Sick leaves:
Understanding disparities between French Departments[1]

Mohamed Ali Ben Halima[2] (IRDES), Thierry Debrand (IRDES), Camille Regaert (IRDES)

June 2011

Abstract:

The purpose of this publication is to better understand disparities of proportions of sick leaves granted in French Departments. The Hygie database was used for this, built by merging a number of administrative files of employees in the private sector in France in 2005. This database enables the determination of "employers/employees" relations, the impact of the characteristics of firms on the health of their employees and interactions between health and work.

After briefly reviewing the various determinants, between the effect of composition and effect of context, sick leaves and their importance for understanding geographic differences, we present a three-phase empirical analysis: a descriptive analysis to detect differences between Departments, a multivariate analysis to highlight explanatory factors of probability of being on sick leave and finally an analysis of determinants of differences between Departments.

Our different models explain a large part of the disparities between Departments. The effects of composition and effects of context account for about half of the absolute difference and two-thirds of the mean square error. These are the variables describing the medical supply (density of general practitioners), verifications by National Health Insurance and patient age when the professional career started, which best explain disparities between Departments concerning sick leave. In contrast to other composition or context included in our model, the percentage of sick leaves verified and the density of general practitioners are important levers of health policies. Our research shows that they could be used as public policy instruments aimed at reducing geographic disparities.

Key words: sick leave, geographic disparities, effect of context, effect of composition, absenteeism.

JEL Code: I18, J21, J29, C23

[1] The Hygie database used in this publication was created at the initiative of the IRDES (Institute of Health Economics Research and Documentation) using data provided by the CNAV (National Retirement Fund) and the CNAM-TS (National Health Insurance, salaried workers) with financing by the DREES (Agency for Research, Studies and Evaluation of Statistics). The authors thank Bruno Crépon, Brigitte Dormont and Renaud Legal for their helpful. The usual disclaimer applies.

[2] Corresponding author: Mohamed Ali Ben Halima, 10 rue Vauvenargues, 75018 Paris, France. e-mail: benhalima@irdes.fr

Sick leaves: Understanding disparities between Departments

Mohamed Ali Ben Halima, Thierry Debrand, Camille Regaert

In 2008, the amount paid out by compulsory National Health Insurance in France for daily sick leave benefits[3] was € 11.3 billion, broken down into 54% for illness/disease, 24% for maternity leave and 22% for occupational accidents, i.e. more than 5% of total health expenditures. This amount of course varies with the economic situation, the regulatory context and outbreaks of epidemics (flu, gastroenteritis, etc.). Between 1995 and 2003, the total amount of daily sick leave benefits increased by 4.3%, whereas between 2003 and 2008, it decreased by 0.5% on average. Since 2008, the amount of benefits has tended to increase. Daily sick leave benefits are the insurance expression to the question of absenteeism for health reasons, long been dealt with in labour economics. This classical problem generally uses the model of Shapiro-Stiglitz (1984) that distinguishes the utility of working from the utility of being absent. Costs of these sick leaves[4] are thus not borne totally by National Health Insurance, since both the firm and the worker pay direct or indirect costs. Considerable work has pointed out the diversity of individual factors for explaining absenteeism: sex (Allen, 1981; Bridges and Mumford, 2000; Ose, 2005), age (Barmby and Stephan, 2000), salary (Leigh, 1991; Barmby, Orme and Treble, 1995) or working conditions (Willard and Vlassenko, 1984; Case and Deaton, 2003).

Aside from changes over time and various explanatory factors, sick leaves in France are marked by a very large geographic heterogeneity, departmental heterogeneity. Department is an administrative area, there are 96 department in France. Thus, in 2005 the proportion of employees with at least one daily sick leave benefit (DSLB) was in the range of 13% in the Hautes-Alpes Department to more than 28% in the Ardennes Department. In its 2006 report on National Health Insurance, the Financial Courts stated that "the considerable geographic differences that exist and that still vary by a factor of 3 can hardly be explained by the socio-professional structure of the working population of the Departments". Our question now becomes an attempt to understand the origin of these differences between Departments. Both sociologists and economists have often studied problems of geographic segregations resulting in differences in terms of both employment (Benadou, 1993; Borjas, 1998; Zenou, 2000) and health (Kawachi and Berkman, 2003; Acevedo-Garcia and Lochner, 2003; *et al*., 2001; Congdon, Shouls and Curtis., 1997). Many publications have demonstrated the existence of external economic factors (Crane, 1991; Cutler and Glaeser, 1997), but few publications have attempted to understand the relations between geographic differences and the rates of absenteeism or sick leaves. Ichino and Maggi (2000) proposed six potential reasons to explain differences between regions: (1) differences in characteristics among populations, (2) differences due to mobility between regions, (3) differences in production sectors and existing amenities, (4) sociological differences on the value of work, sick leaves and levels of needs, (5) differences in discrimination or acceptance of sick leave between Departments and (6) differences in supply and demand of local markets that condition entry in the labour market or different types of jobs.

In order to correctly conduct our analysis of the understanding of differences between Departments, we decided to dissociate the effects of compositions (differences in ages, health status, salaries, working conditions, sectors of activity, characteristics of firms, etc. between Departments) and effects of context. The latter encompass a broad range of factors: economic factors (unemployment rate, birth-rate), medical supply factors (density of general practitioners), factors related to verifications by National Health Insurance and variables characterising enterprises (indicators of severity of workplace accidents, relative salaries). Once the importance of these different factors in the understanding of the probability of having been on at least one sick leave in 2005 is validated, we will see if they can explain disparities between Departments. This publication involves four parts. The first is a literature search on absenteeism to better understand potential differences between regions. The second part is a description of the Hygie database and the methodology used to elucidate determinants of being on sick leave and to measure the importance in the understanding of differences between Departments. Thirdly, we analyse determinants of sick leaves. The fourth and last part is devoted to the analysis of determinants of differences between Departments.

---

3 Daily sick leave benefits for an illness in France are paid every 14 days par National Health Insurance for each day not worked, including weekends and holidays, but starting on the 4th day of work stoppage of the year, i.e. after a waiting period of 3 days.

4 In what follows, we use the term "sick leave" as synonym for work stoppage with payment of daily sick leave allowance by compulsory health insurance

Effect of composition or effect of context

In order to explain differences between Departments, two phenomena can be considered. The first results from differences in the demographic, economic and social structure of the population from one Department to another. If the individual proportion of sick leaves is explained by these determinants, it then becomes highly probable that the average proportions per Department also differ. We call this phenomenon "effect of composition". The second phenomenon is that there may subsist geographic differences that can be imputed to the characteristics of each Department after adjusting for the characteristics of individuals. We call this phenomenon "effect of context".

Thus, determinants of sick leaves can be separated into two categories although the boundaries are not sharp: effect of composition and effect of context. The main distinction between these two types of effects is that the first is characterised by variables proper to each employee or to the firm, while the second is characterised by variables at the level of the Department without being proper to each individual.

Effect of composition

Variables explaining the effect of composition can be clustered in three groups: "individual" and "corporate" characteristics in which people work and "insurance-related" characteristics.

Several individual characteristics have been widely used in the economic literature to study determinants of sick leaves. According to Ose (2005) and Allen (1981), women take more sick leaves than men. This sex effect generally increases as there are young children in the household (Vlassenko and Willard, 1984; Chaupain-Guillot and Guillot, 2007; Primoff and Vistnes, 1997). Age is also often a determinant of sick leaves since increasing age significantly rises the probability of a sick leave (Barmby and Stephan, 2000; Livanos and Zangelidis 2010). According to Depardieu and Lollivier (1985), age can also be used as a proxy for the health status of individuals: since the health status of a person becomes more fragile with growing age, the probability of being on sick leave also increases. Rhodes and Stears (1984) confirmed the positive connection between health status and work absenteeism. The observed differences between Departments for sick leaves can thus be explained by the proportions of women in the work force, the age of workers or health status that are all very heterogeneous depending on the Department.

The second aspect of the effect of composition is all the characteristics of the firm such as size, sector of activity, and salary. Allen (1981), Leigh (1983) and Barmby and Stephan (2000) showed that firm size had a significant influence on sick leave. Employees of smaller firms are absent much less often than those working in large firms. According to Livanos and Zangelidis (2010), absence for sick leave is more frequent is some sectors than others. Based on a panel of 26 European countries between 2004 and 2006, they found that there was a higher risk of absenteeism in the industrial sector than in agriculture. Barmby *et al*., (1995) showed a strong negative effect of salary on absenteeism. Many labour market theories can be invoked to understand relations between salary and absenteeism, in particular between salary and sick leaves. For example, in the “shirking model”, salary is a major determinant of sick leaves. In the efficiency wages model of Shapiro-Stiglitz (1984), salary levels maintain an increasing relationship with employee productivity. Leigh (1991) showed the existence of a salary effect, validating the theory of efficiency wages: workers making more money tend to take fewer sick leaves. In addition, differences between Departments can be explained by the fact that the sectors of activity are not identically distributed throughout the country and that there are salary differences for the same job in the same sector of activity, depending on the Department.

The third group of variables explaining effects of composition is what we call "insurance-related" variables. The phenomenon of moral hazard could thus be one of the main determinants of sick leaves. One aspect of this is the adaptation of the insured worker's efforts with respect to the generosity of the Health Care Insurance Scheme and coverage of financial losses resulting from sick leaves. The employer supports a sick leave without total understanding of the health status of his employee. The hazard on the basis of known elements is related to the individual once he is insured. A person with better coverage will have fewer losses to bear when on sick leave, implying that these individuals will be on sick leave more often (Allen, 1981). Several empirical studies have tried to demonstrate this behaviour pattern. Chaupain-Guillot and Guillot (2007) and Engellandt and Riphahn (2005) used the type of labour contract (temporary vs. permanent contracts) to show that temporary contract workers are less likely to take sick leaves that those with a permanent contract. When a person is in an unstable

labour market position, and fears that his professional situation will not be stabilised by a permanent contract, he takes fewer sick leaves. Aiuppa and Trieschniann (1998) considered that going through successive periods of unemployment incites the person to take fewer sick leaves for fear of once again being unemployed. There is nevertheless a link between poor health and episodes of unemployment and so there could very well be a positive effect of unemployment on the frequency of sick leaves. Moral hazard may also be the result of the French National Health Insurance system characteristics. For instance, workers covered by Alsace and Moselle Health Insurance (special plan) or those with supplementary private insurance benefit from advantages not offered by statutory health insurance. Costs resulting from a sick leave absence are thus lower. People covered by more "generous" health insurance plans could be tempted to increase their consumption of health care and thus take more sick leaves. Henrekson and Persson (2004) used Swedish data from 1955 to 1999 to show that reforms that made the health insurance system more generous for reimbursing sick leaves led to increased rates of absenteeism. Similarly, Johansson and Palme (2002, 2005) used individual data to assess the Swedish reform for reimbursing sick leaves in 1991 and concluded that the frequency and length of workplace absence decreased when the cost of the absence to the worker increased. Finally, Puhani and Sonderhof (2010) reported that in Germany the reduction of sick leave reimbursement from 100% to 80% of salary reduced the average number of days of employee absence by about 2 days a year. All these determinants can explain differences among French Departments, either by the existence of geographic systems or specificities.

Effect of context

To our knowledge, there are no French studies showing the possible effect of context on sick leaves, although this issue is dealt with extensively in foreign publications. Ekblad and Bokenblon (2010) used Swedish data to determine the impact of effects of cultural and geographic contexts on sick leaves taken. They concluded on a major impact of geographic location. The proportion of sick leaves in fact increased for people moving from a region with a low rate of sick leaves to another region with a higher rate than that of the former region. In addition, work by Ichino and Maggi (2000), Barmby and Ercolani (2010) and Little (2007) showed that after controlling individual characteristics, effects of context can explain the difference in sick leaves taken. Sick leave disparities between Departments could thus be due primarily to the structure of the economy and employment in the Departments in question. There are three types of variables explaining the effect of context: socio-economic variables (unemployment rate, birth-rate), firm environment variables and variables insurance and medical supply.

Concerning economic variables, the unemployment rate is one of the principal factors explaining sick leaves taken. An unfavourable economic context characterised by high unemployment implies a reduction in sick leaves (Leigh, 1985; Arai and Thoursie, 2005; Fahr and Frick, 2007, Livanos *et al.*, 2010). This is discipline effect of the workforce. Askildsen *et al*. (2000) confirmed this effect in a study of Norwegian data in 1992 (high unemployment rate) and 1995 (low unemployment rate). In better economic times (1995) workers in fact took more sick leaves. Bliksvaer and Helliesen (1997), on the other hand, showed that national unemployment and absenteeism for reasons of illness were independent. At the level of the individual, however, they found a significant relationship between past unemployment and absenteeism rates that was positive for Slovenia and Spain and negative for Luxemburg and the United States. Other work using the labour-leisure trade-off model (Allen, 1981; Barmby and Treble, 1991; Dunn and Youngblood, 1986) showed another effect of composition of the labour force: in periods of high unemployment, unsatisfied or disgruntled workers tended to take more sick leaves; they all remained on their jobs, whereas they undoubtedly would have changed if the economic situation was more conducive to mobility.

The effect of context is also seen in variables that characterise the firm environment in terms of relative salary, working conditions and job security. In contrast to firm characteristics discussed in the part on effects of composition, in this case we compare the situation of the employee's firm to that of other firms in the same sector and in the same Department. For example, Ose (2005) added a new variable to the basic model of efficiency wages of Shapiro Stiglitz (1984) that reflects working conditions and sick leaves related to these poor conditions. He first showed a negative effect of salary only on short sick leaves, and secondly that long absences are closely linked to poor working conditions. Another effect of context that could explain sick leaves is the physical difficulty of work associated with a particular sector. Sick leaves are in fact more frequent in jobs characterised by strenuous and repeated physical efforts (Willard and Vlassenko, 1984; Case and Deaton, 2003). Olsson (2009) tested the impact of the Swedish law of 2001 on job protection for firms with no more than 10 employees and showed that absence for illness decreased by 13% in the most highly protected firms.

A number of variables related to medical supply may be linked to an effect of context for individual behaviour concerning sick leaves. Based on the theory of physician-induced demand (Rice, 1983), the density of physicians per Department could explain the disparity of sick leaves. Two explanations have been advanced (Expert, 2007). The first is intuitive: a Department with a high density of physicians implies easier access to care and thus a higher frequency of sick leaves. The second is related to the physician-induced demand theory. A Department with a high medial density, i.e., there is elevated competition among physicians and where their remuneration depends on the number of medical acts they conduct, could lead to an increase in the number of medical prescriptions. In addition, in order to limit increased sick leaves and to limit abuses, National Health Insurance conducts a number of verification of individuals receiving sick leaves. Based on the labour economics "shirker-model", in the framework of the theory of agency, the principal levies a penalty such as layoff when it is found that the agent does not provide expected efforts (Ross, 1973; Lazear, 1979). National Health Insurance of course will profit by limiting deviant behaviour with regard to taking sick leaves. This can be done by implementing controls and verifications of either benefit recipients on sick leave or the physicians prescribing them. These controls will increase the probability of identifying "shirker" and thus reducing the number of sick leaves (Kusnik-Joinville *et al*., 2006).

Database and econometric method

Construction of the database

Our study is based on data from the merger of two administrative files, one from National Health Insurance (CNAM-TS) and the other from the national retirement fund (CNAV). We thus have a database containing information on benefit recipients, their professional careers, medical consumptions, sick leaves, the employee's professional context, as well as some characteristics of their employers. Using this base (called Hygie) we can examine relations between health, work, professional career and firm characteristics. Kuhn *et al*. (2009) used information from a similar Austrian database to examine the impact of the economic situation on health expenditures. This type of database for examining these different aspects does not exist in France.

The Hygie database was created using CNAV data as the starting point. The CNAV is a sampling (random selection) of retirement benefit recipients taken from files of the National Career Management System (SNGC) that comprises all private sector employees in France, and from the National Statistical Beneficiary System (SNSP) that comprises all private sector retirees in France. The SNGC was used to extract information on the career of benefit recipients and the SNSP provided information on their retirement. These two sources were used to obtain individual data such as date of birth, sex, etc. This sample was paired with illness data of the CNAM-TS obtained from National Health Insurance Information of different insurance plans (SNIIR-AM). We thus have data on all reimbursements by various branches of National Health Insurance. The CNAM-TS also provided information on recipients' firms, so we have information that characterises the employer. We now have a file that is representative of private sector employees in France with precise information on employees, their firm and their healthcare consumption. The scope of studies with this database is very broad: we are at the boundary of "employers/employees" studies on the labour market (Abowd *et al*., Kramarz and Woodcock, 2008; Haltiwanger *et al.*, 1999), studies on the impact of firm characteristics on the health of their employee (Kuhn *et al*., 2009; Browning et al., 2006) and studies on the relationship between health and work (Bound, 1991; Currie and Madrian, 1999; Strauss and Thomas, 1998).

This database is very well suited for studying differences between Departments. We thus focused our analysis on private sector employees, living in France (95 Departments), between 25 and 65 years of age. Retirees were excluded from the study. Our database includes 262,998 benefit recipients in 146,495 firms. The Department of Paris had both the most recipients (4.4%) and the most firms (3.9%). At the opposite end, the Lozère Department had the fewest recipients (0.1%) and firms (0.1%) but nevertheless accounted for 267 individuals and 194 firms.

We are dealing with two levels of variables: individual and departmental. Individual variables are provided by the Hygie database: sex, age, type of health insurance, etc. Departmental data (unemployment rate, birth-rate, density of general practitioners, etc.) were taken from "Eco-Santé" (health economics) databases. In addition, we created an "indicator of relative salary"[5]. This is the ratio between the worker's salary and the average salary per sector of activity and per Department. This logic is the same used in the efficiency wages theory of Shapiro-Stiglitz (1984) that expresses average wages paid by the firm in comparison to average wages in comparable enterprises. We used this to create an "indicator of severity"[6] that is used as a proxy for physical difficulty of the job or for the risky nature of certain firms. It is defined by the ratio of the number of days lost for work accidents and occupational diseases by the total number of hours worked in the firm, compared to the average severity per sector of activity and per Department.

Econometric method

There are two major groups of variables: the first includes composition variables involving personal data (age, sex, type of health insurance, work status (illness, unemployment), age when entering the labour market, job characteristics (salary, sector, firm size). The second includes context variables describing the situation of each Department (unemployment rate, birth-rate, density of general practitioners, percentage of chronic diseases), relative salary indicator, risk indicator, number of sick leaves verified by National Health Insurance).

In order to calculate the effect of variables on the explanation of differences between Departments, we divided each group into three sub-groups. We were thus able to measure the impact of personal data (age when entering the labour market, work status of the beneficiary in 2004 and 2003, job characteristics), of firms (salary, firm size, sector of activity) and insurance-related aspects (part of the Alsace-Moselle system, universal health coverage (UHC), status changed for UHC, having a chronic disease). The effect of context is measured by the three sub-groups of variables involving the economic context (unemployment rate, birth-rate), medical supply and health insurance (density of general practitioners, percentage of chronic disease, percentage of verifications) and enterprises (relative salary per sector of activity and Department, risk indicator per sector of activity and per Department).

Similar to the procedure of Bolin (2008) and Debrand and Sirven (2009), the influence of each group of variables on the explanation of differences between Departments was calculated using indicators of absolute difference (difference between Departments) and relative difference (variance between Departments) between Departments. This was done in two steps. The first step of the analysis involved estimating three sick leave models with daily sick leave benefit (DSLB), short sick leaves and long sick leaves. The second step involved

---

[5] Indicator of relative salary:

$\forall\, i = 1, \dots, I$ :: individuals

$\forall\, j = 1, \dots, J$: Departments .

$\forall\, a = 1, \dots, A$: sectors of activity

w_{ija}: : Salary of individual *i* belonging to Department *j* in sector *a*

The relative salary of the individual *i* is calculated by comparing his (w_{ija}) to that of employees in the same sector *a* in the same Department j:

$$WR_{ljk} = \frac{w_{ija}}{\overline{w}_{i_{\in ja}}}.$$

[6] Indicator of severity:

$\forall\, l = 1, \dots, L$: firms.

$\forall\, j = 1, \dots, J$: Departments .

$\forall\, a = 1, \dots, A$: sectors of activity

TG_{lja}: number of days lost for work accidents or occupational diseases in firm *l*, sector *a* in Department *j*.

n_{lja}: total number of hours worked in firm *l*, sector *a* in Department *j*.

We define severity as the number of days lost for work accidents and occupational diseases divided by the number of hours worked in firm *l*, sector *a*, Department *j:*

$$TG^*_{lja} = \frac{TG_{lja}}{n_{lja}}.$$

We then calculate the index of severity of firm *l* by comparing the situation of each firm to the situation of firms in the same sector *a* in the same Department *j*:

$$IG_{lja} = \frac{TG^*_{lja}}{\overline{TG}^*_{l_{\in ja}}}.$$

measuring the relative and absolute differences between situations of different Departments and we used the predictions obtained from the nine different estimations[7] that depend in the explanatory variables of the model:

$$\begin{cases} P_{.j}^{ref} = \dfrac{1}{n_i}\displaystyle\sum_{i=1}^{n_i}(P_{i,j}^{ref}) \\ P_{.j}^{est_k} = \dfrac{1}{n_i}\displaystyle\sum_{i=1}^{n_i}(P_{i,j}^{est_k}). \end{cases}$$

$P_{.j}^{ref}$ is the mean proportion estimated on reference variables (age and sex) of individuals (*i*) having had a sick leave in Department *j*, while $P_{.j}^{est_k}$ is the estimated mean proportion (*k*) of individuals (*i*) having had a sick leave in Department *j*.

The absolute indicator is determined by the absolute difference of mean predictions per Departments, i.e., the difference between the two extreme values for the different determinants included in the regressions:

$$I_{abs}^{k} = 100\left(1 - \frac{\max\left(P_{.j}^{est_k}\right) - \min\left(P_{.j}^{est_k}\right)}{\max\left(P_{.j}^{ref}\right) - \min\left(P_{.j}^{ref}\right)}\right).$$

We then calculated the difference between these two mean proportions and the mean weighted by the population of each Department (n_j is the population of one of these Departments and $N = \sum_j n_j$the total population of the J Departments):

$$E_{.j}^{k} = P_{.j}^{ref} - P_{.j}^{est_k} \;\; and \;\; E_{..}^{k} = \frac{1}{J}\sum_{j=1}^{J}\frac{n_i}{N}\left(E_{.j}^{k}\right).$$

We can now determine the mean square error[8] (MSE) and thus the relative indicator of differences between Departments:

$$MSE^{k} = \frac{1}{J}\sum_{j=1}^{J}\left(E_{.j}^{k} - E_{..}^{k}\right)^{2} \;\; and \;\; I_{rel}^{k} = 100\left(1 - \frac{MSE^{k}}{MSE^{ref}}\right).$$

We thus have two indicators: an absolute indicator (I_{abs}^{k}) that measures changes between extreme situations and a relative indicator (I_{rel}^{k}) that is an indicator of variance evolutions between Departments. If differences between Departments are due only to differences in the distribution of characteristics different models, then the values of these indicators should be zero. If on the other hand, the value of indicators is different from zero and is changed by introducing new variables; this means that the latter are explanatory factors of differences between Departments.

Descriptive statistics and determinants of sick leaves

Descriptive statistics

23.1% of our population took at least one short (< 3 months) or long (> 3 months) sick leave in 2005 (see. table 1). The distribution of the proportion of sick leaves per Department was highly unequal, from 13.1% in the Hautes-Alpes Department to 28.9% in the Ardennes Department. These disparities are also found for short and long sick leaves: 21.2% of our population with a sick leave less than three months increased from 11.4% in the Hautes-Alpes to 26.7% in the Bas-Rhin Department. The population having taken sick leaves of more than three months was very low compared to that of short sick leaves. Only 1.5% of our sample was in this situation and

[7] The nine estimations are as follows. Our reference variables were age and sex
Estimation 1: Reference + individual variables
Estimation 2: Reference + insurance-related variables
Estimation 3: Reference + firm variables
Estimation 4: Effect of composition: reference + individual + insurance-related + firm
Estimation 5: Reference + socio-economic variables
Estimation 6: Reference + healthcare supply variables
Estimation 7: Reference + enterprise variables
Estimation 8: Effect of context: reference+ socio-economic + healthcare supply + enterprise
Estimation 9: Total effect: effect of composition + effect of context

[8] As a result of the construction of this indicator, it is very close to the calculation of a within variance.

the same disparities between Departments are seen, from 0.5% in the Hautes-Alpes and to 2.7% for Alpes-de-Haute- Provence.

The male/female distribution is classical, with 55.1% men and 44.9% women (see table 2). Disparities between Departments are again present: in the Ardennes Department, sick leaves reached almost 62.7% for male employees vs. only 49.5% in the Hautes-Pyrenées. On average, women took slightly more sick leaves than men (23.7% *vs.* 19.1%). This trend was the same for long sick leaves. The distribution of benefit recipients per age corresponded to the population pyramid of private sector employees in France. Here again there were substantial disparities between Departments. Paris with 26.1% of employees younger than 30 was the youngest Department and the Meuse was the oldest with 26.6% of employees older than 50. The proportion of sick leaves increased with age of the benefit recipients whether for short- or long-term sick leaves. In addition, there was a decrease in the 60-65 year-old segment since we are in the presence of the phenomenon of "only healthy workers still on the job".

Two-thirds (68.4%) of employees entered the labour market before their 22nd birthday. The Eure-and-Loir and Cantal Departments had the highest proportion of benefit recipients among young adults on the labour market (38.8% for the under 18 group and 55.4% between 19 and 22). Paris was the Department with the largest number of recipients older than 23 at the moment they entered the labour market. It is important to note the special case of the population older than 27 entering the labour market. This may involve recipients with a long educational career, but also people who never entered the labour market for a variety of reasons and entered it many years later, e.g. housewives after their children enter school, or new residents in France. New entrants on the labour market take more sick leaves than others. The proportion of sick leaves of those entering before the age of 18 is 27.5% and for those entering after the age of 27 is 17.2%. The proportion of short sick leaves also decreased with the age when the person entered the labour market, with 24.5% for short sick leaves for the under 18 segment and 15.9% for the over 27 segment.

In 2004, 11.2% of employees went through a period of unemployment and 8.1% were in this situation in 2003 and in 2004 Disparities between Departments are large, with a minimum of 7.7% in the Yvelines Department and a maximum of 18.3% in the Hautes-Pyrenées in 2004. Successive periods of unemployment do not seem to affect sick leaves (whether short or long). The proportion of benefit recipients having had a short sick leave and who also experienced successive periods of unemployment (2003 and 2004) changed little compared to the proportion of recipients having gone through a period of unemployment only in 2004 (16.2% *vs.* 15.5%). Five per cent of recipients in our sample had a sick leave in 2004, dropping to 1.2% if these events occurred in 2003 and 2004. Among recipients having had a short sick leave in all or part of 2003 and 2004, 60.7% also had a sick leave in 2005.

The different health insurance plans of benefit recipients changes the proportion of sick leaves. In our population, 4.2% of the total are covered by the special Alsace-Moselle insurance plan and the proportion of sick leaves was 28.2% *vs.* 22.9% for those not covered by this plan that is limited to the three Departments of Bas-Rhin, Haut-Rhin and Moselle. The insurance plan for the rest of the country, complementary universal healthcare coverage (UHC-C), could have an effect on taking sick leaves; 2.3% of our population benefited from UHC-C. The proportion of sick leaves was 14.9% while it reached 23.3% for non-recipients. In addition, the geographic distribution of those covered by UHC-C is skewed in France with a minimum of 0.3% in the Hautes-Alpes and a maximum of 5.4% in the Pyrenées-Orientales.

The two principal sectors of activity are services (69.2%) and industry (21.2%). There are large disparities between Departments in the industrial sector with 6% of employees in the Hautes-Alpes compared to 39.6% in the Haute-Marne. There are also considerable differences in the services sector, with 49.2% in the Haute-Marne and 85.4% for Paris. The proportion of sick leaves thus varies considerably according to the sector of activity. The agriculture sector, the smallest in our database, had the highest proportion of long sick leaves (4.7%).

Table 3 contains departmental context data. The average unemployment rate per Department is 9.5%. The unemployment rate in 25% of Departments (1st quartile) is lower than 8.3%, while 25% (3rd quartile) are higher than 10.5%. The Herault is the Department with the highest unemployment rate at 14.6%, while the Lozère has the lowest at 5.8%. The mean birth-rate per Department is 11.8% (1st quartile = 10.5%; 3rd quartile= 12.8%), but geographic distribution is highly unequal since the birth-rate in Seine-Saint-Denis is 18.2% *vs.* 8.9% for the Creuse. The mean density of general practitioners is 158.4 per 100,000 inhabitants (1st quartile = 143.5; 3rd quartile = 169.8). The density of general practitioners in the Eure Department is much lower than Paris, with 117.3 vs. 313.3 general practitioners per 100,000 inhabitants. Concerning verifications by National Health Insurance, the average percentage of short-term sick leaves verified is 13.4 but varies substantially from one

Department to another. The lowest verification percentage is in the Mayenne Department and the highest is in the Nièvre (9.7% vs. 17.3%).

Determinants of sick leaves

We have focused in the interpretation of the estimation results of three probit (probability unit) models that model the probability of being on sick leaves, on sick leaves shorter than three months and on sick leaves longer than three months. The results obtained with the three probit models are shown in table 4. We will first comment on the impact of composition variables on sick leaves, followed by the impact of context variables.

In the case of individual variables, the results of econometric estimations show that men have fewer absences for illness, regardless of the duration. There is a non-linear effect of age on the probability of being on sick leave[9] and being on sick leave for less than three months. Age thus has a negative effect on taking a leave for illness. The negative sign of age squared limits this progression, while age cubed with a positive coefficient shows the increase of this probability. This would seem to confirm the notion that taking a sick leave is more frequent after a certain age and primarily as the subject approaches retirement. At these ages, individuals are in poorer health and healthcare systems are a possible avenue of escape to "pre-retirement". Age has no significant effect on long sick leaves.

Absenteeism for illness is the most frequent among young people entering the labour market (younger than 18), regardless of the duration of the leave. The probability of being on sick leave decreases with the age at which the subject entered the labour market. Thus, compared to the under 18 group entering the market, individuals older than 27 who enter have a probability 7.3 points higher of taking a sick leave. Young people entering the labour market are characterised primarily by a low level of human capital and thus their jobs require low skill levels and are characterised by poor working conditions. Inversely, the last (oldest) group entering the labour market is generally composed of people with extensive education, employed in positions of responsibility and whose working conditions are excellent.

Periods of unemployment during a professional career affect behaviour that determines absenteeism. Thus, the individual who was unemployed for all or part of 2003 was less inclined to take sick leaves: the probability for sick leaves in general decreased by 10 points, by 8 points for short leaves and by 0.1 point for sick leaves longer than three months. One explanation for this is the existence of a labour discipline effect. Benefit recipients who were in a situation of unemployment in 2004 and 2003 had a higher probability of being on sick leave. This variable identifies the long duration unemployed or individuals with a particularly difficult career on the labour market and with special health characteristics. Concerning prior sick leaves, the employee who had sick leaves the previous year will tend to take more sick leaves: the probability of sick leaves increased by 5.7% for sick leaves shorter than three months and by 2.6% for long sick leaves for people previously on sick leave in 2004. The variable "old-age insurance for parents at home" (OIPH) is used as a proxy for the presence of children at home. It is generally supposed that sick leave is taken more for women because their children are at home. Being the recipient of OIPH in 2004 had a negative and significant effect on the probability of a sick leave and only for long sick leaves. On the contrary, the probability of recipients with OIPH in 2004 and 2003 being on sick leave was 2.2 points higher.

Concerning employment characteristics, part-time employees and those working at home have a lower probability of taking a sick leave that those working full time. The empirical results confirm the Shapiro-Stiglitz theoretical predictions of efficiency wages (1984), according to which salary considerably reduces the probability of absenteeism. Salary has a negative effect on the probability of being absent and this effect stabilises for very high salaries. These differences can be explained either by a factor "obligation of presence" for the most highly qualified and for those with positions of responsibility or by an effect related to working conditions. Highly paid positions are thus subjected to fewer risks and thus to fewer sick leaves[10].

Concerning firm-related variables, the number of employees is positively correlated with the individual probability of being on sick leave (Ose, 2003). In large firms (perhaps for reasons of less strict control, fewer constraints, less involvement), the absence of a given employee will tend to have less of a negative effect than in

[9] The two points of inflexion are 35 and 55 years for all sick leaves, and 37 and 50 for short leaves

[10] This result is in contradiction to the efficiency wage theory (Ose, 2003; Shapiro and Stiglitz, 1984), according to which an employee with good working conditions will accept a lower salary than an employee with more difficult working conditions in order to compensate the difficulties incurred.

the case of small firms (Weiss, 1985). There may also be differences in production procedures. Thus and compared to an industrial sector, all sectors have a negative and significant effect on the probability of sick leaves. The sectors of agriculture, construction and services have 8.8%, 6.1% and 4.7% fewer chances, respectively, of sick leaves compared to industry.

We will now focus our analysis on effects of context. As a result of its construction, the indicator of severity can be considered as a proxy for working conditions in the firm: the higher the indicator of severity, the higher the risks for the employee compared to other firms in the same sector of activity and in the same Department. Our results show a positive relationship between the firm's indicator of severity and individual sick leaves. The other firm-related context factor is the indicator of relative salary. Introducing this variable enables us to test the results of the theory of efficiency wages (Shapiro and Stiglitz, 1984), where we find a negative correlation. Thus, a high indicator of relative salary is the reflection of a mean salary in the firm that is higher than that of comparable enterprises and is negatively related to individual sick leaves. Salary thus has a dual effect: an individual effect and a relative effect.

Finally, concerning Department variables, we decided to introduce multilevel variables and to determine if there are absolute and saturation effects. For socio-demographic variables, our results show a significant relationship between the unemployment rate and absenteeism for illness (Bliksvaer and Helliesen, 1997). The unemployment rate of a Department also has a positive and significant effect on short sick leaves. Departments with a high unemployment rate also have a higher probability of sick leaves.

Concerning the variables of medical supply and health insurance, the density of general practitioners has a significant concave effect on taking sick leaves. A Department with low density increases the individual probability of being on sick leave. There is a saturation effect starting at 147 physicians per 100,000 inhabitants. Beyond this threshold probability starts to decrease. The percentage of verification of short sick leaves by National Health Insurance negatively and significantly influences taking sick leaves: the probability of sick leave decreases when the frequency of verifications in the Department increases. This may be proof of its effectiveness in decreasing the probability of "shirker" (malingerers) (Ross, 1973; Lazear, 1979). The percentage of chronic diseases in the Department has significant effects on the three types of sick leaves. The probability of sick leaves increases once the percentage of chronic diseases in the Department increases. This relationship is inverted when we consider leaves longer than three months. The birth-rate of a Department has the expected effect on taking sick leaves: it is significant and concave. The relation between birth-rate and sick leaves is stronger for short leaves than for long sick leaves.

Our different models point out the expected effects: composition and context variables indeed have an impact on taking sick leaves. Nevertheless, this first part of our analysis is not sufficient since it does not measure the supply of information from each group of variables. This is why we conducted an analysis of difference and of variance between Departments to obtain this information.

Geographic disparities: effects of composition and context

As we explained, two indicators were created: an absolute indicator (I_{abs}) that measures changes between extreme situations, i.e., the difference in probability of being on sick leaves between the Department where leaves are the highest and the Department where they are the lowest, and a relative indicator (I_{rel}) that is a reflection of changes of variance between Departments, i.e. the mean square difference of probabilities of being on sick leaves for all Departments.

The first observation involves the explanatory power of all of our variables in order to understand differences between Departments. Concerning the absolute indicator, all variables explain 42.4% of absolute differences of the probability of being on sick leave between Departments. This proportion is the same for short sick leaves (39.3%). Our different determinants also explain differences between Departments of being on sick leave longer than three months (all variables explain 23.0% of absolute differences). For the relative indicator, all our variables explain 65.5% of the mean square error of the reference model. This proportion is similar to that of the probability of being on sick leave shorter than three months (63.7%). For long sick leaves, the variables significantly explain 48.1% of disparities between Departments.

The second observation involves the difference between the effect of composition and the effect of context. There seem to be no significant differences between the two effects since either can explain the disparities between Departments. Concerning the absolute indicator, the effect of composition thus explains 23.5% of the

maximum difference of probabilities of being on sick leave between Departments, while the effect of context explains 34.7% of this maximum difference (21.5% and 30.7% for the probability of being on sick leave shorter than three months). Concerning the relative indicator, the proportions of the mean square error explained by the effect of composition are 45.4% and 47.5% for the effect of context of the probability of being on sick leave (43.6% and 46.1% for the probability of being on sick leave shorter than three months, and 43.9% and 11.4% for the probability of being on sick leave longer than three months).

The third observation involves on specific variables into the both effects: effects of context and effects of composition. For the effect of composition, we consolidated the variables into three sub-groups called "individual" (age when entering the labour market, work status of the benefit recipient in 2004 and 2003, previous situation on the labour market), "insurance-related" (covered by the special Alsace-Moselle plan, UHC, status change concerning UHC, being on chronic disease) and "firm" (salary, firm size and sector of activity). For the effect of context, we consolidated the variables into three sub-groups called "socio-economic" (unemployment rate, birth-rate), "insurance and supply" (density of general practitioners, percentage of chronic diseases and verification of sick leaves) and "enterprise" (indicator of relative salary and Department, risk ratio per sector of activity and per Department). The first finding is that there is a difference between the absolute indicator and the relative indicator: whereas all groups of variables are significant for explaining the relative indicator, only two ("individual" for effects of composition and "insurance and supply" for effects of context) are significant for explaining the absolute indicator. All groups of variables, with varying degrees of importance, explain the mean square error (relative indicator) of proportions of sick leaves, but only the two above-mentioned groups provide an explanation of extreme situations. It is to be noted that these two groups are also those that best explain the relative indicator. Concerning effects of composition, variables of the "individual" group explain 19.1% (I_{abs}) of the absolute indicator and 29.4% (I_{rel}^{k} of the relative indicator for the probability of a sick leave. It is thus individual variables that better explain the effect of composition, confirming observations made during the analysis of descriptive statistics. For effects of context, "insurance and supply" apparently play a predominant role for both the absolute and relative indicators. For the probability of being on sick leave, the proportion explained by the indicators are I_{abs} = 34.4% and I_{rel} = 42.4%; for the probability of being on sick leave of less than three months, the proportions are I_{abs} = 32.1% and I_{rel} = 42.4%.

The fourth observation involves on specific variables into two groups of variables that best explain disparities between Departments, i.e., the "individual" effect of composition and the "insurance and supply" effect of context (see table 6). The variables included in these two groups do not have the same effects on the two indicators. The three most determinant variables are: the percentage of sick leaves verified (I_{abs} = 25.7% and I_{rel} = 31.6%), the density of general practitioners (I_{abs} = 21.5% and I_{rel} = 28.8%) and the age when entering the labour market (I_{abs} = 12.8% and I_{rel} = 23.0%). Prior work status also explain disparities between Departments (I_{abs} = 4.4% and I_{rel} = 7.6%) but to a lesser extent. These two composition variables partly reflect the "past" (or original) situation of individuals with respect to the labour market. They could demonstrate the phenomena of hysteresis in the relationship between the structure of the labour market and the proportion of sick leaves.

Just as in the analysis of other types of healthcare expenditures or inequalities of healthcare, geographic disparities of sick leaves are the consequence of differences in the healthcare supply and the number of verifications conducted by National Health Insurance, more than differences of composition, even if the situation of the labour market seems to have a certain degree of importance.

Conclusion

The purpose of this work was to understand disparities in sick leaves in different French Departments. While cyclical macroeconomic changes have been studied often, the same cannot be said of geographic differences. Using the Hygie database constructed by merging several administrative files of private sector employees in France in 2005, and after discussing the various determinants of sick leaves and their importance for understanding geographic disparities, we conducted a 3-step empirical analysis: (1) a descriptive analysis to detect differences between Departments, (2) a multivariate analysis to highlight explanatory factors of individual probability of being on sick leave and (3) an analysis of determinants of differences between Departments using two specific indicators.

Our models have enabled us to show that a considerable part of disparities between Departments can be explained. The effects of composition and the effects of context account for about half of the absolute indicator (variation of the absolute difference) and two-thirds of the relative indicator (variation of the mean square error).

Among the groups of variables we created, "insurance and supply" and "individual" variables best explain disparities between Departments. More precisely, the percentage of sick leaves verified, that can be taken as a control of moral hazard, and the density of general practitioners that require thought being given to physician-induced demand, and the "prior" situation on the labour market would seem to explain differences between Departments.

In contrast to other composition or context variables that that are either affected by a proven temporal change inertia, e.g. birth rate, the industrial sector, etc., or variables for which health policy has few effects, e.g. policy of remunerating enterprises, unemployment rate, the percentage of sick leaves verified and the density of general practitioners are levers of health policies. Our research shows that they could be used as public policy instruments aimed at reducing geographic disparities. It is nevertheless possible to ask if this reduction is desirable since disparity does not automatically mean inequality and even inequity.

Forthcoming work to validate our results will be based on the panel dimension of the Hygie database. We will thus be able to examine these disparities between Departments by taking two specific phenomena into account: the analysis of causality links between determining variables and sick leaves, and an "employers/employees" analysis more detailed than with the introduction of variables of efficiency wages and index of severity.

References

Abowd J., Kramarz F. and S. Woodcock (2008): Econometric Analyses of Linked Employer-Employee Data, in *The Econometrics of Panel Data*, Matyas and Sevestre (eds.), pp. 727-760.

Acevedo-Garcia D and Lochner K.A. (2003): Residential segregation and health, in *Neighborhoods and Health* Kawachi and Berkman (eds.), pp. 265-81.

Aiuppa T. and Trieschniann J. (1998): Moral Hazard in the French Workers' Compensation System, *The Journal of Risk and Insurance*, 65 (1), pp. 125-133.

Allen S.G. (1981): An empirical model of work attendance, *Review of Economics and Statistics*, 63, pp. 77–87.

Arai M. and Thoursie P. (2005): Incentives and selection in cyclical absenteeism, *Labour Economics*, 12, pp. 269–280.

Askildsen J.E., Bratberg E and Nilsen Ø. (2005): Unemployment, labour force composition and sickness absence: A panel data study, *Health Economics*, 14, pp. 1099-1050.

Barmby T., Ercolani M. (2010): Understanding the North-South divide in UK employees' sickness absence: a Blinder-Oaxaca decomposition

Barmby T., Orme C. and Treble J. (1995): Worker absence histories: a panel data study, *Labour Economics*, 2, pp. 53-65.

Barmby T. and Treble J. (1991): Absenteeism in a median-sized manufacturing plant, *Applied Economics*, 23, 161–166.

Barmby, T. and Stephan, G. (2000): Worker Absenteeism: Why Firm Size May Matter, *Manchester School*, 68(5), pp. 568-77.

Benabou R. (1993): Workings of a City: Location, Education, and Production, *The Quarterly Journal of Economics*, 108 (3), pp. 619-652.

Blanchet D. and Debrand T. (2007): Souhaiter prendre sa retraite le plus tôt possible: santé, satisfaction au travail et facteur monétaire, *Economie et Statistique*, 403-404, pp. 39-62.

Bliksvaer T. and Helliesen A. (1997): A study of 11 LES countries, *Luxembourg Employment Study working paper* No. 3.

Bolin K., Lindgren A. and Lundborg P. (2008): Utilization of physician service in the 50+ population. The relative importance of individual versus institutional factor in ten European countries, *NBER Working paper* No. 14096.

Borjas G. (1998): To Ghetto or Not to Ghetto: Ethnicity and Residential Segregation, *Journal of Urban Economics*, 44(2), pp. 228-253

Bound J. (1991): Self-Reported versus Objective Measures of Health in Retirement Models », *Journal of Human Resources*, 26 (1), pp. 106-138.

Bridges S. and Mumford K. (2001): Absenteeism in the UK: A Comparison across Genders, *Manchester School*, 69(3), pp. 276-284.

Browning M., Dano A.M., and Heinesen E. (2006): Job displacement and stress-related health outcomes, *Health Economics*, 15(10), pp. 1061-1075.

Butler R. and Worrall J. (1991): Claims Reporting and Risk Bearing Moral Hazard in Workers' Compensation, *The Journal of Risk and Insurance*, 58 (2), pp. 191-204.

Case A. and Deaton A. (2003): Broken down by work and sex: how our health declines, *NBER Working Paper* 982.

Chaupain-Guillot S. and Guillot O. (2007): Les absences au travail: une analyse à partir des données française du panel européen des ménages, Economie et Statistique, 408-409, pp. 45-75.

Congdon P., Shouls S. and Curtis S. (1997): A multi-Level perspective on small area health and mortality: a case study of england and Wales, *International journal of population geography*, 3, pp. 243-263

Crane J. (1991): The Epidemic Theory of Ghettos and Neighborhood Effects on Dropping Out and Teenage Childbearing, *The American Journal of Sociology*, 96 (5), pp. 1226-1259.

Cutler D., Glaeser E. and Vidgor J. (1999): The rise and decline of the American Ghetto, *Journal of Political Economy*, 107, pp. 455-506.

Depardieu D. and Lollivier S. (1985): Les facteurs de l'absentéisme, *Economie et Statistique*, 176(1), pp. 15-26.

Dionne G. and Michel P. (1991): Workers' compensation and moral hazard, *The Review of Economics and Statistics*, 73 (2), pp. 236-244.

Dunn L. and Youngblood S. (1986): Absenteeism as a mechanism for approaching an optimal labor market equilibrium: an empirical study, *Review of Economics and Statistics*, 68, pp. 668–674.

Engellandt A. and Riphahn R. (2005): Temporary contracts and employee effort, *Labour Economics*, 12(3), pp. 281-299.

Ekblad K. and Bokenblon M. (2010): Sickness absence and local cultures, Working paper, *Swedish Business School*

Expert A. (2007): Les disparités géographiques de consommation d'indemnités journalières maladie », *CNAM Point Repère* No. 11.

Fahr R. and Frick B. (2007): On the Inverse Relationship between Unemployment and Absenteeism: Evidence from Natural Experiments and Worker Heterogeneity, *IZA Discussion Paper* No. 3171.

Grignon M. and Renaud T. (2007): Sickness and injury leave in France: Moral hazard or strain, *IRDES Working Document* No. 4.

Haltiwanger J., Lane J., Spletzer J. and Troske K. (1999): *The Creation and Analysis of Employer-Employee Matched Data*, North-Holland.

Henrekson M. and Persson M. (2004): The effects on sick leave of changes in the sickness insurance system, *Journal of Labor Economics*; 22, pp. 87–113.

Ichino A. and Maggi G. (2000): Work environment and individual background: explaining regional shirking differentials in a large Italian firm, *The Quarterly Journal of Economics*, 115 (3), pp. 1057-1090.

Johansson P. and Palme M. (2002): Assessing the effect of public policy on worker absenteeism, *Journal of Human Resources*, 37, pp. 381–409.

Johansson P. and Palme M. (2005): Moral hazard and sickness insurance, *Journal of Public Economics*, 89, pp. 1879–1890.

Kawachi I. and Berkman L.F. (2003): *Neighborhoods and health*, Oxford University Press.

Kuhn A., Lalive R. and Zweimüller J. (2009): The public health costs of job loss, *Journal of Health Economics*, 28(6), pp. 1099-1115.
Kusnik-Joinville O., Lamy C., Merlière Y. and Polton D. (2006): Déterminants de l'évolution des indemnités journalières maladie, *CNAM Point Repère* No. 5.
Lazear E. (1979): Why is there mandatory retirement? *Journal of Political Economy*, 87, pp. 1261-1284.
Leigh P. (1983): Sex differences in absenteeism, *Industrial Relations*, 22, pp.349-361.
Leigh P. (1985): The effect of unemployment and the business cycle on absenteeism, *Journal of Economics and Business*, 37, pp. 170-195.
Leigh P. (1991): Employee and job attributes as predictors of absenteeism in a national sample of workers: the importance of health and dangerous working conditions, *Social Science & Medicine*, 33 (2), pp. 127-137.
Little A. (2009): Spatial Pattern of Economic Activity and Inactivity in Britain: People or Place Effects? *Regional Studies,* 43 (7), pp. 877 - 897
Livanos I. and Zangelidis A. (2010): Sickness Absence: a Pan-European Study, *MPRA Paper* No. 22627.
Olsson M. (2009): Employment protection and sickness absence, *Labour Economics*, 16, pp. 208-214.
Ose S. (2005): Working conditions, compensation and absenteeism, *Journal of Health Economics*, 24, pp. 161-188.
Primoff Vistnes J. (1997): Gender Differences in Days Lost from Work Due to Illness, *Industrial and Labor Relations Review*, 50 (2), pp. 304-323.
Puhani P. and Sonderhof1 K. (2010): The effects of a sick pay reform on absence and on health-related outcomes, *Journal of Health Economics*, 29, pp. 285–302.
Rhodes S. and Stears R. (1984): Knowledge and speculation about absenteeism, Goodman and Atkin (Eds.), *Absenteeism: New approaches to understanding measuring and managing* absence, pp. 229-275.
Rice T. (1983): The Impact of Changing Medical Care Reimbursement Rates on Physician- Induced Demand, Medical Care, 21 (8), pp. 803-815.
Ross S. (1973): The Economic Theory of Agency: The Principal's Problem, *American Economic Review*, 63, pp. 134-139.
Shapiro C. and Stiglitz J. (1984): Equilibrium unemployment as a worker discipline device, *The American Economic Review*, 74 (3), pp. 433-444.
Strauss J. and Thomas D. (1998): Health, Nutrition, and Economic Development, *Journal of Economic Literature*, 36 (2), pp. 766-817.
Subramanian S., Kawachi I and Kennedy BP (2001): Does the state you live in make a difference? Multilevel analysis of self-rated health in the US, *Social Science and Medicine*; 53, pp. 9–19.
Valssenko E. and Willard J-C. (1984): Absentéisme: le poids des facteurs collectifs, *Economie et Statistique*, 164 (1), pp. 39-51.
Weiss A. (1985): Absenteeism and wages, *Applied Economics*, 19, pp. 277-279.
Zenou Y. (2000): Urban unemployment, agglomeration and transportation policies, Journal of Public Economics, 77 (1), pp. 97-133.

Table 1: Proportion of sick leaves

	Proportion of sick leaves (%) in the sample	Minimum according to Departments (%)	Maximum according to Departments (%)
At least one DSLB[1]	23.1	13.1	28.9
At least one DSLB of less than three months	21.2	11.4	26.7
At least one DSLB of more than three months	2.7	1.2	5.2

[1] daily sick leave benefit

Table 2: Descriptive statistics of individuals of the sample

	Study sample (%)	Minimum (%) according to Departments	Maximum (%) according to Departments	Percentage of the population with one sick leave	Percentage of the population with one sick leave less than 3 months	Percentage of the population with one sick leave more than 3 months
sex						
Male	55.1	49.5	62.7	20.7	19.1	2.3
Female	44.9	37.3	50.5	25.9	23.7	3.2
Age						
[25 30[	16.3	11.4	22.1	21.5	20.5	1.6
[30 35[	16.8	12.7	20.1	23.3	22.1	1.9
[35 40[	16.3	12.7	20.0	22.7	21.4	2.0
[40 45[	15.2	12.2	18.9	22.1	20.5	2.3
[45 50[	13.5	9.7	19.8	23.4	21.3	3.0
[50 55[	11.9	8.8	15.6	25.2	22.2	4.1
[55 60[	8.8	7.0	12.1	25.4	21.2	5.4
[60 65[	1.3	0.4	3.5	18.6	15.0	4.3
Age when entering the labour market						
Younger than 18	24.4	8.2	38.8	27.5	24.5	4.9
19-22	44.0	28.8	55.4	24.3	22.5	2.6
23-26	22.6	13.8	40.1	18.3	17.1	1.6
Older than 27	9.1	3.7	22.9	17.2	15.9	1.8
Work status: undergone an episode of unemployment						
No unemployment in 2004	88.8	81.7	91.5	23.9	21.9	2.8
Unemployment episode in 2004	11.2	7.7	18.3	16.7	15.5	1.7
No unemployment in 2003 and 2004	91.9	86.1	94.6	23.6	21.6	2.7
Unemployment episode in 2003 and 2004	8.1	5.4	13.9	17.5	16.2	1.8
Work status: having been on sick leave						
No sick leave in 2004	95.0	92.0	97.3	21.7	20.7	1.6

Sick leave episode in 2004	5.0	2.7	8.0	48.9	31.1	22.4
No sick leave in 2003 and 2004	98.8	97.0	99.8	22.6	21.0	2.8
Sick leave episode in 2003 and 2004	1.2	0.2	3.0	60.7	33.3	34.4
Recipient of old-age insurance for parents at home (OIPH)						
No OIPH benefits in 2004	96.1	93.7	98.0	23.1	21.2	2.7
Top OIPH in 2004	3.9	2.0	6.3	23.4	21.9	2.3
No OIPH benefits in 2003 and 2004	96.9	94.5	98.6	23.1	21.2	2.7
Top OIPH in 2003 and 2004	3.1	1.4	5.5	22.9	21.4	2.3
Work time						
Full time	74.6	57.6	81.3	23.7	21.9	2.6
Part time, at home and other	25.4	13.2	38.1	21.4	19.3	3.4
Type of health insurance						
Special Alsace Moselle plan	4.2	0.0	87.1	28.2	26.5	2.7
General French plan (excluding Alsace-Moselle)	95.8	12.9	100	22.9	21.0	2.5
Recipient of universal health coverage (UHC)	2.3	0.3	5 .4	14.9	13.6	2.7
Not benefiting from UHC	97.7	94.6	99.7	23.3	21.4	1.8
Status changed with UHC during the year	1.9	0.4	3.9	32.9	30.1	4.0
Status not changed with UHC	98.1	96.1	99.6	22.9	21.0	2.6
With a chronic disease	6.5	4.6	10.2	42.7	31.4	14.9
Without a chronic disease	93.5	89.8	95.4	21.7	20.5	1.8
Sector						
Industry	21.2	6.0	39.6	28.1	26.1	3.0
Agriculture	0.0	0.0	0.6	19.6	17.8	4.7
Construction	6.1	1.7	11.4	20.2	18.5	2.3
Services	69.2	49.2	85.4	22.1	20.2	2.6
Total	**262,998**	**267**	**11,638**	**60,675**	**55,718**	**7 006o**

Table 3: Descriptive statistics of Department variables

	Mean	1st quartile	3rd quartile
Salary of benefit recipients	€ 20,300.40	€ 10, 640.50	€ 25,274.20
Number of worker in the firm	268	10.7	188.1
Mean annual unemployment rate	9.5	8.3	10.5
Birth-rate	11.8	10.5	12.8
Indicator of relative salary	1.3	0.9	1.3
Risk ratio	-0.04	-0.09	0.03
Percentage of chronic disease	13.3	12.1	14.3
Percentage of sick leaves verified	13.4	11.2	14.8
Density of general practitioners	158.4	143.5	169.8

Table 4: Determinants of daily sick leave benefits paid by National Health Insurance (marginal effects)

	Probability of being on sick leave	Probability of being on sick leave less than 3 months	Probability of being on sick leave more than 3 months
Sex			
Male	-0.056***	-0.057***	-0.0003***
Female	***ref***	***ref***	***ref***
Age of benefit recipient			
Age	0.240***	0.227***	-0.006
Age squared	-0.056***	-0.054***	0.001
Age cubed	0.004***	0.004***	-0.000
Age when entering the labour market			
Younger than 18	***ref***	***ref***	***ref***
19-22	-0.019***	-0.020***	0.000
23-26	-0.062***	-0.061***	-0.0003***
Older than 27	-0.073***	-0.066***	-0.001***
Work status: having been unemployed			
Unemployment in 2004	-0.103***	-0.089***	-0.001***
Unemployment in 2003 and 2004	0.045***	0.039***	0.001***
Work status: having been on sick leave			
Sick leave in 2004	0.181***	0.057***	0.026***
Sick leave in 2003 and 2004	0.091***	0.003	0.001***
Receiving of old-age insurance for parents at home (OIPH)			
Top OIPH in 2004	-0.042***	-0.007	-0.001***
Top OIPH in 2003 and 2004	0.022**	-0.012	0.003***
Type of health insurance			
Special Alsace-Moselle plan	0.038***	0.042***	0.000
Recipient of universal health coverage (UHC)	-0.148***	-0.136***	-0.001***
Status with UHC changed in the course of the year	0.240***	0.230***	0.002***
With chronic disease	0.176***	0.101***	0.012***
Work time			
Full time	***ref***	***ref***	***ref***
Part time, at home or other	-0.050***	-0.042***	-0.001***
Salary			
Salary	-0.274***	-0.132***	-0.027***
Salary squared	0.042***	-0.025***	0.028***
Salary cubed	-0.002***	0.001***	-0.008***
Characteristics of the firm			
Number of employees in the firm (×10)	0.020***	0.018***	0.002***
Number of employees in the firm squared (×10²)	-0.001***	-0.001***	0.000***
Sector			
Industry	***ref***	***ref***	***ref***
Agriculture	-0.088**	-0.085**	0.003*
Construction	-0.061***	-0.054***	-0.001***
Services	-0.047***	-0.044***	-0.001***
Economic context			
Mean annual unemployment rate	0.003***	0.003***	0.000
Birth-rate	0.032***	0.025***	0.001***
Birth-rate squared	-0.001***	-0.001***	-0.000***
National Health Insurance			
Density of general practitioners per 100,000 inhabitants (×10²)	0.055***	0.050***	0.001
Density of general practitioners per 100,000 inhabitants squared ($\times 10^4$)	-0.019***	-0.017***	-0.000*
Percentage of chronic disease s(×10²)	0.066***	0.013**	0.005*
Percentage of sick leaves verified	-0.002***	-0.003***	-0.000
Context of the enterprise			
Indicator of relative salary	-0.005***	-0.005***	-0.000
Indicator of severity of accidents (×10²)	0.853***	0.987***	-0.007
Number of observations	262,998	262,998	262,998
Number of observations (sick leave = 1)	60 675	55 718	7 006
Wald χ^2 (35)	31,436.49	21,797.95	20,077.15
Prob > χ^2	0	0	0
Pseudo R2	0.05	0.03	0.27
Obs. P	0.23	0.21	0.03

*Significance threshold: * 0:10%; ** 0:5%; *** 0: 1%*

Table 5: Analysis of difference and variance between Departments.

	Probability of being on sick leave	Confidence interval	Probability of being on sick leave less than 3 months	Confidence interval	Probability of being on sick leave more than 3 months	Confidence interval
Absolute indicator						
Reference	***0.00***		***0.00***		***0.00***	
Individual	19.17	(12.8; 25.5)	16.18	(11.4; 20.9)	12.02	(-4.8; 28.8)
Insurance-related	0.25	(-4.5; 5.0)	1.03	(-3.8; 5.9)	7.54	(-3.4; 18.5)
Firm	4.70	(-6.1; 15.5)	6.85	(-1.4; 15.1)	-9.84	(-29.3; 9.6)
Effect of composition	**23.53**	**(12.8; 34.3)**	**21.52**	**(12.8; 30.2)**	**19.47**	**(-2.0; 41.0)**
Socio-economic	4.02	(-1.8; 9.8)	3.43	(-0.8; 7.6)	1.83	(-5.1; 8.7)
Insurance and supply	34.43	(20.4; 48.5)	32.16	(17.2; 47.1)	2.28	(-8.7; 13.3)
Enterprise	1.28	(-2.1; 4.7)	0.81	(-2.3; 3.9)	0.27	(-0.9; 1.5)
Effect of context	**34.71**	**(20.0; 49.4)**	**30.76**	**(15.3; 46.2)**	**2.72**	**(-9.1; 14.6)**
Total effect	***42.46***	***(27.5; 57.4)***	***39.33***	***(23.0; 55.7)***	***23.04***	***(2.8; 43.3)***
Relative indicator						
Reference	***0.00***		***0.00***		***0.00***	
Individual	29.45	(26.1; 32.8)	26.43	(23.1; 29.7)	26.51	(17.5; 35.5)
Insurance-related	7.65	(4.1; 11.2)	9.11	(6.0; 12.2)	6.88	(0.9; 12.8)
Firm	20.81	(17.2; 24.4)	20.67	(18.0; 23.4)	14.29	(7.0; 21.6)
Effect of composition	**45.44**	**(40.4; 50.5)**	**43.64**	**(38.8; 48.4)**	**43.91**	**(33.9; 53.9)**
Socio-economic	9.70	(6.7; 12.7)	8.82	(5.7; 11.9)	6.75	(2.8; 10.7)
Insurance and supply	42.43	(34.0; 50.9)	42.43	(34.2; 50.6)	6.15	(-1.7; 14.1)
Enterprise	1.72	(1.2; 2.4)	1.58	(1.0; 2.1)	0.51	(-0.1; 1.2)
Effect of context	**47.55**	**(38.5; 56.6)**	**46.19**	**(36.8; 55.5)**	**11.47**	**(4.2; 18.7)**
Total effect	***65.56***	***(57.9; 73.2)***	***63.79***	***(56.0; 71.6)***	***48.14***	***(38.4; 57.9)***

*Note: the mean of effects is based on 400 simulations using the initial database. confidence intervals were calculated from the mean of the simulation ±1.96*standard deviation of the simulation.*

Reference: Age (square and cube), sex,

1- Individual: age when entering the labour market, work status of benefit recipient in 2004 and 2003, prior situation on the labour market, work time.
2- Insurance-related: benefit recipient of the special Alsace-Moselle plan, UHC, having changes UHC status, chronic disease
3- Firm: salary (squared and cubed), firm size, sector of activity,
4- Effect of composition: individual + insurance-related + firm (1+2+3)
5- Socio-economic: unemployment rate, birth-rate (and its square).
6- Insurance and supply: density of general practitioners, percentage of chronic diseases, verification of sick leaves
7- Enterprise: indicator of relative salary and Department, degree of seriousness of occupational accidents per sector of activity and per Department.
8- Effect of context: Socio-economic + healthcare supply + enterprise (4+5+6)
9- Total effect: effect of composition + effect of context (4+8)

Table 6: Analysis of difference and variance of key variables between Departments.

	Probability of being on sick leave	Confidence interval	Probability of being on sick leave less than 3 months	Confidence interval	Probability of being on sick leave more than 3 months	Confidence interval
Absolute indicator						
Individual effect	**19.17**	**(13.8; 25.5)**	**16.18**	**(11.4; 20.9)**	**12.02**	**(-4.8; 28.8)**
Age when entering the labour market	12.86	(6.1; 19.6)	11.33	(5.3; 17.3)	0.24	(-6.1; 6.5)
Work time	2.53	(-1.3; 6.4)	3.20	(-0.8; 7.2)	0.03	(-0.3; 0.4)
Prior work status	4.44	(0.7; 8.2)	1.81	(-0.2; 3.8)	13.31	(-2.1; 28.8)
Insurance and supply effect	**34.43**	**(20.0; 47.6)**	**32.16**	**(17.2; 47.1)**	**2.28**	**(-8.7; 13.3)**
Density of general practitioners	21.59	(14.1; 29.1)	19.66	(12.1; 27.2)	1.58	(-4.4; 7.5)
Percentage of chronic diseases	1.12	(-4.9; 7.1)	1.59	(-3.7; 6.9)	0.60	(-1.5; 2.7)
Percentage of sick leaves verified	25.75	(9.0; 42.5)	24.61	(7.9; 41.3)	-2.57	(-15.5; 10.3)
Relative indicator						
Individual effect	**29.45**	**(26.1; 32.8)**	**26.43**	**(23.61; 29.7)**	**26.51**	**(17.5; 35.5)**
Age when entering the labour market	23.00	(20.3; 25.7)	21.80	(18.9; 24.6)	2.35	(-0.3; 5.1)
Work time	2.66	(1.8; 3.5)	3.27	(2.3; 4.2)	-0.05	(-0.1; 0.03)
Prior work status	7.66	(5.1; 10.2)	3.70	(2.3; 5.1)	26.21	(17.7; 34.7)
Effect Insurance and supply	**42.43**	**(33.6; 51.1)**	**42.43**	**(34.2; 50.6)**	**6.15**	**(-1.7; 14.1)**
Density of general practitioners	28.80	(25.0; 32.6)	28.11	(24.2; 32.0)	4.12	(2.1; 6.1)
Percentage of chronic diseases	0.94	(-2.4; 4.3)	2.37	(-1.3; 6.1)	1.14	(0.1; 2.1)
Percentage of sick leaves verified	31.62	(20.4; 42.9)	33.48	(22.4; 44.5)	-1.69	(-9.8; 6.4)

*Note: the mean of effects is based on 400 simulations using the initial database. confidence intervals were calculated from the mean of the simulation ±1.96*standard deviation of the simulation.*