

Determinants of Employee Turnover in French Firms

Sonia Yousfi[†]

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Abstract:

Innovation and productivity are vital to the success of companies. However, achieving success requires the creation, dissemination, and incorporation of knowledge into the company's products, services, and systems. This process is dependent on individuals, as knowledge is embedded into their minds. Then it is interesting to focus on the extent to which they move between organizations, specifically through employee turnover (Price, 1977). Staff turnover is a key factor in the success of companies, making it essential to identify the determinants of turnover in French companies. In this study, we examine the determinants of this factor in French companies by using various measures of labor turnover and traditional company characteristics, as well as workforce mechanisms like employee profit-sharing, salaries, and professional training. We analyze 6,412 French companies annually between 2005 and 2013¹ using a Tobit type I random effects model. Our findings show that salary negatively influences overall and voluntary turnover rates and that there are effects based on occupation, age, gender, and sector. Additionally, professional training has varying effects on staff turnover depending on the type of training provided.

Keywords: Employee turnover, Tacit knowledge, Explicit knowledge, Firms panel, Type 1 Tobit model.

JEL Classification: C23, C24, J24, J63, O15.

[†]Ph.D. Candidate, Université de Bourgogne, Laboratoire d'Économie de Dijon (LEDi), EA7467, 2 boulevard Gabriel, Dijon, France, 21066, E-mail: sonia.yousfi@u-bourgogne.fr

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1 Introduction

Today's companies operate in an increasingly competitive, changing, and complex environment. The globalization of trade, the fragmentation and increasing diversification of markets represent as many threats as they do opportunities for companies which can only cope with them by accelerating the pace of innovation. To adapt to this environment, companies must increase their investments in Research and Development (R&D). But what distinguishes a successful company from a non-performing one is the quality of its individuals, their skills, and their creativity. Therefore, one of the primary requirements for companies is not only to recruit quality human resources with an important level of qualification but also to retain their employees, i.e., to reduce absenteeism and resignations and encourage individuals to act in accordance with the organization's interests. The interest in staff turnover covers several areas of economic life. Obviously, this phenomenon concerns human resources management services, but it also affects areas of knowledge management and value creation, which are key to the economic success of companies. Indeed, the competitiveness of companies is based on the acquisition, valorization, and development of their competences.

The multidisciplinary aspect associated with employee's turnover gives it a central and unavoidable dimension in the company's life. This specificity can make it both an obstacle and an asset for companies. Droege and Hoobler (2003) show that many companies consider it as an obstacle, however it is also a continuous source of new, fruitful knowledge for the success of the company (Eriksson, Qin, and Wang, 2014). Staff turnover is therefore one of the key factors in the success of companies. It is therefore crucial to identify the determinants of staff turnover in companies.

To do so, we adopt an empirical approach to understand the factors that influence employees' decision to move across firm boundaries. The objective of this study is to identify the main determinants that influence staff turnover, to provide key information for firms to improve their personnel management strategy. To obtain an overview of the situation, the study uses data from French companies of various sizes and sectors of activity between 2005 and 2013. In the first section, we will present the importance of studying turnover, the stakes of this phenomenon, and the determinants traditionally referenced in the literature. Then, we will explain the data sources, the construction of the sample, and the variables of interest. We will continue with the presentation of the methodology. Finally, the results obtained using the sample will be presented and discussed using the literature.

2 Theoretical background

2.1 Knowledge and employee turnover

The success and survival of companies depend on a range of factors that vary based on the industry, size, and economic and social conditions. Among these critical factors, innovation and technical progress hold significant importance (Schumpeter, 1939)². In fact, a company's ability to adapt to changes in the economic environment and to innovate allows it to remain competitive in the market. This often entails adopting new technologies and production methods. Companies that can innovate enjoy a clear competitive advantage. They can offer more efficient, profitable, or environmentally-friendly products and services. Therefore, the acquisition, valorization, and development of knowledge become

²Other authors have also explored this relationship (Arrow (1962), Mansfield (1968), Porter (1990), Christensen (2003), ...)

essential assets for competitiveness. Thus, creating, disseminating, and incorporating this knowledge into a company’s products, services, and systems contributes significantly to its success. The importance of knowledge within companies is well-illustrated by the Japanese firms of the 1980s, and the model developed by Nonaka and Takeuchi (1995). This model is based on the notion that knowledge is created and disseminated through the interactions between tacit and explicit knowledge. Although explicit knowledge can be easily conveyed and shared with others, Nonaka and Takeuchi (1995) emphasizes that it only captures a small portion of actual knowledge. Non-expressed, or tacit knowledge, resides within the minds of workers. This knowledge is individual-specific and intuitive, making it challenging to convey to others. It encompasses know-how, mental models, and schemas. Mental schemas refer to an individual’s perception and mental representation of an object or situation, while mental models symbolize a person’s perception and interpretation of their overall environment. These mental schemas and models impact the way individuals approach and solve problems. Tacit knowledge is gained through experience, observation, practice, and language. Social interactions enable the transfer of tacit knowledge to other individuals, known as externalization. The conversion of implicit knowledge into explicit knowledge is facilitated by dialogues, work documents, and meetings. Knowledge is a crucial aspect of the progress of companies, as it is valuable to them (Wellman, 2009). As tacit knowledge is individual-specific, the process of transferring this knowledge beyond the company’s boundaries, i.e., staff turnover, is worth investigating.

Personnel rotation, also known as staff turnover, refers to the degree of movement of individuals across organizational borders (Price, 1977). As a dynamic concept, turnover focuses on the flow of individuals. It includes movements from one job to another, as well as from employment to unemployment and vice versa (Burdett, 1978; Jovanovic, 1984). Employee turnover is a critical factor in understanding the functioning of the labor market (Rebollo-Sanz, 2012). It reflects an evolutionary process that involves various stages, ranging from passive job search to an individual’s decision to join or leave a company (Frimousse and Swalhi, 2014). Although inevitable in companies or in the economy, there will always be a proportion of staff turnover that remains incompressible (Dalton, Todor, and Krackhardt, 1982). Thus, the concept of turnover is related to the neoclassical theory of the labor market, which suggests that existing unemployment is voluntary or frictional (Walras, 1874).

2.2 Employee turnover issues on firms

Traditionally, turnover has been seen as an obstacle to company growth (Shankar and Ghosh, 2013). It is one thing to attract the best employees to an organization, but it is even more important to retain them. When companies attract talented workers and train them, these employees acquire specific skills and knowledge related to the company (both tacit and explicit). However, if no measures are implemented to encourage them to stay within the organization, the result can be what is known as the “brain drain phenomenon”, leading to a loss of associated human capital (Demmou and Wörgötter, 2015).

Furthermore, turnover disrupts pre-existing social relationships, which can have detrimental effects on firm performance (Droege and Hoobler, 2003). A high turnover rate is associated with significant and costly human changes, thus limiting opportunities for organizational learning. Consequently, this creates numerous structural gaps in the social fabric of the company, resulting in a reduction in the stock of organizational knowledge and a significant disruption of employees’ intuition, interpretation, and integration abilities (Guidice, Thompson Heames, and Wang, 2009). This structural gap has a negative

impact on organizations' ability to achieve their objectives (Price, 2001; Jou, Kuo, and Tang, 2013). Simultaneously, the costs of recruiting and training new employees, as well as the associated productivity loss, also explain the negative impact of staff turnover on firms (Droege and Hoobler, 2003).

Employee turnover is an inevitable phenomenon but not necessarily harmful to the company since it is necessary. In fact, worker mobility leads to an increasingly precise match between employers' expectations and employees' skills over time (Jovanovic, 1979; Rebollo-Sanz, 2012). This phenomenon facilitates the reallocation of talent, meaning that each individual can obtain the position for which they are best qualified (Frimousse and Swalhi, 2014). The movement of employees thus leads to an efficient allocation of workers across different companies (Shankar and Ghosh, 2013).

There is a decreasing trend in workers' efforts over time, and a certain level of worker mobility allows for maintaining a high degree of effort (Staw, 1980). Furthermore, by ensuring the possibility of layoffs in the case of mediocre performance, companies can prevent employees from feeling too secure in their positions (Weel, 2006).

Then, in addition to the "brain drain" phenomenon that is associated with employees leaving the company, staff turnover also includes the entry of new employees into the firm. As a result, these new hires bring with them fresh ideas and knowledge that can be beneficial to the company and its performance. This concept is commonly referred to as "new blood" (Eriksson, Qin, and Wang, 2014).

Employee turnover is a phenomenon that can be understood both in a general and more specific way. Indeed, depending on reasons associated with the movement of employees across company boundaries, staff turnover can be described as voluntary or involuntary. Insofar as the movement of employees is coming from individuals, we talk about voluntary turnover. On the other hand, if these movements are independent of the will of the individuals, we speak of involuntary turnover. Thus, involuntary turnover has causes and consequences that are completely different from those of voluntary turnover, and these concepts need to be approached differently (Shaw, Delery, Jenkins, and Gupta, 1998). An organization with high rates of employee resignations means that employees, for many reasons, find it more attractive to leave the structure rather than stay. For example, the end of a contract reflects a poor hiring decision that needs to be corrected, while a resignation reflects the lower attractiveness of a current job compared to other opportunities (Shaw, Delery, Jenkins, and Gupta, 1998).

2.3 Determinants of employee turnover

The complexity of employee turnover, with the combination of positive and negative effects it entails, highlights the need to investigate the underlying causes of this phenomenon. Numerous factors influence the movements of employees and, more generally, the staff turnover rates observed within companies. Three categories of determinants of employee turnover can be identified. The first category pertains to the company's environment, while the second category encompasses factors specific to the organization itself. Lastly, the third category involves determinants associated with the individuals affected by labor turnover.

Studies in the literature have identified specific determinants related to the company environment among the factors that influence labor turnover. According to Antelius and Lundberg (2000), the rate of employee turnover varies depending on the industry in which the company operates. In high-tech industries, turnover is not perceived negatively by employers; rather, it is viewed as a means of transferring knowledge in research and development across firms (Shankar and Ghosh, 2013). Consequently, these industries

are more prone to personnel movements, while sectors with high average capital returns experience lower turnover rates (Antelius and Lundberg, 2000). The industry in which a company operates also affects employees' attachment to the firm, and thus has an indirect effect on personnel movements.

Labor turnover is not only influenced by the environment in which the company operates but also by factors specific to the company. Among these factors, the size of the company and its role in social interactions between employees seem to have an impact on personnel movements. Intra-firm ties have been identified as one of the reasons why employees tend to stay with a company. However, these ties are more difficult to establish in larger organizations. According to Droege and Hoobler (2003), loyalty to a workgroup is stronger than loyalty to the employer. Barel, Salladarre, and Fremeau (2009) also mention this indirect mechanism: the larger the company, the weaker the employees' attachment to the company, and thus the higher the personnel turnover rate.

As personnel turnover is a major concern for human resources departments in companies, it is evident that the chosen human resource management methods have an influence (Eriksson, Qin, and Wang, 2014). In particular, practices that closely monitor employees intending to improve worker efficiency can have a significant impact on personnel movements. These methods increase employers' expectations of employee performance, but if employees find their work less interesting, they may become less inclined to keep their jobs. This is especially true if less restrictive alternatives in terms of human resources exist elsewhere. As a result, the rate of voluntary turnover is likely to be higher (Shaw, Delery, Jenkins, and Gupta, 1998).

Compensation and labor activity are closely intertwined; thus, there is an undeniable correlation between wages and personnel movements. When employees receive low wages and work in poor conditions, they are more likely to leave the company. Conversely, higher wages are associated with lower rates of personnel turnover (Demmou and Wörgötter, 2015). Indeed, labor turnover entails costs, particularly those related to the search for job opportunities at the individual level. These costs are accompanied by a trade-off between salary and labor turnover. Thus, a high compensation will decrease the probability that an employee will accept job offers from other firms, resulting in lower personnel turnover rates (Rosholm and Svarer, 2004). At the individual level, high wages promote retention of individuals if their interest is maximized by staying within the company. Transparent and incentive compensation promotes employee performance. Indeed, it is observed that resignation and termination rates are particularly high in the least productive firms that survive in the market through low wages (Demmou and Wörgötter, 2015). When the company offers maximized remuneration then the probability of employees staying in the company will be greater (Shaw, 2015). According to Barel, Salladarre, and Fremeau (2009), compensation affects employees' attachment to the company and thus indirectly influences individuals' intentions to leave.

Professional training and its role in knowledge accumulation also play a part in the phenomenon of personnel turnover. However, the relationship between turnover and professional training is complex, with both direct and indirect effects.

To better understand the direct effect of this determinant, it is necessary to first consider two competing theories in neoclassical labor economics that address personnel turnover. The first theory is that of "job matching", where employees who are well-matched to the company are less likely to leave (voluntarily or involuntarily) and tend to stay with the company longer. Professional training enables better matching between individual skills and employer expectations, which results in a decreased probability of termination

(Zaretsky and Coughlin, 1995). The second theory argues that workers decide how much specific human capital to accumulate for the company and do so endogenously (Quintin and Stevens, 2003). When the training provided is general, meaning that individuals are trained to become "multi-tasking," the recorded turnover is higher. The chances for such employees to find a job elsewhere are thus improved, and the probability of personnel turnover is higher. Thus, the effect of professional training depends on the type of training and the targets of these training programs (Martin, 2003).

Professional training also has an indirect effect on personnel turnover rates through employee attachment to the company (Barel, Salladarre, and Fremeau, 2009). Training programs offered by companies signal management's interest in employees, leading to higher employee attachment and a sense of loyalty. Consequently, incentives and investments made for employees make employment more attractive, resulting in a decrease in the voluntary turnover rate (Shaw, Delery, Jenkins, and Gupta, 1998).

To conclude, there is an individual dimension to the study of personnel turnover determinants. Since employees themselves initiate turnover, some factors are unique to them.

Several factors influence employee attachment to their company, including career advancement opportunities (Barel, Salladarre, and Fremeau, 2009). According to the social exchange theory, there exists a relationship between the expected costs and benefits of employment for individuals. When employees provide an important level of effort but receive little recognition or reward from company management, it leads to job dissatisfaction and can initiate employee turnover (Arsalan Khan, 2014).

Similarly, employee status appears to have an impact on intentions to leave the company. For example, executives often express the need to have control over the modalities of their job execution. Thus, if employees influence decisions related to work organization, they are less likely to leave the firm (Barel, Salladarre, and Fremeau, 2009). Shankar and Ghosh (2013) hypothesize that highly skilled workers change jobs more often than those who are less productive.

The personal characteristics of employees also have an impact on personnel movements. Studies have shown that women are more likely to leave a company due to personal reasons, such as family obligations. In particular, the desire to stay at home and take care of their child after birth is often cited as an important reason for their departure (Erosa, Fuster, and Restuccia, 2002). However, women also exhibit a stronger sense of loyalty to their company compared to men (Barel, Salladarre, and Fremeau, 2009). This may be because women are more likely to value interpersonal relationships and seek inclusive work environments where they feel appreciated and supported.

Finally, the literature also highlights the effect of age. Young individuals are more likely to switch jobs to develop their skills and gain experience, while older individuals are less likely to consider new job opportunities (Barel, Salladarre, and Fremeau, 2009). According to Droege and Hoobler (2003), the likelihood of leaving a job decreases with the age and tenure of the individual in the position. This is because employees accumulate organizational knowledge, and their salary is expected to increase relative to other alternatives (if they are paid based on their marginal productivity). If this is not the case, the individual may leave the company (Droege and Hoobler, 2003).

3 Data and variables

3.1 Data

To examine the factors influencing employee turnover, we take an empirical approach. Our analysis is based on a sample of French companies compiled from five sources of data spanning the period from 2005 to 2013.

The first source of information is the survey on workforce movements in metropolitan France, which includes two surveys: the Quarterly Survey on Workforce Movements (EMMO³) for establishments with 1 to 49 employees, and the Monthly Declaration on Workforce Movements (DMMO⁴) for those with at least 50 employees. This mandatory survey, conducted by the Directorate for Animation, Research, Studies, and Statistics (DARES⁵), allows us to track employee movements and provide an overview of the conjunctural evolution of the labor market. It contains general information on the company, records entries and exits of employees, specifies the reason for the movement, as well as the type of contract and characteristics of the employee concerned. We focus on the companies present between 2005 and 2013, which represent 427,543 companies that recorded workforce movements. This source of data allows us to construct annual indicators of employee turnover.

Our second source of data is the Annual Declaration of Social Data (DADS⁶) and is managed by the French National Institute of Statistics and Economic Studies (INSEE⁷). This mandatory administrative formality is intended for all French companies employing salaried workers and aims to gather information on employees and staff. One of the objectives of the DADS is to establish employment and wage statistics by the INSEE and provide information for various social and fiscal administrations. The DADS gathers general information on establishments, employees and their positions, including the nature of employment, type of employment contract, remuneration, and hours worked. Using this information, we can construct an indicator of the representativeness of each profession within each company and calculate the proportion of employees in research positions and their salaries. Additionally, we have the necessary information to determine the median age per company and the gender breakdown. We have analyzed the companies observed between 2005 and 2013, representing 37,420,618 observations.

To gather general information about companies, we utilize two main sources of data: the Unified Complete Files of SUSE⁸ (FICUS⁹), available from 1994 to 2007, and the Approximate Files of ESANE¹⁰ Results (FARE¹¹), available from 2008 to 2018. These sources compile various administrative, fiscal, and statistical data. By using this information, we can obtain an annual overview of the French production system¹², including its key characteristics (such as count of companies and employees) and economic results (such as turnover, investments, exports, and more). For our study, we specifically selected the sectoral membership, turnover, employee profit sharing, and date of creation of

³Enquête trimestrielle sur les Mouvements de Main d'Œuvre

⁴Déclaration mensuelle des Mouvements de Main d'Œuvre

⁵Direction de l'Animation de la Recherche, des Études et des Statistiques

⁶Déclaration Annuelle de Données Sociales

⁷Institut National de la Statistique et des Études Économiques

⁸Unified System of Business Statistics (Système Unifié de Statistiques d'Entreprises)

⁹Fichiers Complets Unifiés de SUSE

¹⁰Elaboration of Annual Business Statistics (Élaboration des Statistiques Annuelles d'Entreprise)

¹¹Approximate Files of ESANE Results (Fichiers Approchés des Résultats d'ESANE)

¹²Metropolitan France and Overseas Departments (DOM)

all companies (excluding those in the agricultural sector) between 2005 and 2013, which represents 28,400,464 observations.

We used a fourth data source, the Declaration of Employer Participation in the Development of continuing vocational training (also known as Declaration 2483). This annual mandatory administrative form, numbered 2483, is regulated by the French labor code and serves to inform the tax administration that the company has fulfilled its minimum obligation of financing for continuing vocational training. This data source, provided by DARES and available between 1990 and 2015, allows for the identification of companies (using the SIREN number taken from the SIRET, sectoral membership, etc.) and contains information specific to vocational training (such as duration, count of trained employees, investment amounts, etc.). For our analysis, we focused on the amounts spent, program durations, and count of employees trained for each company established or domiciled in France with at least 10 employees between 2005 and 2013, i.e., 637,896 observations.

Finally, our final data source is the Patent Atlas, a joint project between the French Ministry of Higher Education, Research and Innovation, and the National Institute of Industrial Property (INPI). This resource aims to provide a comprehensive overview of innovation activity by compiling a database of patents (both applications and publications) and their associated information for the French territory from 2003 to 2015 (42,145 observations). Each patent can be identified by its deposit number assigned by the patent office, which allows us to track the inventor, their gender, their location, the associated company, the year of publication, and the patent's field of technology using international patent classification codes. We focus specifically on the number of patents published in France between 2003 and 2015 to create an annual innovation indicator for each company, which indicates whether the company has published one or more patents.

3.2 Sample and variables

The sample is constructed using a combination of data sources previously presented. It consists of 57,708 observations corresponding to 6,412 French companies observed annually between 2005 and 2013¹³.

In our analysis, we focus on employee turnover, and to account for potential measurement variations, we employ three indicators. The first measure we use is the overall turnover rate, which considers all employees of the observed company, regardless of the reason for the movement or the individual's profession in motion. This variable is calculated as the average of the entry and exit rates of individuals within the company for each year. Then it is expressed as a percentage.

The second measure of employee turnover is the voluntary turnover rate. We distinguish between voluntary and involuntary employee movements to identify if there are different determinants based on the type of movement. Voluntary movements include recruitment, conventional terminations, resignations, other departures initiated by the individual, and pre-retirement departures. The calculation method for this variable is similar to that of the overall turnover rate, with the only difference being that it only takes into account voluntary employee movements.

Finally, we consider the voluntary turnover rate for researchers as our third measure of employee turnover because it can provide insights into the retention and attraction of highly skilled and specialized employees. Firms can identify if they are facing retention

¹³A summary of the variables considered is presented in the appendix (table 1, page 17). All continuous variables undergo a logarithmic transformation before being introduced into the regressions and descriptive statistics can be found on (table 2, page 18)

issues specific to this group and take steps to address them. To construct this indicator, we first identify researchers using the codes from the French occupational nomenclature (PCS-ESE 2003), and then count the voluntary entries and exits of these employees. This variable is calculated as the average of the company’s entries and exits of researchers expressed as a percentage.

Based on the existing literature and the information available in the data files, we explain employee turnover using the variables listed below.

We consider the presence of employee profit-sharing using an indicator variable, which equals 1 if the company offers remuneration to its employees during the year, and 0 otherwise.

In addition, the analysis includes the market share, expressed as a percentage, which reflects the company’s contribution to the overall turnover of its sector. This is calculated using the finest sectoral level of the French activity nomenclature of 2003 (APE 700¹⁴).

To account for company longevity, we use a measure based on the company’s year of establishment in years. We calculate seniority by subtracting the year of analysis from the year the company was founded, giving us its duration of existence.

The remuneration measure considered is the median net hourly wage. We construct this variable using the annual net salary data in euros, which is available in the DADS, for each position. We then divide it by the associated number of salaried hours. We extract the median per company and per year to avoid the influence of extreme salary values within each company.

To examine the hypotheses of Droege and Hoobler (2003), which suggest that the likelihood of leaving a job decreases with age, we consider two measures of age in our analysis. Firstly, we calculate the median age within each company per year using the DADS. Secondly, we use age categories to assess whether behaviors vary according to an individual’s seniority in the workforce. These age categories are based on individuals under 30 years old, or newly graduated young workers, those aged 30-50, and those over 50 years old, who are also referred to as seniors. These variables are constructed by counting the employees present in each age category and measuring their proportion within the total workforce of the company as a percentage.

To investigate the potential impact of gender on staff turnover, we measure the proportion of male employees within each company. We identify the gender of each employee using the DADS and then calculate the percentage of male employees within the company.

Because there is no perfect indicator of professional training, we use three measures proposed by Gallié and Legros (2012). The first measure is the financial participation rate, which is based on the average training expenses per employee within the company. The second measure is the training access rate, i.e., the percentage of employees trained among the total workforce. The final measure is the average duration of training, i.e., the average number of training hours per trained employee per company.

To gain insight into the socio-professional fabric of the company, we construct five variables related to different professions. The DADS provide a code for each employee’s position, allowing us to classify them into different professions. For example, to calculate the share of managers, we count the number of managers in the company, divide it by the total workforce, and express it as a percentage.

Moreover, we determine the size of companies by calculating the average number of employees in 2012, which is available in the FICUS-FARE database.

We incorporate a measure of innovation into our analysis by using the number of patents published per company. We construct a binary variable that takes a value of 1 if the firm published one or more patents during the year and 0 if it did not.

¹⁴“Activité Principale Exercée”: Main Activity Exercised by the company among the 700 available.

We construct a categorical concentration variable to measure the level of industry concentration in which the company operates. This is done using the Herfindahl-Hirschman Index (HHI), which is calculated at a more aggregated level than market share (APE 200). The European Commission provides guidance on assessing levels of sectoral concentration when reviewing horizontal mergers and acquisitions (Naldi and Flamini, 2014). In line with the Commission’s recommendations, the variable takes on values of 1, 2, or 3, depending on whether the market is lowly, moderately, or highly concentrated, respectively¹⁵.

Finally, we model the sectoral affiliation of companies using 9 indicator variables constructed from level 17 of the 2003 version of the French Activity Nomenclature (NA) provided by INSEE.

4 Methodology

4.1 Econometric specification

The measurements of employee turnover have a special nature. Indeed, when a company does not record any labor movement, its employee turnover rate is zero. Since this rate can only take non-negative values, the dependent variable is left-limited (with a lower threshold set at 0). In our case, we have information on all companies, thus we have a sample with a censored limited dependent variable (Wooldridge, 2010). An additional specificity appears in the data since we have information on firms annually between 2005 and 2013. The temporal dimension of our data allows us to account for unobserved individual heterogeneity. Because of the unique characteristics of our data, we implement a Type I Tobit model with random effects (also known as compound error)¹⁶ (Tobin, 1958). The model takes the following form:

$$y_{i,t} = \begin{cases} y_{i,t}^* & \text{if } y_{i,t}^* > 0 \\ 0 & \text{if } y_{i,t}^* \leq 0 \end{cases} \quad (1)$$

with $y_{i,t}^* = x'_{i,t}\beta + u_{i,t}$, and $x'_{i,t} = (x_{i,1}^1, x_{i,2}^2, \dots, x_{i,T}^K)$. The limited dependent variable $y_{i,t}$ represents the employee turnover rate per firm, $i = 1, \dots, N$, in period $t = 1, \dots, T$ and $y_{i,t} \in [0; +\infty[$. We state $u_{i,t} = \alpha_i + \varepsilon_{i,t}$. We impose the following assumptions on perturbations: $\text{cov}(\varepsilon_{i,t}; \varepsilon_{i,t}) = \sigma_\varepsilon^2$, $\text{cov}(\varepsilon_{i,t}; \varepsilon_{i,t'}) \neq 0$, $\text{cov}(\varepsilon_{i,t}; \varepsilon_{j,t}) = 0$, $\text{cov}(\varepsilon_{i,t}; x_{i,t}) = 0$ and $\text{cov}(\varepsilon_{i,t}; x_{j,t'}) = 0$. Assumptions associated with the individual specific term α_i are: $\text{cov}(\alpha_i; x_{i,t}) = 0$ and $\alpha_i \sim \mathcal{N}(0, \sigma_\alpha^2)$. Finally, the explanatory variables $x_{i,t}$ are assumed strictly exogenous and the $y_{i,t}$ independent conditionally on $(x_{i,t}; \alpha_i)$.

4.2 Estimation method

The presented model is estimated using maximum likelihood. The individual contribution of firms, conditional on random effects, is obtained by multiplying the likelihood elements for each positive dependent variable, and those for which the dependent variable is zero. This individual contribution can be expressed as follows (Biørn, 2016):

¹⁵Low concentration: if $HHI < 1000$; Middle concentration: $HHI \in [1000; 2000]$; High concentration: if $HHI \geq 2000$.

¹⁶This model is the most parsimonious, as it considers a significantly reduced number of parameters to be estimated compared to the fixed effects model.

$$L_i(\alpha_i) = \prod_{t:y_{i,t}>0} L_{1,i,t}(\alpha_i) \prod_{t:y_{i,t}=0} L_{0,i,t}(\alpha_i) \quad (2)$$

Here the explained variables $y_{i,1}, \dots, y_{i,T}$ are independent, conditional on explanatory variables $x_{i,t}$. The likelihood elements are $L_{1,i,t} = \frac{1}{\sigma} \phi\left(\frac{y_{i,t} - x_{i,t}\beta - \alpha_i}{\sigma}\right)$, and $L_{0,i,t} = 1 - \Phi\left[\frac{(x_{i,t}\beta + \alpha_i)}{\sigma}\right]$, where ϕ and Φ are the standard normal density and cumulative distribution functions, respectively. The unconditional likelihood at α_i is obtained by multiplying the individual likelihood by the random effects density $g(\alpha_i)$ and integrating over α_i :

$$L_i^* = \int_{-\infty}^{+\infty} L_i(\alpha_i) g(\alpha_i) d\alpha_i \quad (3)$$

Finally, the total likelihood is obtained by multiplying the individual likelihoods, assuming that the firms are independent:

$$L^* = \prod_{i=1}^N \int_{-\infty}^{+\infty} \prod_{t:y_{i,t}>0} \frac{1}{\sigma} \phi\left(\frac{y_{i,t} - x_{i,t}\beta - \alpha_i}{\sigma}\right) \prod_{t:y_{i,t}=0} 1 - \Phi\left[\frac{(x_{i,t}\beta + \alpha_i)}{\sigma}\right] g(\alpha_i) d\alpha_i \quad (4)$$

Evaluation of the likelihood function requires the computation of multiple integrals. The Gauss-Hermite quadrature method is used to approximate these integrals. This numerical analysis method allows the calculation of integrals by a sum weighted by ω_i ¹⁷ of the integration domain at different quadrature points¹⁸.

As there is no analytical solution available for the total likelihood function defined, a numerical optimization algorithm is employed. In this case, we use the Newton-Raphson optimization algorithm.

5 Results and Discussion

The results obtained by our empirical approach allow us to identify a set of explanatory factors for staff turnover. The marginal effects obtained by the maximum likelihood applied to the Tobit type I model with random effects are presented in Appendix (tables 3-8, pages 19-24).

Depending on the measure of employee turnover chosen, there are still some slight differences in the determinants, in line with the results obtained by Shaw, Delery, Jenkins, and Gupta (1998).

To begin with, existence of a remuneration paid to employees and related to the company's profits has a significant positive influence, at the 1% risk threshold, on the probability of companies experiencing staff turnover. The marginal effects associated with the indicator of the existence of employee profit-sharing remain stable according to the training measure used, but also according to the measure of employee age used in our

¹⁷ $\omega_i = \frac{2^{n+1}n!\sqrt{\pi}}{[H_n'(x_i)]^2}$, with n the quadrature points, and $H_n(x_i)$ the Gauss-Hermite polynomial.

¹⁸For our estimations, we retain 12 points of quadratures, other points (20 and 25) have been mobilized and the results remain stable.

specifications. This positive effect is lower depending on the measure of labor turnover used.

Employee access to a share of the firm's profits is associated with a higher global employee turnover rate, relative to the voluntary labor turnover rate. This effect is clearly less strong on the voluntary turnover rate of researchers. These results are not in line with those proposed by Shaw (2015), which suggests a negative relationship between the provision of rewards to low performers (dysfunctional staff turnover) and the probability of staying with the firm. This study highlights that low performers are satisfied with a low salary and leave the company for better alternatives, so the remuneration is not the main argument that pushes them to keep their job.

In addition, the company's market share has a positive and significant effect at the 1% risk level on the probability of experiencing voluntary turnover of researchers within the company. The results have the same magnitude depending on the measure of professional training used. The influence of this determinant is slightly more pronounced on the overall labor turnover rate relative to the other measures. One of the hypotheses behind these results is that a company with a larger market share experiences a high demand for its products or services, which may result in a higher workload. This increases the pressure on employees, making the job less attractive. As a result, employees may be more likely to leave their jobs to find a less stressful work environment.

At the same time, our results show that company age does not have a significant effect on staff turnover overall, regardless of the measures of employee age or professional training used. One exception persists if we focus on the effect of company seniority in explaining the voluntary turnover rate of researchers (table 8, page 24). In this case, for a measure of employee age by group, we observe that as the company ages, its voluntary researcher turnover rate becomes lower. A company that gains experience in the market means that it is successful in subsisting, and this gives a signal of stability to employees. Thus, for researchers, being in a firm that survives in the market allows them to ensure a secure professional future and, probably, a work environment that allows them to establish their research serenely.

We also find that the median net hourly wage is crucial in explaining both global and voluntary turnover rate, except for the voluntary turnover of researchers. Increasing the median hourly wage results in a decrease in the probability that the firm will experiment employee turnover. If the wage increases, then the incentives for internal employees to keep their jobs will increase. This effect is consistent with the intuitions and results found in the literature (Rosholm and Svarer, 2004; Barel, Salladarre, and Fremeau, 2009; Demmou and Wörgötter, 2015; Shaw, 2015). One possibility lies in the measure of salary used to explain the turnover rate of researchers. Indeed, researchers, having a higher reference wage, will prefer to base their decision to join or leave the firm on a salary measure specific to them rather than a global measure.

Then, the assumptions proposed by Droege and Hoobler (2003) about the age of employees are clearly found. In contrast, the magnitude of the effects of age on turnover varies according to the measure of turnover used, the measure of age considered, and according to the way in which training is introduced into our analyses. First, we consider the median age of employees within each firm. This age measure seems to play a role in the occurrence of employee turnover since we detect a negative influence of this determinant. However, this only concerns voluntary movements. This effect varies according to the measure of professional training considered. Specifically, when we measure training by the financial participation rate or the training rate access, the median age within the firm

shows a negative effect on voluntary turnover. This may be attributed to the notion that a company with a more mature workforce tends to be more stable, thus resulting in lower rates of employee turnover. Thus, we agree with the assumptions presented by Droegge and Hoobler (2003), according to which the probability of leaving a job decreases with the age of the individual. Similarly, Barel, Salladarre, and Fremeau (2009) reports that younger populations are more susceptible to move than older populations. To provide a more nuanced understanding of the impact of age on turnover, we suggest examining it through age groups (tables 4-8, pages 20-24). This measure allows to consider a possible non-linearity of the median age. It should be noted that the results remain stable according to the vocational training measure considered. First, we will examine the overall staff turnover rate. Overall, each age group has a significant negative influence on the staff turnover rate (at the 1% risk threshold). It is worth noting that the distribution of employee age is non-linear and can be divided into three sections. The impact of this factor is stronger in the middle of the distribution than at the upper and lower ends. The age groups under thirty years of age have a relatively lower negative impact on the global turnover rate compared to the 30-50 age group, which has three times more negative impact. While the impact of the over-50 age group on the overall staff turnover rate is comparatively lower than that of the aforementioned age groups (-0.05 versus -0.08 for the under-30s and about -0.23 for the 30-50s). The intuition behind these results is based on the idea that people aged from 30 to 50 years old have a different movement behavior than other categories of employees. For these workers, the trade-off between leaving the firm and keeping their jobs within the firm results in fewer moves across firm boundaries. These individuals tend to have more work experience and knowledge of the labor market, especially relative to the younger age group (under 30), and are therefore less likely to leave for a more promising job opportunity. Their commitment and loyalty to the company, coupled with the family and financial responsibilities they typically bear, encourages them to keep their jobs, resulting in less employee turnover. For employees under the age of 30 years old, we find that their presence results in less staff turnover, but to a lesser extent than the middle age group of 30-50. Younger employees tend to be more agile learners and better at adapting to new challenges than their more mature colleagues (Wright and Hamilton, 1978; Mehrabian and Blum, 1996). Similarly, their youth is associated in the collective imagination with stronger motivation and enthusiasm for work (Warr, 2008; Boumans, Jong, and Janssen, 2011). Beyond individuals, companies with a high proportion of workers under the age of 30 are characterized by their dynamic work culture that fosters employee growth and enhances retention rates within the firm. As previously mentioned, the presence of this group within companies results in a negative effect on staff turnover, but this effect is lessened by other insights. Specifically, employees under the age of 30 may have different perspectives on their career prospects, with higher expectations for career advancement compared to more experienced employees. As a result, they may be more likely to take risks and leave the company if they do not feel fulfilled or see opportunities for advancement. Additionally, these employees may have fewer financial responsibilities, which could encourage them to take the risk of leaving their position. Regarding the proportion of people over 50 years old, the negative effect on turnover can be attributed to the notion that individuals in this age group are motivated to retain their jobs as retirement approaches, given the financial obligations they are facing, rather than opting to depart from the company. Additionally, this may be due to employees' desire to preserve existing routines (such as commuting time, housing, or organizational knowledge, among others). However, this negative effect on staff turnover is lower in comparison to other age categories, possibly due to retirements. Indeed, people over 50 years old are more likely to have achieved their professional goals and are therefore

more inclined to leave their job for retirement. Exits of this group of workers from the company are also related to health needs that may require a reduction in workload or even cessation of activity for health reasons. The voluntary turnover rate of the overall workforce or only researchers is similarly influenced, although the marginal effects are subtly less pronounced.

We also assess whether there is a gender effect among the determinants of staff turnover. Overall, this pattern of gender differences in the factors affecting employee turnover is observed in the empirical analysis. Indeed, the employment rate of men within each company have a negative influence on employee turnover, for all measures of workforce rotation, professional training, and employee age. However, there is one exception to note in specifications including the median age of employees, as the employment rate of men is not significant in explaining the level of voluntary turnover. Price (2001) mentions that environmental variables, and in particular family responsibilities, would generate less staff turnover. However, the perception of family responsibilities would differ according to the gender of the employee. We do not find the intuitions of Barel, Salladarre, and Fremeau (2009) pointed out a stronger sensitivity to external job offers among men than women.

Company size is a significant determinant of turnover. In this case, there is a positive effect of the number of employees on staff turnover. The positive influence of size varies depending on the turnover rate considered. Indeed, the overall turnover rate is more sensitive to an increase in size than the voluntary turnover rate. The same rate is more sensitive than the voluntary turnover rate of researchers to any increase in firm size. For instance, in tables 3 to 7 (pages 19-23), we observe that an increase in the number of employees by 1% leads to an increase in the overall turnover rate by 0.48%, the voluntary turnover rate by 0.39%, and the voluntary turnover rate of researchers by 0.13%. This result is consistent with the hypothesis of social attachment to the structure (Droege and Hoobler, 2003; Barel, Salladarre, and Fremeau, 2009). The larger the company is, the less attached the employee is to the company and the greater the likelihood that they will leave.

Furthermore, the results regarding the impact of professional training on turnover have also been examined. The rate of financial participation of companies in vocational training and the average duration of training have a positive and significant effect on the determinants of turnover, in all the measures and specifications considered jointly. However, the rate of access to training appears significant only for few specifications. The average duration of training has a positive effect on the voluntary turnover rate of researchers. This result can be attributed to the indirect effect of this determinant, but also because we do not have enough information on the content of the training provided by the companies. We can assume, in line with the results of Martin (2003), that the training measured in our study is of a general nature and not tailored to the specific needs of the company in which employees are working. Shaw, Delery, Jenkins, and Gupta (1998) also detects a positive effect of training, but on involuntary turnover. This positive effect is attributed by Shaw, Delery, Jenkins, and Gupta (1998) to the positive relationship between the supply of training and the rate of layoffs. Companies that provide general training may prioritize developing their employees' skills and performance, which could lead to a higher rate of employee turnover. Likewise, companies that experience high layoff rates will initiate training programs because of their low quality workforce. Another point emphasized by Price (2001) refers to the human capital theory of Becker (1994). The hypothesis is that an increase in the amount of non-specific training results in a

higher rate of turnover. The general nature of the provided training makes it transferable and applicable in other organizations besides the training company.

Similarly, the analysis of employee turnover determinants also allowed for the examination of the impact of the presence rate of certain professions within the company. The presence of managers in the company has a positive effect on the turnover rate. This conclusion is also shared by Barel, Salladarre, and Fremeau (2009); Shankar and Ghosh (2013) who also detected a tendency for managers to move across company boundaries. Meanwhile, the empirical study shows that the employee proportion has a negative influence on the turnover rate. However, other employee categories have varying effects on turnover, and the significance of these effects depends on measures such as employee age, staff turnover, or professional training. Indeed, the shares of intermediate professions and blue-collar workers positively affect the personnel turnover rate, and in some cases, these determinants are not significant.

Our results also reveal that innovation has an influence on workforce turnover. This effect is not stable depending on the specification considered. Moreover, the direction of the influence of this determinant varies and reflects opposing dynamics in the relationship between innovation and turnover. Overall, the empirical study reveals that innovation has a positive influence on the voluntary turnover rate of researchers, except in the case where employee age is measured by the median age (table 7, page 23). A company publishing one or more patents will experience a 0.03% higher voluntary turnover rate among researchers. Innovation can lead to some job positions becoming obsolete, which may in turn result in employees leaving the company. Additionally, innovation, as measured by published patents, can make competitors of the company eager to enter the market by studying patents and attracting employees of the innovative firm to acquire and spread new knowledge necessary for innovation. We find thus the results of Antelius and Lundberg (2000) showing that industries with a high innovation rate would have a high job turnover rate.

In terms of the company's environment, we detect a sectoral effect in turnover determinants. The concentration level of the sector where the company operates has a negative impact on staff turnover. For both global and voluntary employee turnover rates, the marginal effects do not differ significantly between low and medium concentration markets compared to highly concentrated markets. Specifically, being in a low or medium concentration market has a negative impact on the probability of employee turnover compared to firms in highly concentrated markets with less competition. The difference between low and medium concentration markets is more significant in determining the voluntary turnover rate of researchers.

Finally, the empirical study does reveal that the sectoral affiliation of companies is indeed significant among the determinants of workforce turnover. Sectoral effects are not stable, since depending on the measures of turnover, age or professional training used, marginal effects differ. The sometimes-contradictory influences revealed in our results reflect opposing dynamics. Thus, we partially confirm the results proposed by Antelius and Lundberg (2000) which suggest that sectoral affiliation is significant in staff turnover, particularly in high-tech industries. However, there are still many aspects to consider regarding sectoral effects.

6 Conclusion

The objective of this study was to analyze the determinants of employee turnover in French companies. There are few empirical analyses on the subject, particularly in relation to French companies. One of the advantages of our sample is that it covers a period of 7 years, which enables us to use panel data estimation methods to control for potential unobservable individual effects.

The results obtained from the Type I Tobit model with random effects are consistent with existing literature, which highlights the negative influence of salary on overall and voluntary turnover rates, as well as the positive effect of firm size on turnover. Additionally, we observed a positive influence of the presence of managers on employee turnover.

We obtained some unexpected results, such as the positive effect of company market share and employee participation in company profits on workforce turnover and the negative influence of male employment rate on turnover. Finally, the company's longevity in the market results in a lower voluntary turnover rate among researchers. Furthermore, we found that professional training is a determinant of workforce turnover, with varying effects depending on the type of training provided by the company. Despite the multiple measures of professional training considered, we do not have information on the content of these trainings, or the profiles of the individuals trained. It would be necessary to explore research avenues to identify the type of training provided by the company (Martin, 2003). In other words, the impact of professional training on workforce turnover will depend on its general or specific nature to the company.

We also replicated previous findings from Droege and Hoobler (2003) and detect a negative age effect on voluntary turnover, but detected a nonlinear effect of employees' age on turnover when age groups were introduced in the specifications. The effect of age on employee turnover is not as straightforward as the assumption that older employees are less likely to change jobs.

However, it is necessary to keep in mind that the trends observed in our analysis do not necessarily apply to all employees. Motivations and behaviors can vary significantly from one individual to another. The company's policies and the work environment in which the employee operates can also play a key role in turnover behavior. Overall, understanding the causes of turnover is crucial for effective human resource management. Further research could be conducted to gain a more complete overview of the employee turnover process, using individual-level data, and increasing the sample size.

Finally, the results regarding innovation reveal conflicting dynamics in explaining personnel movements. Indeed, innovation influences voluntary movements of researchers between firms, while the overall turnover rate is negatively affected by this determinant. Given the close relationship between (tacit and explicit) knowledge and innovation, as well as the strong link between knowledge and personnel movements, it is interesting to examine the interconnection between innovation and turnover. One way to approach this relationship is to use other measures of innovation while integrating a relational dimension to the turnover rate. Furthermore, since innovation is an endogenous variable, it could be interesting to implement a simultaneous equation specification. This approach may provide a better understanding of the innovation process in its entirety, by studying the displacement of tacit and explicit knowledge across firm boundaries, through the phenomenon of personnel rotation to innovation.

7 Appendix

7.1 List of variables and their meanings

Table 1: Variables definition

Variable	Definition	Derived from
EXPLAINED VARIABLES: Employee turnover measures		
Global employee turnover	Logarithm of employee turnover rate: average of the employees entry rate and the departure rate per year between 2005 and 2013	DMMO-EMMO DADS
Voluntary employee turnover	Logarithm of voluntary employee turnover rate: average of the employees voluntary entry rate and the voluntary departure rate per year between 2005 and 2013	DMMO-EMMO DADS
Voluntary researcher turnover	Logarithm of voluntary researcher turnover rate: average of the researcher voluntary entry rate and the researcher voluntary departure rate per year between 2005 and 2013	DMMO-EMMO DADS
EXPLANATORY VARIABLES		
Firm's characteristics		
Employee profit sharing	Existence of an Employee profit sharing: dummy variable being 1 if the company pays a contribution during the year (between 2005 and 2013), 0 otherwise	FICUS-FARE
Market share	Logarithm of the share of the company's total sales on industry's total sales (APE 700)	FICUS-FARE
Median net hourly wage	Logarithm of the median net hourly wage per employee paid in euros by the company per year (between 2005 and 2013)	DADS
Age of the company	Logarithm of the company's seniority in years	FICUS-FARE
Median age of employees	Logarithm of the median age of employees by company, by year between 2005 and 2013	DADS
Share of -30 year olds	Logarithm of the percentage of employees under 30 years old within the company, per year between 2005 and 2013	DADS
Share of 30-50 year olds	Logarithm of the percentage of employees aged between 30 and 50 within the company, per year between 2005 and 2013	DADS
Share of over 50s	Logarithm of the percentage of employees aged over 50 within the company, per year between 2005 and 2013	DADS
Male employment rate	Logarithm of the percentage of male employees in the company per year	DADS
Firm size	Logarithm of average employee's number per firm per year	DADS
Professional training measures		
Rate of financial participation	Logarithm of average training expenditure per employee (excluding payments to OPCAs) by company and per year (2005-2013)	Déclaration 2483 DADS
Rate of access to training	Logarithm of the share of employees trained within each company between 2005 and 2013	Déclaration 2483 DADS
Average duration of training	Logarithm of the average duration in hours of training per employee, per company, per year between 2005 and 2013	Déclaration 2483
Share of professions (6)	Logarithm of the representation rate of each profession within the company	DADS
Innovation: Patents published	Patent publication indicator between 2005 and 2015: if the company publishes at least one patent application the indicator takes the value 1, 0 otherwise	Atlas des brevets
Market characteristics		
Industry concentration	Dummy variable being 1 if the market is lightly concentrated, 2 if moderately concentrated and 3 if highly concentrated (derived from the Herfindahl-Hirschmann concentration index builded from APE 200)	FARE
Industry dummies (9)	Dummy variable being 1 according to the firm's sector belonging, 0 otherwise (APE 17)	FARE

N=57 708, i.e., 6 412 firms observed per year between 2005 and 2013

Table 2: Descriptive statistics of continuous variables

Variables	Min.	Max.	Mean	Q1	Med.	Q3	Std. dev.	Coef. var.
Employee's number	3.00	1,365,461.00	530.64	40.00	71.00	165.00	14,334.85	2,701.44
Age of the company	0.00	113.00	27.09	16.00	24.00	37.00	14.34	52.93
Median net hourly wage	2.88	114.89	10.98	8.86	10.15	11.94	3.60	32.80
Total turnover	-14,449.11	14,446,544.19	53,831.96	3,117.53	7,186.18	20,563.51	318,427.09	591.52
Global employee turnover	0.00	1,017.95	10.39	0.00	0.00	12.77	28.52	274.58
Voluntary employee turnover	0.00	509.89	6.09	0.00	0.00	7.43	15.41	253.00
Involuntary employee turnover	0.00	508.06	4.30	0.00	0.00	4.38	13.59	316.47
Voluntary researcher turnover	0.00	3,866.67	2.61	0.00	0.00	0.00	27.63	1,059.14
Median age of employees	19.00	61.00	37.99	34.00	38.50	42.50	6.38	16.78
Market share	-0.08	100.00	0.80	0.03	0.08	0.29	4.03	500.67
Share of farmers	0.00	0.78	0.01	0.00	0.00	0.00	0.12	5,659.31
Share of artisans	0.00	85.00	0.97	0.00	0.00	1.33	2.03	210.65
Share of managers	0.00	98.24	9.99	1.47	5.22	12.07	13.54	136.75
Share of intermediate professions	0.00	100.00	14.25	4.88	13.47	3.57	44.00	64.02
Share of employees	0.00	100.00	17.60	4.00	8.92	22.58	20.26	115.14
Share of workers	0.00	100.00	38.10	6.25	42.76	62.81	28.30	74.27
Share of -30 year olds	0.00	100.00	28.53	16.57	25.93	37.50	16.82	58.96
Share of 30-50 year olds	0.00	100.00	49.93	42.18	50.00	58.42	12.82	25.68
Share of over 50s	0.00	90.32	21.52	12.44	20.00	29.03	12.37	57.49
Male employment rate	0.00	100.00	68.28	50.00	76.67	89.19	24.97	36.57
Rate of access to training	0.00	8.21	0.19	0.00	0.14	0.29	0.20	105.91
Rate of financial participation	0.00	7,454.54	119.94	0.00	2.43	128.63	254.55	212.23
Average duration of training	0.00	960.17	20.55	0.00	17.00	26.38	33.20	161.58

N=57.708. i.e 6.412 french firms observed from 2005 to 2013

7.2 Determinants of overall employee turnover rate

Table 3: Determinants of global employee turnover rate (Median age)

Explained variable: Global employee turnover rate (log)						
Model	I		II		III	
	ME	SE	ME	SE	ME	SE
Firm's characteristics						
Employee participation	0.2225***	0.0138	0.2241***	0.0138	0.2239***	0.0138
Market share	0.0222***	0.0070	0.0242***	0.0070	0.0234***	0.0070
Median salary	-0.1529***	0.0356	-0.1455***	0.0356	-0.1490***	0.0356
Age of the company	0.0161	0.0165	0.0153	0.0165	0.0145	0.0165
Median age of employees	-0.5562***	0.0379	-0.5580***	0.0380	-0.5590***	0.0379
Male employment rate	-0.0404*	0.0221	-0.0362*	0.0221	-0.0404*	0.0221
Size (Employee in log)	0.4801***	0.0114	0.4835***	0.0115	0.4763***	0.0114
Training: Financial participation rate	0.0133***	0.0027	-	-	-	-
Training: Rate of access to training	-	-	0.0002	0.0057	-	-
Training: Average length of training	-	-	-	-	0.0268***	0.0048
Share of farmers	0.0918	0.0659	0.0907	0.0659	0.0904	0.0659
Share of artisans	0.0098	0.0093	0.0099	0.0093	0.0097	0.0093
Share of managers	0.0722***	0.0082	0.0758***	0.0081	0.0734***	0.0081
Share of employees	-0.0256***	0.0074	-0.0270***	0.0074	-0.0268***	0.00747
Share of intermediate professions	0.0107	0.0073	0.0121*	0.0073	0.0100	0.0073
Share of workers	0.0176***	0.0065	0.0174***	0.0065	0.0175***	0.0065
Innovation: Publication of one or more patents (Dummy 1/0)	-0.0459	0.0320	-0.0442	0.0321	-0.0444	0.0321
Sectorial characteristics						
Indicators of industry concentration						
Low concentration market	-0.1844***	0.0171	-0.1835***	0.0171	-0.1831***	0.0171
Medium concentrated market	-0.1846***	0.0196	-0.1838***	0.0196	-0.1834***	0.0197
Highly concentrated market	ref.	ref.	ref.	ref.	ref.	ref.
Industry indicators						
Manufacturing industry (Sector D)	-0.0184	0.0738	-0.0323	0.0738	-0.0250	0.0736
Construction (Sector F)	-0.2868***	0.0787	-0.3045***	0.0787	-0.2872***	0.0786
Trade; repair of automobiles and household goods (Sector G)	-0.3016***	0.0750	-0.3156***	0.0751	-0.3063***	0.0749
Hotels and restaurants (Sector H)	-0.2655***	0.0967	-0.2953***	0.0967	-0.2831***	0.0964
Transport and communications (Sector I)	0.0135	0.0853	0.0133	0.0855	0.0140	0.0852
Real estate, rental and business services (Sector K)	-0.1602**	0.0776	-0.1721**	0.0777	-0.1665**	0.0774
Health and social action (Sector N)	0.0642	0.1035	0.0436	0.1036	0.0465	0.1033
Community, social and personal services (Sector O)	-0.1575*	0.0932	-0.1739*	0.0933	-0.1722*	0.0931
Other industries (Sector Z)	ref.	ref.	ref.	ref.	ref.	ref.
$\hat{\sigma}_u^2$	2.1805***	0.0309	2.1868***	0.0308	2.1741***	0.0309
$\hat{\sigma}_\varepsilon^2$	1.9640***	0.0111	1.9640***	0.0111	1.9646***	0.0111
$\rho = \hat{\sigma}_u^2/\hat{\sigma}_\varepsilon^2$	0.5521	0.0071	0.5535	0.0071	0.5505	0.0072
Log-likelihood	-61,609.06		-61,621.57		-61,605.74	
Wald Statistic	4,785.01***		4,752.49***		4,801.06***	
Significativity: * at 10%, ** at 5%, *** at 1%; ME=Marginal Effects; SE=Standard Error						

N=57,708, i.e 6,412 french firms observed from 2005 to 2013

Table 4: Determinants of Gross Employee Turnover (Age groups)

Explained variable: Gross employee turnover rate (log)						
Model	I		II		III	
	ME	SE	ME	SE	ME	SE
Firm's characteristics						
Employee participation	0.2307***	0.0138	0.2322***	0.0138	0.2320***	0.0138
Market share	0.0264***	0.0070	0.0283***	0.0070	0.0277***	0.0070
Median salary	-0.2861***	0.0344	-0.2802***	0.0344	-0.2836***	0.0344
Age of the company	-0.0190	0.0167	-0.0205	0.0167	-0.0210	0.0167
Share of people under 30 years old	-0.0793***	0.0123	-0.0802***	0.0123	-0.0797***	0.0123
Share of 30-50 year olds	-0.2387***	0.0234	-0.2397***	0.0234	-0.2389***	0.0234
Share of people over 50 years old	-0.0469***	0.0138	-0.0455***	0.0139	-0.0464***	0.0138
Male employment rate	-0.0814***	0.0219	-0.0772***	0.0220	-0.0820***	0.0219
Size (Employee in log)	0.4872***	0.0119	0.4913***	0.0120	0.4835***	0.0119
Training: Financial participation rate	0.0133***	0.0219	-	-	-	-
Training: Rate of access to training	-	-	0.0017	0.0057	-	-
Training: Average length of training	-	-	-	-	0.0260***	0.0048
Share of farmers	0.0916	0.0662	0.0905	0.0662	0.0901	0.0663
Share of artisans	0.0057	0.0094	0.0058	0.0094	0.0055	0.0094
Share of managers	0.0751***	0.0082	0.0785***	0.0082	0.0763***	0.0082
Share of employees	-0.0282***	0.0075	-0.0296***	0.0075	-0.0294***	0.0075
Share of intermediate professions	0.0111	0.0073	0.0125*	0.0073	0.0105	0.0073
Share of workers	0.0106*	0.0065	0.0102	0.0066	0.0104	0.0066
Innovation: Publication of one or more patents (Dummy 1/0)	-0.0396	0.0321	-0.0379	0.0321	-0.0379	0.0321
Sectorial characteristics						
Indicators of industry concentration						
Low concentration market	-0.1808***	0.0171	-0.1799***	0.0172	-0.1795***	0.0171
Medium concentrated market	-0.1885***	0.0197	-0.1877***	0.0197	-0.1873***	0.0197
Highly concentrated market	ref.	ref.	ref.	ref.	ref.	ref.
Industry indicators						
Manufacturing industry (D)	-0.1569**	0.0723	-0.1705**	0.0724	-0.1652**	0.0722
Construction (F)	-0.3709***	0.0785	-0.3884***	0.0786	-0.3728***	0.0784
Trade; repair of automobiles and household goods (G)	-0.4052***	0.0745	-0.4184***	0.0746	-0.4112***	0.0744
Hotels and restaurants (H)	-0.4513***	0.0966	-0.4790***	0.0966	-0.4697***	0.0964
Transport and communications (I)	-0.1285	0.0840	-0.1291	0.0841	-0.1296	0.0839
Real estate. rental and business services (K)	-0.2708***	0.0770	-0.2822***	0.0771	-0.2786***	0.0769
Health and social action (N)	-0.1013	0.1027	-0.1220	0.1029	-0.1212	0.1025
Community, social and personal services (O)	-0.2570***	0.0931	-0.2724***	0.0932	-0.2727***	0.0929
Other industries (Z)	ref.	ref.	ref.	ref.	ref.	ref.
$\hat{\sigma}_u^2$	2.1828***	0.0309	2.1894***	0.0310	2.1774***	0.0309
$\hat{\sigma}_\varepsilon^2$	1.9671***	0.0111	1.9671***	0.0111	1.9676***	0.0111
$\rho = \hat{\sigma}_u^2/\hat{\sigma}_\varepsilon^2$	0.5518	0.0071	0.5533	0.0071	0.5505	0.0072
Log-likelihood	-61,653.24		-61,665.55		-61,650.83	
Wald Statistic	4,719.47***		4,686.18***		4,731.84***	
Significativity: * at 10%. ** at 5%. *** at 1%; ME=Marginal Effects; SE=Standard Error						

N=57,708. i.e 6,412 french firms observed from 2005 to 2013

7.3 Determinants of voluntary employee turnover

Table 5: Determinants of voluntary employee turnover (Median age)

Explained variable: Voluntary job turnover rate (log)						
Model	I		II		III	
	ME	SE	ME	SE	ME	SE
Firm's characteristics						
Employee participation	0.2039***	0.0117	0.2053***	0.0117	0.2050***	0.0117
Market share	0.0150***	0.0059	0.0168***	0.0059	0.0161***	0.0059
Median salary	-0.1506***	0.0302	-0.1440***	0.0302	-0.1469***	0.0302
Age of the company	0.0158	0.0139	0.0150	0.0139	0.0144	0.0139
Median age of employees	-0.5258***	0.0323	-0.5274***	0.0324	-0.5284***	0.0323
Male employment rate	0.0059	0.0188	0.0096	0.0188	0.0062	0.0188
Size (Employee in log)	0.3898***	0.0096	0.3928***	0.0097	0.3866***	0.0097
Training: Financial participation rate	0.0117***	0.0022	-	-	-	-
Training: Rate of access to training	-	-	0.0001	0.0048	-	-
Training: Average length of training	-	-	-	-	0.0227***	0.0040
Share of farmers	0.0650	0.0555	0.0640	0.0554	0.0638	0.0555
Share of artisans	0.0078	0.0079	0.0079	0.0079	0.0077	0.0079
Share of managers	0.0591***	0.0069	0.0622***	0.0069	0.0602***	0.0069
Share of employees	-0.0190***	0.0063	-0.0203***	0.0063	-0.0205***	0.0063
Share of intermediate professions	0.0116*	0.0062	0.0129**	0.0062	0.0112*	0.0062
Share of workers	0.0123**	0.0055	0.0121**	0.0055	0.0122**	0.0055
Innovation: Publication of one or more patents (Dummy 1/0)	-0.0381	0.0270	-0.0366	0.0270	-0.0368	0.0270
Sectorial characteristics						
Indicators of industry concentration						
Low concentration market	-0.1536***	0.0145	-0.1528***	0.0145	-0.1525***	0.0145
Medium concentrated market	-0.1528***	0.0167	-0.1520***	0.0167	-0.1518***	0.0167
Highly concentrated market	ref.	ref.	ref.	ref.	ref.	ref.
Industry indicators						
Manufacturing industry (D)	0.0724	0.0631	0.0600	0.0631	0.0662	0.0629
Construction (F)	-0.1485**	0.0671	-0.1641***	0.0671	-0.1496**	0.0670
Trade; repair of automobiles and household goods (G)	-0.1520**	0.0640	-0.1643***	0.0641	-0.1565***	0.0639
Hotels and restaurants (H)	-0.1001	0.0820	-0.1265	0.0820	-0.1163	0.0817
Transport and communications (I)	0.1263*	0.0727	0.1262*	0.0728	0.1266*	0.0726
Real estate, rental and business services (K)	-0.0304	0.0662	-0.0411	0.0662	-0.0362	0.0661
Health and social action (N)	0.2233***	0.0878	0.2051**	0.0879	0.2077**	0.0876
Community, social and personal services (O)	-0.0306	0.0794	-0.0453	0.0795	-0.0437	0.0793
Other industries (Z)	ref.	ref.	ref.	ref.	ref.	ref.
$\hat{\sigma}_u^2$	1.9979***	0.0284	1.9962***	0.0284	1.9841***	0.0283
$\hat{\sigma}_\varepsilon^2$	1.7188***	0.0098	1.7190***	0.0098	1.7196***	0.0098
$\rho = \hat{\sigma}_u^2/\hat{\sigma}_\varepsilon^2$	0.5746	0.0071	0.5742	0.0071	0.5711	0.0071
Log-likelihood	-57,958.76		-57,960.61		-57,941.68	
Wald Statistic	3,936.14***		3,934.25***		3,983.33***	
Significativity: * at 10%, ** at 5%, *** at 1%; ME=Marginal Effects; SE=Standard Error						

N=57,708, i.e 6,412 french firms observed from 2005 to 2013

Table 6: Determinants of voluntary employee turnover (Age groups)

Explained variable: Voluntary job turnover rate (log)						
Model	I		II		III	
	ME	SE	ME	SE	ME	SE
Firm's characteristics						
Employee participation	0.2096***	0.0117	0.2110***	0.0118	0.2108***	0.0117
Market share	0.0245***	0.0060	0.0263***	0.0060	0.0257***	0.0060
Median salary	-0.2664***	0.0293	-0.2611***	0.0293	-0.2640***	0.0293
Age of the company	-0.0123	0.0142	-0.0137	0.0142	-0.0142	0.0141
Share of people under 30 years old	-0.0242**	0.0107	-0.0249**	0.0107	-0.0245**	0.0107
Share of 30-50 year olds	-0.2018***	0.0199	-0.2027***	0.0200	-0.2020***	0.0199
Share of people over 50 years old	-0.0516***	0.0117	-0.0503***	0.0118	-0.0511***	0.0117
Male employment rate	-0.0619***	0.0187	-0.0580***	0.0187	-0.0621***	0.0187
Size (Employee in log)	0.3807***	0.0100	0.3844***	0.0101	0.3778***	0.0101
Training: Financial participation rate	0.0121***	0.0023	-	-	-	-
Training: Rate of access to training	-	-	0.0016	0.0048	-	-
Training: Average length of training	-	-	-	-	0.0222***	0.0041
Share of farmers	0.0642	0.0560	0.0632	0.0559	0.0629	0.0560
Share of artisans	0.0034	0.0079	0.0035	0.0080	0.0033	0.0080
Share of managers	0.0644***	0.0070	0.0675***	0.0070	0.0656***	0.0070
Share of employees	-0.0260***	0.0064	-0.0273***	0.0064	-0.0271***	0.0063
Share of intermediate professions	0.0128**	0.0063	0.0140**	0.0062	0.0124**	0.0062
Share of workers	0.0083	0.0056	0.0079	0.0056	0.0081	0.0056
Innovation: Publication of one or more patents (Dummy 1/0)	-0.0302	0.0272	-0.0288	0.0272	-0.0287	0.0272
Sectorial characteristics						
Indicators of industry concentration						
Low concentration market	-0.1498***	0.0146	-0.1490***	0.0146	-0.1487***	0.0146
Medium concentrated market	-0.1551***	0.0168	-0.1544***	0.0168	-0.1542***	0.0168
Highly concentrated market	ref.	ref.	ref.	ref.	ref.	ref.
Industry indicators						
Manufacturing industry (D)	-0.1277**	0.0618	-0.1402**	0.0618	-0.1359**	0.0617
Construction (F)	-0.3020***	0.0670	-0.3180***	0.0671	-0.3047***	0.0669
Trade; repair of automobiles and household goods (G)	-0.3267***	0.0636	-0.3388***	0.0637	-0.3328***	0.0636
Hotels and restaurants (H)	-0.3622***	0.0821	-0.3875***	0.0821	-0.3798***	0.0819
Transport and communications (I)	-0.0517	0.0716	-0.0523	0.0717	-0.0529	0.0715
Real estate. rental and business services (K)	-0.2092***	0.0657	-0.2199***	0.0658	-0.2168***	0.0656
Health and social action (N)	-0.0316	0.0874	-0.0506	0.0875	-0.0501	0.0872
Community, social and personal services (O)	-0.2093***	0.0794	-0.2236***	0.0795	-0.2239***	0.0793
Other industries (Z)	ref.	ref.	ref.	ref.	ref.	ref.
$\hat{\sigma}_u^2$	1.9125***	0.0272	1.9185***	0.0272	1.9081***	0.0272
$\hat{\sigma}_\varepsilon^2$	1.7147***	0.0098	1.7148***	0.0098	1.7152***	0.0098
$\rho = \hat{\sigma}_u^2/\hat{\sigma}_\varepsilon^2$	0.5544	0.0072	0.5559	0.0071	0.5531	0.0072
Log-likelihood	-57,659.27		-57,673.43		-57,658.53	
Wald Statistic	4,572.98***		4,538.18***		4,581.12***	
Significativity: * at 10%. ** at 5%. *** at 1%; ME=Marginal Effects; SE=Standard Error						

N=57,708. i.e 6,412 french firms observed from 2005 to 2013

7.4 Determinants of voluntary researcher's turnover

Table 7: Determinants of voluntary researcher's turnover (Median age)

Explained variable: voluntary researcher's turnover (log)						
Model	I		II		III	
	ME	SE	ME	SE	ME	SE
Firm's characteristics						
Employee participation	0.0310***	0.0066	0.0319***	0.0066	0.0314***	0.0066
Market share	0.0173***	0.0032	0.0179***	0.0032	0.0186***	0.0032
Median salary	-0.0280	0.0175	-0.0177	0.0173	-0.0172	0.0173
Age of the company	-0.0069	0.0070	-0.0065	0.0070	-0.0066	0.0070
Median age of employees	-0.3320***	0.0202	-0.3340***	0.0203	-0.3401***	0.0202
Male employment rate	-0.0335***	0.0110	-0.0320***	0.0109	-0.0342***	0.0110
Size (Employee in log)	0.1271***	0.0054	0.1319***	0.0055	0.1271***	0.0054
Training: Financial participation rate	0.0095***	0.0014	-	-	-	-
Training: Rate of access to training	-	-	0.0112***	0.0038	-	-
Training: Average length of training	-	-	-	-	0.0147***	0.0033
Share of farmers	0.0104	0.0214	0.0101	0.0214	0.0099	0.0214
Share of artisans	0.0060	0.0040	0.0061	0.0040	0.0058	0.0040
Share of managers	0.1220***	0.0059	0.1244***	0.0059	0.1241***	0.0059
Share of employees	-0.0325***	0.0040	-0.0342***	0.0040	-0.0339***	0.0040
Share of intermediate professions	0.0345***	0.0043	0.0355***	0.0043	0.0352***	0.0043
Share of workers	0.0176***	0.0036	0.0171***	0.0036	0.0176***	0.0036
Innovation: Publication of one or more patents (Dummy 1/0)	0.0161	0.0113	0.0155	0.0113	0.0165	0.0113
Sectorial characteristics						
Indicators of industry concentration						
Low concentration market	-0.0276***	0.0082	-0.0286***	0.0082	-0.0272***	0.0082
Medium concentrated market	-0.0204**	0.0098	-0.0203**	0.0098	-0.0201**	0.0098
Highly concentrated market	ref.	ref.	ref.	ref.	ref.	ref.
Industry indicators						
Manufacturing industry (D)	0.1147***	0.0319	0.1071***	0.0318	0.1059***	0.0317
Construction (F)	-0.1181***	0.0362	-0.1361***	0.0361	-0.1314***	0.0361
Trade; repair of automobiles and household goods (G)	-0.1098***	0.0329	-0.1208***	0.0328	-0.1203***	0.0328
Hotels and restaurants (H)	-0.1760***	0.0581	-0.1900***	0.0579	-0.1905***	0.0578
Transport and communications (I)	-0.0847**	0.0396	-0.0854**	0.0396	-0.0848**	0.0395
Real estate, rental and business services (K)	0.0378	0.0326	0.0285	0.0324	0.0293	0.0324
Health and social action (N)	-0.0457	0.0479	-0.0639	0.0479	-0.0654	0.0478
Community, social and personal services (O)	-0.0950**	0.0410	-0.1073***	0.0410	-0.1115***	0.0409
Other industries (Z)	ref.	ref.	ref.	ref.	ref.	ref.
$\hat{\sigma}_u^2$	2.6442***	0.0714	2.6672***	0.0718	2.6506***	0.0716
$\hat{\sigma}_\varepsilon^2$	3.0427***	0.0385	3.0443***	0.0386	3.0464***	0.0386
$\rho = \hat{\sigma}_u^2/\hat{\sigma}_\varepsilon^2$	0.4303	0.0132	0.4343	0.0132	0.4309	0.0132
Log-likelihood	-17,453.10		-17,472.28		-17,466.70	
Wald Statistic	3,238.37***		3,231.60***		3,231.07***	
Significativity: * at 10%, ** at 5%, *** at 1%; ME=Marginal Effects; SE=Standard Error						

N=57,708, i.e 6,412 french firms observed from 2005 to 2013

Table 8: Determinants of voluntary researcher's turnover (Age groups)

Explained variable: voluntary researcher's turnover (log)						
Model	I		II		III	
	ME	SE	ME	SE	ME	SE
Firm's characteristics						
Employee participation	0.0362***	0.0066	0.0373***	0.0066	0.0369***	0.0066
Market share	0.0189***	0.0032	0.0195***	0.0032	0.0204***	0.0032
Median salary	-0.0865***	0.0167	-0.0770***	0.0166	-0.0774***	0.0166
Age of the company	-0.0160**	0.0070	-0.0164**	0.0071	-0.0164**	0.0071
Share of people under 30 years old	-0.0456***	0.0064	-0.0452***	0.0064	-0.0464***	0.0064
Share of 30-50 year olds	-0.1675***	0.0125	-0.1707***	0.0125	-0.1729***	0.0125
Share of people over 50 years old	-0.0519***	0.0070	-0.0493***	0.0070	-0.0512***	0.0071
Male employment rate	-0.0477***	0.0106	-0.0456***	0.0105	-0.0485***	0.0106
Size (Employee in log)	0.1289***	0.0056	0.1341***	0.0057	0.1291***	0.0056
Training: Financial participation rate	0.0098***	0.0014	-	-	-	-
Training: Rate of access to training	-	-	0.0127***	0.0038	-	-
Training: Average length of training	-	-	-	-	0.0143***	0.0033
Share of farmers	0.0092	0.0214	0.0089	0.0214	0.0086	0.0214
Share of artisans	0.0039	0.0040	0.0040	0.0040	0.0036	0.0040
Share of managers	0.1272***	0.0059	0.1297***	0.0059	0.1297***	0.0059
Share of employees	-0.0344***	0.0040	-0.0360***	0.0040	-0.0358***	0.0040
Share of intermediate professions	0.0344***	0.0043	0.0353***	0.0043	0.0351***	0.0043
Share of workers	0.0144***	0.0036	0.0136***	0.0036	0.0141***	0.0036
Innovation: Publication of one or more patents (Dummy 1/0)	0.0207*	0.0113	0.0200*	0.0113	0.0213*	0.0113
Sectorial characteristics						
Indicators of industry concentration						
Low concentration market	-0.0262***	0.0082	-0.0274***	0.0082	-0.0260***	0.0082
Medium concentrated market	-0.0243***	0.0098	-0.0243***	0.0098	-0.0242**	0.0098
Highly concentrated market	ref.	ref.	ref.	ref.	ref.	ref.
Industry indicators						
Manufacturing industry (D)	0.0674**	0.0303	0.0602**	0.0302	0.0575*	0.0301
Construction (F)	-0.1413***	0.0353	-0.1594***	0.0353	-0.1554***	0.0353
Trade; repair of automobiles and household goods (G)	-0.1452***	0.0319	-0.1553***	0.0319	-0.1562***	0.0318
Hotels and restaurants (H)	-0.2930***	0.0545	-0.3065***	0.0545	-0.3156***	0.0543
Transport and communications (I)	-0.1217***	0.0386	-0.1216***	0.0386	-0.1220***	0.0385
Real estate. rental and business services (K)	0.0058	0.0315	-0.0024	0.0314	-0.0028	0.0314
Health and social action (N)	-0.0931**	0.0471	-0.1117**	0.0471	-0.1140***	0.0471
Community, social and personal services (O)	-0.1271***	0.0405	-0.1378***	0.0405	-0.1433***	0.0404
Other industries (Z)	ref.	ref.	ref.	ref.	ref.	ref.
$\hat{\sigma}_u^2$	2.6560***	0.0715	2.6803***	0.0719	2.6655***	0.0717
$\hat{\sigma}_\varepsilon^2$	3.0500***	0.0387	3.0516***	0.0387	3.0538***	0.0387
$\rho = \hat{\sigma}_u^2/\hat{\sigma}_\varepsilon^2$	0.4313	0.0132	0.4355	0.0131	0.4324	0.0132
Log-likelihood	-17,495.15		-17,514.58		-17,510.71	
Wald Statistic	3,246.12***		3,238.14***		3,236.40***	
Significativity: * at 10%. ** at 5%. *** at 1%; ME=Marginal Effects; SE=Standard Error						

N=57,708. i.e 6,412 french firms observed from 2005 to 2013

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