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Duration of Sick Leave, Income and Health Insurance: Evidence from French French linked employer-employee data

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Abstract

This article analyses the relationship between the duration of sick leave, income and health insurance. The analysis is based on a modified version of the model developed by Allen (1981), taking into account the specificity of the French model. We used the HYGIE database constructed from the merger of administrative files on private sector employees in France in 2005. The estimates are calculated using a discrete time-proportional hazard model that allows for unobserved heterogeneity. Estimation results show that current wage has a negative effect on the duration of sick leave. Moreover, the different Health Insurance modalities appear to modify employee behaviours concerning work absences.

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1. Introduction

In France, daily benefit allowances paid out in 2008 by the Statutory National Health Insurance cost 11.3 billion Euros. Broken down, 54 % covered sickness benefits, 24 % covered maternity benefits and 22 % covered occupational accidents, representing over 5 % of health care costs. This amount varies according to economic fluctuations, regulatory changes and epidemics (e.g., influenza or gastroenteritis). Between 1995 and 2003, daily sick leave benefits rose by 4.3 %, followed by an average decrease of 0.5 % between 2003 and 2008. Since 2008, the overall cost of benefits is once again on the rise.

Economic research on absenteeism can be grouped into three categories (Afsa and Givord, 2009). The first category falls within the traditional research framework based on the labour-leisure trade-off model (Allen, 1981). Employees seek to maximise their utility function under budgetary constraints. Periods of absenteeism are adjusted according to the loss of earnings and applicable monetary penalties. The second category follows Shapiro and Stiglitz's (1984) model that distinguishes the utility of work attendance from the utility of non-attendance. Employees will choose the level of effort that guarantees an income level that maximises their utility. Absenteeism can thus represent the difference between the effort expended and the contracted working hours. Employers are unable to fully understand an employee's reasons for missing work due to sickness (due to a lack of awareness of the worker's effort and health status). Consequently, employers are confronted with the classic problem of moral hazard. Although health status is not totally absent from the first two models (see, for example, Allen, 1981), it is not a core element of their paradigms. Sickness absence is no longer an individual choice (labour-leisure trade-off; worker effort function) but can be the result of deteriorated health status due to illness or difficult working conditions. Grignon and Renaud (2007) propose separating voluntary work absences chosen by the employee (moral hazard) from absences resulting from working conditions. Working conditions are the employer's responsibility, so employers control that aspect of health status (moral hazard ex ante). The models proposed below attempt to understand employees' allocation of labour supply. It should be remembered that absenteeism affects companies' labour demand and can generate considerable costs (loss of production, replacement costs). The third trend in economic literature attempts to reintroduce the notion of health status as a determinant of sick leave. These three models emphasise the importance of salary and remuneration in agents' decisions concerning absenteeism. Our aim is to explore the relationship between wage rate and the duration of sick leave (Barmby, Orme and Treble, 1995). However, as demonstrated by Allen (1981), the effect of wages on absenteeism and the duration of absence appear to be relatively indeterminate. It is therefore necessary to return to the notion of wages. Employees are not exclusively interested in their nominal instantaneous individual salary, and other factors may intervene. Labour market economists have developed numerous theories to understand the relationship between labour market participation and wages. Generally, the four principal parameters used are the current wage level, the overall career wage progression rate (return on educational investment), wage increases over the last two years (monetary recompense) and the efficiency wage hypothesis. Moreover, insurance benefits act as a substitute for wages, thus reducing financial losses due to work absence. Other factors also intervene within this relationship. Numerous studies emphasise the diversity of such factors, including gender, age and working conditions.

Taking the model developed by Allen (1981), we return to the specific relationship between wages, social protection and absenteeism. The rest of the paper is organized as follows. Section 2 describes the HYGIE database and presents some descriptive statistics. In section 3, we analyse the determinants of the duration of sick leave. Section 4 presents the conclusions

2. Database and econometric model

2.1. HYGIE Database

Our study is based on data from the merger of two administrative files, the National Health Insurance (CNAMTS) and the National Pension Fund (CNAV). The resulting database contains information on benefit recipients, their professional careers, their health care consumption, sick leave, the employees' professional context and certain characteristics of the companies employing them. Using this database (called HYGIE, 2005), we are able to study the relationships between health, work environment, professional career and company characteristics. Until recently, there was no database that facilitated the simultaneous study of these different dimensions in France. The HYGIE database was created using CNAV data as the starting point. The CNAV data are derived from a sample (random selection) of beneficiaries taken from the National Career Management System (SNGC). The SNGC contains information on all private sector employees in France. In addition, the National Statistical Beneficiary System (SNSP) houses information on all private sector retirees in France. The SNGC was used to extract information concerning beneficiaries' careers, and the SNSP provided information on their retirement. These two data sources provided information about individuals, such as date of birth, gender, etc. This sample was combined with the CNAMTS sick leave data obtained from the National Health Insurance Inter-regime Information System (SNIIR-AM). We thus had available data concerning all of the reimbursements paid out by the different branches of the National Health Insurance. The CNAMTS also provides information on the companies that employ the recipients of the benefits. Thus, we have information on employers' characteristics. Consequently, the resulting file is representative of private sector employees in France and contains detailed information on employees, the companies employing them and their healthcare consumptions. The scope of potential studies with this database is extremely broad. We situate ourselves at the boundary of 'employer/employee' studies on the labour market, studies on the impact of company characteristics on employees' health and studies on the health/work relationship.

This database is particularly suited to analyse the determinants of sick leave as it provides all the periods of absence for all the individuals included in the sample. The HYGIE database provides information on whether the period of sick leave has been concluded at the time of the survey. Moreover, we take into account the right-censoring of individuals because, at the time of the survey, some were still sick and continuing to receive sick leave benefits.

The duration of absence was measured in days, and the period of observation was the year 2005. In this study, the duration of sick leave is placed within the interval [1, 90]. We chose to limit our analysis to durations of less than 90 days for two reasons. First, after 90 days sick leave, the National Health Insurance systematically implements controls on benefit recipients and their GPs to justify the prolonged absence from work. This measure should lead to the diminution of moral hazard ex post. Second, long-term sick leave is relatively rare (7 %). Our final sample is thus composed of 61,905 work absences, of which 5 % are right-censored.

The distribution of individuals by age (see. table 1) corresponds to the age pyramid for private sector employees in France. In total, 33.8 % are between 25 and 34, with diminishing proportions of higher age range. The 55-65 age group represents only 9.5 % of the population.

Three-quarters of employees (75.3 %) entered the labour market before the age of 22. It is important to note that the population entering the labour market at over 27 years old (6.8 %) is exceptional. It encompasses workers entering the market after very long periods of education and individuals that entered the labour market later in life for various reasons.

77.5 % of sampled individuals were employed full time. Individuals covered by the specific Alsace Moselle insurance branch represent 5.5 % of the total sample. In terms of health data, 6.7 % of employees had at least one period of sick leave in 2004. Of all individuals sampled, 10.3 % suffered from a long-term chronic illness (ALD).

The distribution of individuals by company size varies little. In total, 26.2 % of individuals work in companies with 50 to 199 employees. Four business sectors emerge from our database: industry (27 %), real estate (15.6 %), commerce (14.3 %) and health (11.1 %). The three other sectors are less well represented with 12.6 % in the commercial sector, 13.9 % in real estate and only 4.4 % in the health sector.

Table 1: DESCRIPTIVE STATISTICS: TOTAL SAMPLE

Variables	Total sample (%)
Age	
[25; 34]	33.8
[35; 44]	31.0
[45; 54]	25.8
[55; 65]	9.5
Age of entry into the labour market	
Less than 18	28.3
19-22	47.0
23-26	17.9
More than 27	6.8
Working time	
Full time	77.5
Part-time	22.5
Company size	
[1; 9]	15.3
[10; 49]	24.2
[50; 199]	26.2
[200; 499]	17.3
[500; +]	17.0
Industry group	
Agriculture, fishing	0.0
Mining industry	0.2
Manufacturing industry	27.0
Production of electricity, natural gas and water	0.3
Construction	5.0
Trade	14.3
Hotels and restaurants	2.9
Transportation and communication	5.2
Finance	3.4
Real estate, renting and corporate services	15.6
Public sector administration	6.7
Education	1.6
Health and social work services	11.1
Community, social and personal services	4.1
Extraterritorial activities	0.0
Other variables	
Episodes of sick leaves in 2004	6.7
Health insurance scheme for the Alsace-Moselle region	5.5
Having a long-term illness	10.3

The average duration of sick leave is 15 days (see table 2). For all individuals sampled, 25 % (first quartile) were absent from work for less than 5 days, and 25 % (third quartile) were absent for over 17 days. The average unemployment rate is 9.8 %. (first quartile = 8.5 %; third quartile = 10.9 %). The birth rate average is 12.7 % (first quartile = 11.5 %; third quartile = 13.9 %). The average quarterly income is 4,948 euros with the average income variation between $(t+1)$ et (t) is 9.9 %. Beneficiaries in the first quartile have a negative income variation (-2.3 %). The average annual income progression index is 6.7 %.

Table 2: DESCRIPTIVE STATISTICS OF CONTINUOUS VARIABLES: TOTAL SAMPLE

Variables	Average	Q1	Q3
Duration of sick leave	14.8	5	17
Extraterritorial activities	9.8	8.5	10.9
Birth rate	12.7	11.5	13.9
Quarterly income	4,948	3,232	6,030
Index of long-term salary progression	0.067	0.033	0.085
Index of efficiency wage	1.121	0.854	1.275
Salary variation between (t +1) and (t)	0.099	-0.023	0.099

2.2. Econometric model

The econometric analysis is based on a discreet time proportional hazard model using the formulation proposed by Cox (1972) and Jenkins (1995). The baseline hazard was specified using a semiparametric approach (piecewise constant hazard) by specifying the duration dependence terms representing the duration of sick leave. It is nevertheless probable that numerous variables (such as moral hazard and adverse selection of individuals for example) are unknown to the econometrist even if they influence the process of leaving the work absence state. Not taking this unobservable heterogeneity into account may result in a negative bias in the estimation of the temporal dependence parameter. In order to take the unobserved heterogeneity of agents into account, we introduce a multiplicative function into the hazard equation ϵ_i distributed according to a Gamma distribution with a mean 1 and variance $\sigma^2 \equiv \upsilon$ (Lancaster, 1979). The instantaneous hazard rate for the equation is specified as follows:

$$\lambda_{it} = \lambda_0(t)\epsilon_i \, exp(X'_{it}\beta) = \lambda_0(t) \, exp(X'_{it}\beta + \log(\epsilon_i))$$

That is t signifies the duration of the work absence spell, λ_0(t)is the 'baseline' hazard, X_{it} the vector of individual characteristics for the individual i and β the vector for parameters to be estimated.

The discrete time hazard function corresponding to the equation is written:

$$h_j(X_{ij}) = 1 - exp\left[-exp\left(X'_{ij}\beta + \gamma_j + log(\epsilon_i)\right)\right]$$

3. Results

We analyse the influence of worker characteristics, company traits on the duration of sick leave.

Then, to remove the indeterminate income effect on the duration of work absence, we introduced the four income variables separately: current income, total career wage progression, wage progression over the last two years and efficiency wage.

The baseline hazard, specified as a piecewise constant retained here, assumes a constant hazard in three day intervals from the 1^{er}.to 9^{e} day ($\gamma_1, \gamma_2, \gamma_3$), then 10 day intervals from the 10^{e} to the 29^{e} day (γ_4, γ_5), then 15 day intervals from day 30^{e} to 59^{e} day (γ_6, γ_7), and finally, a last interval up to90^{e} day (γ_8) (*cf.* Jenkins, 1995). The variables γ_1 to γ_8 are temporal dummies defining the baseline hazard[1]. The terms of the baseline hazard with a short-duration, between 1 and 3 days, have a negative and significant effect on the instantaneous rate of leaving the work absence state. This tendency is inverted for longer periods of sick leave, lasting between 4 and 9 days, for which the terms of the baseline hazard terms have a positive and significant effect. This effect tends to reduce the duration of sick leave and, as a result, increases the likelihood of returning to work. For longer spells of sick leave, up to two months duration, the baseline hazard has a negative effect on the rate of leaving the work absence state and thus significantly increases the duration of sick leave during these periods.

Table 3: DETERMINING THE DURATION OF SICK LEAVE

	Models					
	(1)	(2)	(3)	(4)	(5)	(6)
Term of basis risk						
γ_1 [1; 3]	-2.555***	-2.547***	-2.554***	-2.555***	-2.555***	-2.545***
γ_2 [4; 6]	0.121***	0.128***	0.121***	0.120***	0.120***	0.130***
γ_3 [7; 9]	0.096***	0.101***	0.096***	0.096***	0.096***	0.102***
γ_4 [10; 19]	-0.217***	-0.216***	-0.217***	-0.217***	-0.218***	-0.216***
γ_5 [20; 29]	-0.305***	-0.307***	-0.305***	-0.305***	-0.305***	-0.308***
γ_6 [30; 44]	-0.216***	-0.223***	-0.216***	-0.216***	-0.216***	-0.225***
γ_7 [45; 59]	-0.099**	-0.111**	-0.099**	-0.099**	-0.098**	-0.113**
γ_8 [60; 90]	0.656***	0.635***	0.655***	0.656***	0.656***	0.630***
Gender						
Male	0.156***	0.121***	0.157***	0.155***	0.157***	0.120***
Age (Ref: [25; 34])						
[35; 44]	-0.026*	-0.073***	-0.027*	-0.025*	-0.025*	-0.095***
[45; 54]	-0.103***	-0.175***	-0.106***	-0.102***	-0.103***	-0.205***
[55; 65]	-0.224***	-0.301***	-0.226***	-0.223***	-0.223***	-0.331***
Age of entry into the labour market (Ref.: Less than 18 years old)						
19-22	0.073***	0.045**	0.073***	0.074***	0.073***	0.044**
23-26	0.106***	0.045**	0.107***	0.108***	0.106***	0.051**
More than 27	0.075**	0.066**	0.076**	0.076**	0.075**	0.074**
Working time (Ref.: Part time)						
Full time	0.107***	0.023	0.108***	0.107***	0.107***	0.023

[1] The constant was omitted to avoid perfect collinearity with the temporal dummies (Jenkins, 1995).

Episodes of sick leave in 2004	-0.213***	-0.186***	-0.214***	-0.213***	-0.211***	-0.200***
Health insurance scheme for the Alsace-Moselle region	0.206***	0.191***	0.206***	0.206***	0.206***	0.191***
Having a long-term illness (ALD)	-0.326***	-0.295***	-0.326***	-0.326***	-0.326***	-0.297***
Company size (Ref.: [1; 9])						
[10; 49]	0.147***	0.119***	0.147***	0.149***	0.147***	0.122***
[50; 199]	0.217***	0.191***	0.217***	0.220***	0.217***	0.196***
[200; 499]	0.239***	0.198***	0.239***	0.242***	0.239***	0.201***
[500; +]	0.276***	0.198***	0.277***	0.280***	0.277***	0.206***
Industry group (Ref.: Trade)						
Agriculture. fishing	-0.190	-0.160	-0.189	-0.190	-0.190	-0.147
Mining industry	0.282**	0.230*	0.283**	0.283**	0.282**	0.234*
Manufacturing industry	0.135***	0.115***	0.135***	0.135***	0.135***	0.114***
Production of electricity. natural gas and water	0.147	0.127	0.147	0.147	0.147	0.128
Construction	0.067**	0.123***	0.067**	0.068**	0.067**	0.126***
Hotels and restaurants	-0.157***	-0.112**	-0.158***	-0.157***	-0.157***	-0.111**
Transportation and communication	0.074**	0.073**	0.074**	0.073**	0.073**	0.073**
Finance	0.196***	0.112***	0.197***	0.195***	0.196***	0.112***
Real estate. renting and corporate services	0.043**	0.047**	0.043**	0.043**	0.043**	0.050**
Public sector administration	0.213***	0.227***	0.213***	0.212***	0.213***	0.226***
Education	0.228***	0.248***	0.228***	0.228***	0.229***	0.249***
Health and social work services	0.078***	0.109***	0.078***	0.077***	0.078***	0.107***
Community. social and personal services	0.096**	0.115***	0.096**	0.097**	0.096**	0.119***
Extraterritorial activities	0.640	0.500	0.644	0.641	0.640	0.539
Others variables						
Average annual unemployment rate	0.002	0.005	0.002	0.002	0.002	0.004
Birth rate	0.033***	0.024***	0.034***	0.034***	0.033***	0.025***
Salary variables						
Log (Salary)		0.250***				0.269***
Index of long-term salary progression			-0.058			-0.660***
Index of efficiency wage				-0.010**		-0.019***
Salary variation between (t +1) and (t)					0.007	0.010**
Heterogeneity of variance Gamma						
Number of observations	918,243	918,243	918,243	918,243	918,243	918,243
Number of episodes	61,905	61,905	61,905	61,905	61,905	61,905
Log-Likelihood	-203,891.82	-203,572.43	-203,891.57	-203,889.17	-203,891.42	-203,538.27
LR Gamma 2 (01)	392,976	393,999	392,818	393,684	393,753	391,110

There is an increasing relationship between age and the duration of sick leave in the age range (25-34 years old). Individuals over 34 years old have significantly longer spells of sick leave (negative and significant effect of the coefficients which correspond to a reduction in the rate of leaving the work absence state).Two principal reasons can explain this relationship

between age and duration. First, there is a correlation between age and health status. Additionally, a longer work absence corresponds to a poorer health status. Second, in France, and many other western countries, sick leave can be one of the ways of withdrawing from the labour market for elderly employees.

Compared with individuals entering the labour market at 18 years old and under, those entering the market later have significantly shorter spells of sick leave. Individuals entering the labour market at an early age are essentially characterised by a low level of human capital. They are more likely to be employed in jobs requiring lower skill levels and characterised by poorer working conditions. Inversely, late entrants to the labour market recording significantly shorter spells of work absence, generally have a higher level of education, are employed in jobs with a greater degree of responsibility, autonomy and recompense and benefit from better working conditions.

Periods of work absence during an employee's career significantly influences sickness absence behaviours. In effect, the duration of sick leave tends to be longer among employees that have already had a period of sick leave during the previous year. This correlation reveals an accumulative effect of work absence and gravity of the illness

Regarding current employment characteristics, employment status has a significant effect on the instantaneous rate of returning to work. The characteristics of individuals working full or part-time are, however, very different. Consequently, it does not necessarily relate to the marginal increase in working hours or even a complete change in the relationship to work. Moreover, part-time work is often a constrained employment contract for unskilled jobs. Thus, one could conclude that this correlation reveals 'working conditions' and 'intra-family relationship' effects.

The duration of sickness-related work absences is positively correlated to company size. The instantaneous rate of change from the state of work absence to work attendance increases with the size of the company. Individuals working in companies with between 10 and 49 employees are 15 % more likely to have shorter periods of sick leave than those working in smaller companies (model 1, table 3). This probability increases continuously to 28 % for workers in companies with over 500 employees. One reason can essentially explain this relationship: in large companies, it is possible that absence monitoring is less prevalent and there is a feeling that one's role is less important than in a small company. There is probably also a health insurance effect.

In relation to the commercial sector, the industry and health sectors have a positive and statistically significant effect on the rate of leaving the work absence state. Similar to the effects of company size, the existence of more favourable branches or sectoral collective agreements can explain these differences. It may also be due to a selection process in the labour market that orients more fragile workers towards certain sectors rather than others.

All other things being equalindividuals with a long-term chronic illness (ALD) (Model 1, table 3) are, respectively 33 % more likely to have longer periods of sick leave and to remain in that state longer than non-ALD individuals. This effect undoubtedly corresponds to health concerns, but there is also an insurance coverage effect. The ALD scheme does not have a direct impact on wage compensation. Rather, it has a more indirect effect. If the work absence is due to the recognised chronic condition, the related health expenditures are reimbursed at 100 %. The relative cost of the illness is thus reduced. For example, the GP consultation prescribing sickness absence and the related health expenditures will be reimbursed at 100 % for a patient benefitting from ALD if the work absence is directly related to this recognised

chronic condition. This is not the case for non-ALD patients. It should not be forgotten, however, that individuals with ALD coverage are in a poorer state of health than those without and that the longer periods of sick leave are due primarily to a deteriorated health status.

In France, we have a natural experiment linked to the history of the territory. Indeed, the labor law of the Alsace Moselle department rely on German law, which plans, in case of disease, the preservation by the employer of the complete remuneration, without period of deficiency and conditions of seniority. Workers in this plan lose a lower share of their wages than regular French workers. Coverage under the Alsace Moselle Health Insurance plan reduces the duration of sick leave. Because this regime is more generous in terms of covering wage loss, it should be positively correlated with longer durations. This finding confirms that the generosity of the Alsace Moselle regime incentivises repetitive absences of shorter duration (Ben Halima, Debrand and Regaert, 2011). However, the specificities of the Alsace Moselle insurance scheme are not limited to health insurance coverage (Chemin and Wasmer, 2008).

Regarding the four income variables used for this study, the effects are contrasted. There is a negative correlation between salary and the duration of sick leave. Among the men, we find this negative effect for wage progression since the beginning of the career variable, with the inverse being true for women. The other variables have no influence on the duration of sick leave for men. For women, the relative wage[2] variable is positively correlated with the duration of sick leave. This result contradicts the efficiency wage theory. Effectively, women earning higher salaries than other women working in the same sector and within the same department have longer periods of sick leave. However, this indicator may represent a social protection effect. If one admits the hypothesis that complementary health insurance coverage is complementary in terms of salary (the dual economy hypothesis: a well-protected sector with high levels of remuneration and a less well-protected sector with lower wages), it would not be illogical to observe a positive relationship between the duration of sick leave and relative wage. Contrary to what we could have expected, we are unable to demonstrate a short-term wage progression effect on work absence duration.

4. Conclusion

The aim of this article was to reveal the relationships between the duration of sick leave, income and Health Insurance. We estimated a discrete time proportional hazard model taking unobserved heterogeneity into account. The results show that current income has a negative effect on the duration of sick leave. In contrast, a significant long-term wage progression tends to reduce the duration of sick leave for men but lengthen it for women. Moreover, the different Health insurance modalities appear to modify employees' behaviour concerning sick leave.

[2] We determine employees' income positions relative to average incomes within the same department and business sector.

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

$\forall j = 1, \dots, J$: departments,

$\forall \alpha = 1, \dots, A$: business sectors,

w_{ija}: Income of an individual i belonging to department j within the business sector a.

We calculate the individual's relative income i by comparing the individual's situation (w_{ija}) with the average situation of other employees in the same department and business sector:

$$WR_{ljk} = \frac{w_{ija}}{w_{\iota \epsilon ja}}.$$

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