. The three HPWO practices reinforce, thus, each other, and their interaction is positively related to more important labor flows. The quality control procedures continue to be negatively correlated to the managers' turnover, however, their effect is much less strong than the one of TEAMWORK* (see table 8).

- Job stability of intermediary professionals is still uniquely affected by the reduction in the number of hierarchical levels and complementarities play no role.

Table 8: Contribution of the complementary practices (multiplicative clusters) to the observed labor flows of each professional category. French establishments 1998.

	Dependent variable: labor flows for													
	MANAGERS		INT. PROFES.		EMPLOYEES		WORKERS		TOTAL		WOMEN		MEN	
OBSERVED FLOWS	0.741		0.764		0.697		0.921		0.574		1.081		0.845	
	Coef.	%	Coef.	%	Coef.	%	Coef.	%	Coef.	%	Coef.	%	Coef.	%
COMPUTER	-1.16	ns	0.19	ns	0.24	ns	0.17	ns	0.06	ns	0.06	ns	0.12	ns
NET	-0.47	ns	-0.01	ns	-0.06	ns	0.38	65.7%	-0.11	ns	-0.12	ns	-0.20	ns
CHAIN	-0.57	ns	0.06	ns	-0.19	ns	-0.27	-46.4%	-0.05	ns	-0.20	ns	-0.10	ns
AUTONOMOUS	-0.03	ns	0.11	ns	-0.31	ns	-0.07	ns	-0.01	ns	-0.04	ns	0.15	ns
PROJECT	0.70	ns	-0.31	ns	-0.37	ns	-0.32	ns	-0.12	ns	-0.16	ns	-0.15	ns
ROTATION	-1.42	ns	0.14	ns	-0.08	ns	-0.07	ns	-0.03	ns	0.04	ns	0.00	ns
QUALITY	-2.50	-327.3%	0.18	ns	-0.02	ns	-0.08	ns	-0.08	ns	-0.20	ns	0.20	ns
HIERARCHY	0.51	ns	-0.20	-28.9%	-0.41	-44.7%	0.02	ns	-0.08	ns	-0.03	ns	-0.09	ns
J.I.T.	0.97	ns	-0.04	ns	-0.05	ns	0.07	ns	0.02	ns	0.03	ns	0.01	ns
TEAMWORK*	5.85	766.3%	0.08	ns	0.39	ns	0.05	ns	0.16	ns	0.00	ns	0.15	ns
ICT FLEXIBILITY	-0.18	ns	0.23	ns	2.36	256.2%	-0.34	ns	0.68	91.8%	0.89	82.5%	0.80	94.6%
Observations	1390		1376		1361		1080		1335		1384		1389	
Adj R^2	0.049		0.145		0.080		0.084		0.137		0.066		0.126	

Coef.: Estimated coefficient in the OLS regression

%: Percentage of the observed labor flows explained by the corresponding coefficient.

ns: not significant.

Source: REPONSE and DMMO surveys.

- Concerning employees, the combination of new technologies and flexible organizational practices (ICT FLEXIBILITY), is positively correlated to their turnover, its effect being very important, *i.e.* an upturn in ICT FLEXIBILITY by one unit is associated with an increase in the employees labor flows by 2.56 units. The HPWO practice consisting in delegating responsibilities to lower hierarchical levels (HIERARCHY) seems to act in the opposite sense, reducing job instability, but its effect is almost six times smaller than the one of ICT FLEXIBILITY.

- Finally, results regarding the manual workers' turnover are not modified with respect to table 3. The combined reduction in chain production systems and the increased use of new technologies are positively correlated to the rise in labor flows. In this case, the potential complementarities among technological and organizational variables are not significant.

To sum up, complementarities among HPWO practices (TEAMWORK*) or among technological and organizational practices (ICT FLEXIBILITY) must also be considered when analyzing labor flows issues. More particularly, the combination of ICT and flexible job assignment practices is positively correlated to the turnover of all workers, women workers, men workers and employees. In contrast, the combination of HPWO practices (TEAMWORK*) has mainly affected managers. In all cases, the impact of these complementarities on the labor flows is more important than the effect of the individual variables.

5.3 Separating decisions

5.3.1 A descriptive analysis of the labor flows

Table 9 shows that 31.5% of the establishments do not have managers' labor flows. This percentage reduces to 19% when considering intermediary professionals and employees. For manual workers, women workers and men workers less than 10% of the establishments have zero labor flows. Finally, when we consider all professional categories together (TOTAL) there is no establishment having zero turnover. These figures suggest that when dealing with managers, intermediary professions, employees and, potentially, manual workers, establishments must make two decisions: one concerning whether to have or not labor flows and, a second one, regarding the amount of labor flows. This idea is reinforced by figure 3, representing graphically the frequency distribution of the labor flows per establishment for the four professional categories under consideration.

Table 9: Percentage of establishments with zero labor flows. French establishments 1998.

Dependent variable: percentage of establishments with 0 labor flows for:						
MANAGERS	INT.PROFES.	EMPLOYEES	WORKERS	TOTAL	WOMEN	MEN
31.51%	18.95%	19.80%	9.94%	0.00%	5.00%	1.61%

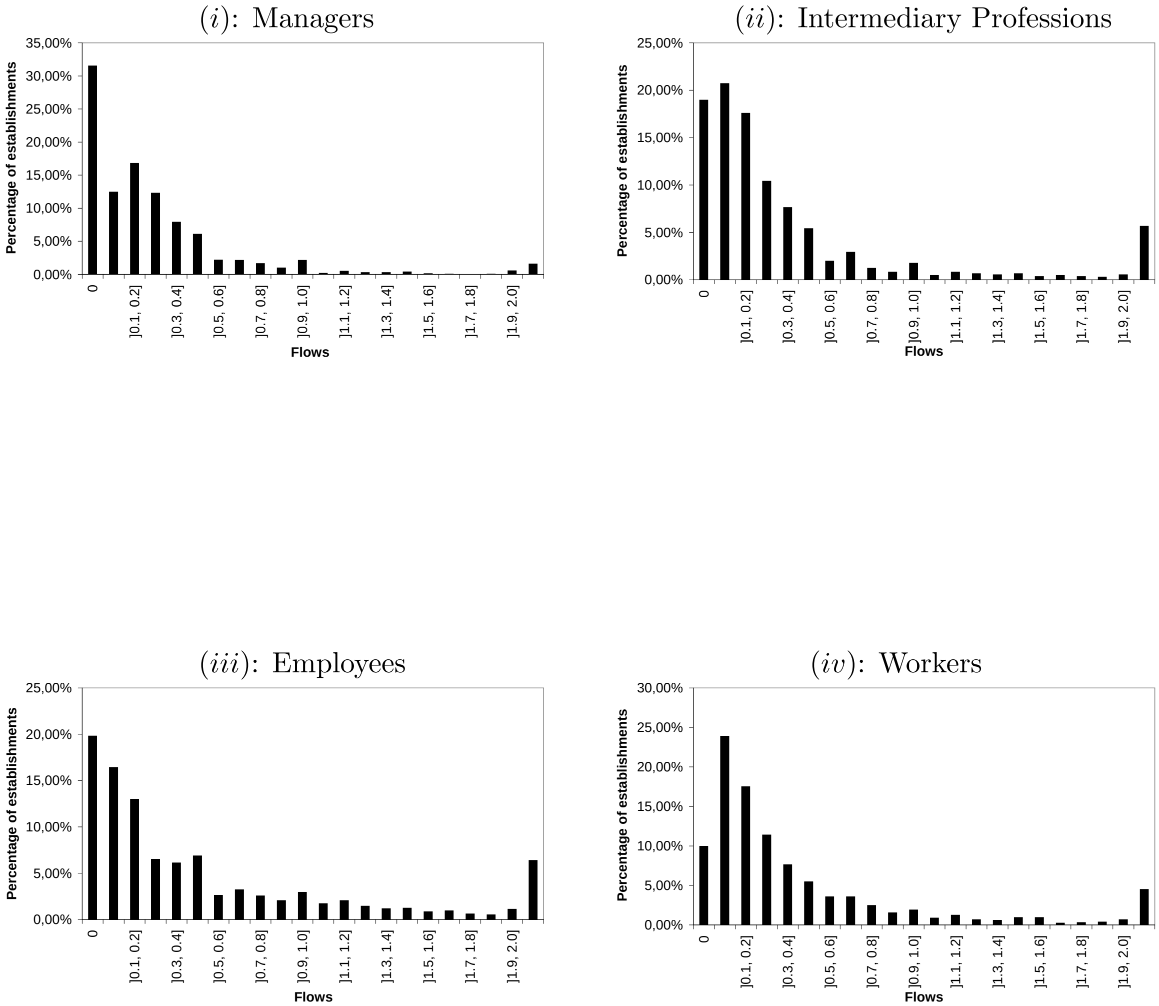
Source: REPONSE and DMMO surveys.

The above description of the data reveals, therefore, that the econometric analysis must distinguish two different phenomena, at least when dealing with managers, intermediary professions, employees and manual workers: the first phenomenon to be studied refers to the factors that lead establishments to have labor flows; and the second one, concerns the determinants of the amount of flows in the establishments that already present a non null turnover.

5.3.2 Heckman estimations

The best way to study the two mentioned decision problems is through a Heckman selection method. As explained in section 4, this method estimates, first, the determinants of the presence of non null labor flows through a probit model. Then, it estimates the determinants of the amount of flows in those establishments presenting positive turnover. Finally, the Heckman method provides the correlation coefficient (ρ) between the decision of having non zero labor flows and the amount of these flows. If this coefficient is significantly different from zero (Prob> χ^2 is smaller than 0.10) both decisions are correlated and the Heckman method gives consistent, asymptotically efficient estimates for all parameters. If ρ is not significantly different from zero, both decisions are independent and the results provided by the Heckman method are the same as if we had directly implemented an OLS regression on the establishments presenting positive flows, since there is no selection bias.

Table 10 displays the results of a probit model where the dependent variable equals one in case



Lecture: The X-axe represents the amount of labor flows of each professional category per intervals. The Y-axe corresponds to the percentage of establishments presenting the indicated labor flows.

Figure 3: Histograms of the labor flows associated to each professional category.

of non zero labor flows. As a general comment we notice that the smaller (bigger) the size of the establishment the less (more) likely is the presence of labor flows. Moreover, the larger the proportion of employees, managers and fixed duration contracts in the establishment the higher the probability of observing labor turnover. The use of *tayloristic* production systems is positively related to the presence of labor flows for managers, intermediary professionals and employees.

Regarding in detail each professional category, we observe that the reduction in the number of hierarchical levels inside the establishment as well as the presence of unions positively influences the decision to have managers' labor flows. In what concerns intermediary professionals, while a high degree of penetration of internet is positively related to the presence of turnover, an increasing economic context negatively affects it. NET increases the probability of having labor flows for employees and INTERNET decreases the probability of having labor flows for manual workers.

Estimations of equation (20), that is, once we are only considering establishments with non null flows, are summarized in table 11. Apart from INT.PROFES. where the correlation coefficient (ρ) is significantly different from zero, for the rest of the professional categories it can be claimed that there is independence between the decision of having or not labor flows and the decision concerning the amount of labor flows. For these professional categories, the estimations provided in table 11 are thus equivalent as if we had directly implemented an OLS regression on the establishments having non null labor flows, since there is no selection bias.

When comparing the results in tables 3 and 11 we observe that the estimates are essentially the same except from the intermediary professionals' case where, once we correct for the selection bias, no technological or organizational variable is significant. In the employees' case we also observe that the HPWO practice consisting in making the workers rotate among tasks is positively correlated to the amount of labor flows.

Table 10: Determinants of the presence of labor flows (probit model). French establishments 1998.

	Dependent variable equals 1 when there are labor flows			
	MANAGERS	INT.PROFES.	EMPLOYEES	WORKERS
ICT:				
COMPUTER	0	0	0	0
NET	0	0	+++	0
INTERNET	0	+++	0	- - -
CHAIN	+++	+	++	0
HPWO:				
AUTONOMOUS	0	0	0	++
PROJECT	0	0	0	0
ROTATION	0	0	0	0
QUALITY	0	0	0	0
HIERARCHY	+++	0	0	0
J.I.T.	0	0	0	0
Controls:				
Union	++	0	0	0
Variation	0	0	0	0
Tech. change	0	0	0	0
Strongly increasing	0	0	0	0
Increasing	0	- -	0	0
Decreasing	0	+	0	0
Strongly decreasing	0	0	0	0
Size 20-50	- - -	- - -	- - -	- -
Size +500	+++	+++	+++	0
Hours	0	0	0	0
P. Employees	+++	+++	+++	0
P. Technicians	++	- - -	++	0
P. Managers	+++	+++	0	0
P. Women	0	0	0	0
P. Contract	0	+	++	0

Lecture: 0 Non significant. + Positive coefficient significant at 10%.++ Positive coefficient significant at 5%.+++ Positive coefficient significant at 1%. - Negative coefficient significant at 10%. - - Negative coefficient significant at 5%. - - - Negative coefficient significant at 1%.

Source: REPONSE and DMMO surveys.

Table 11: Determinants of the amount of labor flows for each professional category. French establishments 1998.

	Dependent variable: non null labor flows for			
	MANAGERS	INT.PROFES.	EMPLOYEES	WORKERS
COMPUTER	0	0	++	0
NET	0	0	0	++
CHAIN	0	0	0	-
AUTONOMOUS	+	0	0	0
PROJECT	+	0	0	- -
ROTATION	0	0	+	0
QUALITY	-	0	0	0
HIERARCHY	0	0	- -	0
J.I.T.	0	0	0	0
Constant	0	- - -	+++	0
	Statistics of the Heckman model			
Observations	1388	1374	1359	1079
Censored Observations	418	235	245	90
Uncensored Observations	970	1139	1114	989
Wald χ^2	107.310	243.040	143.720	130.540
Prob> χ^2	0.000	0.000	0.000	0.000
ρ	-0.019	1.000	-0.016	-0.048
	(0.066)	(0.000)	(0.078)	(0.069)
$\chi^2(1)$	0.070	657.880	0.040	0.380
Prob> χ^2	0.794	0.000	0.851	0.537

Lecture: 0 Non significant. + Positive coefficient significant at 10%.++ Positive coefficient significant at 5%.+++ Positive coefficient significant at 1%. - Negative coefficient significant at 10%. - - Negative coefficient significant at 5%. - - - Negative coefficient significant at 1%.

Numbers in parentheses are standard errors.

Source: REPONSE and DMMO surveys.

6 Conclusion

The main objective of this paper was to shed some light on one aspect for which the existent literature is not very abundant: the effect of ICT and HPWO practices on job stability (labor flows). We first develop a very simple theoretical setup inspired in Cahuc and Postel-Vinay (2002). The comparative static analysis exercise facilitates the understanding of the economic mechanisms underlying behind the empirical evidence: any technological or organizational change improving the relative productivity of one type of job will tend to reduce its turnover and increase the turnover of the other jobs.

We then develop an empirical analysis based on a French database and covering more than twenty-five hundred establishments. Our estimations reveal that, when considering all professional categories together (all workers, women workers or men workers) the only significant correlation comes from the complementarities arising between ICT and flexible job assignment practices, the individual technological and organizational practices being non significant.

The detailed analysis by professional categories shows that the adoption of innovative workplace organizational practices (either progressively or simultaneously) has positively influenced the managers' turnover. In contrast, these practices are negatively correlated to the labor flows of intermediary professionals, employees and manual workers. This result is probably due to the fact that HPWO practices tend to stimulate the productivity of blue collar workers.

Finally, ICT adoption is positively associated with a higher turnover of employees and manual workers, whose relative productivity is likely to be deteriorated by the introduction of these new technologies. Moreover, the progressive disappearance of the *tayloristic* production systems is also positively correlated to the manual workers' turnover.

References

Abowd, J., and F. Kramarz. 2003. "The Costs of Hiring and Separations." *Labour Economics* 10 (5): 499–530.

Addison, J.T., and J. Wagner. 1994. "UK Unionism and Innovative Activity: Some Cautionary Remarks on the basis of a simple Cross-Country Test." *Bristish Journal on Industrial Relations* 32:85–98.

Allen, S. 1988. "Productivity Levels and Productivity Change under Unionism." *Industrial Relations* 27:94–113.

Askenazy, P., and C. Gianella. 2000. "Le Paradoxe de Productivité: les Changements Organisationnels, facteur complémentaire à l'informatisation." *Economie et Statistique* 9/10 (339-340): 219–242.

Bauer, T. 2004. "High Performance Workplace Practices and Job Satisfaction: Evidence from Europe." *IZA Working Paper*, pp. 1–33.

Bauer, T., and S. Bender. 2004. "Technological Change, Organizational Change, and Job Turnover." *Labour Economics* 11, no. 265-292.

Berman, E., J. Bound, and Z. Griliches. 1994. "Changes in the demand for skilled labor within U.S. manufacturing: evidence from the Annual Survey of Manufacturers." *Quarterly Journal of Economics* 109:367–397.

Bresnahan, T.F., E. Brynjolfsson, and L.M. Hitt. 2002. "Information Technology, Workplace organization, and the Demand for skilled Labor: Firm-Level Evidence." *The Quarterly Journal of Economics* 117 (1): 339–376.

Burgess, S.M., J. Lane, and D. Stevens. 2000. "Job Flows , Worker Flows, and Churning." *Journal of Labor Economics* 18 (3): 473–502 (July).

Burgess, S.M., and S. Nickell. 1990. "Labour Turnover in UK Manufacturing." *Economica* 57 (227): 295–317 (August).

Cahuc, P., and F. Postel-Vinay. 2002. "Temporary Jobs, Employment Protection and Labor Market Performance." *Labour Economics* 9:63–91.

Cappelli, P. 1996. "Technology and Skill Requirements: Implications for Establishment Wage Structures." *New England Economic Review*, pp. 139–154.

Caroli, E., and J. Van Reenen. 2001. "Skilled Biased Technological Change? Evidence from a Pannel of British and French Establishments." *Quarterly Journal of Economics* 116 (4): 1449–1492.

Davis, S., and J. Haltiwanger. 1991. "Wage Dispersion between and within U.S. Manufacturing Plants." *Brookings Papers on Economic Activity. Microeconomics* 1991:115–200.

Evans, J., and J. Dean. 2003. *Total quality: Management, Organization and Strategy.* South Westerns Pub: Cincinati.

Fitz Roy, F., and M. Funke. 1995. "Capital Skill Complementarity in West German Manufacturing." *Empirical Economics* 20:651–665.

Givord, P., and E. Maurin. 2004. "Changes in job security and their causes: An empirical analysis for France, 1982-2002." *European Economic Review* 48 (3): 595–615 (June).

Greenan, N. 1996. "Progrès Technique et Changements Organisationnels: leur Impact sur l'Emploi et les Qualifications." *Economie et Statistique* CCXCVIII:35–44.

Hamermesh, D., W.H.J. Hassink, and J.C. Van-Ours. 1996. "Job Turnover and Labor Turnover: A Taxonomy of Employment Dynamics." *Annales d'Économie et de Statistique* 41/42:21–39.

Ichniowski, C., K. Shaw, and G. Prennushi. 1997. "The Effects of Human Resource Management Practices on Productivity: A Study of Steel Finishing Lines." *The American Economic Review* 87 (3): 291–313 (June).

Ilmakunnas, P., and M. Maliranta. 2003. "Worker Inflow, Outflow and Churning." *William Davidson Institute Working Paper*, no. 611.

Jones, D.C., T. Kato, and A. Weinberg. 2003, September. *Low Wage in America.* Edited by E. Appelbaum, A. Bernhardt, and R.J. Murnane. Russell Sage Foundation. Chapter 13: Managerial Discretion, Business Strategy, and the Quality of Jobs: Evidence from Medium-Sized Manufacturing Establishments in Central New York.

Kramarz, F., S. Lollivier, and L.P. Pelé. 1996. "Wage Inequalities and Firm-Specific Compensation Policies in France." *Annales d'Économie et de Statistique*, no. 41/42:369–386.

Krusell, P., L.E. Ohanian, J.V. Rios-Rull, and G.L. Violante. 2000. "Capital skill complementarity and inequality: A macroeconomic analysis." *Econometrica* 68 (5): 1029–53.

Machin, S., A. Ryan, and J. Van Reenen. 1998. "Technology and changes in skill structure: Evidence from seven OECD countries." *Quarterly Journal of Economics* 113:1215–44.

Menezes-Filho, N., D. Ulph, and J. Van Reenen. 1998. "The determination of R&D: Empirical Evidence on the Role of Unions." *European Economic Review* 42:919–930.

Michelacci, C., and D. Lopez-Salido. 2004. "Technology Shocks and Job Flows." *CEMFI. Mimeo.*

Moreno-Galbis, E. 2002. "Causes of the Change in the Skill Structure of the Labour Force: An Empirical Application to the Spanish case." *IRES Dicussion Paper*, no. No. 35.

Mortensen, D., and C.A. Pissarides. 1994. "Job Creation and Job Destruction in the Theory of Unemployment." *Review of Economic Studies* 61:397–415.

Neumark, D., D. Polsky, and D. Hansen. 1999. "Has Job Stability Declined Yet? New Evidence for the 1990s." *Journal of Labor Economics* 4, no. S29-S64 (October).

Neumark, D., and D. Reed. 2004. "Employment Relationships in the New Economy." *Labour Economics* 11 (1): 1–31 (February).

OECD. 1996, July. "OECD Employment Outlook." Technical Report, OECD.

Pissarides, C. 2000. *Equilibrium Unemployment Theory.* Edited by MIT Press. Cambridge, Massachusetts: MIT Press.

Schnabel, C., and J. Wagner. 1992. "Unions and Innovative Activity in Germany." *Journal of Labour Research* 13:393–406.

Valletta, R.D. 1999. "Declining Job Security." *Journal of Labor Economics* 17 (4): S170–S197.

7 Appendix A: Steady state.

At the equilibrium the firms open vacancies until no more benefit can be obtained, that is, all rents are exhausted and the free entry condition applies: $\Pi^{v^c} = 0$ and $\Pi^{v^s} = 0$. From equations (5), (6), (7) and (8) we derive the following expressions for each period:

$$\frac{a^c}{\beta(1-\eta)\, q(\vartheta^c)} = \int_{\underline{\varepsilon}}^{\overline{\varepsilon}} Max[S^c(x), 0]\, d\Phi(x)\ , \tag{24}$$

$$\frac{a^s}{\beta(1-\eta)\, q(\vartheta^s)} = \int_{\underline{\varepsilon}}^{\overline{\varepsilon}} Max[S^s(x), 0]\, d\Phi(x)\ . \tag{25}$$

All job contacts will not lead to a job creation since, once the contact is made and the idiosyncratic productivity revealed, both parties may realize that the match is not productive enough to compensate for the search and hiring efforts. A contact will become a productive match if and only if the joint surplus (the one obtained by the firm plus the one of the worker) is positive. Therefore, for each type of job there exists a a critical productivity level, ε^c and ε^s, such that $S^c(\varepsilon^c) = 0$ and $S^s(\varepsilon^s) = 0$. Below these reservation productivity levels the joint surplus is negative and it is not profitable to create or continue a job.

To compute ε^c and ε^s, we first define the joint surplus of both types of jobs using equations (5)-(14) as well as the free entry conditions, (24) and (25):

$$S^c(\varepsilon) = \varepsilon + h_1 - w^u + \beta(1-\lambda) Max[S^c(\varepsilon), 0] + \beta\lambda \int_{\underline{\varepsilon}}^{\overline{\varepsilon}} Max[S^c(x), 0] d\Phi(x) - \frac{\eta a^c \vartheta^c}{1-\eta}\ , \tag{26}$$

$$S^s(\varepsilon) = \varepsilon + h_2 - w^u + \beta(1-\lambda) Max[S^s(\varepsilon), 0] + \beta\lambda \int_{\underline{\varepsilon}}^{\overline{\varepsilon}} Max[S^s(x), 0] d\Phi(x) - \frac{\eta a^s \vartheta^s}{1-\eta}\ . \tag{27}$$

At the threshold values ε^c and ε^s, equations (26) and (27) respectively become zero leading to:

$$\frac{\eta\, a^c\, \vartheta^c}{1-\eta} = \varepsilon^c + h_1 - w^u + \beta\, \lambda \int_{\varepsilon^c}^{\overline{\varepsilon}} S^c(x)\, d\Phi(x)\ , \tag{28}$$

$$\frac{\eta\, a^s\, \vartheta^s}{1-\eta} = \varepsilon^s + h_2 - w^u + \beta\, \lambda \int_{\varepsilon^s}^{\overline{\varepsilon}} S^s(x)\, d\Phi(x)\ . \tag{29}$$

From (26) and (27) we know that $S'^{\,c} = \frac{1}{1-\beta(1-\lambda)} > 0$ and $S'^{\,s} = \frac{1}{1-\beta(1-\lambda)} > 0$, for $\varepsilon \geq \varepsilon^c$ and $\varepsilon \geq \varepsilon^s$, respectively. Using these results and integrating by parts the integrals in (28) and (29) permits to determine the complex and simple job destruction rules:

$$\frac{\eta\, a^c\, \vartheta^c}{1-\eta} = \varepsilon^c + h_1 - w^u + \frac{\beta\, \lambda}{1-\beta(1-\lambda)} \int_{\varepsilon^c}^{\overline{\varepsilon}} (1-\Phi(x))\, dx\ , \tag{30}$$

$$\frac{\eta\, a^s\, \vartheta^s}{1-\eta} = \varepsilon^s + h_2 - w^u + \frac{\beta\, \lambda}{1-\beta(1-\lambda)} \int_{\varepsilon^s}^{\overline{\varepsilon}} (1-\Phi(x))\, dx\ . \tag{31}$$

Whether we consider the complex or the simple segment of the labor market we observe a positive relationship between the market tightness of the corresponding segment and its reservation productivity (see proof below). Therefore, the job destruction curves of the complex and simple segment of the labor market are positively sloped in the space $(\vartheta^c, \varepsilon)$ and $(\vartheta^s, \varepsilon)$, respectively.

Proof.

We analyze the slope of the complex job destruction curve:

$$\begin{aligned}
\frac{\eta\, a^c}{1-\eta}\,\frac{d\vartheta^c}{d\varepsilon^c} &= 1 + \frac{\beta\,\lambda}{1-\beta(1-\lambda)}\,\frac{d}{d\varepsilon^c}\int_{\varepsilon^c}^{\overline{\varepsilon}}(1-\Phi(x))dx\ , \qquad (32)\\
&= 1 + \frac{\beta\,\lambda}{1-\beta(1-\lambda)}\left(-\frac{d}{d\varepsilon^c}\int_{\overline{\varepsilon}}^{\varepsilon^c}(1-\Phi(x))dx\right),\\
&= 1 - \frac{\beta\,\lambda}{1-\beta(1-\lambda)}(1-\Phi(\varepsilon^c))\ .
\end{aligned}$$

From the previous expression we realize that:

$$sign\ \frac{d\vartheta^c}{d\varepsilon^c} = sign\ \left(1-\frac{\beta\,\lambda}{1-\beta(1-\lambda)}(1-\Phi(\varepsilon^c))\right) \qquad (33)$$

We proceed then to determine the sign of the right hand side of equation (33). Because $0<\beta<1$ we know that $1-\beta+\beta\,\lambda>\beta\,\lambda$. Therefore:

$$0 < \frac{\beta\,\lambda}{1-\beta(1-\lambda)} < 1\ .$$

At the same time, since $\Phi(x)$ is a probability distribution function we have that $0 \leq 1-\Phi(\varepsilon^c) \leq 1$. Multiplying two positive numbers smaller than one leads to a positive number smaller than one, so that:

$$1-\frac{\beta\,\lambda}{1-\beta(1-\lambda)}(1-\Phi(\varepsilon^c)) > 0 \quad \text{which implies} \quad \frac{d\vartheta^c}{d\varepsilon^c} > 0\ . \qquad (34)$$

The job destruction curve in the complex segment is positive sloped. The positivity of the slope in the simple segment can be determined in a similar way. ■

We apply on equations (24) and (25) the same procedure developed to compute (30) and (31) in order to determine the job creation rule of each type of job:

$$\frac{a^c}{\beta(1-\eta)\, q(\vartheta^c)} = \frac{1}{1-\beta(1-\lambda)} \int_{\varepsilon^c}^{\overline{\varepsilon}} (1-\Phi(x))\, dx\ , \tag{35}$$

$$\frac{a^s}{\beta(1-\eta)\, q(\vartheta^s)} = \frac{1}{1-\beta(1-\lambda)} \int_{\varepsilon^s}^{\overline{\varepsilon}} (1-\Phi(x))\, dx\ ,\ . \tag{36}$$

We prove now that both equations determine a negative relationship between the market tightness and ε, meaning that the job creation curves are negatively sloped in the space $(\vartheta^i, \varepsilon)$ for $i = c, s$.

Proof.

We develop the proof for the complex case but, here again, the same procedure applies for the simple segment.

$$-\frac{a^c}{\beta\,(1-\eta)} \frac{q'(\vartheta^c)}{q^2(\vartheta^c)} \frac{d\vartheta^c}{d\varepsilon^c} = \frac{1}{1-\beta(1-\lambda)} \frac{d}{d\varepsilon^c} \int_{\varepsilon^c}^{\overline{\varepsilon}} (1-\Phi(x))dx\ , \tag{37}$$

$$-\frac{a^c}{\beta\,(1-\eta)} \frac{q'(\vartheta^c)}{q^2(\vartheta^c)} \frac{d\vartheta^c}{d\varepsilon^c} = -\frac{1}{1-\beta(1-\lambda)} \frac{d}{d\varepsilon^c} \int_{\overline{\varepsilon}}^{\varepsilon^c} (1-\Phi(x))dx\ ,$$

$$\frac{a^c}{\beta\,(1-\eta)} \frac{q'(\vartheta^c)}{q^2(\vartheta^c)} \frac{d\vartheta^c}{d\varepsilon^c} = \frac{1}{1-\beta(1-\lambda)}(1-\Phi(\varepsilon^c))\ .$$

Because $0 < \beta < 1$, $0 < \eta < 1$ and $a^c > 0$ the first term on the left hand side, $\frac{a^c}{\beta\,(1-\eta)}$, is positive. At the same time, since $0 < \lambda < 1$ and $\Phi(x)$ is a probability distribution function, the right hand part of equation (37) is positive. Therefore:

$$sign\ \frac{d\vartheta^c}{d\varepsilon^c} = sign\ \frac{q^2(\vartheta^c)}{q'(\vartheta^c)} \tag{38}$$

As $q^2(\vartheta^c)$ is always positive and the probability of filling a vacancy is a decreasing function on the labor market tightness ($q'(\vartheta^c) < 0$), we find that $\frac{q^2(\vartheta^c)}{q'(\vartheta^c)} < 0$. The job creation curve is negatively sloped. ■

Finally, substituting the value functions into the surplus sharing rules (5) and (6) we obtain the following expression for the wages (see Pissarides (2000) chapter 2):

$$w^c(\varepsilon) = (1-\eta)\, w^u + \eta(\varepsilon + h_1 + a^c\vartheta^c)\ , \tag{39}$$

$$w^s(\varepsilon) = (1-\eta)\, w^u + \eta(\varepsilon + h_2 + a^s\vartheta^s). \tag{40}$$

8 Appendix B: Econometric results

OLS estimations

Table 12: Determinants of managers' labor flows. French establishments 1998.

	Dependent variable: labor flows for		
	MANAGERS: model 1	MANAGERS: model 2	MANAGERS: model 3
COMPUTER	-1.096 (1.736)	-1.277 (1.709)	-1.397 (1.488)
NET	-0.167 (1.572)	-0.277 (1.533)	-0.343 (1.404)
INTERNET	-0.867 (2.834)		
CHAIN	-0.570 (0.945)	-0.524 (0.922)	-0.565 (0.756)
AUTONOMOUS	2.697 (1.485)*	2.616 (1.466)*	2.489 (1.347)*
PROJECT	3.115 (1.481)**	3.037 (1.460)**	2.635 (1.326)**
ROTATION	-1.508 (1.380)	-1.562 (1.363)	-1.455 (1.246)
QUALITY	-2.849 (1.364)**	-2.691 (1.347)**	-2.360 (1.204)**
HIERARCHY	0.960 (0.875)	0.974 (0.862)	0.743 (0.783)
J.I.T.	1.075 (0.741)	1.119 (0.730)	1.109 (0.663)*
Union	0.989 (1.206)		
Variation	1.065 (1.241)	0.960 (1.212)	0.610 (1.084)
Tech. change	-1.022 (1.514)		
Strongly increasing	-0.391 (1.989)	-0.395 (1.768)	
Increasing	-0.122 (1.381)		
Decreasing	5.062 (2.037)***	5.131 (1.844)***	4.949 (1.656)***
Strongly decreasing	0.226 (3.919)		
Size 20-50	-0.855 (2.082)		
Size +500	-0.285 (1.712)		
Hours	4.282 (1.768)**	4.360 (1.748)***	4.226 (1.615)***
P. Employees	4.818 (2.987)	4.817 (2.952)*	4.453 (2.382)*
P. Technicians	-0.617 (4.514)	-0.528 (4.469)	
P. Managers	-3.272 (5.472)	-3.292 (5.216)	-1.939 (4.474)
P. Women	0.808 (2.922)	0.418 (2.731)	
P. Contract	-6.606 (5.642)	-6.542 (5.575)	-4.308 (5.119)
Sectors	(16)	(10)	(3)
Constant	-1.656 (8.506)	-1.573 (2.459)	-1.277 (1.684)
Observations	1388	1390	1511
Adj R^2	0.037	0.043	0.046

For Sectors we write in parentheses the number of economic sectors included in the regression.
*Significant at 10%.**Significant at 5%.***Significant at 1%.
Source: REPONSE and DMMO surveys.

Table 13: Determinants of the intermediary professionals' labor flows. French establishments 1998.

	Dependent variable: labor flows for		
	INT.PROFES.: model 1	INT.PROFES.: model 2	INT.PROFES.: model 3
COMPUTER	0.259	0.242	0.237
	(0.231)	(0.228)	(0.224)
NET	0.042	-0.006	-0.007
	(0.210)	(0.205)	(0.204)
INTERNET	-0.373		
	(0.375)		
CHAIN	0.086	0.061	0.063
	(0.126)	(0.123)	(0.110)
AUTONOMOUS	0.103	0.145	0.153
	(0.197)	(0.195)	(0.193)
PROJECT	-0.283	-0.278	-0.278
	(0.197)	(0.194)	(0.193)
ROTATION	0.170	0.185	0.190
	(0.184)	(0.182)	(0.180)
QUALITY	0.182	0.175	0.178
	(0.181)	(0.179)	(0.177)
HIERARCHY	-0.182	-0.194	-0.196
	(0.117)	(0.115)*	(0.114)*
J.I.T.	-0.034	-0.039	-0.043
	(0.098)	(0.097)	(0.096)
Union	0.055		
	(0.160)		
Variation	0.130	0.132	0.132
	(0.165)	(0.162)	(0.160)
Tech. change	0.137		
	(0.201)		
Strongly increasing	-0.167	-0.234	-0.234
	(0.265)	(0.236)	(0.235)
Increasing	0.098		
	(0.184)		
Decreasing	0.488	0.440	0.445
	(0.271)*	(0.246)*	(0.244)*
Strongly decreasing	-0.127		
	(0.519)		
Size 20-50	0.259		
	(0.280)		
Size +500	-0.346		
	(0.228)		
Hours	0.286	0.258	0.262
	(0.234)	(0.232)	(0.230)
P. Employees	0.708	0.733	0.669
	(0.397)*	(0.393)*	(0.341)**
P. Technicians	-3.237	-3.199	-3.216
	(0.602)***	(0.597)***	(0.582)***
P. Managers	3.420	3.230	3.237
	(0.726)***	(0.693)***	(0.683)***
P. Women	0.403	0.334	0.304
	(0.388)	(0.363)	(0.343)
P. Contract	0.787	0.745	0.733
	(0.748)	(0.740)	(0.735)
Sectors	(16)	(10)	(4)
Constant	0.130	0.084	0.101
	(0.842)	(0.330)	(0.285)
Observations	1374	1376	1376
Adj R^2	0.143	0.146	0.150

For Sectors we write in parentheses the number of economic sectors included in the regression.
*Significant at 10%.**Significant at 5%.***Significant at 1%.
Source: REPONSE and DMMO surveys.

Table 14: Determinants of the employees' labor flows. French establishments 1998.

	Dependent variable: labor flows for		
	EMPLOYEES: model 1	EMPLOYEES: model 2	EMPLOYEES: model 3
COMPUTER	0.794 (0.369)**	0.796 (0.364)**	0.729 (0.335)**
NET	-0.067 (0.337)	-0.051 (0.328)	-0.079 (0.316)
INTERNET	0.049 (0.617)		
CHAIN	-0.193 (0.201)	-0.186 (0.196)	-0.189 (0.185)
AUTONOMOUS	-0.153 (0.317)	-0.124 (0.314)	-0.122 (0.305)
PROJECT	-0.189 (0.316)	-0.197 (0.312)	-0.191 (0.302)
ROTATION	0.427 (0.295)	0.411 (0.291)	0.399 (0.281)
QUALITY	-0.052 (0.289)	-0.025 (0.286)	-0.020 (0.277)
HIERARCHY	-0.329 (0.187)*	-0.360 (0.184)**	-0.323 (0.178)*
J.I.T.	-0.023 (0.158)	-0.026 (0.156)	-0.032 (0.150)
Union	-0.382 (0.256)		
Variation	0.021 (0.264)	0.088 (0.259)	
Tech. change	-0.032 (0.322)		
Strongly increasing	0.120 (0.427)	-0.058 (0.380)	
Increasing	0.374 (0.294)		
Decreasing	0.235 (0.435)	-0.033 (0.394)	
Strongly decreasing	0.312 (0.827)		
Size 20-50	-0.362 (0.443)		
Size +500	0.103 (0.369)		
Hours	-0.190 (0.377)	-0.190 (0.373)	-0.196 (0.363)
P. Employees	-3.839 (0.633)***	-3.820 (0.627)***	-3.785 (0.594)***
P. Technicians	-2.334 (0.983)**	-2.326 (0.974)**	-2.116 (0.939)**
P. Managers	-0.167 (1.172)	-0.223 (1.124)	
P. Women	1.712 (0.622)***	1.519 (0.581)***	1.450 (0.543)***
P. Contract	2.789 (1.200)**	2.936 (1.187)***	2.929 (1.143)***
Sectors	(16)	(10)	(7)
Constant	0.737 (1.794)	1.169 (0.523)**	1.146 (0.452)***
Observations	1359	1361	1403
Adj R^2	0.069	0.072	0.078

For Sectors we write in parentheses the number of economic sectors included in the regression.
*Significant at 10%.**Significant at 5%.***Significant at 1%.
Source: REPONSE and DMMO surveys.

Table 15: Determinants of the manual workers' labor flows. French establishments 1998.

	Dependent variable: labor flows for		
	WORKERS: model 1	WORKERS: model 2	WORKERS: model 3
COMPUTER	0.116	0.074	0.093
	(0.214)	(0.212)	(0.195)
NET	0.455	0.378	0.361
	(0.191)**	(0.188)**	(0.177)**
INTERNET	-0.718		
	(0.405)*		
CHAIN	-0.206	-0.264	-0.254
	(0.114)*	(0.111)**	(0.096)***
AUTONOMOUS	-0.047	-0.045	-0.041
	(0.171)	(0.170)	(0.162)
PROJECT	-0.252	-0.296	-0.271
	(0.179)	(0.177)*	(0.169)
ROTATION	-0.148	-0.134	-0.120
	(0.159)	(0.157)	(0.150)
QUALITY	-0.062	-0.084	-0.080
	(0.171)	(0.170)	(0.161)
HIERARCHY	0.065	0.024	0.017
	(0.105)	(0.104)	(0.098)
J.I.T.	0.079	0.073	0.067
	(0.087)	(0.086)	(0.082)
Union	-0.188		
	(0.147)		
Variation	0.020	-0.007	
	(0.149)	(0.146)	
Tech. change	-0.371		
	(0.190)**		
Strongly increasing	-0.254	-0.180	-0.159
	(0.247)	(0.220)	(0.209)
Increasing	-0.064		
	(0.169)		
Decreasing	-0.235	-0.232	-0.218
	(0.240)	(0.216)	(0.204)
Strongly decreasing	-0.035		
	(0.441)		
Size 20-50	0.381		
	(0.272)		
Size +500	-0.186		
	(0.199)		
Hours	-0.045	-0.057	
	(0.206)	(0.204)	
P. Employees	2.934	2.865	2.705
	(0.498)***	(0.495)***	(0.471)***
P. Technicians	1.126	0.968	0.801
	(0.619)*	(0.612)	(0.579)
P. Managers	0.626	0.161	
	(0.825)	(0.796)	
P. Women	0.676	0.578	0.532
	(0.361)*	(0.337)*	(0.308)*
P. Contract	1.181	1.068	0.981
	(0.686)*	(0.679)	(0.635)
Sectors	(16)	(10)	(8)
Constant	-1.175	0.133	0.170
	(1.350)	(0.296)	(0.237)
Observations	1079	1080	1128
Adj R^2	0.088	0.085	0.083

For Sectors we write in parentheses the number of economic sectors included in the regression.
*Significant at 10%.**Significant at 5%.***Significant at 1%.
Source: REPONSE and DMMO surveys.

Table 16: Determinants of total labor flows. French establishments 1998.

	Dependent variable: labor flows for		
	TOTAL: model 1	TOTAL: model 2	TOTAL: model 3
COMPUTER	0.239	0.228	0.240
	(0.113)**	(0.112)**	(0.101)**
NET	-0.075	-0.107	-0.076
	(0.104)	(0.102)	(0.098)
INTERNET	-0.091		
	(0.187)		
CHAIN	-0.011	-0.053	-0.046
	(0.063)	(0.062)	(0.057)
AUTONOMOUS	0.051	0.055	0.035
	(0.099)	(0.098)	(0.095)
PROJECT	-0.036	-0.055	-0.040
	(0.098)	(0.097)	(0.094)
ROTATION	0.094	0.123	0.103
	(0.092)	(0.091)	(0.087)
QUALITY	-0.063	-0.080	-0.049
	(0.090)	(0.089)	(0.086)
HIERARCHY	-0.047	-0.058	-0.050
	(0.058)	(0.057)	(0.055)
J.I.T.	0.038	0.028	0.036
	(0.049)	(0.048)	(0.046)
Union	0.030		
	(0.080)		
Variation	0.137	0.118	0.121
	(0.083)*	(0.081)	(0.077)
Tech. change	-0.131		
	(0.100)		
Strongly increasing	-0.238	-0.179	-0.230
	(0.133)*	(0.119)	(0.122)*
Increasing	-0.108		-0.098
	(0.092)		(0.079)
Decreasing	0.039	0.103	
	(0.135)	(0.122)	
Strongly decreasing	0.148		
	(0.246)		
Size 20-50	0.270		0.167
	(0.139)**		(0.129)
Size +500	-0.188		-0.183
	(0.112)*		(0.107)*
Hours	-0.027	-0.018	
	(0.117)	(0.116)	
P. Employees	0.535	0.557	0.621
	(0.201)***	(0.199)***	(0.165)***
P. Technicians	-0.574	-0.552	-0.465
	(0.296)**	(0.295)*	(0.281)*
P. Managers	0.147	0.128	
	(0.369)	(0.352)	
P. Women	0.255	0.211	0.277
	(0.196)	(0.185)	(0.169)*
P. Contract	0.455	0.375	0.424
	(0.410)	(0.406)	(0.374)
Sectors	(16)	(10)	(5)
Constant	1.906	0.351	0.353
	(0.649)***	(0.164)**	(0.145)***
Observations	1333	1335	1392
Adj R^2	0.132	0.130	0.141

For Sectors we write in parentheses the number of economic sectors included in the regression.
*Significant at 10%.**Significant at 5%.***Significant at 1%.
Source: REPONSE and DMMO surveys.

Table 17: Determinants of women's labor flows. French establishments 1998.

	Dependent variable: labor flows for		
	WOMEN: model 1	WOMEN: model 2	WOMEN: model 3
COMPUTER	0.255	0.274	0.276
	(0.248)	(0.246)	(0.228)
NET	-0.103	-0.120	-0.118
	(0.225)	(0.220)	(0.214)
INTERNET	0.167		
	(0.405)		
CHAIN	-0.133	-0.205	-0.213
	(0.136)	(0.133)	(0.129)*
AUTONOMOUS	-0.048	-0.041	-0.041
	(0.213)	(0.211)	(0.208)
PROJECT	-0.140	-0.154	-0.148
	(0.212)	(0.210)	(0.205)
ROTATION	0.210	0.232	0.190
	(0.198)	(0.196)	(0.191)
QUALITY	-0.177	-0.195	-0.182
	(0.195)	(0.194)	(0.189)
HIERARCHY	-0.023	-0.019	-0.021
	(0.125)	(0.124)	(0.122)
J.I.T.	0.064	0.039	0.038
	(0.106)	(0.105)	(0.103)
Union	0.196		
	(0.173)		
Variation	-0.106	-0.099	-0.110
	(0.178)	(0.175)	(0.170)
Tech. change	-0.239		
	(0.217)		
Strongly increasing	-0.036	-0.289	-0.274
	(0.285)	(0.254)	(0.249)
Increasing	0.308		
	(0.198)		
Decreasing	0.103	-0.061	
	(0.291)	(0.265)	
Strongly decreasing	0.420		
	(0.568)		
Size 20-50	0.350		
	(0.299)		
Size +500	-0.362		
	(0.245)		
Hours	-0.211	-0.180	-0.180
	(0.253)	(0.251)	(0.248)
P. Employees	1.505	1.456	1.408
	(0.428)***	(0.424)***	(0.405)***
P. Technicians	-1.032	-1.033	-0.996
	(0.647)	(0.644)	(0.633)
P. Managers	-0.011	-0.015	
	(0.783)	(0.750)	
P. Women	-2.724	-2.475	-2.384
	(0.419)***	(0.393)***	(0.381)***
P. Contract	1.242	1.259	1.330
	(0.810)	(0.804)	(0.788)*
Sectors	(16)	(10)	(8)
Constant	2.038	1.685	1.673
	(1.217)*	(0.355)***	(0.334)***
Observations	1382	1384	1407
Adj R^2	0.066	0.065	0.066

For Sectors we write in parentheses the number of economic sectors included in the regression.
*Significant at 10%.**Significant at 5%.***Significant at 1%.
Source: REPONSE and DMMO surveys.

Table 18: Determinants of men's labor flows. French establishments 1998.

	Dependent variable: labor flows for		
	MEN: model 1	MEN: model 2	MEN: model 3
COMPUTER	0.348	0.315	0.289
	(0.199)*	(0.196)	(0.192)
NET	-0.134	-0.196	-0.198
	(0.180)	(0.176)	(0.180)
INTERNET	-0.442		
	(0.324)		
CHAIN	-0.067	-0.102	-0.131
	(0.108)	(0.105)	(0.109)
AUTONOMOUS	0.197	0.219	0.203
	(0.170)	(0.168)	(0.175)
PROJECT	-0.068	-0.090	-0.094
	(0.170)	(0.168)	(0.172)
ROTATION	0.147	0.173	0.157
	(0.158)	(0.156)	(0.161)
QUALITY	0.206	0.195	0.280
	(0.156)	(0.155)	(0.159)*
HIERARCHY	-0.042	-0.069	-0.116
	(0.100)	(0.099)	(0.102)
J.I.T.	0.028	0.021	0.038
	(0.085)	(0.084)	(0.087)
Union	-0.075		
	(0.138)		
Variation	0.180	0.165	0.208
	(0.142)	(0.139)	(0.143)
Tech. change	-0.080		
	(0.174)		
Strongly increasing	-0.167	-0.145	-0.166
	(0.228)	(0.203)	(0.211)
Increasing	-0.020		
	(0.158)		
Decreasing	0.512	0.524	0.485
	(0.233)**	(0.212)***	(0.217)**
Strongly decreasing	-0.066		
	(0.449)		
Size 20-50	0.300		
	(0.239)		
Size +500	-0.258		
	(0.196)		
Hours	-0.064	-0.085	-0.116
	(0.202)	(0.200)	(0.208)
P. Employees	0.226	0.248	0.411
	(0.342)	(0.339)	(0.341)
P. Technicians	-0.806	-0.799	-0.698
	(0.517)	(0.513)	(0.529)
P. Managers	0.315	0.113	
	(0.627)	(0.598)	
P. Women	2.002	1.865	
	(0.335)***	(0.313)***	
P. Contract	-0.130	-0.186	2.096
	(0.646)	(0.640)	(0.318)***
Sectors	(16)	(10)	(10)
Constant	0.134	-0.250	-0.330
	(0.728)	(0.282)	(0.282)
Observations	1387	1389	1428
Adj R^2	0.121	0.124	0.123

For Sectors we write in parentheses the number of economic sectors included in the regression.
*Significant at 10%.**Significant at 5%.***Significant at 1%.
Source: REPONSE and DMMO surveys.

OLS estimations with incremental organization

Table 19: Effect of incremental organization (additive clusters) on the labor flows of different professional categories. French establishments 1998.

	Dependent variable: labor flows for						
	MANAGERS	INT.PROFES.	EMPLOYEES	WORKERS	TOTAL	WOMEN	MEN
TECHNOLOGY	-0.687	0.097	0.337	0.227	0.046	0.056	0.032
	(0.951)	(0.126)	(0.203)*	(0.119)**	(0.063)	(0.136)	(0.109)
CHAIN	-0.448	0.054	-0.203	-0.251	-0.055	-0.210	-0.106
	(0.920)	(0.123)	(0.196)	(0.111)**	(0.062)	(0.132)	(0.106)
TEAMWORK	1.864	-0.143	-0.278	-0.063	-0.035	-0.060	-0.015
	(0.600)***	(0.080)*	(0.128)**	(0.072)	(0.040)	(0.086)	(0.069)
FLEXIBILITY	0.466	0.013	0.072	0.024	0.048	0.084	0.054
	(0.616)	(0.082)	(0.132)	(0.072)	(0.041)	(0.089)	(0.071)
QUALITY	-2.532	0.162	-0.052	-0.077	-0.087	-0.211	0.181
	(1.345)*	(0.179)	(0.286)	(0.170)	(0.089)	(0.193)	(0.154)
Variation	0.866	0.133	0.091	-0.008	0.126	-0.089	0.170
	(1.210)	(0.161)	(0.258)	(0.146)	(0.081)	(0.174)	(0.139)
Strongly increasing	-0.329	-0.224	-0.054	-0.168	-0.179	-0.289	-0.136
	(1.767)	(0.236)	(0.380)	(0.220)	(0.119)	(0.254)	(0.203)
Decreasing	5.140	0.427	-0.040	-0.213	0.104	-0.059	0.520
	(1.842)***	(0.245)*	(0.394)	(0.216)	(0.122)	(0.264)	(0.211)***
Hours	4.096	0.241	-0.207	-0.037	-0.026	-0.168	-0.102
	(1.740)**	(0.231)	(0.372)	(0.203)	(0.115)	(0.250)	(0.200)
P. Employees	4.808	0.730	-3.766	2.813	0.573	1.478	0.273
	(2.944)*	(0.391)*	(0.625)***	(0.494)***	(0.199)***	(0.423)***	(0.338)
P. Technicians	-0.716	-3.171	-2.132	0.828	-0.497	-0.965	-0.712
	(4.431)	(0.592)***	(0.967)**	(0.607)	(0.293)*	(0.638)	(0.509)
P. Managers	-2.611	3.075	-0.168	0.089	0.142	-0.018	0.081
	(5.100)	(0.677)***	(1.100)	(0.786)	(0.345)	(0.732)	(0.585)
P. Women	0.282	0.342	1.545	0.562	0.221	-2.458	1.879
	(2.730)	(0.363)	(0.581)***	(0.337)*	(0.185)	(0.393)***	(0.313)***
P. Contract	-6.357	0.772	3.014	1.041	0.401	1.263	-0.146
	(5.570)	(0.739)	(1.186)***	(0.678)	(0.406)	(0.803)	(0.639)
Sectors	(10)	(10)	(10)	(10)	(10)	(10)	(10)
Constant	-2.318	0.110	1.149	0.193	0.339	1.718	-0.259
	(2.417)	(0.324)	(0.514)**	(0.289)	(0.162)**	(0.348)***	(0.277)
Observations	1390	1376	1361	1080	1335	1384	1389
Adj R^2	0.043	0.146	0.072	0.084	0.129	0.066	0.122

For Sectors we write in parentheses the number of economic sectors included in the regression.
*Significant at 10%.**Significant at 5%.***Significant at 1%.
Source: REPONSE and DMMO surveys.

OLS estimations with multiplicative clusters

Table 20: Effect of multiplicative clusters on the labor flows of different professional categories. French establishments 1998.

	Dependent variable: labor flows for						
	MANAGERS	INT.PROFES.	EMPLOYEES	WORKERS	TOTAL	WOMEN	MEN
COMPUTER	-1.163	0.187	0.236	0.168	0.064	0.056	0.122
	(1.869)	(0.250)	(0.397)	(0.238)	(0.123)	(0.269)	(0.215)
NET	-0.473	-0.008	-0.055	0.377	-0.114	-0.115	-0.198
	(1.529)	(0.205)	(0.327)	(0.188)**	(0.102)	(0.220)	(0.176)
CHAIN	-0.572	0.061	-0.187	-0.266	-0.055	-0.204	-0.101
	(0.919)	(0.123)	(0.195)	(0.111)**	(0.061)	(0.133)	(0.106)
AUTONOMOUS	-0.028	0.110	-0.306	-0.066	-0.013	-0.041	0.150
	(1.668)	(0.223)	(0.357)	(0.191)	(0.111)	(0.241)	(0.192)
PROJECT	0.702	-0.311	-0.373	-0.322	-0.122	-0.158	-0.155
	(1.620)	(0.216)	(0.346)	(0.202)	(0.107)	(0.233)	(0.186)
ROTATION	-1.417	0.136	-0.083	-0.072	-0.029	0.038	0.002
	(1.522)	(0.204)	(0.324)	(0.173)	(0.102)	(0.219)	(0.175)
QUALITY	-2.501	0.177	-0.018	-0.078	-0.076	-0.198	0.197
	(1.344)*	(0.180)	(0.285)	(0.170)	(0.089)	(0.194)	(0.155)
HIERARCHY	0.513	-0.202	-0.411	0.023	-0.076	-0.026	-0.087
	(0.871)	(0.117)*	(0.186)**	(0.105)	(0.058)	(0.126)	(0.100)
J.I.T.	0.972	-0.043	-0.052	0.074	0.020	0.032	0.011
	(0.730)	(0.097)	(0.155)	(0.087)	(0.048)	(0.105)	(0.084)
TEAMWORK*	5.855	0.079	0.392	0.051	0.156	0.001	0.154
	(1.781)***	(0.237)	(0.380)	(0.212)	(0.117)	(0.257)	(0.205)
ICT FLEXIBILITY	-0.180	0.231	2.360	-0.341	0.680	0.892	0.799
	(3.149)	(0.421)	(0.679)***	(0.395)	(0.206)***	(0.453)**	(0.362)**
Variation	0.835	0.133	0.112	-0.013	0.124	-0.089	0.171
	(1.210)	(0.162)	(0.258)	(0.147)	(0.081)	(0.175)	(0.139)
Strongly increasing	-0.536	-0.233	-0.035	-0.186	-0.172	-0.277	-0.139
	(1.763)	(0.236)	(0.379)	(0.220)	(0.118)	(0.254)	(0.203)
Decreasing	5.084	0.439	-0.046	-0.237	0.098	-0.062	0.523
	(1.838)***	(0.246)*	(0.392)	(0.216)	(0.122)	(0.265)	(0.211)***
Hours	4.633	0.256	-0.205	-0.045	-0.025	-0.198	-0.094
	(1.745)***	(0.232)	(0.372)	(0.205)	(0.116)	(0.251)	(0.201)
P. Employees	4.672	0.722	-3.938	2.861	0.531	1.419	0.211
	(2.946)	(0.393)*	(0.625)***	(0.495)***	(0.199)***	(0.424)***	(0.339)
P. Technicians	-0.392	-3.209	-2.429	0.981	-0.566	-1.076	-0.831
	(4.457)	(0.598)***	(0.970)***	(0.613)	(0.293)**	(0.643)*	(0.512)*
P. Managers	-2.397	3.280	0.250	0.126	0.263	0.133	0.269
	(5.231)	(0.697)***	(1.127)	(0.799)	(0.352)	(0.754)	(0.601)
P. Women	0.786	0.346	1.599	0.576	0.233	-2.454	1.894
	(2.725)	(0.364)	(0.579)***	(0.338)*	(0.185)	(0.394)***	(0.313)***
P. Contract	-6.903	0.732	2.811	1.059	0.343	1.220	-0.227
	(5.559)	(0.741)	(1.182)**	(0.680)	(0.405)	(0.804)	(0.639)
Sectors	(10)	(10)	(10)	(10)	(10)	(10)	(10)
Constant	-0.811	0.110	1.373	0.122	0.417	1.745	-0.177
	(2.470)	(0.332)	(0.525)***	(0.297)	(0.165)***	(0.357)***	(0.284)
Observations	1390	1376	1361	1080	1335	1384	1389
Adj R^2	0.049	0.145	0.080	0.084	0.137	0.066	0.126

*Significant at 10%.**Significant at 5%.***Significant at 1%.
Source: REPONSE and DMMO surveys.

Heckman estimations

Estimations of equation (20): Determinants of the amount of labor flows.

Table 21: Determinants of the amount of labor flows. French establishments 1998.

	Dependent variable: non null labor flows for						
	MANAGERS	INT.PROFES.	EMPLOYEES	WORKERS	TOTAL	WOMEN	MEN
COMPUTER	-2.369	0.222	0.972	0.148	0.228	0.317	0.305
	(2.324)	(0.260)	(0.420)**	(0.220)	(0.112)**	(0.251)	(0.196)
NET	-0.969	0.110	-0.144	0.417	-0.107	-0.116	-0.177
	(2.018)	(0.233)	(0.382)	(0.199)**	(0.102)	(0.226)	(0.176)
CHAIN	-0.805	0.229	-0.346	-0.204	-0.053	-0.091	-0.083
	(1.318)	(0.142)	(0.245)	(0.113)*	(0.062)	(0.134)	(0.106)
AUTONOMOUS	3.872	0.196	-0.176	-0.061	0.055	-0.091	0.201
	(2.025)*	(0.221)	(0.384)	(0.178)	(0.098)	(0.216)	(0.169)
PROJECT	3.666	-0.214	-0.241	-0.386	-0.055	-0.118	-0.068
	(1.942)*	(0.220)	(0.361)	(0.189)**	(0.097)	(0.215)	(0.168)
ROTATION	-1.873	0.151	0.586	-0.115	0.123	0.267	0.162
	(1.910)	(0.207)	(0.354)*	(0.166)	(0.091)	(0.202)	(0.157)
QUALITY	-3.359	0.294	0.086	-0.056	-0.080	-0.179	0.212
	(1.972)*	(0.208)	(0.342)	(0.184)	(0.089)	(0.200)	(0.155)
HIERARCHY	1.141	-0.212	-0.476	0.042	-0.058	-0.009	-0.078
	(1.213)	(0.132)	(0.218)**	(0.110)	(0.057)	(0.127)	(0.099)
J.I.T.	1.432	-0.038	-0.057	0.096	0.028	0.091	0.023
	(1.001)	(0.112)	(0.188)	(0.090)	(0.048)	(0.108)	(0.084)
Variation	0.466	0.201	0.065	0.013	0.118	-0.095	0.182
	(1.705)	(0.185)	(0.311)	(0.155)	(0.081)	(0.180)	(0.138)
Strongly increasing	-1.117	-0.398	-0.040	-0.195	-0.179	-0.256	-0.169
	(2.466)	(0.271)	(0.456)	(0.231)	(0.119)	(0.261)	(0.201)
Decreasing	7.031	0.573	-0.156	-0.178	0.103	-0.139	0.475
	(2.517)***	(0.292)**	(0.476)	(0.230)	(0.122)	(0.273)	(0.040)***
Hours	5.449	0.258	-0.250	0.004	-0.018	-0.170	-0.088
	(2.339)**	(0.288)	(0.448)	(0.214)	(0.116)	(0.259)	(0.201)
P. Employees	9.882	1.243	-5.606	2.701	0.557	1.540	0.248
	(4.819)**	(0.457)***	(0.777)***	(0.504)***	(0.199)***	(0.436)***	(0.341)
P. Technicians	2.308	-2.306	-3.878	0.491	-0.552	-0.925	-0.791
	(6.284)	(0.677)***	(1.174)***	(0.653)	(0.295)*	(0.662)	(0.514)
P. Managers	-2.390	4.139	-0.653	0.263	0.128	0.014	0.139
	(6.963)	(0.788)***	(1.341)	(0.917)	(0.352)	(0.772)	(0.602)
P. Women	2.063	0.310	2.184	0.292	0.211	-2.094	1.875
	(4.236)	(0.420)	(0.714)***	(0.343)	(0.185)	(0.397)***	(0.316)***
P. Contract	-8.387	1.409	2.933	0.868	0.375	1.414	-0.087
	(9.246)	(0.840)*	(1.371)**	(0.728)	(0.406)	(0.828)*	(0.638)
Sectors	(10)	(10)	(10)	(10)	(10)	(10)	(10)
Constant	-2.585	-1.012	1.996	0.088	0.351	1.105	-0.306
	(3.919)	(0.381)***	(0.702)***	(0.314)	(0.164)**	(0.350)***	(0.282)

For Sectors we write in parentheses the number of economic sectors included in the regression.
*Significant at 10%.**Significant at 5%.***Significant at 1%.
Source: REPONSE and DMMO surveys.

Estimations of equation (21): Determinants of the presence of labor flows.

Table 22: Determinants of the presence of labor flows (probit model). French establishments 1998.

	Dependent variable equals 1 if there are non null labor flows						
	MANAGERS	INT.PROFES.	EMPLOYEES	WORKERS	TOTAL	WOMEN	MEN
COMPUTER	0.033	0.073	0.042	0.180		0.097	0.040
	(0.124)	(0.085)	(0.143)	(0.232)		(0.083)	(0.086)
NET	0.126	0.039	0.339	0.159		-0.018	0.078
	(0.117)	(0.076)	(0.133)***	(0.199)		(0.090)	(0.075)
INTERNET	0.031	0.028	-0.243	-1.028		-0.006	0.012
	(0.249)	(0.007)***	(0.247)	(0.316)***		(0.019)	(0.021)
CHAIN	0.194	0.079	0.152	-0.065		-0.024	0.061
	(0.066)***	(0.046)*	(0.069)**	(0.114)		(0.060)	(0.046)
AUTONOMOUS	-0.038	0.057	-0.131	0.433		-0.032	-0.035
	(0.104)	(0.072)	(0.107)	(0.201)**		(0.075)	(0.071)
PROJECT	0.026	-0.066	0.203	0.260		-0.047	0.042
	(0.110)	(0.072)	(0.125)	(0.175)		(0.071)	(0.070)
ROTATION	0.034	0.048	0.009	0.095		0.106	0.086
	(0.097)	(0.068)	(0.102)	(0.164)		(0.067)	(0.066)
QUALITY	0.053	0.099	-0.126	0.076		-0.030	0.047
	(0.091)	(0.068)	(0.108)	(0.150)		(0.067)	(0.067)
HIERARCHY	0.227	-0.065	0.042	0.033		0.000	0.012
	(0.061)***	(0.043)	(0.068)	(0.104)		(0.042)	(0.042)
J.I.T.	0.042	-0.013	0.019	-0.075		0.030	0.020
	(0.052)	(0.037)	(0.055)	(0.090)		(0.046)	(0.035)
Union	0.190	0.002	-0.022	-0.083		0.003	0.129
	(0.084)**	(0.004)	(0.095)	(0.142)		(0.004)	(0.024)***
Variation	0.053	0.067	-0.027	0.081		-0.041	0.142
	(0.087)	(0.061)	(0.094)	(0.146)		(0.063)	(0.058)***
Tech. change	-0.102	0.004	-0.079	-0.049		0.026	-0.103
	(0.107)	(0.004)	(0.121)	(0.188)		(0.155)	(0.006)***
Strongly increasing	-0.189	-0.139	-0.068	0.011		-0.059	-0.289
	(0.140)	(0.089)	(0.152)	(0.273)		(0.102)	(0.085)***
Increasing	-0.076	-0.006	0.088	-0.255		0.004	-0.112
	(0.095)	(0.003)**	(0.109)	(0.163)		(0.002)**	(0.012)***
Decreasing	0.079	0.175	0.013	-0.298		-0.027	
	(0.146)	(0.094)*	(0.153)	(0.227)		(0.108)	
Strongly decreasing	-0.014	-0.003	0.396	-0.280		0.032	
	(0.276)	(0.009)	(0.287)	(0.416)		(0.132)	
Size 20-50	-0.755	-0.039	-0.621	-0.487		-0.185	-0.116
	(0.137)***	(0.005)***	(0.149)***	(0.213)**		(0.083)**	(0.009)***
Size +500	0.710	0.049	0.655	0.369			
	(0.155)***	(0.004)***	(0.166)***	(0.229)			
Hours	-0.005	0.075	-0.050	-0.121		-0.092	-0.114
	(0.128)	(0.093)	(0.134)	(0.215)		(0.106)	(0.084)
P. Employees	0.734	0.396	1.643	0.151		0.526	0.043
	(0.198)***	(0.149)***	(0.261)***	(0.398)		(0.150)***	(0.149)
P. Technicians	0.783	-0.576	0.871	-0.248		-0.206	-0.254
	(0.337)**	(0.225)***	(0.375)**	(0.523)		(0.275)	(0.214)
P. Managers	4.100	1.312	0.405	-0.862		-0.237	-0.334
	(0.573)***	(0.258)***	(0.462)	(0.664)		(0.471)	(0.254)
P. Women	-0.077	0.091	0.299	0.044		-0.031	0.325
	(0.194)	(0.137)	(0.221)	(0.341)		(0.175)	(0.144)**
P. Contract	0.010	0.455	1.190	0.541		0.408	-0.035
	(0.377)	(0.275)*	(0.527)**	(0.688)		(0.269)	(0.265)
Sectors	(16)	(16)	(16)	(16)		(16)	(16)
Constant	0.887	-0.358	0.095	2.173		0.858	2.000
	(0.626)	(0.309)	(0.748)	(0.415)***		(0.228)***	(0.389)***

For Sectors we write in parentheses the number of economic sectors included in the regression.
*Significant at 10%.**Significant at 5%.***Significant at 1%.
Source: REPONSE and DMMO surveys.

Table 23: Statistics associated to the Heckman procedure. French establishments 1998.

	Statistics of the Heckman selection model for:						
	MANAGERS	INT.PROFES.	EMPLOYEES	WORKERS	TOTAL	WOMEN	MEN
Observations	1388	1374	1359	1079	1335	1382	1387
Censored Observations	418	235	245	90		68	21
Uncensored Observations	970	1139	1114	989		1314	1366
Wald χ^2	107.310	243.040	143.720	130.540		115.500	356.500
Prob> χ^2	0.000	0.000	0.000	0.000		0.000	0.000
ρ	-0.019	1.000	-0.016	-0.048		1.000	1.000
	(0.066)	(0.000)	(0.078)	(0.069)		0.000	0.000
$\chi^2(1)$	0.070	657.880	0.040	0.380		217.580	97.750
Prob> χ^2	0.794	0.000	0.851	0.537		0.000	0.000

For Sectors we write in parentheses the number of economic sectors included in the regression.
Numbers in parentheses are standard errors.
Source: REPONSE and DMMO surveys.

9 Appendix C: Descriptive statistics

Means and standard deviations

Table 24: Mean and standard deviation of variables in cross section analysis.

Variables	Observations	Mean	Standard Deviations
TOTAL	2024	0.741	2.213
MANAGERS	1825	0.764	18.800
INT. PROFES.	1720	0.697	2.835
EMPLOYEES	1803	0.921	4.323
WORKERS	1378	0.574	2.149
WOMEN	1979	1.081	4.338
MEN	1983	0.845	2.536
COMPUTER	2841	0.317	0.465
NET	2844	0.252	0.435
INTERNET	2844	0.069	0.254
CHAIN	2828	0.780	0.806
AUTONOMOUS	2844	0.192	0.394
PROJECT	2844	0.244	0.430
ROTATION	2833	0.252	0.434
QUALITY	2831	0.609	0.488
HIERARCHY	2789	0.931	0.728
J.I.T.	2760	0.722	0.852
Union	2844	0.392	0.488
Variation	2821	0.424	0.494
Tech. change	2837	0.185	0.388
Strongly increasing	2818	0.133	0.339
Increasing	2818	0.426	0.495
Decreasing	2818	0.118	0.322
Strongly decreasing	2818	0.022	0.147
Size 20-50	2844	0.252	0.434
Size +500	2844	0.124	0.329
Hours	2767	0.109	0.312
P. Employees	2430	0.362	1.453
P. Technicians	2252	0.270	2.593
P. Managers	2456	0.127	0.152
P. Women	2649	0.380	0.285
P. Contract	2628	0.058	0.114

Source: REPONSE and DMMO surveys.

Correlation matrix

Table 25: Correlation matrix.

	MANAGERS	INT. PROFES.	EMPLOYEES	WORKERS	TOTAL	WOMEN	MEN
MANAGERS	1.000						
INT. PROFES.	-0.003	1.000					
	(0.887)						
EMPLOYEES	-0.001	0.199	1.000				
	(0.959)	(0.000)					
WORKERS	0.036	0.089	0.160	1.000			
	(0.187)	(0.001)	(0.000)				
TOTAL	0.214	0.224	0.452	0.270	1.000		
	(0.000)	(0.000)	(0.000)	(0.000)			
WOMEN	0.016	0.190	0.212	0.151	0.348	1.000	
	(0.516)	(0.000)	(0.000)	(0.000)	(0.000)		
MEN	0.301	0.444	0.486	0.251	0.727	0.272	1.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	
COMPUTER	-0.016	-0.004	0.023	0.075	0.031	-0.026	0.014
	(0.481)	(0.854)	(0.337)	(0.005)	(0.163)	(0.249)	(0.525)
NET	-0.015	-0.024	-0.023	0.073	-0.044	-0.057	-0.060
	(0.533)	(0.320)	(0.328)	(0.007)	(0.049)	(0.012)	(0.007)
CHAIN	-0.028	-0.122	-0.116	-0.118	-0.149	-0.117	-0.152
	(0.234)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
AUTONOMOUS	0.046	-0.039	-0.031	-0.047	-0.042	-0.032	-0.013
	(0.049)	(0.108)	(0.193)	(0.079)	(0.056)	(0.153)	(0.557)
PROJECT	0.039	0.002	0.007	-0.037	-0.023	0.008	-0.010
	(0.092)	(0.932)	(0.765)	(0.166)	(0.304)	(0.717)	(0.666)
ROTATION	-0.014	-0.039	0.001	-0.058	-0.029	-0.020	-0.014
	(0.540)	(0.102)	(0.982)	(0.033)	(0.191)	(0.380)	(0.541)
QUALITY	-0.037	-0.045	-0.046	-0.058	-0.103	-0.033	-0.034
	(0.113)	(0.063)	(0.049)	(0.031)	(0.000)	(0.147)	(0.128)
HIERARCHY	0.032	-0.101	-0.080	-0.028	-0.043	-0.048	-0.064
	(0.173)	(0.000)	(0.001)	(0.300)	(0.051)	(0.033)	(0.004)
J.I.T.	0.032	-0.0890	-0.058	-0.033	-0.039	-0.040	-0.057
	(0.172)	(0.000)	(0.013)	(0.223)	(0.081)	(0.078)	(0.011)

	COMPUTER	NET	CHAIN	AUTONOMOUS	PROJECT	ROTATION	QUALITY
COMPUTER	1.000						
NET	0.496	1.000					
	(0.000)						
CHAIN	-0.012	0.086	1.000				
	(0.531)	(0.000)					
AUTONOMOUS	-0.038	0.036	0.171	1.000			
	(0.042)	(0.056)	(0.000)				
PROJECT	0.184	0.204	0.061	0.153	1.000		
	(0.000)	(0.000)	(0.001)	(0.000)			
ROTATION	-0.107	-0.049	0.134	0.098	-0.004	1.000	
	(0.000)	(0.010)	(0.000)	(0.000)	(0.822)		
QUALITY	-0.004	0.061	0.317	0.159	0.100	0.095	1.000
	(0.841)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	
HIERARCHY	0.075	0.136	0.249	0.117	0.144	0.061	0.209
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
J.I.T.	-0.081	-0.002	0.316	0.135	0.007	0.169	0.242
	(0.000)	(0.931)	(0.000)	(0.000)	(0.696)	(0.000)	(0.000)

	HIERARCHY	
HIERARCHY	1.000	
J.I.T.	0.210	1.000
	(0.000)	

() Significance levels.
Source: REPONSE and DMMO surveys.