Workers Compensation Systems: does experience rating influence firms' practices?

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Abstract

In France, the public Workers compensation system (covering the private sector) is funded by firms. Premiums paid by employers are experience rated (as in many other countries), in a way to encourage firms' investment in workplace prevention. This article provides empirical results on the question of the influence of experience rating on firms' practices. We measure the impact of experience rating on absence days due to work-related injuries, using a longitudinal administrative establishments database for the years 2005 to 2008. The method consists of a fixed effect estimation combined with an instrumental strategy. Our results suggest that experienced rating induces a decrease in absence days due to work-related injuries.

Key-words: experience rating, work-related injuries

JEL: J28; I13; I18

Introduction

Exposures to work-related health risks concern a large proportion of working populations, as statistics on working conditions and workplace injuries and illnesses show. In several countries, facing the need to improve health and safety at work, many policy incentive tools were introduced (Kankaanpää, 2010). This article examines one of those tools in France: the experience rating premium setting of the compulsory workers compensation insurance system. This system is funded by firms. Premiums paid by employers are experience rated as a mechanism to encourage firms' investment in workplace prevention measures.

Is experience rating really effective in inciting employers to invest more extensively in prevention? This system may be insufficiently incentive insofar as a large part of the cost of work-related health problems is not internalized through its rules. Furthermore, several other firms' behaviours in reaction to that system may be supposed: other practices have been documented in the literature (Kralj, 1994; Hyatt and Kralj, 1995; Thomason and Pozzebon,

2002; Askenazy, 2005; Tompa et al., 2012) such as monitoring and challenging claims, but also risk externalization, zero injuries practices, workers selection and so on.

Empirical studies are relatively few (Askenazy, 2005; Tompa et al., 2007, 2012; Esler et al. 2010). The question has not been investigated in France. However, the development of knowledge in this field is essential as a means of informing public makers in implementing or reforming the existing systems. Especially, the text adopted by the European Parliament defining EU strategy concerning Health and Safety at Work encouraged Member States to carry out this type of analysis.

This article provides empirical insights for France on the influence of experience rating on firm's practices. We presents a measure of the impact of experienced rating on absence days due to work-related injuries. We use an administrative panel establishments database for the years 2005 to 2008, extracted from the database Hygie carried out by the Institute for Research and Information in Health Economics (IRDES).

Section 1 provides a description of the French workers compensation insurance system. Section 2 presents theoretical considerations and an empirical literature review. Section 3 exposes data and method. Section 4 presents empirical results.

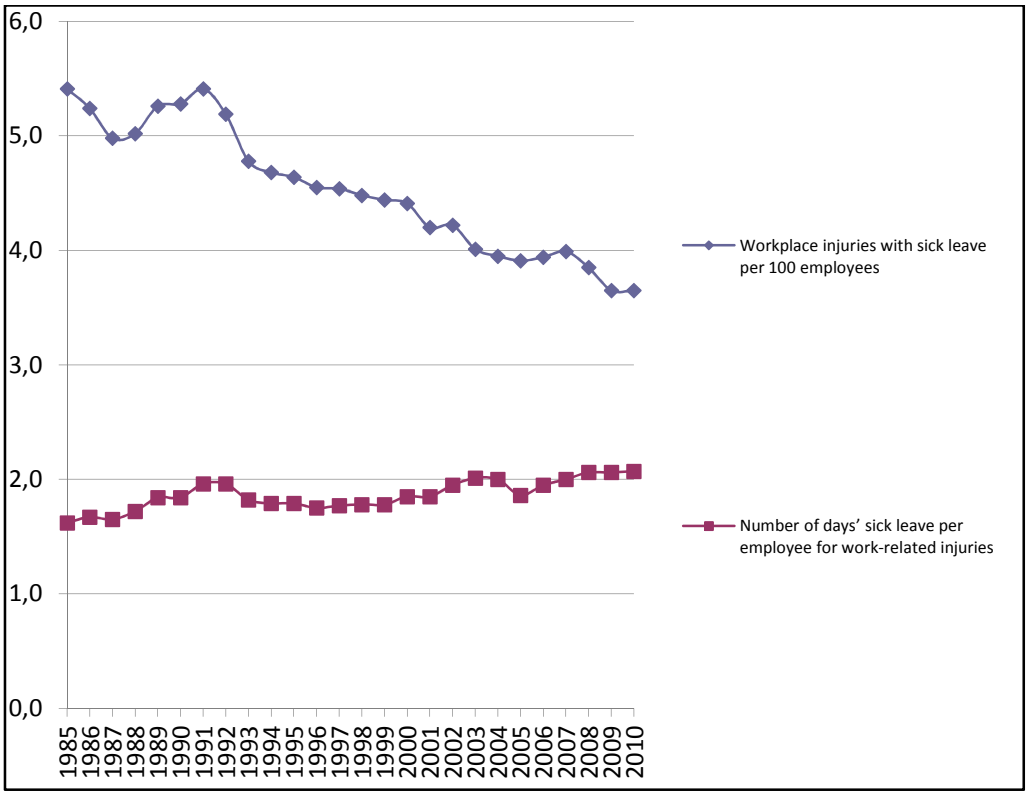
1. Workers Compensation Insurance system in France

In the 19th Century, employers were in general not liable in the case of workplace injury. The financial and non-financial consequences of workplace injuries were borne entirely by the employees concerned and their households. The Law of April 9th 1898 on workers' compensation for workplace injuries instituted the employer no-fault liability. A work-related injury was thereby defined as any injury, whatever its cause, that occurred in the workplace.

The basic foundations of the workers compensation system as it exists today were established in 1946 (Viet and Ruffat, 1999). The legislation instituted a pricing system linking the cost of employers' workers' compensation insurance premiums to their claims history, whilst making provision for a partial risk-pooling mechanism (for small firms notably). Workplace prevention was the primary motive in introducing this system.

Work-related injuries rate has decreased during the last thirty years (graph 1), linked with the automation, the disappearance of very high-risk work activities and investments in workplace hazard prevention. However, on the other hand, the number of absence days per employee for work-related injuries has tended to increase, that may be correlated with the overall deterioration of working conditions and a labour force composition effect related to ageing.

Graph 1 Evolution of workplace injuries with absence days

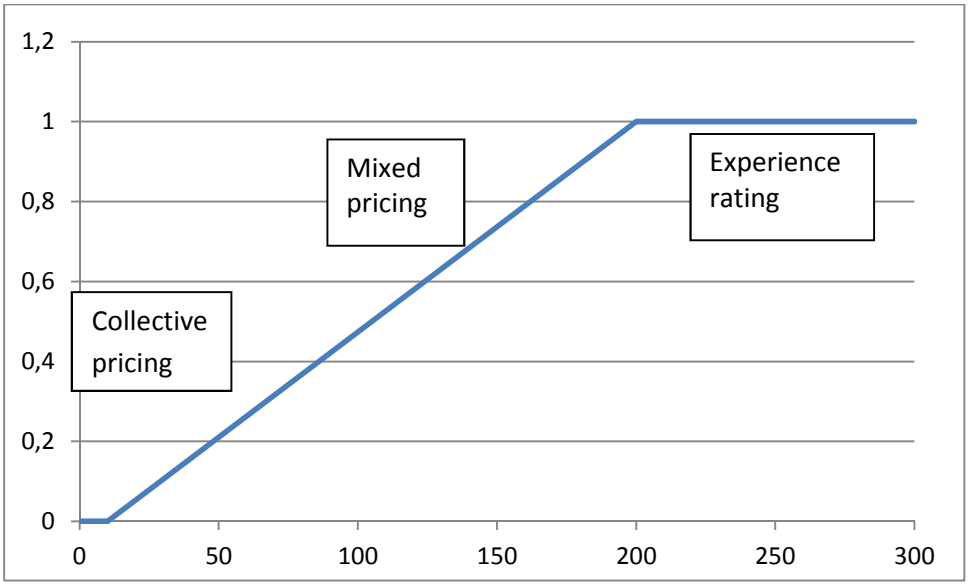


The general rules are the following ones. Firms counting from one to ten employees paid a collective premium by type of risk class; in this article, it will be said *Collective pricing*. The different homogenous risk classes (almost 700) are pre-established by the public insurer. Premiums for firms with over 200 employees were set according to the observed cost of claims in previous years; in this article, it will be said *Experience rating*. A medium-sized firm was subject to a mixed pricing in which premiums are only partially based on the firm's previous claims history, depending on the size of the firm (graph 2); in this article, it will be said *Mixed pricing*.

Firms of several activity sectors are assigned to the *Collective pricing* whatever their size for the main reason that those sectors present a very low frequency of workplace injuries and

illnesses: bank, insurance, administrative private sectors…

Graph 2 Level of experience rating noted i according to firm size



As mentioned previously, the annual premium rate for a firm subject to the *Collective Pricing* is determined by the aggregated claims for the entire risk class to which the firm belongs. More precisely, for each establishment of the firm, this premium rate is calculated according to risk class claims history in t-2, t-3 and t-4. The premium rate is calculated as follows:

$$tx_{collective} = \frac{DI_{Class}(t-2,t-3,t-4)}{MS_{Class}(t-2,t-3,t-4)}$$

Where:
- DI_{Class} : total claims costs attributable to all firms within the risk class,
- MS_{Class} : total payroll in that risk class.

If the firm is subject to *Experience rating*, the premium rate will be determined entirely by the firm's results. More precisely, for each establishment making up the firm, the premium rate takes the value:

$$tx_{experience-rated} = \frac{di_{Establishment}(t-2,t-3,t-4)}{ms_{Establishment}(t-2,t-3,t-4)}$$

Where:
- $di_{Establishment}$: claims costs attributable to the establishment,
- $ms_{Etablishment}$: total payroll of the establishment.

If the firm is subject to *Mixed pricing* with a degree of experience rating *i*, then for each establishment making up this firm, the premium rate takes the value:

$$tx_{mixed} = itx_{\exp erience-rated} + (1-i)tx_{collective}$$

2. Theoretical considerations and previous evidence

Several theoretical arguments are given in favour of an experience rating system in the field of workplace health and safety, as developed by Diamond (1977), Carmichael (1986), Bruce and Atkins (1998) and also civil liability, insurance and pigouvian taxation theories.

The optimality of the employer no-fault liability system is analysed theoretically by Diamond (1977) notably. The author compares this system (that may be comparable to a compulsory workers compensation system funded by employers perfectly experience rated) to an alternative system in which employees are strictly liable and bear all the costs. Both employees and employers are supposed to be able to modify the level of injury risk by adjusting the allocation of resources to prevention; the occurrence of an injury would thus depend on both employers' behaviour in terms of prevention investment *x* and that of employees *y*. Employer and employee investments in prevention are two convex functions *A(x)* and *B(y)*. The expected cost of workplace injuries and illnesses is expressed as *C(x, y)*. The social cost of workplace injury *CS(x, y)* is equal to the sum of employees' and employers' investments in prevention and the expected cost of workplace injuries and illnesses: CS(x, y) = A(x) + B(y) + C(x, y). If the firm bears the cost of workers compensation (employer no-fault liability), it will invest in risk prevention x^* minimising the social cost of workplace injury for a given level of employer investment *y*; employee investment is minimal y^0. In this case, the situation is not optimal: employee investment in safety is below the optimal level required y^* to minimise social costs. In this framework, liability rules are socially optimal only if the injured party is unable to influence the probability of injury. Diamond (1977) points out that a compulsory workers compensation system funded by the employer does not minimize the social costs of work-related injuries. He however suggests that if employer investments in safety measures reduce risk more effectively than employee investments in prevention, then this system would be preferable than the employee liable system.

Bruce and Atkins (1998) advance other arguments in favour of a compulsory workers'

compensation system funded by the employer. In supplying their employees with insurance against workplace hazards at a lower price than if each employee had to purchase individual contracts on the insurance market, employers generate economies of scale. Bruce and Atkins (1993) also point out that if one considers the employer to be better informed concerning the injury risks of the firm, it is preferable to place liability on the employer. They however also indicate that it is preferable to combine this system with one that also incites employees to invest in safety measures and/or including employee contributions to the cost of insurance.

Empirical evidence on the incentive effects of experience rating in the field of workplace safety is scarce but give insights. Different empirical methodologies have been used.

Over the last decades, several countries have adopted such an incentive tool. In certain cases, the regulatory change has been the subject of empirical 'before and after' measures of the effects of the new system (Bruce and Atkins, 1993; Kralj, 1994; Kötz and Shäffer, 1993; Koning, 2009).

In the United States, firms are subject to the obligation to purchase workers compensation insurance from either a private or public insurance agent, or can self-insure. A minimum compensation rate, fixed at State level, must be guaranteed for each employee. Insurance premiums are generally experience rated and the level of experience rating increases the larger the size of the firm. Krueger (1990), Ruser (1985, 1991), Moore and Viscusi (1989) and Asfaw et al. (2009) adopted a similar empirical method that consists in comparing workplace safety among employees working in self-insured firms with those working in firms with private insurance contracts. The hypothesis examined is as follows: firms subscribing to private insurance contracts pay insurance premiums imperfectly experience rated contrary to self-insured firms.

Hyatt and Thomason (1998) used a survey carried out in British Columbia firms, examined employers' decisions to adopt safety measures during the period 1994-1996. In order to identify the effects of experience rating on safety measures, the statistical method used consists in comparing employers' aware of this experience rating system, with those claiming they are not informed. Thomason and Pozzebon (2002) used data from a survey carried out in 1996 in Québec. Three pricing mechanisms were compared: collective pricing, mixed pricing and an entirely experience rated pricing calculated for the current year. Firms' assignation to

one or other of these categories was calculated according to its payroll and the collective rate for the group. Firms were contacted by telephone and the survey carried out with the person identified as being responsible for health and safety issues within the company. To our knowledge, Tompa *et al.* (2012) present the most recent results, using longitudinal administrative micro-level data.

A part of the results suggest that experience rating has an effect in reducing workplace injuries rates and the number of absence days due to workplace injuries. These results are indirect effects in the sense that they identify a relationship between experience rating and observed injury without analysing the causal chain behind. Other results give insights on this causal chain: as suggested, employers react to experience rating by developing different practices. Other than increasing employers' prevention efforts (workplace health and safety training, adaptation of jobs after an injury, calling on specialised consultants…), experience rating provides an incentive to monitor compensation claims, claims costs and to challenge claims.

3. Data and method

Data

We used a data set from the database Hygie constituted by IRDES[1]. Hygie was extracted from files of the French public health and retirement insurance data systems covering the private sector. It allows following 553,951 workers or ex-workers aged between 20 and 70 in 2005 during the period 2005-2008 and contains workers' establishments characteristics.

The sample we use contains establishments extracted from this database. It is constructed as follows. First we selected the subsample of individuals who work in the same establishments all along the four years; thus it corresponds to a sample of stable workers and their establishments. The database Hygie contains several variables on the establishments for each year: workplace injuries, size, total payroll, activity sectors, premiums rate and geographical information. We selected the activity sectors concerned by the experience rating mechanisms, i.e. manufacturing, construction, commerce, food services and transport. Then we selected individuals working in establishments that registered workplace injuries or illnesses each

[1] http://www.irdes.fr/EspaceRecherche/Partenariats/Hygie/index.htm

year; indeed, a limit of this database is that the variables on establishments are only available for those particular establishments. Thus our analysis focuses on this subsample of establishments that registered workplace injuries or illnesses each year; in particular, this sample concentrated the establishments characterized by a high level of workplace injuries or illnesses. In spite of that limit, the sample selected offer the possibility to study 44,689 distinct establishments with establishments' information available for the four years 2005-2008. Those establishments employ roughly 2.9 million workers.

Tables 1 and 2 provide descriptive statistics. The manufacturing industry, construction and services represent respectively 36.6%, 17.8% and 45.6% of the establishments in our sample. A large majority of those establishments (more than 60% each year) belongs to firms subject to *Mixed Pricing*. *Experience Rating* and *Collective Pricing* concern respectively around 27% and 11% of the establishments. As expected, we observe a high injury level in the sample. Approximately 86% of establishments registered workplace injuries with absence days. On average, each year, a worker reports 3.5 to 3.7 absence days due to workplace injuries, that is higher than the national figures; this number is increasing over the period 2005-2008, that is coherent with the national trend (see graph 1).

Table 1 Descriptive statistics

	2005	2006	2007	2008
Number of establishments	44,689	44,689	44,689	44,689
Agregated activity sectors				
Manufacturing	0.366			
Construction	0.178			
Commerce	0.261			
Food services	0.091			
Transport	0.103			
Type of pricing				
Experience rating	0.261	0.272	0.275	0.278
Mixed pricing	0.601	0.621	0.633	0.634
Collective pricing	0.115	0.105	0.091	0.088
Injuries rate	0.867	0.862	0.862	0.846

Table 2 Descriptive statistics

	Year	Mean	Standard deviation	1srt quartile	Median	3rd quartile
Number of absence days per worker	2005	3.539	5.526	0.385	1.563	4.308
	2006	3.657	5.765	0.357	1.542	4.359
	2007	3.672	5.717	0.364	1.567	4.484
	2008	3.712	5.835	0.314	1.528	4.563
Total payroll (euros)	2005	2,187,440	8,096,388	391,792	785,476	1,785,042
	2006	2,243,762	8,139,772	408,322	811,803	1,845,267
	2007	2,319,722	8,460,187	421,139	844,031	1,904,694
	2008	2,374,250	8,561,841	425,808	862,473	1,965,661
Establishment size	2005	83	237	19	37	78
	2006	83	233	19	37	78
	2007	83	227	19	37	78
	2008	82	221	19	37	78
Premium rate	2005	3.19	2.17	1.81	2.47	4.13
	2006	3.38	2.18	1.97	2.63	4.36
	2007	3.40	2.12	1.99	2.68	4.37
	2008	3.35	2.00	2.00	2.69	4.34

Econometric method

The outcome is the number of absence days due to workplace injuries, noted y_{et} corresponding to the establishment *e* and the year *t*. We examine the following hypothesis. For firms subject to *Experience Rating*, a high level of premium rate should have an effect on employers behaviour (notably greater prevention efforts) that may induce, in turn, a lower number of absence days due to workplace injuries; on the contrary, a relatively low premium

rate is likely to result in less effort in terms of risk prevention (or other practices aimed at reducing costs) that may induce a lower number of absence days due to workplace injuries. For firms assigned to *Mixed Pricing*, the sense of the expected effect is the same but its strength may be lower. For firms assigned to *Collective Pricing*, the premium rate does not influence practices and, thus, does not influence the number of absence days due to workplace injuries.

We consider the following linear equation for two dates t=2007 and 2008.

$$(1) \qquad y_{et} = X_{et}\beta + \gamma p_{et} + u_e + \varepsilon_{et} \qquad e: establishment \qquad t = 2007,2008$$

Where X_{et} is a vector of time variant establishments characteristics; p_{et} is the logarithm of the premium rate of the establishment for the year *t*; u_e are the establishments fixed effects that control for invariant unobserved determinants of the number of absence days due to workplace injuries; ε_{et} is the error term. More precisely, the vector X_{et} includes the establishment size, the establishment total payroll and an interaction between sector activities and time.

The first difference eliminates the establishments fixed effects.

$$(2) \qquad \Delta y_{et} = \Delta\alpha_t + \Delta X_{et}\beta + \gamma\Delta p_{et} + \Delta\varepsilon_{et}$$

The parameter of interest γ represents the relation between the premium rate and the outcome. According to our hypothesis, it is expected that it will be negative. First we use OLS (ordinary Least Square) regression models in order to measure the relation between the premium rate variation and the outcome variation, for different groups determined by the type of pricing (*Experience rating*, *Mixed pricing* and *Collective pricing*) and establishment size in 2007. Remind that the firm size determines the type of pricing; the premium rate is calculated at the establishment level, whatever its size; consequently a small establishment that belongs to a firm of more than 200 workers for instance will be assigned to *Experience rating*. We defined seven groups: establishments subject to *Experience rating* with less than 50 workers (1), 50 to 100 (2), more than 100 workers (3); *Mixed pricing* with less than 50 workers (4), 50 to 100 (5) and more than 100 workers (6); establishments subject to *Collective pricing* (7). This stratification allows analysing potential differences in the relation between the premium rate variation and the outcome variation. In establishments subject to *Mixed pricing*, the strength

of the relation may be lower than in establishments subject to *Experience Rating*. Furthermore, the strength of the relation may be related to the establishment size because of economies of scale.

However the hypothesis of the exogeneity of Δp_{et} may be unreliable and OLS estimators may be inconsistent. Especially, we may suspect that the variations of the outcome and the premium rate are correlated to unobserved factors. We may suspect also a 'return to mean' phenomenon. In order to overcome the potential endogeneity problems, we use a 2SLS (two-stage least squares) instrumental variable approach. We instrument Δp_{et} using a lagged variable: the variation of the total payroll between the years 2005 and 2006, noted z_e. The intuition behind this choice is as follows. Insofar as the calculation of the premium rate p_{et} depends on the total payroll of the years t-2 and t-3, the premium variation Δp_{et} may be strongly correlated to z_e. Indeed, we verify this first condition for establishments of more than 50 employees (see Fisher statistics presented in the results tables 3 to 5). We find a highly negative correlation between Δp_{et} and z_e. In other words, the premium rate decreases between 2007 and 2008 when the total payroll of the establishment between 2005 and 2006 increases. Indeed an increase of total pay roll may be the consequence of new hiring of qualified workers that are less exposed to injuries rate or temporary workers little inclined to report injuries, thus decreasing the premium rate (that is the ratio of injuries costs to payroll). A validate instrument implies also that $\text{cov}(z_e, \Delta\varepsilon_{et}) = 0$. We assume that the total payroll variation between 2005 and 2006 is sufficiently lagged to be uncorrelated with the variation of the outcome between 2007 and 2008 (Δy_{et}).

4. Results

For establishments subject to *Experience rating*, OLS results indicate a decrease of the number of absence days when the premium rate increase (table 3). This relation is significant for establishments of less than 100 workers. 2SLS models have been estimated only for establishments with more than 50 workers because the instrument does not verify the first condition (correlation between the endogenous variable and the instrument) for establishment of less than 50 workers. The estimations indicate a significant negative influence of premium rates on the outcome for establishments of more than 100 workers. Table 4 presents the

results for *Mixed Pricing.* OLS results indicate a significant decrease of the number of absence days when the premium rate increases. Again 2SLS estimations have been estimated only for establishments with more than 50 workers. They indicate a significant negative influence of premium rates on the outcome for establishments of more than 100 workers. Thus those results are coherent with the hypothesis of an effect of *Experience rating* and *Mixed rating* on firms' practices leading to a decrease of injuries absences.

We note too that variations in absence days due to workplace injuries are negatively correlated with variations of establishment size and total payroll, that may be due to the characteristics of last hiring (more qualified workers, workers that are less inclined to report injuries…).

Finally, table 5 presents OLS regression results for *Collective pricing*. Those estimations indicate an absence of correlation between the premium rate and the number of absences days. Thus, this result seems to suggest that *Collective pricing* does not introduce any incentives in terms of firms' practices, as expected.

Table 3 Establishments subject to *Experience rating*

Group:	(1)		(2)		(3)	
Establishment size:	less than 50		[50;100[		100 or more	
	OLS	2SLS	OLS	2SLS	OLS	2SLS
d ln(premium rate)	-3.123***		-0.698*	7.027	-0.301	-10.49**
	(0.862)		(0.416)	(7.224)	(0.198)	(4.319)
d ln(total payroll)	-0.650		-0.0480	0.0704	0.722	0.697
	(0.444)		(0.625)	(0.714)	(0.693)	(0.660)
d ln(size)	-0.225		-1.408**	-1.441**	-2.314***	-2.423***
	(1.057)		(0.625)	(0.632)	(0.749)	(0.700)
Construction	0.531		0.0230	0.178	0.0201	-0.303
	(0.385)		(0.172)	(0.250)	(0.0940)	(0.199)
Commerce	0.494*		0.0376	-0.0979	0.0425	0.00747
	(0.270)		(0.144)	(0.215)	(0.0634)	(0.0663)
Food services	0.772**		-0.127	-0.208	0.126	0.0421
	(0.384)		(0.303)	(0.345)	(0.182)	(0.212)
Transport	0.855**		0.378	0.319	0.0388	-0.0802
	(0.347)		(0.310)	(0.255)	(0.0631)	(0.111)
Constant	-0.338		-0.0291	0.00556	0.0643**	0.148***
	(0.239)		(0.106)	(0.127)	(0.0304)	(0.0519)
N	4,038	4,038	2,464	2,464	5,918	5,918
Fisher statistics		2.07		***		***
Hausman Test				***		***

Robust standard errors clustered by activity sectors in brackets
*** p<0.01
** p<0.05
* p<0.1

Table 4 Establishments subject to *Mixed Pricing*

Group:	(4)		(5)		(6)	
Establishment size:	less than 50		[50;100[		100 or more	
	OLS	2SLS	OLS	2SLS	OLS	2SLS
d ln(premium rate)	-4.875***		-1.138**	-11.70	-1.181***	-17.69**
	(0.724)		(0.517)	(7.828)	(0.368)	(7.274)
d ln(total payroll)	-1.092***		-1.861**	-2.158**	-0.788	-1.460*
	(0.359)		(0.889)	(0.990)	(0.565)	(0.857)
d ln(size)	0.583		-0.794	-0.768	-1.142	-1.037
	(0.460)		(0.866)	(0.932)	(0.803)	(0.846)
Construction	-0.179		-0.127	-0.530*	0.366	-0.709
	(0.137)		(0.178)	(0.318)	(0.239)	(0.566)
Commerce	-0.144		-0.128	-0.0839	-0.0631	-0.230
	(0.122)		(0.0864)	(0.101)	(0.0819)	(0.145)
Food services	-0.314***		-0.156	-0.151	-0.230*	-0.192
	(0.112)		(0.139)	(0.166)	(0.127)	(0.224)
Transport	-0.0947		-0.146	-0.229	0.0161	-0.482
	(0.184)		(0.118)	(0.171)	(0.118)	(0.299)
Constant	0.0953		0.254***	0.263***	0.183***	0.405***
	(0.0716)		(0.0729)	(0.0683)	(0.0527)	(0.131)
N	19,804	19,804	5,880	5,880	2,657	2,657
Fisher statistics		non significant		***		***
Hausman Test				non significant		***

Robust standard errors clustered by activity sectors in brackets
*** p<0.01
** p<0.05
* p<0.1

Table 5 Establishments subject to *Collective pricing*

	Group (7) OLS
d ln(premium rate)	1.094
	(2.613)
d ln(total payroll)	-0.330
	(0.361)
d ln(size)	-0.392
	(0.620)
Construction	0.514
	(0.402)
Commerce	-0.117
	(0.404)
Food services	-0.195
	(0.530)
Transport	0.988**
	(0.438)
Constant	-0.516*
	(0.275)
N	3,917

Robust standard errors clustered by activity sectors in brackets
*** p<0.01
** p<0.05
* p<0.1

Conclusion

Using a French establishments database and a fixed effects estimation combined with an instrumental identification strategy, we find evidence that experience rating induces a reduction of absence days due to workplace injuries for establishments of more than 100 workers belonging to firms that are assigned to a partial or complete experience rating. Those results are consistent with the hypothesis according to which experience rating influence firms' practices. However, other empirical studies are needed in order to identify the mechanisms behind: does this relation reflect an improvement of work-related health and safety? Does it reflect the effect of an incentive to control claims and the duration of absences or even to externalize dangerous activities? In order to investigate these questions, we are studying currently the possibility to construct a database extracted from Workers Compensation boards that will allow us to study the impact of experience rating on several identified outcomes. As a new system was adopted in 2012 (notably instituting a more rapid repercussion of the cost of work-related injuries and illnesses on premium rates and an increase in the level of experience rating), and as the next retirement reform introduces a similar incentive tool aiming at reducing negative work-related health effects, new knowledge on firms' practices in reaction to these policy tools are needed, especially in the context of the current recession.

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