The Effects of the Complementary Sickness Benefits (CSB) on Sick Leave Duration: an Approach Based on Collective Bargaining Agreements

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Abstract*

In France, wage-replacement benefits that cover employee absences due to illness are financed via a three-tier system. The first tier is compulsory and provides identical coverage to all employees. It includes per diem sickness benefits that are paid by the National Health Insurance scheme and complemented by the employer. The second tier consists of complementary private insurance coverage that is provided by the employer with respect to collective bargaining agreement s (CBA). The third-tier is managed at the firm level and is not addressed in this paper.

We use a rather detailed description of the allowance parameters for the 46 most representative collective agreements and the HYGIE database enriched with collective agreement allowance parameters.

The empirical estimations enable us to study the impact of different levels of complementary sickness benefits on the frequency of sickness absences (fixed effects logistic model), the number of days of sick leave per year (fixed effects negative binomial model), and sick-leave duration (discrete time proportional hazard model). The results show that the simple presence of a CBA has a positive effect on the probability of having a sick-leave spell during a given year, the number of sick days and sick-leave duration. The same applies to the waiting period. A waiting period of less than the 10-day legal minimum is associated with more frequent and longer sickness absences and a higher number of absent days. The wage replacement rate by sub-periods (1-3, 4-10, 41-70, 71-90) also has a globally positive effect on the three aspects of sickness absence.

I. INTRODUCTION

Every year, nearly one out of every five employees experience a spell of sickness absence from work. The number of days of leave that are taken for non-work-related illness has increased steadily over the last ten years. The number of paid sick days funded by the National Health Insurance Fund for Salaried Workers (CNAMTS) increased from 180 million in 2008 to 205 million in 2011. In tandem, the cost of statutory sick-days covered by the general health insurance scheme increased from 4.3 billion euros in 2000 to 6.4 billion euros in 2011. These expenditures constitute a key issue for French public finance.

The generosity of sickness insurance coverage and its impact on employees' work absence behavior highly depend on national institutional backgrounds. FRICK and MALO [2005] specifically note the role played by the level of both social protection and wage compensation in the case of illness. The average

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number of sick days varies considerably across European countries, with the main part of this variability due to differences in sickness benefit levels. Sickness insurance coverage is thus both a key public health policy issue and a labor market policy issue in its effects on labor supply.

In the current article, we analyze the relationship between sickness benefits and sickness absence from work. We focus on the duration and frequency of sick-leave spells. The contribution of this study is two-fold. First, we document an important (but thus far neglected) aspect of the sickness insurance scheme that is provided by collective bargaining agreements (CBA). Supplementary benefits that are provided by CBA substantially modify the guaranteed statutory benefits by optionally enhancing the benefits that are delivered to the sick employee. It also creates significant disparities in risk coverage between employees. Each CBA has a specific profile in terms of sickness insurance marked by day-by-day variations in wage replacement rates. We compute the day-by-day wage replacement rate for the most representative CBA, which covered approximately 60% of private sector employees.

The second contribution of this study is that it assesses the impact of wage replacement rate on sick-leave duration by exploiting the time-varying wage replacement rate in a duration model. The daily value of the wage replacement rate has a significant effect on the instantaneous probability of leaving the work absence state. To perform this assessment, we used a discrete time duration model with a piecewise constant hazard. We also propose alternative estimations to test the following sickness absence outcomes: the probability of having a sick-leave spell in a given year (using a fixed-effect logistic model) and the total number of sick days in a given year (using a fixed-effect binomial negative model).

Section II reviews the literature on sick-leave and sickness benefits, introduces the question and reviews key results that have been obtained in the economic literature. Sections III and IV describe the data sources that were used in this study and present the French sickness insurance system and the role played by collective bargaining agreements in indemnification levels. Section IV presents statistics on the indemnification levels that were negotiated by various collective agreements, covering 60% of private sector employees, the texts of which were analyzed in detail. Section V provides a detailed presentation of the duration models that were employed in the study to measure the overall effect and time-interval effects of indemnification levels. The discrete time duration model with a piecewise constant hazard more specifically enables the measurement of variations in the probability of leaving the work absence state according to day-by-day variations in sickness benefit rates. Section VI discusses the different results obtained using the global and time interval approaches. The variables that characterize sickness benefit levels provided by different collective agreements have a significant effect throughout the sick-leave spell with the exception of executives, for whom indemnification effects are generally less significant. The rate of indemnification for each sub-period has a significant impact on leaving the work absence state at the corresponding moment. As a result, the sickness benefit system has an effect not only on the global volume of sickness absences (frequency, overall number of days) but also on their modulation by duration.

The estimated models measure behavioral differences related to benefit levels but do not allow a clear-cut distinction between the following two possible interpretations of the results: the 'absenteeism' theory, according to which high indemnification levels result in an overly large volume of sick days (in view of economic performance objectives, for example), and the 'presenteeism' theory, according to which low sickness benefits lead to a premature return to work to the detriment of an employee's health (public health objective and longer-term economic performance). Only longitudinal studies that examine both the consequences on employee health status and economic performance can assess the magnitude and impact of these mechanisms; however, such an examination is beyond the scope of the current study.

II. LITERATURE

Sickness insurance aims to compensate (at least partially) wage losses due to absence from work for health reasons. The positive link between absenteeism and "replacement rate" was first demonstrated in the Economic literature by BUZZARD and SHAW in 1952. However, little research exists on the relationship between sickness benefits and sickness absence [KARLSSON and ZIEBARTH, 2010]. Indeed, in comparison with other domains (such as unemployment benefits), the lack of a unified theoretical frame has led to several, mostly independent, empirical approaches [BROWN and SESSIONS, 1996].

The determinants of sickness absence are potentially numerous and vary greatly across publications. These determinants include health status, gender, income level, working conditions and sickness insurance. Economic research on absenteeism can be grouped into three categories [AFSA and GIVORD, 2009]. The simplest of these models is the classic work-leisure trade-off model [ALLEN, 1981]. This model has the disadvantage of only taking into account a limited number of determinants of health-related work absence. Employees seek to maximize their utility function under budgetary constraints. Periods of absenteeism are adjusted according to the loss of earnings and applicable monetary penalties. This result is confirmed by an empirical study that was conducted on French medico-administrative data and showed that an employee's current wage has a negative effect on the duration of sick leave and that high wage increases over the long term tend to reduce sick leave duration at least for men [BEN HALIMA and REGAERT, 2013].

Several studies have emphasized the level of an employee's work effort, with work attendance as a modality. In the absence of information on an employee's health status, his/her work effort can be interpreted in terms of moral hazard. In this context, a reduction in sickness benefits (wage-replacement rate) reduces the rate of absenteeism. The second group of absenteeism research follows SHAPIRO and STIGLITZ'S [1984] model, which distinguishes the utility of work attendance from the utility of non-attendance. Employees choose the level of effort that guarantees an income level that maximizes their utility. Absenteeism can, thus, represent the difference between the effort expended and contracted working hours. As employers are unable to fully understand an employee's motivations in taking sick leave (due to a lack of awareness of the worker's effort and health status), they are confronted with the classic problem of moral hazard.

The third approach in absenteeism research takes health status into account as a factor that determines the utility of attending work. This approach attempts to reintroduce the notion of health status as a decisive variable in taking sick leave. Although the health status dimension is not completely absent from the first two groups [ALLEN, 1981; BARMBY et al., 1994], it is not a core element of their paradigms. Health-related absenteeism is no longer an individual choice (work-leisure trade-off; effort function) but can be the result of deteriorated health status, either due to illness or difficult working conditions [OSE, 2005]. Recent studies [AFSA and GIVORD, 2009; DARES, 2013] have effectively underlined the significant role of working conditions in employee absenteeism. GRIGNON and RENAUD [2007] dissociate sick leave, which is the result of employees' choices (ex post moral hazard), from absenteeism due to working conditions[1], which is the responsibility of the employer, by controlling for health status (*ex ante* moral hazard).

In the current article, we examine the link between sickness insurance and sickness absence. Contrary to previous studies, we take into account the indemnification levels, including supplementary benefits provided by the CBAs. The indemnification level is measured by the *wage-replacement rate*, which is the ratio between sickness benefit and previous wage. The replacement rate generally varies day-by-day during the absence spell, and the data we use allow us to compute this day-by-day replacement rate *for each day of every sick-leave spell*.

We also test the impact of indemnification levels on two other outcomes, the probability of taking sick leave and the total number of days absent. Our data sources include a large set of individual characteristics that cover the majority of covariates used in the literature, with the exception of working conditions, which are poorly proxied by variables at the firm level (firm size and sector).

The factors that the literature has addressed to account for the occurrence and duration of sick leave include insurance parameters and daily sickness benefit systems [ALLEN, 1981; DRAGO and WOODEN, 1992; BARMBY et al., 1995; PER and MÅRTEN, 1996; CHAUPIN-GUILLOTAND GUILLOT, 2009; BEN HALIMA et al., 2012]. In France, several agents are involved in this system. The guaranteed minimum benefit, which jointly involves Social Security and the employing firm, is often completed by collective agreement provisions that increase this guaranteed minimum. Collective agreement provisions vary considerably across branches, and eligibility is often determined by employee characteristics. Several studies have revealed the role that sickness benefit systems play in explaining the gaps in sick leave rates within the European Union [BONATO and LUSINYAN, 2004; OSTERKAMP and RÖHN, 2007]. Empirical results have shown a positive relationship between the level of sickness benefits and sick leave rates [BONATO and LUSINYAN, 2004; CHAUPAIN-GUILLOT and GUILLOT, 2009], the number of sick days [OSTERKAMP and RÖHN, 2007; FRICK and MALO, 2005], or sick leave duration [JOHANSSON and PALME, 2002; BEN HALIMA et al., 2012]. The latter studies concluded that employees adapt their sick leave behavior to the level of the health insurance system's sickness benefits. MEYER et al. [1995], GALIZZI and BODEN [2003] and SPIERDIJK et al. [2009] observed that wage replacement rates have a positive effect on the duration of sick leave spells.

III. AN ORIGINAL DATABASE ON SICK LEAVES

[1] Bad working conditions may be compensated by higher wages [Rosen, 1974].

In this study, data concerning sickness absences are provided by the HYGIE database. This database, which has been used in several studies, provides a detailed description of the sick-leave spells of a representative sample of employees provided by the Statutory National Health Insurance Scheme for the period 2005-2008. It includes information on the position held, the employing company and medical consumption data of each employee included in the sample.

This database is a unique source of information whose origins lay in questions regarding the mechanisms that govern sickness absence among private sector employees. The project of creating a specific database on daily sickness benefits was the result of a call for tender that was launched by the Ministry of Health Directorate for Research, Studies, Assessment and Statistics (DREES). The Institute for Research and Information in Health Economics (IRDES) was charged with conducting this study. To successfully complete this research, the IRDES constructed a database containing the necessary information on both health-related work absences and associated health care consumption data based on employees' individual and professional context and elements of their companies.

The 2005-2008 HYGIE data were extracted from the National Pension Fund (CNAV) and the National Health Insurance Fund for Salaried Workers (CNAMTS) administrative databases. More specifically, files were extracted from the National Career Management System (SNGC), which groups all of the private sector employees in France, and the National Statistical Beneficiaries System (SNSP), which groups all of the private sector retirees in France, matched with sickness benefit data taken from the National Health Insurance Inter-regime Information System (SNIIR-AM). The CNAV data constituted the point of entry and included a random sample of beneficiaries aged 22 to 70 years old who contributed to the general pension fund at least once in their lives. The CNAMTS data concerns both primary and secondary beneficiaries of the National Health Insurance scheme who received sickness benefits for at least one spell of sick leave in 2004 and/or 2005. The linkage of the CNAV and CNAMTS data enabled us to build the HYGIE database panel of 538,870 beneficiaries from 2005 to 2008.

Contrary to habitual data sources that generally only provide the annual number of sick days, the HYGIE database provides individualized data that contain a detailed description of each sick-leave spell. This is important because the distribution of sick days during different sick-leave spells is crucial to the study of the relationship between sickness insurance benefits and sickness absence. Indemnification for a sick leave spell is a non-linear function in relation to duration. For a given total number of sick days, a long spell of sick-leave is not indemnified in the same manner as several short spells.

The HYGIE database also includes key variables that have been used in the literature to describe the frequency and duration of sick-leave spells. More specifically, we have access to medical consumption data according to main expenditure items (general practitioners, specialists and hospital expenditures for each individual and each year concerned). This database was further enriched for this study by indemnification parameters taken from the collective agreement database, which allowed us to reconstitute the day-by-day rate of indemnification for each sick-leave spell. The HYGIE database does not, however, contain detailed information on employees' specific working conditions, except in an indirect manner by taking company size and sector into account.

IV. THE FRENCH SICKNESS BENEFIT SYSTEM

The majority of sickness benefit systems are hybrid models that call on both the State and employers. An international comparison of sickness benefit systems was conducted by HEYMANN et al. [2009]. They assess 22 countries and highlight three main types of possible benefits in the case of health-related work absences.

In countries such as England, Switzerland and Australia, employers provide sickness insurance coverage for their employees. In England, the employer provides a 20.3% wage replacement rate over a period of 28 weeks. Furthermore, daily sick-leave benefits in Switzerland and Australia are covered by the employer at 100% replacement rate for a period of 3 weeks and 10 days, respectively. A different state subsidized system is applied in countries such as France (50% wage replacement rate over a period of 12 months for 3 years) and Canada (55% wage replacement rate over 15 weeks). In these two countries, the employer can provide supplementary benefits in accordance with collective agreements. In Germany, the employer indemnifies its employees at 100% for the first six weeks. Thereafter, the employees are covered by the state at a 70% wage replacement rate for a period of 78 weeks over three years. The United States is the exception because neither the state nor the employer provides sickness insurance coverage.

The French sickness benefit system is a three-tier system that involves different players at each level. Social protection systems are often constituted on a professional basis, and the generalization and standardization of Social Security coverage is based on the provision of universal guaranteed minimum benefits while maintaining the level of complementary sickness benefits negotiated on a professional basis.

IV.1. The Three Tiers of the French Sickness Insurance System

- **The first tier**, which guarantees the statutory universal minimum benefit, is jointly covered by Social Security and employing firms. This tier can be described as mandatory and uniform. Social Security covers a wage replacement benefit of up to 50% under certain conditions and within the limits of the 1/720th of the Social Security annual threshold after a three-day waiting period (Appendix 1). However, under certain conditions, the employer must pay a supplementary benefit from the 11th day of sick leave (for the period studied, appendix 1) to reach a global wage replacement rate of 90% for the first 30 days and 66.6% for the following 30 days (Appendix 1).

- **The second-tier** benefits are provided by the collective agreement on which the employee depends. This tier can be qualified as heterogeneous and mandatory “ex post.” Indeed, the collective agreement is freely decided on the basis of branch negotiations. Once an agreement is reached, all companies covered by the agreement are obliged to apply the provided measures. If the first tier is the same for all employees, CBA provisions vary in the level of sickness benefits provided and are dependent on the employees’ qualifications and years of seniority.

- **The third-tier** benefits are optional and are dependent on the provisions made by employer-provided complementary health insurance. This tier can be qualified as heterogeneous and optional. The employer can make provisions for a more advantageous scheme. Thus, CBA provisions provide, if not an exact estimate, at least a lower bound for real conditions under which employees are entitled to sickness benefits.

The third tier is not addressed in the current study due to a lack of adequate data. The first two tiers a priori, thus, reflect the lower bound of the real conditions under which employees are entitled to sickness benefits. In reality, in the majority of cases, the employee's sickness insurance benefits are accurate. Employer-provided complementary insurance often serves to cover long-term sick leave spells of over 6 months when Social Security coverage ceases and the employee shifts to a sickness benefit plan, a qualitatively different risk from that of the classic sick leave.

IV.2. Description of the Indemnification Scheme

In France, collective agreements are relatively disparate and cover a wide range of different domains. According to the Ministry of Labor, of the thousand or so existing CBAs, slightly less than 250 of them cover over 5000 employees. The CBA determines the indemnification scheme applicable to each employee. The scheme can depend on the employee's status such that one collective agreement generally encompasses several different schemes (a maximum of 4 corresponding to employee status, executives, supervisory staff, employees, workers). To a lesser extent, seniority plays a role in the duration of sickness benefits.

From the in-depth analysis of CBAs, we built an innovative data set that describes the indemnification scheme of the 46 most representative CBAs, covering 60% of the employees of the HYGIE database. In the majority of cases, CBAs make provisions for different sickness benefit plans according to employee categories. Each agreement was, thus, separated into different categories. In total, 80 indemnification schemes were identified and documented. Typically, within a scheme, the replacement rate is zero during the waiting period and then reaches a maximum value during a second (favorable) period, a less favorable value during a second period and then returns to the social security basic rate (50%). Each indemnification scheme was coded using five parameters (D_0, D_1, D_2, R_2, R_1):

- A waiting period D_0, lasting at most 10 days, during which the employer is not legally bound to contribute to sick leave benefits.

- A favorable allowance period, lasting D_1, during which the employer supplements the employee’s sickness benefits at a favorable replacement rate (R_1). The employer is legally required to ensure that D_1 is at least 90 days and R_1 is at least 0.9.

- A less favorable allowance period, lasting D_2, in which the replacement rate is fixed at a lower level (R_2, with $R_2 < R_1$).

These five parameters are quite variable across collective agreements (Figure 1). The parameters are important in the duration analysis, as they allow the computation of day-by-day replacement rates for each indemnification scheme.

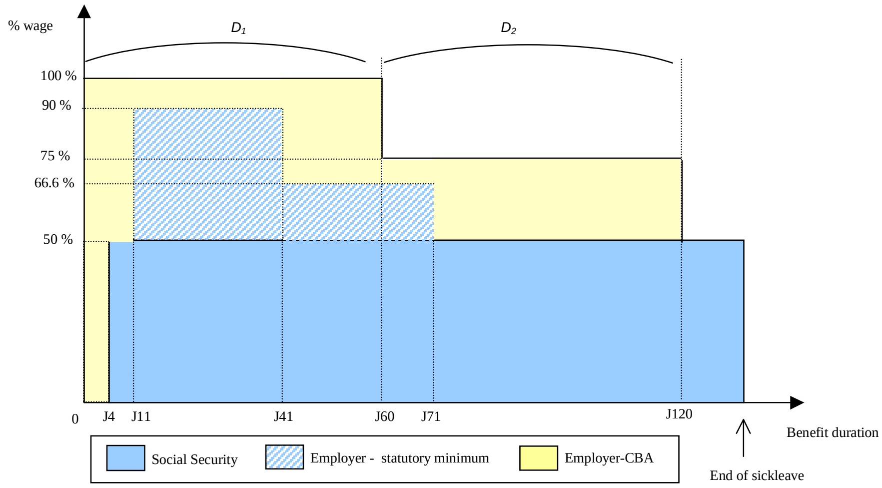


Figure 1. — An Example of a Standard Sick-Leave Indemnification Scheme (D_0=0, R_1=1, D_1=60, R_2=0.75, D_2=60)

Reading: Indemnification chart for an executive with 1 year seniority on the first day of non-work related sickness absence under the collective agreement IDCC 493 (National Collective Agreement for wines, fruit juices, syrups, spirits and liquors of France).

The initial sample of the HYGIE database (E_1) is composed of 403,428 sick leave spells for 167,416 individuals, of which 0.9% are right censored. The sub-sample (E_2) for which the CBA's indemnification parameters have been computed is composed of 233,352 sick leave spells for 103,295 individuals, of which 0.85% are right censored. The initial and filtered samples are statistically similar (Detailed statistics are provided in Appendix 4).

A considerable proportion of employees are not covered by a CBA. These employees represent 13.5% of the employees in sample E_1, but only 10.7% of the employees have a sick leave spell during the course of the year. They are retained in sample E_2, which explains a slightly higher proportion in sample E_2 (18.6% of sample E_2, 15.9% when restricted to employees that have taken sick leave).

The average duration of a sick-leave spell is 15.6 days in sample E_1 (15.7 days in E_2), with an average duration of 15.1 days in 2005 and 15.8 (16 days) in 2008 (cf. Table I). The gender-based analysis shows that sick-leave duration among women is on average 16.3 days (16.4 days) compared to 14.7 days (14.8 days) for men. The analysis of health-related work absence duration based on the French private sector employees' age pyramid reveals that individuals in the 55-65 age group have the longest sick leave spells at 18.2 days (18 days).

Individuals with part-time work contracts have longer sick leave spells than full-time workers [17.2 days (17 days) vs. 15.1 days (15.3 days), respectively]. This result is also valid for the sub-populations of men and women. The average duration of health-related work absences among men and women who work full-time is lower than that among part-time employees. The distribution of sick-leave duration according to business sector reveals significant disparities. Individuals who work in the manufacturing sector industries have the lowest average sick leave duration of 13.3 days (113.1 days), compared to 18.2 days (18.3 days) in the transport and communications sectors. In general, health-related work absence decreases as the size of the company increases. Large companies (over 1000 employees) record average sick leave durations of 14.3 days (14.3 days), compared to an average duration of 19.7 days (18.4 days) in small companies (less than 10 employees). The South of France records the highest average duration, with 16.8 days (16.7 days), whereas the North of France records the lowest average duration, with14.5 days (14.6 days).

Sick-leave duration is clearly subject to a seasonality effect. Sick leave spells beginning on a Sunday are the longest, among both men and women, with an average duration of 22.6 days (22.2 days) for women and 22.8 days (22.5 days) for men. By contrast, the shortest sick leave spells are those that begin on a Tuesday, with an average duration of 14.9 days (15 days) for women and 13 days (13 days) for men.

The subsequent analyses will focus exclusively on sub-sample $E_{2.}$

IV.3. Disparities in the Replacement Rate Are Strong between Days 11 and 40

The guaranteed statutory minimum scheme corresponds to the set of parameters (D_0=10, R_1=0.9, D_1=30, R_2=0.66, D_2=30). Social security provides sick leave with a replacement rate of 0.5 after a 3-day waiting period. After a waiting period (10 days maximum), the employer is legally required to complete this replacement rate to 0.9 for at least 30 days. Depending on the collective agreement negotiated at the industry level, firms may cover all or part of the 3-day Social Security waiting period, reduce the employer's 10-day waiting period or increase the wage replacement rate. In general, CBAs are more generous to executives in terms of waiting periods, CSB rates and benefit duration. None of the 10 main collective agreements (i.e., covering the greatest number of employees) make any provision for a waiting period for executives with over three years seniority. These 10 CBAs guarantee a 100% wage replacement rate for a minimum period of two months for executives with 3 years seniority (from 1 year of seniority in 8 out of the 10 collective agreements) and guarantee the same for the first 3 months of sick leave (often four months) for executives with over five years seniority. By contrast, provisions that are made by some collective agreements, particularly those concerning unskilled workers and employees, are occasionally less favorable than the statutory guarantees in terms of benefit duration. The replacement rates on days 1-10 vary considerably across CBAs because the waiting period D_0 varies. The value of the replacement rate over this period is quite dichotomous; it is either 0 or at least 0.9.

Table I. — DISTRIBUTION OF THE WAITING PERIOD OF THE EMPLOYER (D0)

D_0	Total	Non-executives	Executives
0	31.9%	22.6%	68.7%
3	15.2%	18.0%	3.9%
4-9	16.7%	20.1%	3.1%
10	36.2%	39.3%	24.3%
Total	100.0%	100.0%	100.0%

Source: HYGIE 2005-2008 database (IRDES), Collective agreement database (INSEE, IRDES)

From days 11 to 40, replacement rates are quite homogeneous, varying between 0.9 and 1, because of legal constraints. The variability rises again after day 40.

This variability is due not only to differences in duration (D_1, D_2) but also to indemnification rates that take different values according to CBA. Figure 2 summarizes the day-by-day distribution of the wage replacement rate up to the 90th day.

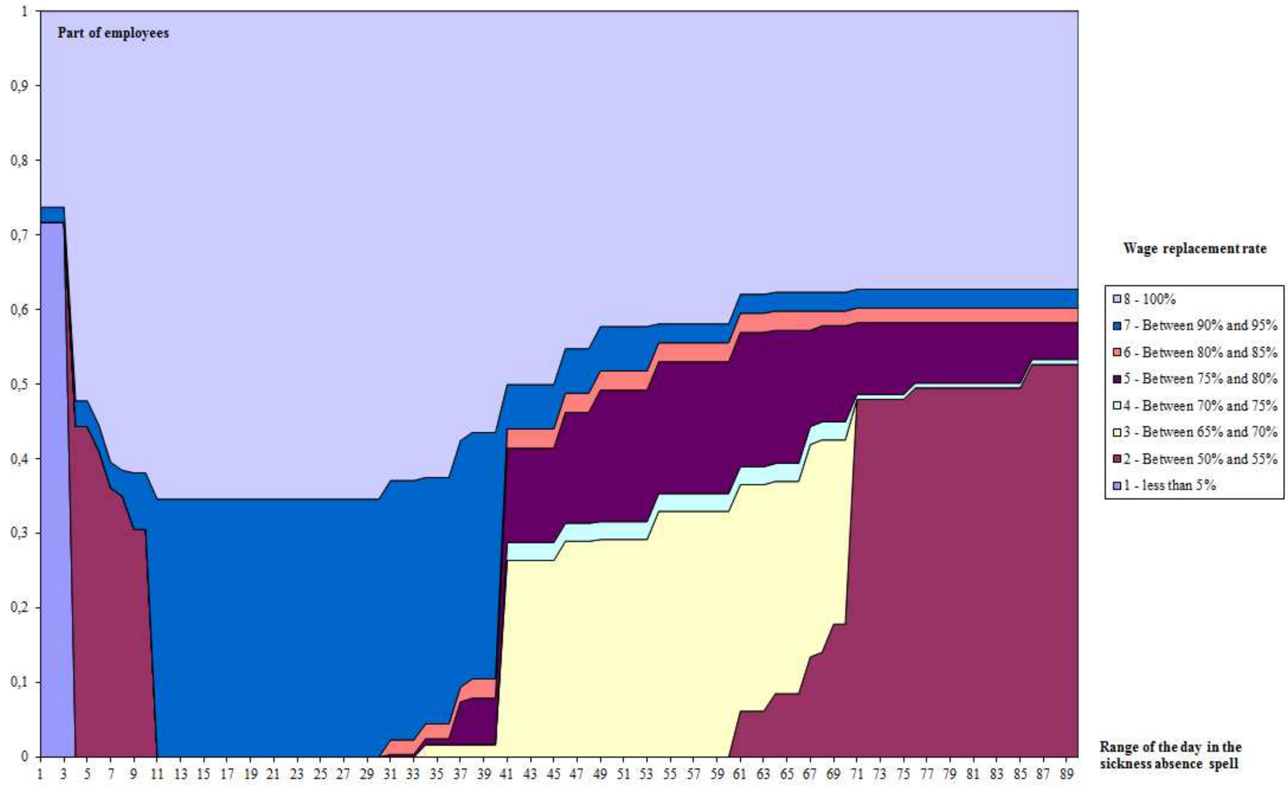


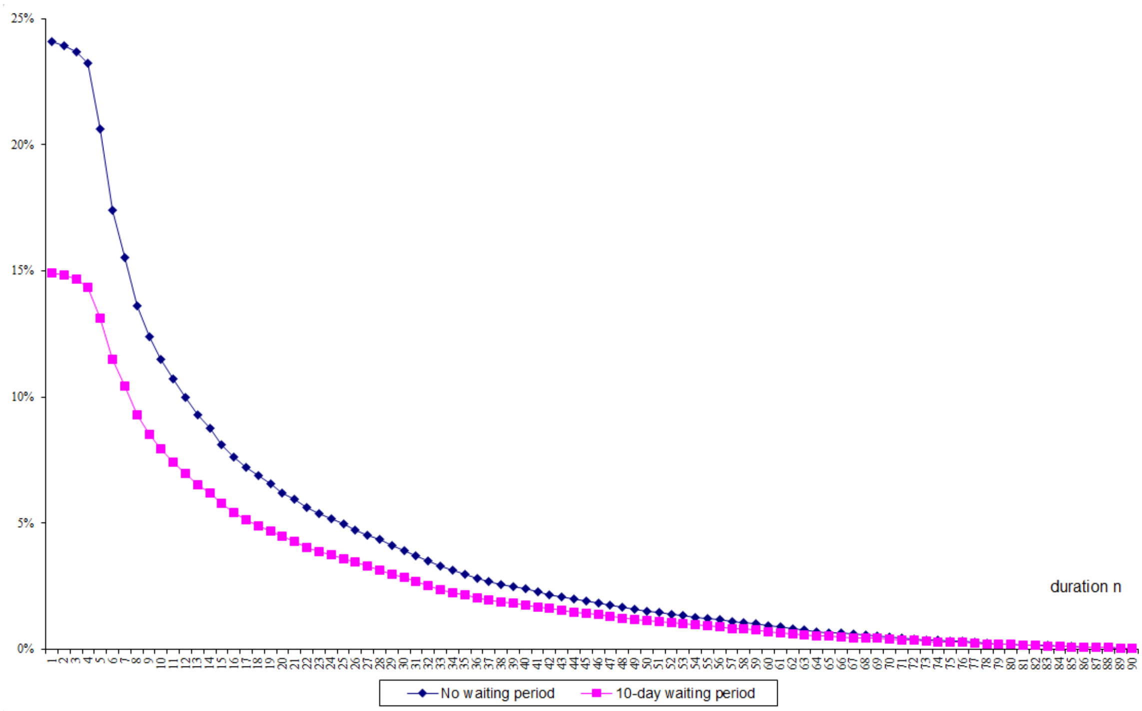
Figure 2. — Day-by-Day Distribution of the Replacement Rate

Reading: The first three days of sick leave are not indemnified for about 70% of employees in the sample. The 20th day replacement rate has a value of 0.9 for 35% of the employees and 1 for the remaining 65%.

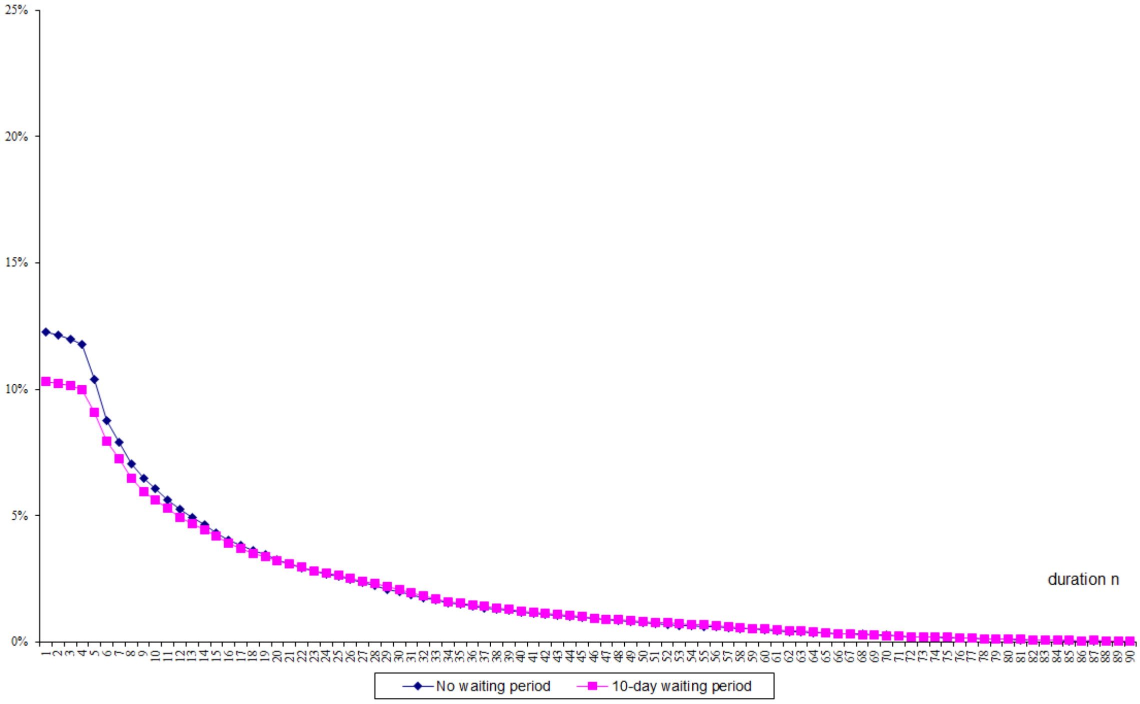
Source: HYGIE 2005-2008 database (IRDES), collective agreement database (INSEE, IRDES)

IV.4. Frequency and duration of sick-leave spells are positively correlated with sickness benefit levels

The frequency and duration of sick-leave spells depend on employee category and are positively correlated with the level of indemnification. Let us consider the first indemnification parameter, for example, the waiting period D_0. The following graphs provide, for each employee category and two waiting period values (0 and 10), the frequency of sick-leaves lasting *n* days and over according to the value of *n*. The first abscissa (*n*=1) simply measures the frequency of sick leave. For each category of employee, this frequency decreases with waiting period. This decrease differs according to the employee category. Executives appear to be less influenced by a waiting period in their sick-leave behaviors. The frequency of health-related work absences among executives covered from the first day of sick leave is 18% higher than among employees who are subject to the maximum 10-day waiting period. This sensitivity is even more marked among workers (+ 69%) and supervisory staff (+ 61%) and, to a lesser extent, employees (+ 54%).



3a. Non-executives



3b. Executives

Figure 3. — Probability of Having a Sick Leave Spell of at Least n Days, According to n, per Employee Category and Waiting Period

<u>Reading</u>: Among non-executives who are subject to a 10-day waiting period, 10% have at least one sick leave spell lasting 7 days during the year.

<u>Source</u>: HYGIE 2005-2008 database (IRDES), collective agreement database (INSEE, IRDES)

Furthermore, indemnification for the first 10 days appears to have a differentiated effect on the probability of taking sick leave according to its duration. This suggests that the replacement rate on a given day (here, days 1 to 10) may influence sick leave duration. It is, therefore, important to be able to test the effect of indemnification levels on several sets of indicators, including the overall replacement rate and the replacement rates corresponding to the different sub-periods in a given sick leave spell.

To complete the descriptive analysis of sample E_1, we estimated the survival function in the sick leave state by applying non-parametric analysis using the Kaplan-Meier[2] estimator according to individual variables such as gender and quarterly wage (Figure 4). Additional analyses using information supplied by the collective agreements in 'sample E_2' were conducted using employer-provided sickness benefit level indicators.

The non-parametric estimation of the survival function shows a profile gap between men and women (cf. Figure 4). The two non-parametric estimations show that as the duration of sick leave lengthens, the probability of a work absence spell extension decreases for both men and women. The survival

[2] The probability distribution of the duration T can be specified by the cumulative distribution function, $F(t) = P(T < t)$ representing the probability that the duration of sick leave will be at least t periods. The survival function is defined by$(t) = 1 - F(t) = P(T \geq t)$; $S(t)$ designates the probability that is not concluded after t units of time.

function for both genders is subject to a considerable decline, as 75% of women and 74% of men are likely to have a sick leave spell that lasts longer than 4 days. The estimated survival function for women is consistently higher than that for men[3]. However, the probability of a prolonged absence is nearly identical for men and women for the first four days of sick leave. Beyond this time, women survive longer in the state than do men.

The non-parametric estimations of the survival function according to quarterly wage quartiles reveal (cf. Figure 4b) that wage level has an especially discriminating correlation with the duration of sick leave. The highest rate is observed among individuals with a quarterly wage of less than 3,500 €. By contrast, the shortest duration of sick leave spells is observed among individuals in the third and fourth income quartiles (that is, with a quarterly wage of over 5,000 €). These two groups of survival curves are similar but significantly different. Finally, we note an inversion in the survival rate curves between individuals with a low quarterly income (less than 3,500 €) and individuals with a high quarterly income (over 5,000 €) beyond the 4th day of sick leave. This result is similar to the existence of supplementary guarantees provided by collective agreements with comprehensive coverage of short-term sick leave spells for individuals in the higher income brackets. By contrast, individuals who earn low wages benefit from a less generous coverage, which explains the difference in behavior during the first days of sickness absence.

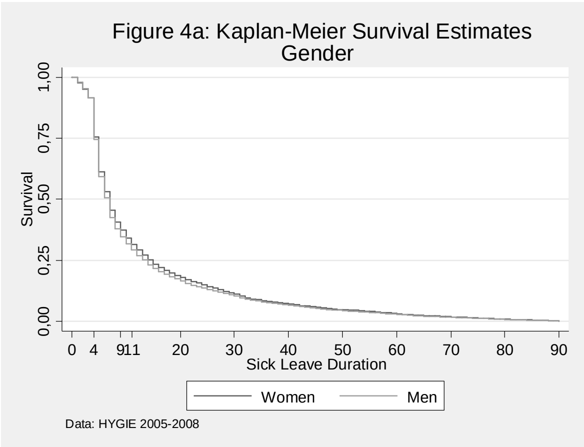
We define a global replacement rate, Rmean, for each separate sick leave spell. The global replacement rate for sick leave is the average CSB rate relative to each day of leave. This rate is calculated using a logic that is similar to that of FRICK and MALO [2008]. However, we employ an adapted methodology that is applied at a finer-grained level, as Frick and Malo only take into account first-tier sickness benefit systems in different European countries.

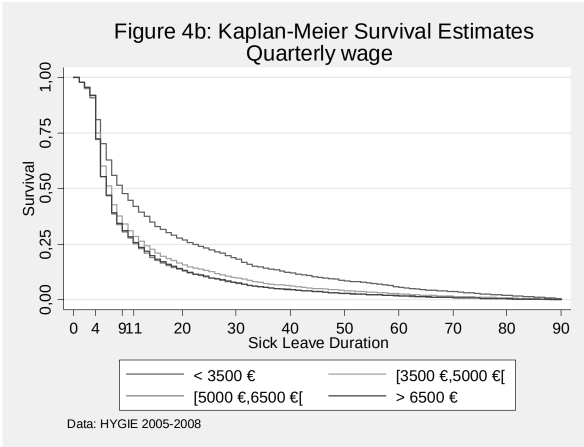
The following three groups of employees were defined according to wage replacement rate: ‘low level’ (average replacement rate of less than 66.66%), ‘medium level’ (average replacement rate between 66.66% and 90%), and ‘high level’ (average replacement rate between 90% and 100%). We observe that survival in the sick leave state is, on average, longer among employees who benefit from a higher level of average CSB (medium and high level) than among employees who benefit from a lower level of average CSB. The median sick leave spell is 6 days for employees who are covered by ‘low level’ collective agreement replacement rates versus a significantly longer spell of 27 days for those covered by ‘medium level’ replacement rates and 7 days for ‘high level’ replacement rates. According to the replacement rate level, this gap further widens as the duration of the sick leave spell lengthens. Individuals who are covered by a ‘low level’ of average CSB are 25% more likely to have a sick leave spell that lasts over 8 days, compared to 42 days and 14 days for individuals who are covered by a ‘medium level’ or ‘high level’ of average CSB, respectively.

However, these estimations are calculated under the assumption of a homogeneous population and must, therefore, be supplemented by an analysis of sick leave durations that takes individual

[3] A Wilcoxon test was also carried out to test the equality of the two survival functions (men/women). The value of the chi test 2(1) = 157,80 allows us to reject the null hypothesis and, as a result, to validate the alternative hypothesis, according to which there are significant differences between the two survival functions.

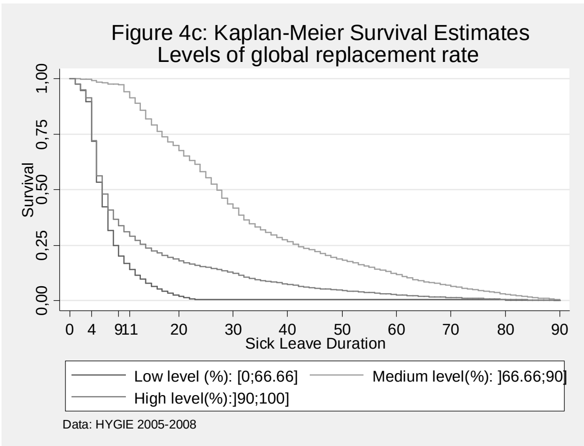
heterogeneity into account. To perform this analysis, we conducted a semi-parametric estimation using a discrete time proportional hazard model.





Wilcoxon test of equality of survival functions
*chi2(1) = 104,78****

Wilcoxon test of equality of survival functions
*chi2(1) = 3944.72****



Wilcoxon test of equality of survival functions
*chi2(1) = 24176,64****

Figure 4. — Analysis of Survival in the Health-Related Work Absence State

Source: HYGIE 2005-2008 database (IRDES), collective agreement database (INSEE, IRDES)

V. MODELING DURATIONS

We model the duration of sick leave using a discrete time duration model. We opted for a semi-parametric specification of the baseline hazard, which is piecewise constant. This specification is sufficiently flexible to allow for differentiation by sub-periods and, thus, takes into account variations in benefit levels between the different periods (National Health Insurance waiting time, employer waiting time, favorable period at $Rate_{max}$ and less favorable period at $Rate_{min}$). The model includes a broad range of individual characteristics in addition to the variable of interest (which is the benefit level).

The econometric analysis that is used here is based on a discrete time proportional hazard model that employs the formulation proposed by ALLISON [1982]. The same econometric framework was used by JENKINS [1995]. More specifically, we take into account unobserved individual heterogeneity using a parametric approach.

V.1. A Discrete Time Proportional Hazard Duration Model

In the work absence decision process, individual behaviors are completely heterogeneous. This heterogeneity is composed of observable (individual characteristics and past history on the labor market) and non-observable characteristics[4]. We situate this study within the framework of proportional hazard models, in which the hazard rate for an individual *i* at a moment in time is written as follows:

$$lim_{h\rightarrow 0}\frac{Prob(t+h>T_i\geq t|T_i\geq t)}{h}=\lambda_{it}=\lambda_0(t)exp(X'_i\beta) \quad (1)$$

In this formula, t signifies the duration of the work absence spell, $\lambda_0(t)$ is the 'baseline' hazard, X_i is the vector of individual observable characteristics for the individual i during the work absence spell, and β is the vector for the parameters to be estimated[5].

V.2. Piecewise Constant Hazard

The return to work following a sick leave spell is only observed in disjointed time intervals $j = [a_{j-1}, a_j)$. Within the framework of proportional hazard models, it is possible to take the discrete nature of data into account while preserving continuous duration.

This discrete time model enables us to identify individuals' behaviors at each moment of the sick leave spell according to the variations in the replacement rate defined by the indemnification parameters of the collective agreement in force for each employee and company.

The baseline hazard was specified using a semi-parametric approach (piecewise constant hazard) by specifying the duration dependence terms that represent the duration of sick leave (COX'S [1972], PRENTICE and GLOECKLER [1978]). The hazard rate during the time interval, that is, the probability of leaving the work absence state during the interval $j= [a_{j-1}, a_j]$, knowing that the state was not previously left, may be computed using equation (1).

---

[4] The amount of non-observable information could be reduced by conducting more detailed surveys; inversely, a proportion of non-observables will always exist.

[5] We advance the hypothesis that episodes of health-related absence are independent for all individuals. It should be noted that individuals who take more than one sick-leave spell do not exceed 6% in the current sample.

$$h_j(X_i) = prob\left(T_i \in [a_{j-1}, a_j] \middle| T_i \geq a_{j-1}\right) = 1 - exp\left[-\int_{a_{j-1}}^{a_j} \lambda(\tau, X_i) d\tau\right] \quad (2)$$

The discrete time hazard in the j^{th} interval is written

$$h_j(X_i) = 1 - exp\left[-exp\left(X'_i\beta + \delta_j\right)\right] \quad (3)$$

$$with\ \ \delta_j = log\left(\int_{a_{j-1}}^{a_j} \lambda_0(\tau) d\tau\right) for\ j = 1, \ldots, k. \quad (4)$$

The δ_j parameter represents the temporal dependence parameters that define the baseline hazard. They are treated as parameters to be estimated directly and are interpreted as the hazard logarithm on the j^{th} interval.

This specification allows for a fully non-parametric baseline hazard with a separate parameter for each duration interval. The duration intervals or baseline hazard is assumed to be constant and obtained by grouping days according to a double criterion. On the one hand, an examination of the raw hazard (Appendix 4) reveals considerable variations in the rates of leaving the sick leave state on certain dates. For example, the rate is particularly high between the two waiting periods (National Health Insurance and employer) between days 4 and 9 and after the first month (at days 31-32) and also increases around the 90th day. On the other hand, a close examination of the parameters (D_0, D_1, D_2) for the 80 analyzed indemnification schemes reveals key dates on which collective agreement replacement rates change. Taking these two criteria into account enables the definition of 10 sub-periods for which the baseline hazard is constant (Appendix 2). The specification of the piecewise constant baseline hazard retained in the current model is as follows: Interval 1 [1; 3], Interval 2 [4; 6], Interval 3 [7; 9], Interval 4 [10; 12], Interval 5 [13; 15], Interval 6 [16; 30], Interval 7 [31; 45], Interval 8 [46; 60], Interval 9 [61; 75] and Interval 10 [76; 90].

Some health-related absences are prolonged beyond the studied period and are, thus, censored (in other words, only partially observed). This characteristic must be taken into account in the estimated likelihood (observation failure) of leaving the work absence state. The indicator variable takes the value $y_{it} = 1$ if the individual i leaves the state of work absence during the time interval $[t-1, t]$; otherwise, $y_{it} = 0$. The log-likelihood for the sample is, thus, written as follows:

$$LogL = \sum_{i=1}^{n} \sum_{j=1}^{t_i} \left\{ y_{ij} log\left[h_j(X_{ij})\right] + (1 - y_{ij}) log\left[1 - h_j(X_{ij})\right] \right\}. \quad (5)$$

This expression represents the log-likelihood of the preliminary version of the final model. This preliminary version does not take the unobserved heterogeneity between individuals into account and implicitly assumes that any heterogeneity among agents has been measured and integrated in X_i.

V.3. Taking Individual Heterogeneity into Account in Parametric Form

It is probable that numerous variables (such as moral hazard and adverse selection of individuals) are unknown to the econometrist, even if they influence the process of leaving the work absence state. If this unobservable heterogeneity is not taken into account, a negative bias in the estimation of the temporal dependence parameter may result. This bias, due to the “mover-stayer" phenomenon, can be schematized as follows: if the studied population is composed of homogeneous groups with a constant (although different) baseline hazard, then the population structure remaining in a state of work absence will change over time and will consist of increasing numbers of individuals with a low hazard rate (stayers) and decreasing numbers of individuals with a high hazard rate (movers). As a result, the temporal dependence parameters, rather than indicating a constant hazard rate, will indicate a decreasing rate with the time spent in a state of work absence.

The differences in unobserved heterogeneity between individuals poses a problem in duration models. The non-treatment of this difference can generate bias at the estimation level. If we consider a group of individuals with individual characteristics that are associated with a fairly high risk of health-related work absence, this group will, on average, have a lower probability of leaving the work absence state than the remainder of the sample. As time that this group of individuals spends in the work absence state increases, their chances of leaving this state decreases. Therefore, if unobservable characteristics are not taken into account, the probability of leaving the work absence state will decrease with time. LANCASTER and NICKELL [1980] showed that the presence of unobserved differences between individuals can reduce the proportional effect of the model's variables on the rate of leaving the work absence state.

To take the unobserved heterogeneity of agents into account, we introduce a multiplier function into the hazard equation distributed according to a Gamma distribution with a mean of 1 and variance of $\sigma^2 \equiv \upsilon$ (LANCASTER [1979], HAN and HAUSMAN [1990], DOLTON and O'NEILL [1996]). MEYER [1990] expands upon this analysis method by introducing parametric or non-parametric heterogeneity, and HAN and HAUSMAN [1990] generalizes it to concurrent risk models.

The instantaneous hazard rate for the equation is now specified as follows:

$$\lambda_{it} = \lambda_0(t)\epsilon_i exp(X'_i\beta) = \lambda_0(t)exp\big(X'_i\beta + log(\epsilon_i)\big) \qquad (6)$$

The discrete time hazard function in the j^{th} interval is written as follows:

$$h_j(X_i) = 1 - exp\left[-exp\left(X'_i\beta + \gamma_j + log(\epsilon_i)\right)\right] \qquad (7)$$

VI. RESULTS

VI.1. Control Variable Results

The variables that we are interested in are related to wage-replacement rates. Our estimations also include several other covariates for individual heterogeneity. We also control for unobserved heterogeneity and possess information on the censoring of work absence spells. In the following analysis, we take into account the right censoring of individuals, as some of them remained on sick leave at the end of 2008. The unit of time retained to measure the duration of the work absence spell is the day and the period of observation between 2005 and 2008. A first group of variables refers to individual characteristics (age, gender, insurance regime [CMU], age of entry into the labor market and health status, approximated by the number of visits to a general practitioner and number of days of hospitalization). A second group of variables represents employment characteristics (wage, working time, sector and size of the company). A third group of regional variables is introduced to measure the effect of economic context (region of residence and unemployment rate per department). Finally, the following two types of variables that are specific to the sick leave start date are introduced into the estimations: the day of the week on which sick leave began and the closeness of this start date to a day before or following an official public holiday.

Regarding individual variables, the results of econometric estimates show that men have significantly shorter spells of sickness absences from work than women. These results are consistent with those that have been obtained in several empirical studies [ALLEN, 1981; BRIDGES and MUMFORD, 2000; OSE, 2005]. Age has a negative and significant effect on the rate of leaving the sickness absence state. This result appears to confirm the existence of an incremental relationship between age and sick leave duration. The duration of sick leave spells among individuals aged over 34 are significantly longer[6] than those among individuals in the 25-34-year-old age group. This effect increases with age; that is, the rate of leaving the work absence state decreases with age. All other things being equal, individuals over 55 reduce their likelihood of concluding a sick leave spell by 28%[7] in relation to individuals under 34 (Table III, column 2). Two main factors can explain this relationship between age and sick leave duration. First, there is a correlation between age and health status such that older age corresponds to a deteriorated health status. This correlation is partly captured by the coefficient of age if the *proxy* of health status is imperfect. Second, in France, as in a number of other industrialized countries, ceasing work as a result of sickness can be one method through which elderly employees withdraw from the labor market. Longer absences from work can, thus, appear to be the result of employees' more or less constrained choices concerning their labor market participation. This age effect also exists concerning the likelihood of being on sick leave [BEN HALIMA et al., 2012].

Compared to early entrants into the labor market (under 18 years old), later entrants have considerably shorter spells of work absence. This variable can be considered as a proxy for age at leaving the education system (Table III, column 1-3). From that point, young people who enter the labor market early are essentially characterized by a low level of human capital. It is thus probable that they hold less prestigious jobs that require fewer skills. By contrast, late entrants to the market who register significantly shorter work absence spells generally have a higher level of education and have jobs with more responsibility and autonomy, better rewards and better working conditions [Ose, 2005].

Concerning employment characteristics, individuals who work part-time have a 5.9% higher likelihood of leaving the work absence state than individuals who work full time, all other things being equal (Table III, column 2). Quarterly wage levels also seem to play a significant role in sick leave duration. All other things being equal, individuals who earn a quarterly wage of over 3,500€ have significantly

[6] A negative and significant effect of the coefficients corresponds to a reduction in the rate of leaving the work absence state and the prolongation of sick leave duration

[7] Exponentiated coefficients are reported in estimation tables

shorter sick leave spells than executives. The duration of sick leave spells decreases with wage level (Table III, column 3).

The variables that are used as a proxy for health status do not have the same effect on the rate of leaving the sickness absence state. As expected, a high number of visits to a specialist in the previous year tends to significantly reduce an individual's likelihood of leaving the sickness spell and extends the duration of sick leave. On the other hand, an increase in the number of visits to a general practitioner in the previous year has a negative and significant effect on the duration of the work absence spell as a result of sickness (Table III, column 3). Thus, we posit that general practitioners play an important and efficient role alongside occupational physicians in terms of improving health at work because a GP is most frequently consulted when workers have health problems. Numerous work situations can alter patients' state of health, and certain diseases have repercussions on individuals' ability to work [MENARD, 2009].

Concerning the regional variables, the current results reveal a negative and significant relationship between '*department*' unemployment rates and sickness absence duration. As a result, the frequency and gravity of health-related absenteeism should be lower in periods of economic downturn. Several empirical results confirm this theory, such as those obtained by HENREKSON and PERSSON [2004] and JOHANSSON and PALME [1996, 2002], who showed that sickness absence spells are shorter during periods of high unemployment. Localization in the west, south and south-west employment areas reduce the duration of sickness absence compared to employment areas in the Paris region. On the other hand, individuals who reside in the north increase their likelihood of leaving the sick leave state by 13.4% (Table III, column 2).

The 'day of the week' effect (with Friday as the reference) and the day prior to or following an official public holiday reveal significant effects on the rate of leaving the sickness absence state (Table III, column 2-3). In effect, sick leave duration is significantly longer when the start day is a Saturday or Sunday or the day prior to or following an official public holiday. This weekend and public holiday effect can be explained as the result of an individual choice to prolong a weekend or an official public holiday [BROSTRÖM et al., 2004]. We observe the opposite effect for the other days of the week.

Compared with individuals who work in small companies with less than 10 employees, those who work in medium or large companies (over 50 employees) take shorter periods of sick leave. Employees who work in companies with 10 to 49 employees, however, have a higher probability of having longer work absence spells than those who work in small companies because their likelihood of leaving the sickness state is reduced by 12% (Table III, column 2). This result may be because working conditions in these companies are less favorable and expose workers to more health problems [ASKENAZY and CAROLI, 2010].

In relation to the commercial sector, the manufacturing industries, construction sector, hotel and catering sector, financial activities, real estate, rental and business services, public administration, health and social services and extra-territorial activities have positive and significant effects on the rate of leaving the work absence state. Employees in these sectors have significantly shorter sickness absence spells than those in the commercial sector. By contrast, individuals who work in the transport and communications sector have significantly longer sick leave spells (Table III, column 2-3).

VI.2. Overall Compensation Effect

In this section, we examine the relationship between sickness indemnification and sickness absence. We focus on covariates that represent the global level of replacement rate, and the effect is assumed to be constant along the absence spell (in the next section, this assumption will be released). In short, the indemnification variables considered here are time-independent. Several sets of variables that measure the level of compensation are used, including a dummy variable that indicates if the employee benefits from a CBA. This variable is used because the employees who are not covered by CBA form an interesting control group. The remaining compensation variables are as follows:

- The duration of the waiting period D_0. As demonstrated by the basic statistics, this waiting period plays an important role both in terms of the frequency of sick leave spells and their duration.

- The average replacement rates by sub-periods (expressed by rank of the day), as follows: 0-3, 4-10, 41-70, 71-90. The average rate in period 11-40 has been discarded because of its lack of variability.

These three sets of variables were considered separately in the estimations because they partially overlap. Thus, the absence of a CBA (first estimation) is a subcategory of employees who are subject to a 10-day waiting period (second estimation). The average rates per sub-period (third estimation) cover all of the indemnification parameters.

We particularly focus our attention on the effect of these variables on the duration of sick leave spells. This overall approach is, however, completed by estimating the effect of these variables on the following two indicators of the volume of sickness absences: the frequency of absences and the annual number of days sick leave for each employee. The first indicator takes into account the large proportion of employees who do not take sick leave during the course of the year (four-fifths of employees in a given year), and the second evaluates sick leave volumes related to the financial burden that they represent.

We cannot entirely dismiss potential endogeneity in indemnification levels. It is possible that companies, via collective agreement negotiations, adapt indemnification levels to the health risks of their employees, for example, risks related to working conditions. Here, company variables (sector and size) do not entirely take working conditions into account. It is also a possibility that employees with high health risk factors take a company's sickness insurance benefits into account when choosing an employer. We only partially control for employee health status (via lagged variables concerning medical consumption) and employees' unobserved heterogeneity via fixed individual effects for the logistic and binomial negative models and parametrically in the duration model.

Although sick-leave spell duration is the main dependent variable that is analyzed using the duration model, two other outcomes were also tested, as follows: the probability of having a sick-leave spell in a given year (using fixed-effect logistic model) and the total number of sick days taken in a given year (using fixed-effect binomial negative model).

The richness of the database allows these complementary estimations because the panel data that we use includes information on all private sector employees in the sample (including those who do not take sick leave). Moreover, the data cover the years 2005 to 2008 so that unobserved heterogeneity may be controlled for by individual fixed effects. The probability of having at least one absence due to sickness in the year is analyzed using a fixed-effect logistic model, and the annual number of sickness absence days is analyzed using a fixed-effect negative binomial model. In addition to indemnification parameters, a large list of control variables was introduced (this list is the same as that in Table III).

Being covered by a CBA (in addition to the statutory minimum coverage) has a positive and significant effect on the three outcomes (probability of absence, duration of the absence spell and number of sick-leave days in the year). In a duration model (see table II), a coefficient that is less than 1 indicates a lower propensity to interrupt the sick leave and, therefore, a tendency to prolong it.

The estimation also emphasizes the crucial role of the waiting period D_0. Even if this parameter only partially proxies the global level of indemnification, it has a strong effect on spell frequency and duration as well as the total number of sick days.

Average replacement rates by sub-periods have contrasted effects on the different outcomes. In terms of the probability of taking sick leave, replacement rates on the 4^{th} to the 70^{th} day have a slightly significant effect, but the most significant effects concern the number of absent days. The intensity of this effect diminishes with the rank of the day. A possible explanation for this result is that the rate of indemnification on day *n* intensifies the probability of interrupting sick leave on day *n* and thus tends to shorten sick leave spells that are *longer or equal to n*. Therefore, the rate at the beginning of the period has an effect on a greater number of sick leave spells than the rate at the end of the period.

The replacement rate on days 71-90 even appears to have a negative effect on the annual number of sickness absence days. Although this result may be due to a shortage of personnel (prolonged absences have a rather low frequency), the overall approach used here measures the effect of the average replacement rate on days 71-90 on *all* health-related absences regardless of their duration and without taking into account possible substitution effects between different durations. For example, a reduction in sickness benefits at a given point in the duration tends to shorten the sick leave spell. This can be compensated by multiplying shorter sick leave spells, resulting in a positive effect on the annual number of sickness absence days.

These results are consistent with those of ZIEBARTH and KALSSON [2010, 2013], who showed that a reform that reduces sickness benefits leads to a reduction in work absences, whereas an increase in benefits leads to an increase in the duration of sick leave spells.

Table II. — RESULTS OF THE MODEL ESTIMATIONS USING AN OVERALL APPROACH

	Fixed-effect logistic model	**Fixed-effects negative binomial model**	**Duration model**
Dependant variable	**Having at least one annual sick-leave spell**	**Annual number of days absence**	**Duration of sick leaves**

Presence of collective agreement	0.077*** (0.023)			0.103*** (0.012)			0.934*** (0.007)		
Ref : absence	-			-			-		
Waiting period 0-3 days		0.108*** (0.022)			0.164*** (0.011)			0.976*** (0.007)	
Waiting period 4-9 days		0.043*** (0.026)			0.035*** (0.014)			0.947*** (0.009)	
Ref : Waiting period=10 days		-			-			-	
Replacement rate 1-3			ns			0.002*** (0.000)			1.001*** (0.000)
Replacement rate 4-10			0.0015** (0.001)			0.001*** (0.000)			0.999*** (0.000)
Replacement rate 41-70			ns			ns			ns
Replacement rate 71-90			ns			- 0.001** (0.001)			0.999*** (0.000)
Unobserved heterogeneity	Individual fixed effects			Individual fixed effects			Parametric : Gamma		
Control variables	**yes**	**yes**	**yes**	**yes**	**yes**	**yes**	**yes**	**yes**	**yes**
Number of observations	295,527	295,527	295,527	316,861	316,861	316,861	3,536,597	3,536,597	3,536,597
Number of individuals/spells(1)	85,577	85,577	85,577	93,187	93,187	93,187	223,979	223,979	223,979
Log-Likelihood	-106,665	-106,659	-106,662	-355,747	-355,666	-355,556	-779,859	-779,880	-779,752
Chi2/lltest (2)	5,439	5,452	5,447	10,160	10,302	10,523	1,248	1,249	1,263

Note: *** p<0.01, ** p<0.05, * p<0.1

(1) individuals for the logistic and binomial models, episodes for the duration model

(2) chi2 for the logistic and binomial negative models, lltest for the duration model

Reading: Each column corresponds to a model estimation. Three types of models (fixed-effect logistic, fixed-effect binomial negative, and duration models) were estimated. For each model, three sets of indemnification variables were tested, as follows: 1)being covered by a collective agreement 2)Different waiting period lengths (for this variable, three indicators corresponding to the following $\mathbf{D_0}$ interval values were created: 0-3, 4-9 and 10. The last value, a priori providing the least incentive to take sick-leave, constitutes the modality of reference).3)Average wage replacement rates by main sub-periods. To simplify the presentation, only estimated coefficients relative to these indemnification variables are presented in the table, and excluding those relative to other control variables (age, gender, socio-professional category, employment conditions, salary, company size and business sector), unemployment rate by *department* and major region.

Source: HYGIE 2005-2008 database (IRDES), collective agreement database (INSEE, IRDES)

VI.3. Effects of Indemnification Level by Time Interval

In this section, we move away from the overall approach to focus more precisely on the effects of indemnification level at different time periods during the sick leave spell. As previously shown, the rate of indemnification on different days of the sick leave spell does not have the same effect on short-duration and long-duration spells. To generalize this relationship, the proposed estimations exploit the flexibility of the duration model, presented in the preceding section. This method allows us to cross the replacement rate *at different moments during the sickness absence spell* with the rate of leaving the sickness absence state *at the corresponding moment. The indemnifation variables considered here are time-dependant.*

a) Baseline hazard dummies

Modeling the retained durations modulates the baseline hazard and, thus, the probability of leaving the sickness absence state according to different time intervals on the baseline hazard (the baseline hazard is piecewise constant). This flexible specification enables us to measure the effect of indemnification variables with the different 'time-pieces' of the baseline hazard. The periods that are retained for the baseline hazard are 3-day intervals up to the 15th day, followed by 15-day intervals up to the 90th day (Table IV). Table IV presents the results of the discrete time proportional hazard model using various sickness benefit indicators. Only the coefficients that are relative to the baseline hazard and indemnification variables are presented.

b) Current and short-term anticipated wage replacement rate

Two sets of indemnification variables are used. One set is the current replacement rate, as defined by crossing each moment of sickness absence with the replacement rate determined by each employee's collective agreement. It is defined according to the following four modalities: current wage replacement rate, replacement rate five days after the beginning of the sickness absence, 6 to 10 days after the beginning of the sickness absence and over eleven days. This rate is calculated to avoid eventual endogeneity between sick leave duration and supplementary benefit rates, and the average rate of indemnification on the different periods corresponding to the 'time-pieces' of the baseline hazard: $t_{[1,3]}$, $t_{[4,6]}$, etc.

The specification of the piece-wise constant baseline hazard retained here assumes a constant hazard in three-day intervals from the 1st to the 15th day (interval 1-5), followed by 15-day intervals from the 15th to the 90th day (interval 6-10) [*cf.* JENKINS, 1995]. Intervals 1 to 10 are temporal *dummies* that define the baseline hazard[8].

The baseline hazard does not vary monotonically with the rank of the start day of sick leave, justifying the use of a flexible hazard model. Although it is weak between 1 and 3 days, the rate of leaving the work absence state intensifies between days 4 and 9 before regularly decreasing up to day 30 or 45. Beyond the 45th day, the rate tends to increase.

The terms of the baseline hazard with a short duration (between the first and the third days) have a negative and significant effect on the instantaneous rate of leaving the work absence state. This trend remains the same for longer work absence spells (from the 6th to the 30th day), but the effects are weaker. This tends to significantly reduce the duration of the sickness absence spell and, consequently, increases the likelihood that an employee returns to work up to the end of the first month. Beyond the first month, the negative effect of the baseline hazard tends to decrease and, thus, reduces the likelihood of leaving the sickness absence state. These results are specified further and include benefit levels and their variations during the course of the sick leave spell.

c) Baseline intervals crossed with average wage replacement rate on the corresponding interval

The results of crossing the baseline hazard with the level of the CSB rate proper to each collective agreement provision, calculated in three-day intervals from the 1st to the 15th day and then in 15-day intervals from the 15th to the 90th day (Table IV, column 1), show that the risk does not vary monotonically according to duration. The terms of the first baseline hazard with a short duration of between 1 and 3 days, crossed with the level of the CSB rate, have a negative and significant effect.

[8] The constant was not included so as to avoid perfect co-linearity with the temporal *dummies* [JENKINS, 1995].

Thus, a 1% increase in the level of the CSB rate during the 3-day waiting period reduces the rate of leaving the work absence state by 0.1%. By contrast, this tendency is inverted for the next period of sick leave lasting between 4 and 6 days, for which the respective term of the baseline hazard has a positive and significant effect. We conclude that a high CSB rate during this period of sickness absence from work does not encourage individuals to prolong their work absence spell and, consequently, increases the probability of a return to work.

For longer spells of sick leave, from the 7th day up to the 45th day, generous collective agreement provisions have a negative effect on leaving the work absence state and, thus, significantly increase the duration of the work absence spell during these periods. The drop in the legal daily sickness benefit rate to 66.6% during this period leaves room for strong variability in benefit levels, as collective agreement provisions for sickness benefits can reach a 100% replacement rate in certain cases. Therefore, during this sickness absence spell, there is a positive relationship between sickness insurance benefit levels and the duration of sick leave.

Although weakly significant, the current replacement rate that corresponds to the rate practiced on the first day of sick-leave has a negative effect on sick leave duration (Table IV, column 2). We also observe that a high replacement rate between the first and fifth days of sick leave increases the probability of remaining in the work absence state.

VI.4. The Special Case of Executives

In this analysis of the duration of sick leave spells, executives constitute a sub-population with rather specific behavior patterns. The first estimate indicates that the global benefit level provided for by the collective agreement has less influence on executives' behavior (Table IV, column 3). Thus, the estimated parameter relative to the global average CSB rate is significant but less so than for non-executives (Table IV, column 5). For the executive category, the baseline hazard is less variable by sub-period, which indicates that these employees' sick leave spells are more evenly distributed and, thus, less subject to cumulative effects around the key dates, indicating a variation in benefit levels. This result is confirmed by the fourth estimation (Table IV, column 4). In effect, for the executive category, the sickness benefit level estimator by sub-period is not significant except for the period situated between the 7th and 9th day (negative effect of 0.995, indicating a lower withdrawal from the work absence state), the period from the 10th to the 12th day (slightly negative effect of 0.994), the 16th to the 30th day (negative effect of 0.986), and the 31st to the 45th day (negative effect of 0.980). The results are quite similar for the non-executives; however, for the sub-periods that cover the period from the 4th to the 6th day, the effect is slightly positive (1.002).

VII. Conclusion

Several recent studies have highlighted the significant influence on employee's sickness absence behaviour. Those studies focused on the universal minimum first tier sickness benefits provided by the National Health Insurance. This effect is confirmed in the current paper from the angle of supplementary benefits that are provided within the framework of collective bargaining agreements, whose rather diverse provisions result in branch-level agreements. The provisions that are made by approximately forty collective agreements were analyzed in detail and standardized in the form of parameters that are specific to each agreement. The current study is the first to utilize this method. This study does not take employer-provided complementary sickness insurance into account; as such, insurance extends beyond the benefits that are provided by collective agreements.

The collective agreement tier especially interesting in that, contrary to the first tier, it generates considerable disparities in daily sickness benefit levels between employees. These disparities have repercussions on employee behaviors. The benefit levels that are provided by the collective agreements, thus, vary considerably across collective agreements. In addition, they vary by sub-period proper to each collective agreement; replacement rate variations according to sick-leave duration vary in each collective agreement. For example, certain CBAs are generous for long periods after a specified waiting period, whereas others do not apply a waiting period but are generous for shorter periods. However, the current estimations do not take into account potential endogeneity in the level of indemnification.

Potential endogeneity can be the result of various factors. Employees who present the highest health risks may take company sickness insurance benefits into account when choosing an employer. Furthermore, employees who present a specific risk may tend to apply self-selection by choosing companies that are covered by a collective agreement that offers a high level of sickness benefits. We do not have the means to empirically validate or invalidate this possibility. Similarly, employers may take sector-related or employee health risks into account to modulate their sickness insurance contributions, for example, to optimize the overall volume of health-related work absences [LANFRANCHI and TREBLE, 2010]. Several of the control variables used in the current study capture part of employees' health status, such as lagged health care consumption (number of consultations with a general practitioner, specialists, number of days hospitalization). Unfortunately, we were unable to address the potential endogeneity problem in an overall manner due to the lack of adequate instrumental variables. Only an exogenous variation of generosity, following a reform that changes the conditions of sickness benefit entitlement (such as in the studies conducted by HENREKSON and PERSSON [2004] and ZIEBARTH [2014]), or additional data on health risks (working conditions, job arduousness, company claims rate) could have solved this problem. Within the framework of this study, and given the difficulty of obtaining valid instruments, we emit the hypothesis that the level of supplementary sickness benefits obtained by the employee is completely exogenous.

Several indemnification parameters that are insensitive to sick leave duration were used in the empirical section. One such parameter captures the presence of a collective agreement, a second parameter describes the existence of waiting periods from 0-3 days, 4-9 days and 10 days, and a third set of parameters describes the average wage replacement rate by sub-periods (0-3, 4-10, 41-70, 71-90). We studied the impact of these different complementary indemnification parameters separately by sick leave duration (discrete time duration model), the frequency of sick leave spells (fixed-effect probit model) and the employee's annual number of sick days (fixed-effect binomial negative model). The results show that the simple presence of a collective agreement has a positive effect on the probability of taking sick leave during the course of the year, on the number of absent days and sick leave duration. The same applies for the waiting period. A waiting period of less than the legal minimum of ten days is associated with longer and more frequent health-related absences and a higher number of absent days. The wage replacement rate by sub-periods (1-3, 4-10, 41-70, 71-90) also has an overall positive effect on these three aspects of sick-leave. We also found some hints of the role of the current wage replacement rate on the instantaneous probability of interrupting sick leave spell.

The current results have several public policy implications. First, considerable disparities in sickness insurance coverage between employees raise the question of equity. Can these differences be justified if they compensate for differences in working conditions, notably job arduousness? This is a particularly important future area of investigation because it has an effect on the key variables of the social protection system (health status, pensions) and, at first glance, there is no apparent correlation between collective agreement generosity and difficult working conditions.

Sickness insurance benefits have an impact on labor supply. Thus, the question should be studied from the point of view of economic performance and the organization of production. There is a choice between two economic performance objectives. The first objective consists in providing effort incentives within the framework of employer controls on its employees and would tend to reduce the generosity of benefits. The second objective, at the origins of the occupational accident insurance system, aims to maintain employee health and, thus, employee productivity. Whereas collective agreement benefits result in the majority from the weight of history, this choice raises the economic question of the optimal level of generosity and the gap between this optimal level and real practices.

Finally, the results of this study suggest that the optimality of sickness insurance benefits should not only be examined only from a global viewpoint but also in relation to the duration of work-related absences. The French sickness insurance system not only plays on the overall number of days absence but also manages the distribution of short and long health-related absences, through the day-by-day within-CBA changes of the wage-replacement rate. Employees with a good level of coverage seem to be less hesitant than others in taking short sick-leave spells. By contrast, employees who forego short-duration sickness absences may have a retarded impact on costs in an analogous manner to foregoing health care. As a measure of prevention, short-duration spells should be favored in terms of efficiency. The question of the efficiency (health and productive) of short-duration absences remains, as does the question of the social costs of foregoing sick-leave.

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Table 3. —RESULTS OF THE DISCREET TIME PROPORTIONAL HAZARD MODEL ESTIMATES – CONTROL VARIABLES

	(1)		(2)		(3)	
Baseline risk terms						
Interval 1 [1; 3]	0.000***	(0.171)	0.000***	(0.179)	0.000***	(0.185)
Interval 2 [4; 6]	0.004***	(0.169)	0.001***	(0.178)	0.002***	(0.184)
Interval 3 [7; 9]	0.004***	(0.165)	0.001***	(0.176)	0.002***	(0.181)
Interval 4 [10; 12]	0.003***	(0.163)	0.001***	(0.174)	0.001***	(0.180)
Interval 5 [13; 15]	0.003***	(0.161)	0.001***	(0.174)	0.001***	(0.179)
Interval 6 [16; 30]	0.002***	(0.158)	0.001***	(0.172)	0.001***	(0.177)
Interval 7 [31; 45]	0.002***	(0.153)	0.001***	(0.169)	0.001***	(0.174)
Interval 8 [46; 60]	0.003***	(0.149)	0.002***	(0.168)	0.002***	(0.172)
Interval 9 [61; 75]	0.005***	(0.145)	0.003***	(0.166)	0.003***	(0.170)
Interval 10 [76; 89]	0.013***	(0.141)	0.008***	(0.164)	0.009***	(0.167)
Gender						
Male	1.136***	(0.006)	1.093***	(0.007)	1.073***	(0.008)
Age (Ref: [25; 34])						
[35; 44]	0.984**	(0.007)	0.905***	(0.007)	0.912***	(0.009)
[45; 54]	0.899***	(0.008)	0.783***	(0.009)	0.782***	(0.010)
[55; 65]	0.798***	(0.011)	0.698***	(0.012)	0.696***	(0.014)
Age of entry into the labor market (Ref.: under 18 years old)						
19-22 years old	1.069***	(0.008)	1.055***	(0.009)	1.054***	(0.010)
23-26 years old	1.078***	(0.009)	1.029**	(0.010)	1.031**	(0.012)
Over 27 years old	1.089***	(0.010)	1.113***	(0.011)	1.125***	(0.013)
Working time (Ref.: full time)						
Part time	0.896***	(0.006)	1.059***	(0.007)	1.068***	(0.008)
Beneficiaries of the Alsace Moselle regime	1.165***	(0.013)	1.152***	(0.017)	1.154***	(0.020)
CMU-C beneficiary	0.968	(0.025)	1.006	(0.030)	1.015	(0.034)
Company size (Ref.: [1; 9])						
[10; 49]			0.879***	(0.014)	0.889***	(0.016)
[50; 199]			0.969**	(0.013)	0.975*	(0.015)
[200; 499]			1.028**	(0.012)	1.037**	(0.014)
[500; +]			1.008	(0.016)	1.010	(0.018)
Sectors of activity (Réf.: Commerce)						
Agriculture. Fisheries			1.037	(0.158)	1.023	(0.190)
Mining industries			1.049***	(0.011)	1.054***	(0.012)
Manufacturing industries			1.495**	(0.205)	1.618*	(0.253)
Production and distribution of electricity, gas and water			1.239***	(0.064)	1.257**	(0.075)
Construction			1.053**	(0.016)	1.049**	(0.018)
Hotels and restaurants			1.017	(0.013)	1.038**	(0.014)
Transports and communications			0.922***	(0.015)	0.917***	(0.018)
Financial activities			1.065**	(0.020)	1.092***	(0.024)
Real estate, rentals and business services			1.014	(0.017)	1.017	(0.019)
Public administration			1.085**	(0.026)	1.080**	(0.030)
Education			0.994	(0.015)	1.001	(0.017)
Health and social services			1.059***	(0.011)	1.056***	(0.012)
Collective, social and personal services			1.232***	(0.013)	1.226***	(0.016)
Extra-territorial organizations			1.058***	(0.010)	1.048***	(0.011)
Quarterly wage (Ref: less than 3,500€)						
Between 3,500 € and 5,000 €			1.383***	(0.009)	1.366***	(0.010)
Between 5,000 € and 6,500 €			1.771***	(0.009)	1.773***	(0.011)
Over 6,500 €			1.928***	(0.010)	1.950***	(0.012)
Region of residence (Réf.: Paris)						
North			1.134***	(0.013)	1.147***	(0.016)
West			0.948***	(0.009)	0.939***	(0.011)
South-West			0.929***	(0.011)	0.921***	(0.013)

South		0.964**	(0.013)	0.973*	(0.015)
South-East		0.982*	(0.011)	0.980*	(0.012)
East		0.990	(0.012)	0.983	(0.014)
Leave start day (Ref: Friday)					
Sunday		0.774***	(0.017)	0.788***	(0.019)
Monday		1.390***	(0.010)	1.372***	(0.012)
Tuesday		1.581***	(0.012)	1.559***	(0.013)
Wednesday		1.201***	(0.012)	1.170***	(0.014)
Thursday		1.107***	(0.012)	1.087***	(0.014)
Saturday		0.897***	(0.014)	0.893***	(0.016)
Start day on a public holiday (Yes/No)		0.623***	(0.017)	0.631***	(0.018)
Economic context					
Unemployment rate		0.991***	(0.002)	0.989***	(0.003)
Panel year (Réf.: 2005)					
Year 2006		0.971***	(0.008)		
Year 2007		0.961***	(0.008)		
Year 2008		0.903***	(0.009)		
Medical care consumption					
Number of GP consultations (or visits) the previous year				1.002***	(0.001)
Number of specialist consultations (or visits) the previous year				0.993***	(0.001)
Number of days hospitalization the previous year				1.000	(0.001)
Gamma heterogeneity	1.36***	1.56***		1.55***	
Number of observations	3,673,225	3,536,597		2,688,396	
Number of episodes	233,252	223,979		168,180	
Log-Likelihood	-818,564.08	-779,261.8		-587,093.4	

Note: *** p<0.001, ** p<0.05, * p<0.1

Field: Employees for whom the collective agreement was analyzed.

Sources: Administrative data base HYGIE 2005-2008, data base of collective agreements (Insee, Irdes).

Reading: Exponentiated coefficients are reported in estimation tables.

Table 4. — Results of the Discreet Time Duration Proportional Hazard Model Estimates –Effect of the CSB Rate

	Global				Executives				Non-executives			
	(1)		(2)		(3)		(4)		(5)		(6)	
Terms of the baseline hazard												
Interval 1 [1; 3]	0,008***	(0,041)	0,007***	(0,044)	0,005***	(0,143)	0,004***	(0,162)	0,008***	(0,044)	0,007***	(0,046)
Interval 2 [4; 6]	0,062***	(0,040)	0,045***	(0,048)	0,046***	(0,141)	0,028***	(0,186)	0,063***	(0,043)	0,047***	(0,050)
Interval 3 [7; 9]	0,055***	(0,040)	0,050***	(0,049)	0,040***	(0,139)	0,037***	(0,187)	0,056***	(0,042)	0,051***	(0,051)
Interval 4 [10; 12]	0,045***	(0,040)	0,051***	(0,083)	0,035***	(0,138)	0,036***	(0,280)	0,045***	(0,042)	0,052***	(0,088)
Interval 5 [13; 15]	0,044***	(0,040)	0,116***	(0,192)	0,037***	(0,138)	0,057***	(0,632)	0,043***	(0,043)	0,125***	(0,203)
Interval 6 [16; 30]	0,035***	(0,040)	0,073***	(0,139)	0,031***	(0,136)	0,067***	(0,472)	0,034***	(0,042)	0,073***	(0,147)
Interval 7 [31; 45]	0,039***	(0,040)	0,102***	(0,128)	0,038***	(0,137)	0,146***	(0,398)	0,038***	(0,042)	0,098***	(0,137)
Interval 8 [46; 60]	0,047***	(0,042)	0,059***	(0,093)	0,048***	(0,143)	0,071***	(0,281)	0,045***	(0,044)	0,056***	(0,101)
Interval 9 [61; 75]	0,076***	(0,045)	0,070***	(0,052)	0,095***	(0,152)	0,091***	(0,199)	0,071***	(0,048)	0,067***	(0,054)
Interval 10 [76; 90]	0,199***	(0,051)	0,166***	(0,056)	0,270***	(0,169)	0,170***	(0,200)	0,186***	(0,054)	0,160***	(0,058)
Interval 1 [1; 3] *$t_{[1,3]}$			0,999***	(0,000)			0,995***	(0,002)			0,999*	(0,000)
Interval 2 [4; 6] *$t_{[4,6]}$			1,001***	(0,001)			0,999	(0,002)			1,002***	(0,001)
Interval 3 [7; 9] *$t_{[7,9]}$			0,999***	(0,001)			0,995***	(0,002)			0,999*	(0,001)
Interval 4 [10; 12] * $t_{[10,12]}$			0,996***	(0,001)			0,994**	(0,003)			0,997***	(0,001)
Interval 5 [13; 15] * $t_{[13,15]}$			0,988***	(0,002)			0,990	(0,007)			0,987***	(0,002)
Interval 6 [16; 30] *$t_{[16,30]}$			0,990***	(0,001)			0,986***	(0,005)			0,990***	(0,002)
Interval 7 [31; 45] * $t_{[31,45]}$			0,988***	(0,001)			0,980***	(0,005)			0,988***	(0,002)
Interval 8 [46; 60] * $t_{[46,60]}$			0,996**	(0,002)			0,995	(0,005)			0,996**	(0,002)
Interval 9 [61; 75] * $t_{[61,75]}$			0,999	(0,001)			0,995	(0,004)			0,999	(0,001)
Interval 10 [76; 90] * $t_{[76,89]}$			0,998***	(0,000)			0,994***	(0,002)			0,998***	(0,000)
Replacement rate (Ref: more than 11 days)												
Current replacement rate (0 days)	1,000	(0,000)	1,001*	(0,000)	0,999	(0,001)	1,004**	(0,002)	1,000	(0,000)	1,001	(0,000)
Replacement rate 1 to 5 days after	1,001	(0,000)	0,998***	(0,001)	0,999	(0,002)	0,992***	(0,003)	1,001	(0,000)	0,998***	(0,001)
Replacement rate 6 to 10 days after	1,001***	(0,001)	1,006***	(0,001)	1,006***	(0,002)	1,014***	(0,003)	1,001**	(0,001)	1,005***	(0,001)
Gamma variance heterogeneity	**1.340*** **		**1.327*** **		**1.547*** **		**1.546*** **		**1.310*** **		**1.296*** **	
Number of observations	2 688 396		2 688 396		327 764		327 764		2 360 632		2 360 632	
Number of episodes	168 180		168 180		20 863		20 863		147 317		147 317	
Log-Likelihood	-587 782.42		-587 667.47		-72 544.16		-72 521		-514 947.44		-514 853.84	

Note: *** p<0.001. ** p<0.05. * p<0.1

Field: Employees for whom the collective agreement was analyzed.

Sources: Administrative data base HYGIE 2005-2008, data base of collective agreements (Insee, Irdes).

Reading: Exponentiated coefficients are reported in estimation tables. All explanatory variables (gender, age, age of entry into the labor market, working time, company size, sectors of activity, quarterly wage, region of residence, leave start day, economic context, medical care consumption) were included in the estimations.

Appendix 1: Regulations concerning daily sickness benefits under the National Health Insurance System[9]

In France, the sickness insurance system that aims to replace an employee's wage during her absence due to illness is multi-tiered. This appendix describes the first, universal tier. It includes daily sickness benefits that are paid by the National Health Insurance Fund and supplementary benefits that are paid by the employer.

The General Health Insurance scheme provides the payment of daily sickness benefits from the 4th day following the medical intervention that prescribes sick leave. This daily allowance corresponds to 50% of the employee's gross daily income for a maximum duration of three years (within a 360-day limit). The wage base that is used to calculate daily sickness benefits is limited to 1/720th of the annual Social Security ceiling for the period under study. This ceiling was amended to 1/730th of the annual Social Security ceiling (reassessed on January 1st of each year) from December 10th, 2010 (Circular of November 25th, 2010, relative to certain modes of calculating daily benefits), then to 1.8 times the minimum wage (SMIC) as of the 1st of January, 2012 (Decree no. 2011-1957 of December 26th, 2011, relative to the modes of allocating daily sickness benefits entitled under the health insurance system). This change limited the daily benefit to 41.38 € on January 1, 2012.

Eligibility for daily sickness benefits is subject to not only registration under the compulsory national health insurance scheme but also to a minimum contribution rate that is equivalent to 200 hours worked over the previous three months or 800 hours over a year. The conditions under which daily sickness benefits are allocated are expressed in the number of hours that are worked. They can also be expressed as equivalent wages subject to social security contributions, which is 1,015 times the hourly minimum wage over the last six months for 200 hours and 2,030 times the hourly minimum wage over the last 12 months for 800 hours. The calculation of daily sickness benefits is based on earnings during the three months preceding the sick leave spell.

A percentage of the working population does not benefit from coverage against the risk of sickness absence, specifically, workers who have not worked 200 hours over the course of the previous three months (or paid contributions equivalent to 1,015 times the hourly minimum wage over the course of the last six months) and do not meet the conditions of eligibility for daily sickness benefits. This mobile population in precarious employment has not yet been estimated, although the situation in the job market and the resulting increase in the number of employment gaps in individuals' career paths tend to aggravate this type of situation.

The employer is legally obliged to supplement, under certain conditions subject to a waiting period, the benefits that are paid by the health insurance scheme. Prior to the passage of the law of 2008, benefits were paid at the latest from the 11th day of sick leave. Following this reform, they were paid at the latest from the 8th day. It aims to reach a global replacement rate of 90% over at least 30 days. In the event of successive work absences over a period of 12 months, the total duration of benefits is limited to the maximum duration. These benefits are increased according to the number of years of service. The conditions for eligibility and the waiting period were amended by Law no. 2008-596 on June 25, 2008, 'concerning the modernization of the labor market.' The employee must justify a minimum number of years' service in the employing company or establishment (3 years until June 26, 2008, reduced to 1 year by Law no. 2008-596 of June 25, 2008, 'concerning the modernization of the labor market'). Furthermore, supplementary benefits do not apply to employees who work from home, seasonal workers, casual or temporary employees.

[9] Source : http://vosdroits.service-public.fr/F3053.xhtml

Appendix 2: Information Collected and Indicators Calculated from Collective Agreements

The necessary process of analyzing collective agreement texts

As underlined in several recent reports, there are no available statistics on supplementary sickness benefits, particularly those relative to collective agreement provisions. The texts of the collective agreements are available on the *LégiFrance* website, but the information has not been formatted. The different collective agreements do not include the same level of detail and are not presented in a homogeneous manner, and the basic texts have often been amended by subsequent agreements.

For this reason, it was necessary to undertake a considerable amount of research and analysis effort regarding these legal texts. The texts of the 46 collective agreements that are most represented in the HYGIE database were analyzed. Taking into account the different provisions according to employee category and amendments applicable during the course of the period studied, the 46 agreements contain 79 different benefit provisions.

List of collective agreements whose texts were analyzed

IDCC	Title	Number of different provisions
00016	Road transport	3
00018	Textile industries	3
00029	Private Hospitals: non-profit private care, cure and assistance hospitals (FEHAP)	3
00044	Chemical industries	4
00045	Rubber	3
00054	Metal industry Paris Region	1
00086	Advertising	1
00176	Pharmaceutical industry	1
00184	General printing industry and print media industry graphic	2
00218	Social Security agencies	1
00292	Plastics processing	2
00413	The disabled: establishments and services for disabled persons	1
00573	Wholesale trade	3
00650	Metal industry executives	1
00675	Retail clothing outlets	3
00787	Chartered accountants	1
00843	Artisan bakeries and confectioners	1
01043	Building watchmen, caretakers and building management employees	1
01090	Automobile services	2
01147	Medical surgeries	1
01258	Home assistance or support organizations	1
01266	Contract catering sector	1
01351	Prevention and safety	3
01413	Temporary work–permanent employees	1
01486	Engineering and design consultancies SYNTEC	3
01501	Fast food industry	1
01516	Training organizations	1
01517	Non-food retail trade	1
01518	Animation	2
01527	Real estate	1
01596	Construction workers up to 10 employees	1
01597	Construction workers over 10 employees	1
01672	Insurance companies	1
01702	Civil engineering workers	1
01810	Cleaning industry	3
01979	Hotels, Cafés and Restaurants	1
01996	Retail pharmacies	3
02098	Service sector service providers	2
02120	Banks	1
02216	Predominant food retail and wholesale trade	3
02264	Private for-profit hospitals	4
02378	Temporary work–casual workers	1

02408	Administrative and economic personnel, educational personnel, and librarians in private schools	1
05003	FPE (non-tenured)	1
05021	FPT (non-tenured)	1
05516	La Poste-Telecom	1
Total		**79**

Construction of a statistical database describing the benefit provisions for each collective agreement:

For each of the collective agreements, the portions of the text concerning sickness benefit provision were analyzed. Information concerning the payment of daily sickness benefits was collected in the form of datasheets.

These datasheets were then used to construct a database for the collective agreements, including a certain number of parameters regarding rules of eligibility for sickness benefits for each socio-professional category that was in force during the period 2005-2008:

- Seniority required
- Waiting time (D_0)
- Maximum benefit rate and benefit duration at maximum rate ($Rate_{max}$ and D_1)
- Minimal benefit rate and benefit duration at minimal rate ($Rate_{mix}$ and D_2)
- Links to articles of reference.

A first analysis of legal data revealed a certain number of typical rates and durations corresponding to amendments in collective agreement benefit schemes. We also noted the particular importance of certain sub-periods beyond which the benefits system changes in certain collective agreements. This led to a relatively fine division of time periods for the first three months of benefits (which will be slightly modified for use in the model depending on the statistical results). The specification of the piecewise constant baseline hazard retained for our model is as follows: Interval 1 [1; 3], Interval 2 [4; 6], Interval 3 [7; 9], Interval 4 [10; 12], Interval 5 [13; 15], Interval 6 [16; 30], Interval 7 [31; 45], Interval 8 [46; 60], Interval 9 [61; 75] and Interval 10 [76; 90].

Then, over forty legislative texts on collective bargaining agreements were analyzed. For the HYGIE database observations concerning these CBAs, it was possible to recreate the sickness benefit levels day-by-day in terms of the CSB rate for the first two tiers of the system (statutory guaranteed benefits and supplementary scheme as a result of a CBA). With this information, it is possible to exploit sickness benefit variability as a determining factor of sick leave duration. This legislative analysis covered a sufficiently representative sample of collective agreements, including the specificities of the Alsace-Moselle insurance scheme[10]. The enhancement of the HYGIE database with information concerning CBA provisions for sickness benefits was carried out in several phases.

A collective agreement identifier based on the DADS

To enrich the HYGIE database with administrative information, the DADS database enabled us to match data between the HYGIE database and the CBA database. Data matching was conducted with DADS data (Annual Declaration of Social Data) and establishment data. The database, thus, contains information on individual beneficiaries, their career paths, healthcare consumption and sick leave spells, reimbursements received from the National Health Insurance schemes, their professional context and a number of characteristics concerning the employing firms. Using this database, we were able to study the relationships between health, work, professional career and firm characteristics.

The HYGIE database was further enhanced for this study with microeconomic data on CBA provisions for supplementary sickness benefits. In an initial phase, using the Annual Declaration of Social Data (DADS) and the establishment identification number (SIRET) from the HYGIE database and taking into account each employee's socio-professional category, it was possible to allocate a collective agreement code for over 90% of the observations

[10] Private sector employees in the Alsace-Moselle region are covered by local, regional labor rights, inherited from a German labor law that makes provision for total wage replacement benefits from the employer without a waiting period and without seniority conditions in the case of absence from work as the result of sickness.

(Table I, Figure 4)

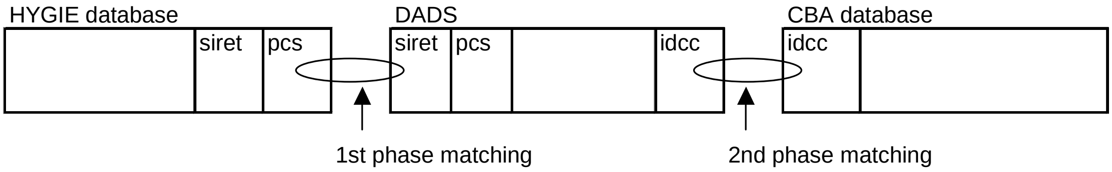

Figure 5. — HYGIE, DADS and Collective Agreement Data-Matching Diagram

Table 5. — COLLECTIVE AGREEMENT IDENTIFIER CODE (IDCC) ALLOCATION RATE

	2005	2006	2007	2008
Employee with at least one sick leave spell	89%	93%	93%	94%
Total employees in the HYGIE database	84%	86%	88%	89%

The addition of compensation parameters in the HYGIE (daily sickness benefit) database

The CBA database grouped all of the legislative information necessary to recalculate, for each sick leave spell covered by the list of main collective agreements, the complete sickness benefit profile for a given CBA day by day. To do this, the following indicators were collected for each legislative scheme: durations (D_0, D_1, D_2) and CBS rates ($Rate_{max}$, $Rate_{min}$).

From this information, the wage-replacement rates for each day of sick leave were calculated, as follows: RATE1, RATE2,.., RATE90. To reduce the number of descriptive variables, these rates were grouped into sub-periods and averaged for each sub-period. The sub-periods were chosen in such a way as to respect the most frequent dates on which legislative changes to the sickness benefit system occurred.

Appendix 3: Example of an analyzed text (extracts)

Concrete example of an article concerning daily sickness benefits in the national collective agreement for accounting and auditing firms of December 9th 1974; IDCC 787.

An article: 7.3. Guaranteed income in the case of illness or work-related accident [….]

‘After a year of service in the firm, employees’ and executives’ income level is maintained in the case of illness, occupational accident or non-work-related accident under the following conditions:

Entitlement to sickness benefits is subordinate to the daily sickness benefits paid by the general health insurance scheme. The total duration of work absences, including waiting time defined in the following sub-paragraph below, with benefits entitlement, cannot exceed thirty calendar days per illness or occupational accident. If several sickness or occupational accident leaves with benefit entitlement occur during the same calendar year, the total benefit duration will not exceed thirty calendar days;

The net value of benefits, calculated from the fourth calendar day of absence, will complete the daily sickness benefit paid by Social Security to concur with the net employment salary;

In the case of personnel on proportional remuneration, the supplementary benefit defined in the preceding paragraph will be calculated on the basis of a net employment salary corresponding to the net average earnings over the last twelve months preceding work absence.’

The underlined elements provide the essential facts for the current datasheet, as follows:

- The way in which sickness and accidents are covered (work-related or not). In this case, there is no distinction between non-work-related and work-related accidents, and there is no explicit distinction concerning illness (ambiguity). Work-related illness seems to be (implicitly) classed with work-related accidents or simply as illness with no distinction.
- Years of service required: one year
- Socio-professional categories: grouped into employees and executives
- Waiting period: ‘from the fourth calendar day of absence,’ thus, 3 days
- One can guess the identity of the financer (the company) AND the 100% replacement rate (50% company and 50% social security) ‘salary rate will be maintained’. However, for the financer, the article concerning the Welfare and Pension scheme confirms this, as the compensation system differs from that of the company
- Maximum benefit duration: ‘30 calendar days,’ thus, 1 month
- The Welfare and Pensions scheme operates separately, as defined in one of the articles of the collective agreement. The following extracts allow us to elaborate the welfare section of the datasheet:

‘Firms must subscribe an insurance policy though a certified body covering all employees with a minimum of one year service in the firm, against death, inability to work and disability (…)’

This extract informs us that to benefit from the welfare plan, employees must have a minimum of one year of service.

‘In the case of absence resulting in the inability to work for a period of over one month, the insurance scheme will pay a gross daily benefit equal to 80p. 100 of gross income after deduction of daily sickness benefits paid by the general social security scheme.’

This extract indicates that the welfare plan will finance complementary benefits (50% of salary subject to an annual Social Security ceiling) for Social Security and that the remaining benefits will be paid by the welfare plan.

‘This compensation will be paid from the thirty first day of work absence and for the whole duration of temporary invalidity benefits paid by Social Security, including beyond the eventual termination of the employment contract.'

This passage clearly indicates that the welfare benefits plan takes over from the company in financing benefits, cf. above where the company finances sick leave for a maximum period of 30 calendar days (and can initiate a dismissal procedure if the prescribed leave requires suspending work for a period of over six months). Furthermore, the insurance plan only provides financing as long as Social Security does. Collective agreements are the most represented in the HYGIE database.

Appendix 4: Average characteristics of the sample used

In this study, the indemnification parameters of approximately fifty collective agreements were calculated. Employees provided for by these collective agreements (sample E_2) represent a sub-sample of the initial sample taken from the HYGIE database (sample E_1). The following table compares the characteristics between individuals in sample E_1 and individuals in sample E_2.

	Sample (E_1)			Sample (E_2)	
	Women	Men	Combined	Women	Men
Age 25-34	16.27	13.21	14.94	16.38	13.42
Age 35-44	15.59	14.31	14.97	15.67	14.43
Age 45-54	16.78	15.9	16.35	16.73	15.96
Age 55-65	18.19	18.25	18.22	17.93	18.25
Age of entry into the labor market: under 18 years old	17.38	16.06	16.65	17.49	16.3
Age of entry into the labor market: 19-22	16.17	14.27	15.29	16.22	14.5
Age of entry into the labor market: 23-26	16	14.04	15.17	16.14	14
Age of entry into the labor market: over 36 years old	16.38	14.96	15.83	16.11	14.43
Full-time	15.83	14.47	15.11	15.95	14.62
Part-time	17.52	16.65	17.28	17.26	16.1
Alsace Moselle insurance regime	14.44	13.06	13.76	14.61	13.3
Complementary CMU beneficiary	17.18	16.96	17.09	17.24	16.32
Change of status regarding CMU-C	16.94	16.81	16.89	16.95	16.21
Agriculture, Fisheries	16.77	15.38	15.62	17.35	13.54
Mining industries	15.42	13.54	14.2	15.6	13.67
Manufacturing industries	15.26	13.1	13.46	15.11	13.08
Production and distribution of electricity, gas and water	15.68	15.04	15.17	14.94	12.63
Construction	16.55	15.03	15.22	16.59	14.31
Commerce	17.43	15.33	16.57	17.58	15.23
Hotels and restaurants	14.69	14.85	14.79	14.99	15.19
Transport and communications	18.57	17.54	18.22	18.83	17.41
Financial sector	14.15	13.01	13.63	14.38	12.96
Real estate, rentals and company services sector	14.77	14.04	14.53	14.77	14.29
Public administration	15.65	15.73	15.68	15.62	16.24
Education	15.65	14.63	15.29	15.5	14.41
Health and social action	16.89	15.76	16.35	17.11	15.91
Collective, social and personal services	14.78	16.43	15.41	14.56	14.82
Extra-territorial activities	17	14.39	16.48	16.91	14.21
Company size [1; 9]	19	17.99	18.47	20.18	18.89
Company size [10; 49]	18.07	16.92	17.56	18.02	16.82
Company size [50; 499]	16.52	14.87	15.74	16.63	14.99
Company size [500; 999]	15.66	13.85	14.82	15.93	14
Company size [1000; +]	15.22	13.29	14.37	15.64	13.54
Quarterly wage: less than 3,500€	20.92	20.26	20.72	20.85	19.46
Quarterly wage: between 3,500 € and 5,000 €	15.68	15.53	15.52	16.29	15.92
Quarterly wage: between 5,000 € and 6,500 €	13.34	13.16	13.24	13.66	13.38
Quarterly wage: above 6 500 €	12.97	12.92	12.94	13.05	12.95
Day sick-leave began: Sunday	22.63	22.87	22.75	22.22	22.54
Day sick-leave began: Monday	15.04	13.36	14.21	15.12	13.4

Day sick-leave began: Tuesday	14.98	13.06	14.08	15.04	13.08
Day sick-leave began: Wednesday	16.62	14.62	15.7	16.71	14.72
Day sick-leave began: Thursday	17.13	15.5	16.41	17.13	15.58
Day sick-leave began: Friday	17.71	16.29	17.11	17.63	16.08
Day sick-leave began: Saturday	18.35	17.91	18.15	18.34	18.1
Year 2005	15.89	14.29	15.14	15.78	14.23
Year 2006	16.74	15.1	15.97	16.67	15.04
Year 2007	16.34	14.88	15.66	16.41	14.96
Year 2008	16.61	14.86	15.8	16.8	15.05

Sources: Administrative data HYGIE 2005-2008 database, collective agreement database (INSEE, IRDES).

Reading: Sample E_1 is taken entirely from the HYGIE database. Sample E_2 consists of employees whose collective agreement was analyzed and for whom we have the indemnification parameters (60% of E_1).

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