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Experience Rating, Incidence of Musculoskeletal Disorders and Related Absences

Results from a Natural Experiment

Pascale Lengagne, Anissa Afrite (Irdes)

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Irdes - 117bis, rue Manin - 75019 Paris - Tél. : 01 53 93 43 00 - www.irdes.fr

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Experience Rating, Incidence of Musculoskeletal Disorders and Related Absences

Results from a Natural Experiment

Pascale Lengagne[a], Anissa Afrite[a]

Abstract: In many countries, the cost of workers' compensation insurance is borne by firms. The contributions paid by a given firm are linked to its past health costs of occupational injuries and illnesses. This experience rating scheme should encourage firms to invest in occupational prevention, thereby reducing the social costs of adverse occupational exposures. This paper provides results on whether firms respond to an increase in their contribution to occupational musculoskeletal disorder health costs by reducing the incidence of these diseases and related absences. Our identification strategy exploits a natural experiment in the French context in 2007. We use administrative data on establishments for the years 2004 to 2010. Estimations are based on a Difference-in-differences model. The key result is that in activity sectors with a high prevalence of occupational musculoskeletal disorders, which have experimented the highest contribution increase, this increase has induced a substantial diminution of the incidence of those diseases, related absence days and wage indemnities.

JEL codes: J28, I13, I18.

Keywords: Experience rating, Workers' compensation, Occupational musculoskeletal disorders, Work absences.

[a] Institut de recherche et documentation en économie de la santé, Irdes.
Authors for correspondance: lengagne@irdes.fr; afrite@irdes.fr

Tarification à l'expérience, incidence des troubles musculo-squelettiques et arrêts de travail

Pascale Lengagne[a], Anissa Afrite[a]

Résumé : Dans un grand nombre de pays, l'assurance des risques professionnels est financée par les entreprises qui versent des contributions modulées selon leur sinistralité passée. En France, pour une entreprise de plus de 10 salariés, plus le nombre et la gravité des accidents et maladies professionnels sont importants, plus le montant de sa contribution sera élevée. Ce mode de tarification devrait contribuer à sensibiliser les employeurs à l'intérêt de développer des démarches préventives (primaires ou secondaires), afin de réduire leur coût d'assurance, et ainsi contribuer à minimiser le coût social des accidents du travail et maladies professionnels. À partir d'une expérience naturelle observée en 2007 dans le contexte français, nous étudions l'influence d'une augmentation exogène de la contribution des entreprises au coût des troubles musculo-squelettiques (TMS) sur l'incidence de ces maladies et les arrêts de travail associés. Nous estimons un modèle de différence-de-différences, à partir des données administratives de tarification des risques professionnels pour la période 2004-2010. Selon nos résultats, cette augmentation a entraîné une diminution substantielle de l'incidence des TMS, du nombre de jours d'arrêt de travail et du montant des indemnités journalières associés.

Codes JEL : J28, I13, I18.

Mots clés : Tarification à l'expérience, Assurance des risques professionnels, Troubles musculo-squelettiques, Arrêt de travail.

[a] Institut de recherche et documentation en économie de la santé, Irdes.
Auteurs pour correspondance: lengagne@irdes.fr; afrite@irdes.fr

1. Introduction

Exposures to adverse working conditions concern a large proportion of working population, inducing substantial costs to individuals, firms and insurers. In many countries, facing the need to improve work-related health and safety, several policy tools were implemented, among them an appreciable range of firm's financial incentives to invest in work-related health (European Commission, 2010; EU-OSHA, 2010, 2011), which complement law enforcement. Our article examines one of those tools in France: the experience rating scheme in the public workers' compensation insurance (WCI).

The French WCI providing benefits to private sector workers in case of occupational injuries and illnesses is financed by firms. The contributions they have to pay are experience rated[1], in that health costs related to occupational injuries and illnesses of workers in a given firm are charged to its account (fully or partially according to firm size notably). Experience rating (ER) schemes exist in many countries in private or public WCI systems. ER should encourage firms to invest in occupational prevention (primary or secondary), thereby reducing the social costs of adverse occupational exposures. However, this incentive effect is debatable. First, it might be advanced that incentives are ineffective insofar as a large portion of the cost of work-related health problems is not internalized. A substantial part of work-related health problems, such as those induced by adverse psychosocial factors, is unrecognized through workers' compensation; furthermore, a sizeable portion of occupational injuries and illnesses may be underreported (Biddle *et al.*, 1998; Boone and Van Ours, 2006; Galizzi, 2013). Second, several firm behaviors in reaction to ER are suspected, as documented in the literature (Kralj, 1994; Hyatt and Kralj, 1995; Thomason and Pozzebon, 2002; Yakolev and Russel, 2010; Askenazy, 2005; Tompa *et al.*, 2012). Firms may substitute prevention effort with other practices that are less costly, such as monitoring and challenging claims, putting pressure on workers not to report occupational injuries or illnesses, substituting more capital for labor, subcontracting, selecting workers (according to health criteria for instance) or implementing contentious procedures to contest the insurance costs imputed to firms.

ER is a widespread scheme implemented in various areas, notably unemployment insurance and environmental pollution taxation. Theoretical arguments are given in favor of ER in the area of occupational health and safety, as developed by Diamond (1977), Carmichael (1986), Bruce and Atkins (1993), and also civil liability, insurance and Pigouvian taxation theories. If one considers the employer has the ability to realize more prevention investments than employees and is better informed of injury risks within the establishment, it is preferable to place liability on the employer rather than on employees; furthermore, in supplying their workers with insurance against occupational hazards at a lower price than if each worker had to purchase individual contracts on the insurance market, economies of scale may be achieved. In addition, if firms' insurance costs are individualized (fully or only partially) at the firm level, they pay only for their own risk, which may serve a purpose of equity between firms.

Empirical studies of the impact of ER on occupational injuries and illnesses are relatively scarce. Few results are established in the French context. "Before and after"

[1] Except for firms with less than 10 workers.

studies measure the effects on injury, illness or disability outcomes of the introduction of ER systems in Canada, Germany, the Netherlands and the United States (Bruce and Atkins, 1993; Kötz and Schaefer, 1993; Koning, 2009; Krueger 1990, Ruser 1985, 1991, Moore and Viscusi, 1989; Asfaw and Pana-Cryan, 2009; Tompa *et al.*, 2012, 2013). The empirical literature suggests that ER reduces substantially occupational injury rates and the number of absence days due to injuries and occupational musculoskeletal disorders (OMSDs). However, several studies provide only "indirect measurements" in the sense that they identify a relationship between ER and observed injuries without analyzing the underlying causal chain (Kralj, 1994), especially without providing results in terms of improving work-related health and safety (Lengagne, 2015).

This paper provides results on whether firms respond to an exogenous increase in their experience-rated contribution to OMSD health costs by reducing the incidence of those diseases and related absences, in the French context. Our identification strategy exploits a natural experiment that occured in 2007 in a French region. We use establishments data extracted from the public Health insurance files, for the years 2004 to 2010. These data allow to study OMSD outcomes at the establishment level and to focus on activity sectors where OMSDs are particularly prevalent. OMSDs are health troubles in the locomotor apparatus (muscles, tendons, skeleton, cartilage, ligaments and nerves); different parts of the body may be affected: upper and lower back, neck, shoulders, arms, legs, feet and hands. OMSD prevention is an important public health and worker well-being public policy issue. Those disorders are the most prevalent occupational diseases indemnized by WCI. They induce long work absences and permanent disabilities. Those disorders are particularly prevalent in food industry and trade, construction and services to individuals.

Section 2 provides a description of the institutional background: experience rating in France, OMSDs and a detailed description of the natural experiment studied here. Section 3 presents the data and method. Section 4 presents the empirical results. Section 5 concludes.

2. Institutional background

2.1. Experience rating in France

In the 19th century, an employer was usually not liable when a worker was injured in the workplace. The financial and non-financial consequences of occupational injuries were borne by the worker concerned. The law issued on April 9, 1898 on workers' compensation for occupational injuries instituted an employer's no-fault liability. Under this regime, injuried workers received a compensation, paid by employers. An occupational injury was thereby defined as any injury, whatever its cause, that occurred in the workplace.

The basic foundations of the current public WCI as it exists today were established in 1946 (Viet and Ruffat, 1999). The legislation instituted a rating system that links WCI contribution paid by the firm to its past costs (*i.e.* compensation to the employees who had recognized occupational injuries or diseases) while making provisions for a partial risk-pooling mechanism for medium-sized firms and full risk-pooling for small firms.

Firms with over 200 workers are subject to a full experience rating. For the calculation of the contribution (calculated during the year t and due by the firm in t+1), the total costs in the previous years (more precisely t-1, t-2 and t-3) are taken into account; costs included are the total health expenditure insured (wage compensation, hospital expenditure, pharmaceutical expenditure…) related to recognized occupational injuries and illnesses. Firms with one to ten workers are subject to a collective rating. An annual collective contribution rate, calculated at the aggregated level of the risk class, is applied to the total payroll of those firms. The different risk classes (almost 600) are pre-established by the public insurer; each firm is classified in a risk class that corresponds to its activity sector. Medium-sized firms are subject to a mixed rating, in which firm contributions are only partially experience rated (depending on the firm size). Those general rules are those of the period of our study; note that parameters have changed since 2012.

There are some exceptions to those rules. At least, some activity sectors are not concerned and are assigned systematically to the collective rating regardless of their size, because those sectors have a very low frequency of occupational injuries and illnesses. These include bank, insurance and administrative private sectors. The newly created firms are also assigned systematically to the collective rating during the first three years; after this starting period, the type of rating is determined according to the above-mentioned general rules.

2.2. Occupational musculoskeletal disorders: from claiming to recognizing

As mentioned in the introduction, our study focuses on OMSDs. An important point to have in mind is the process from OMSD claiming by workers to recognizing by the insurer. First, the diagnosis of an OMSD is established by a physician. This diagnosis requires the identification of the worker's adverse working conditions and all the processes involved in a typical workday. Specific criteria are required for the recognizing. Consideration is given to the frequency, intensity, duration, and regularity of each task performed at work. The medical diagnosis is established if all criteria are met. If the diagnosis is positive, the worker is supposed to send his/her claim to the local health insurance office. The employer is informed of this claim by the local office at the same time. Then, the occupational nature of the disease has to be determined by this office within a maximal delay of six months.

2.3. Natural experiment

When an OMSD is recognized, the local insurance office sends the information to the regional insurance office. Then this regional office has to decide to charge or not the OMSD costs to the firm. Charging to the firm means that the calculation of its contribution will include the OMSD costs. If not, the employer is not considered liable and does not pay for the OMSD.

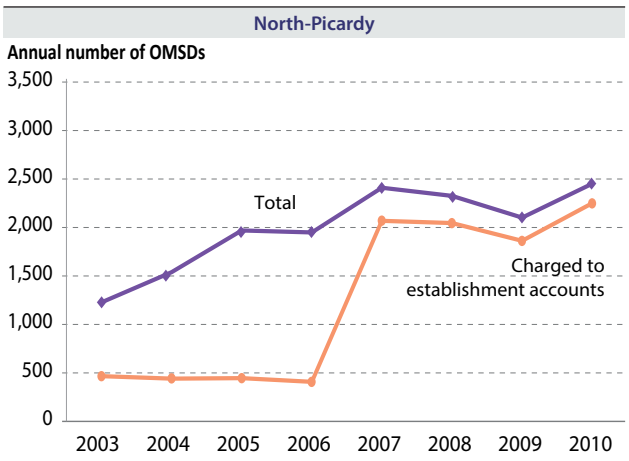
Before 2007, at the regional office level, the question of charging OMSD costs to firms received heterogeneous interpretations because of the absence of an explicit practice standard. OMSDs were still emergent recognized occupational diseases. The jurisprudence specified that if an OMSD is claimed and recognized because of adverse working

conditions in an identified firm, an imputability presumption must be retained: OMSD costs must be charged to that firm, even if the worker has been exposed to the same adverse working conditions in other firms in the past. A network communication mailed to all regional offices presented explicitly the norm for the interpretation of the legislation. A "standard rule" has been explicitly exposed: OMSDs have to be charged to the last firm where the worker has been exposed to adverse working conditions. When it is not possible to identify this firm, costs cannot be imputed to any employers. This situation may occur when a person is exposed to adverse working conditions in two different firms at the same time; in that situation, it is not possible to identify the liability of one firm. The network communication precised also that not imputing to firm accounts should occur only in exceptional situations.

Before 2007, we can observe indeed different regional practices. The North-Picardy region presents an extreme situation. A small number of OMSDs were charged to firm accounts before 2007; thus a large number of firms did not pay for OMSD costs and, consequently, was not encouraged to reduce OMSD outcomes. The situation has been regularized dramatically since then (*cf.* Figure 1), not only because of the network letter but also because of a specific intervention of the national insurance office in that region in 2007. In Figure 1, we observe the strong change which occurred between 2006 and 2007 in North-Picardy: The total number of OMSDs imputed to firms increased strongly.

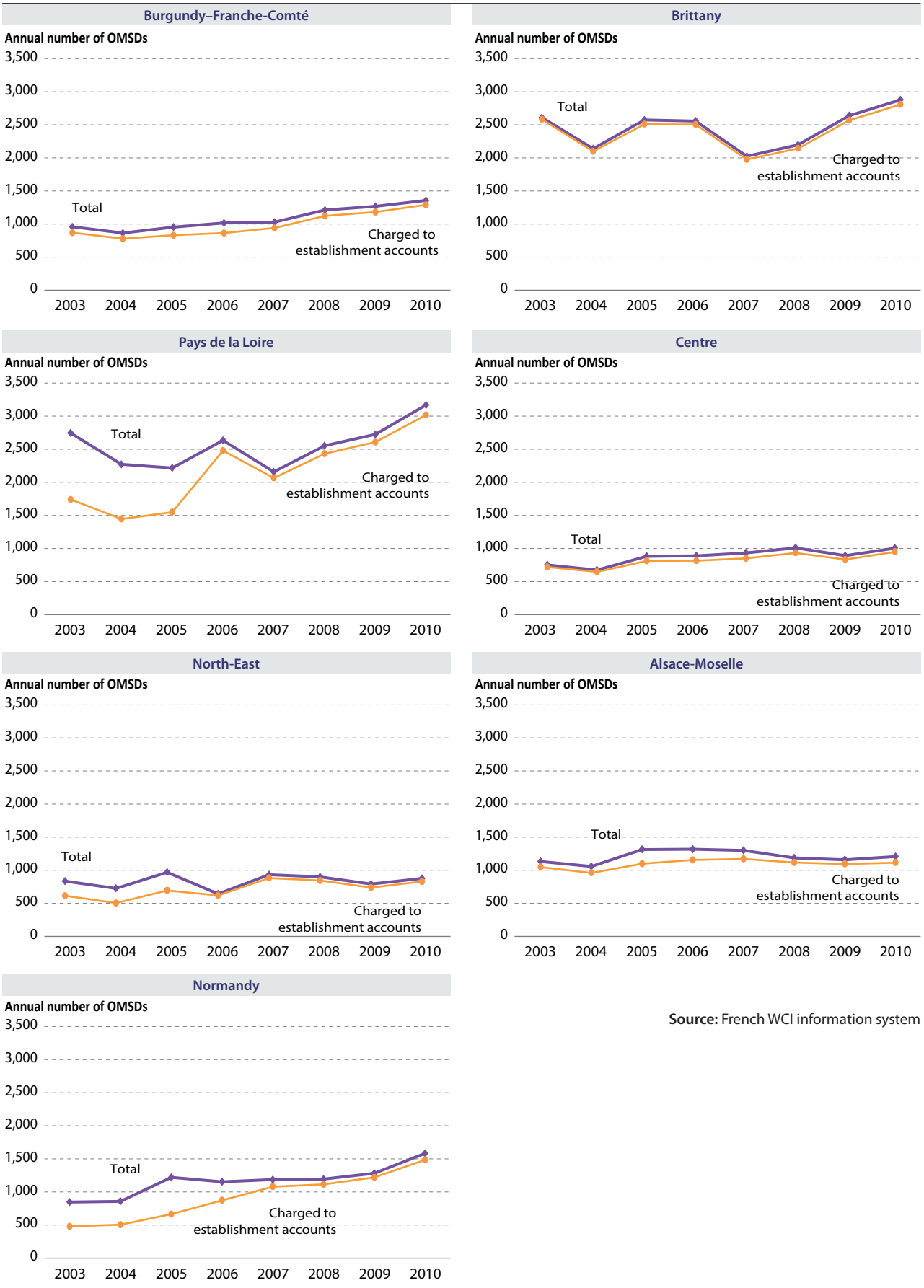
In the other northern regions, we do not observe such a strong break, as illustrated in Figure 2 which shows the evolution of OMSDs for the seven nearest regions. Graphics stress that in some regions, virtually all OMSDs were charged to firm accounts before and after 2007 in accordance with the standard: Burgundy Franche-Comté, Alsace-Moselle, Brittany and Centre. In the other regions (Pays de la Loire, North-East and Normandy), a gap appears between the OMSD total number and the number of OMSDs charged to firms. In reaction to the internal network communication, those

Figure 1. Annual OMSD number in North-Picardy: Total number and number charged to firm accounts



Source: Public French Workers' Compensation Insurance information system.
Scope: All establishments localized in North-Picardy.
Reading: In 2004, 1,536 OMSDs were claimed by workers and recognized for compensation. Among this total, only 441 OMSDs were charged to firm accounts by the regional office.

Figure 2. Annual OMSD number in French northern regions: Total number and number charged to establishment accounts



Source: French WCI information system

regions had to adapt their practices, but it appears that this adaptation was not as strong and sharp as in North-Picardy.

Our study exploits the regional practice change in charging OMSDs to firms in North-Picardy as a natural experiment. This change results in an increase in firms' contribution to OMSD health costs. Establishments in North-Picardy constitute our treated group. Establishments localized in the four regions where we do not observe any change graphically are included as controls in our methodology design. The choice of these mid-north regions is justified insofar as they are geographically closest to North-Picardy, which provides a relative comparability in terms of activity sectors notably. Note that the region Ile-de-France — whose economic and demographic characteristics are different from those of the provincial regions — is not retained here.

3. Econometric method

3.1. Data

We use administrative data on establishments for the period 2004-2010, extracted from the French WCI information system. These data provide several variables on occupational injuries and diseases in all private sector establishments that belong to firms with at least 10 workers. They include frequency, compensation expenditures (wage indemnities, pharmaceutical expenses, hospital bills…) and number of absence days related to OMSDs charged to establishments by regional offices. They provide also establishment characteristics (establishment size, firm size, total payroll and activity sector). We focus on establishments localized in the regions we have selected: the North-Picardy region, where we observe a strong change from 2007 in charging OMSDs to establishment accounts, corresponding to our treatment group, and northern surrounding regions defined as our control groups, where no change is observed, as explained in section 2. Furthermore, we restrict the sample to establishments subject to ER (partial or full ER). Thus, it excludes firms that are under collective rating: newly created establishments and firms from bank, insurance and administrative sectors. Table A1 in Appendix provides the number of establishments in the sample for each region included in the study. The North-Picardy region is the largest in terms of establishment number. The number of establishments increased steadily over the period 2004-2008; then, a relative diminution is observed due to a reduction of firm demography following the 2008 crisis.

3.2. Outcomes

We retain three OMSD outcomes. First, we consider the number of OMSDs charged to establishments during the year t, noted as Y_t^1. The second outcome is the annual number of absence days related to these OMSDs, noted as Y_t^2, and the third outcome is the amount of absence indemnities related to these OMSDs, noted as Y_t^3. These outcomes are indicators of OMSD costs on which firms may have an influence by adaptating working conditions and accelerating workers' return to work.

3.3. Hypotheses to be tested

As mentioned above, the North-Picardy insurance office has strongly increased the number of OMSDs charged to establishment accounts, from 2007. This was a change in the internal office practice; firms in that region were not informed of this internal change, so we may assume that the increase was unexpected from the firm perspective and thereby potential anticipation effects cannot be suspected. Furthermore, the increase of the number of OMSDs charged to firm accounts could only have been perceived by firms during the second semester of 2008. Indeed, for a given OMSD recognized during the year t (2007), the employer is not immediately informed of the decision of the regional office: This information is communicated to the employer only during the second semester of the next year t+1 (2008). Thus, firms' potential reaction to the increase of OMSDs charged to their accounts in North-Picardy could not have occured before the second semester of 2008.

We examine the hypothesis that the increase in OMSDs charged to establishment accounts in 2007 has influenced employer behaviors in North-Picardy after the year 2008. These behaviours may consist of investment in primary or secondary prevention practices, claims control, worker selection (based on age or health criteria, for instance, to eliminate workers with a propensity of OMSD incidence) but even pressure on employers to induce the under-reporting of illnesses. These behaviours may have resulted in a lower incidence of OMSDs and related absences. As we do not observe these various possible behaviours in our data, supplementary analyses will be realized using more detailed data on workers and firms.

Furthermore, we study the hypothesis that the effect of the increase may have been higher for establishments with a high OMSD prevalence than for those with low OMSD prevalence. OMSD cost increase may be more acutely perceived by employers if the number of OMSDs charged to their accounts is substantial. On the contrary, if OMSDs are scarce, it may induce a low awareness of employers on OMSD prevention and costs. To examine this hypothesis, we conduct separate analyses for two subgroups. We identify two aggregated sectors according to their OMSD prevalence. The sectors with a high OMSD prevalence are industries (food industries, metallurgy, transportation, water, gas, electricity, publishing and communication industries, chemical, rubber and plastic product manufacturing industries, woodworking, furniture, paper and paper products, textile, clothing, leather and skins, refractory stone and clay industries), construction, service II (cleaning workers, private workers in the social and health sectors, territorial authorities) and food trade. Sectors with a lower OMSD prevalence are non-food trade and service I (technical engineering, scientific studies and research).

3.4. Retained sample

We retain the sample of establishments that exist during the whole period 2004-2010, localized in the treatment group or the control group. The balancing is justified in this study because to observe firms' behavior changes, we have to focus on establishments that experienced the old rule, before 2007, and the new system after the change.

Furthermore, we have restricted our sample to firms with fewer than 10,000 workers; indeed, for higher scales, the number of firms is too small to allow for valid comparisons between the treatment and control groups.

The study sample is composed of the treated group which include 14,623 establishments localized in North-Picardy and the control group made up of establishments localized in the geographically nearest regions: 7,404 in Centre, 8,593 in Burgundy Franche-Comté, 8,766 in Brittany and 8,526 in Alsace-Moselle. Hereafter, this sample will be referred as the *treatment test sample*.

3.5. Econometric strategy

Our econometric strategy is divided into two steps. In the first step, we analyze the intensity of the increase in OMSDs charged to establishment accounts in North-Picardy. Discontinuity regressions are used to estimate the magnitude of this increase. In the second step, we measure the effect of this increase on the three OMSD outcomes after 2008, by using a Difference-in-differences approach.

3.5.1. First step: intensity of the increase in North-Picardy

Here we focus on the subsample of establishments in North-Picardy. Using discontinuity regression, we measure the exogenous increase of the number of OMSDs charged to establishment accounts at the discontinuity point which is the year 2007. The number of OMSDs charged to establishment accounts, noted as Y^1_{et} for establishment e and year t, is the outcome of interest in this first step. Let $C_{NP\,e}$ be a dummy variable for establishment e with $C_{NP\,e} = 1$ when the year is 2007 or over and $C_{NP\,e} = 0$ otherwise. Let $Y^1_{et}(1)$ be the potential outcome for establishment e under the new rule; let $Y^1_{et}(0)$ be the potential outcome for establishment e under the old rule. We do not observe these two potential outcomes simultaneously. Only the following outcome is observed:

$$(1) \qquad Y^1_{et} = C_{NP\,e}\, Y^1_{et}(1) + (1 - C_{NP\,e})\; Y^1_{et}(0)$$

We measure the average increase, which is written as follows:

$$(2) \qquad \tau_e = \lim_{z \to 2007^+} E(Y^1_{et} \mid t = z) - \lim_{z \to 2007^-} E(Y^1_{et} \mid t = z)$$

We estimate this parameter in the following linear regression equation:

$$(3) \qquad Y^1_{et} = \alpha + \tau_e\, C_{NP\,e} + f(t) + X_{et}\,\delta + \varepsilon_{et}$$

with: t=2004… 2010

where:

- $f(t)$ is a function representing the relationship between Y^1_{et} and t;
- X_{et} are characteristics of the establishments observed annually: establishment size, firm size, contribution rate, establishment seniority and dummy variables corresponding to activity sectors;
- ε_{et} is a random error term;
- α is the constant term.

Three time bandwidths are retained: the largest time period (2004-2010), a bandwidth of three years before and after 2007 (2004-2009) and a bandwidth of two years before and after 2007 (2005-2008).

As mentioned by Lee and Card (2008), when the "forcing variable" – which is year t here – is discrete, a functional form is required to specify the relationship between the outcome and the forcing variable. The standard practice consists of choosing a parametrical specification, which in most cases is a low-order polynomial specification. Four polynomial specifications for the function of time $f(t)$ are retained (the forcing variable is centered at cutoff year):

- Linear (*Model* 1): $f(t) = \beta_1 (t - 2007)$
- Linear and interaction (*Model* 2): $f(t) = \beta_2 (t - 2007) + \beta'_2 (t - 2007) I_{e\{t \geq 2007\}}$
- Two order-polynomial form (*Model* 3): $f(t) = \beta_3 (t - 2007) + \beta'_3 (t - 2007)^2$
- Two order-polynomial form with interaction (*Model* 4): $f(t) = \beta_4 (t - 2007) + \beta'_4 (t - 2007) I_{e\{t \geq 2007\}} + \beta_5 (t - 2007)^2 + \beta'_5 (t - 2007)^2 I_{e\{t \geq 2007\}}$

Interaction terms permit differences in the slope before and after the cutoff year. When a bandwidth of two years is considered, only the linear specifications are estimated because of the small range of the forcing variable.

To determine the best functional form for the relationship between the forcing variable t and our outcome of interest, we use Lee and Card's (2008) goodness-of-fit test for a regression discontinuity design. This test compares a restrictive regression with an unrestrictive one. The restrictive regression is the equation above (3) with a polynomial function for the variable *t*. The unrestrictive regression consists of regressing the outcome variable on the full set of dummy variables corresponding to the values of the discrete variable *t* and covariates. The distance between the regressions reflects the amplitude of the misspecification of the restrictive equation. The goodness-of-fit statistic is given by:

$$(4) \qquad G = \frac{(ESS_R - ESS_{UR})/(J - K)}{ESS_{UR}/(N\text{-}J)}$$

with:

- ESS_R: error sum of squares from the restrictive regression;
- ESS_{UR}: error sum of squares from the unrestrictive regression;
- J: number of values of the variable *t;*
- K: number of constraints in the restrictive regression;
- N: number of observations

Under this specification, $G \cdot (J - K)$ is asymptotically distributed as $\chi^2 (J - K)$ The null hypothesis is that the restrictive model with a polynomial specification of the time variable is well specified.

To take into account a possible dependence between all establishments belonging to the same firm that can affect the estimation of the variance-covariance matrix, we use corrective block bootstrap with 100 replications.

We implement those measures on the whole North-Picardy sample and separately in high and low OMSD-prevalence sectors in order to assess the magnitude of increase in the incentives for firms after 2007 in these two subgroups.

3.5.2. Second step: difference-in-differences approach

To measure firms' reaction to the increase in the number of OMSDs charged to their accounts in North-Picardy, we use a Difference-in-differences approach. The control group is composed of establishments localized in regions where we do not observe any change (Burgundy Franche-Comté, Brittany, Centre and Alsace-Moselle, as identified in section 2).

We consider the period 2007 to 2010. The year 2007 is the start year of "good" practices of the North-Picardy insurance office. In 2007 and until the second semester of the year 2008, employers in North-Picardy did not perceive the change because of the delay of one year (explained above) between the region's decision to charge to establishment accounts and the communication to employers of the list of OMSDs charged. During the second semester of the year 2008, employers in North-Picardy received that list. They may have reacted by reducing OMSD outcomes thereafter. We examine the hypothesis of the diminution of the three outcomes between 2008 and 2010.

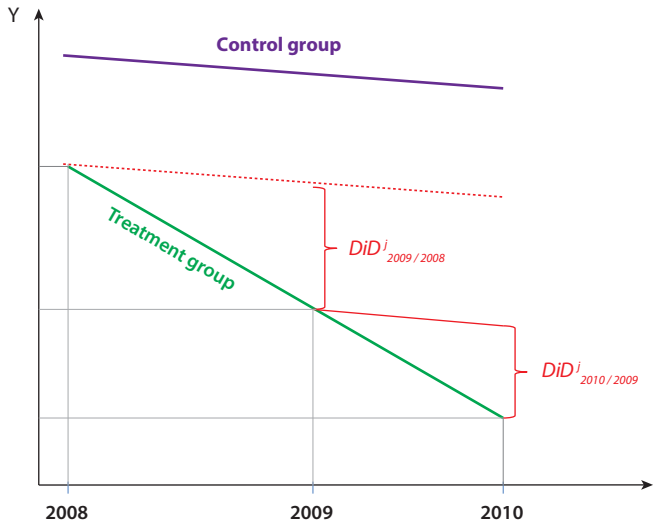
Let T_e be a dummy variable equal to 1 if establishment e is localized in the treated region and equal to 0 if establishment e is localized in the control group. The Difference-in-differences (DiD) estimators for each outcome (Y^j with j = 1, 2, 3) are as follows:

$$(5)\quad DiD^j_{2009/2008} = [E(Y^j_{e2009} \mid T_e = 1) - E(Y^j_{e2008} \mid T_e = 1)] - [E(Y^j_{e2009} \mid T_e = 0) - E(Y^j_{e2008} \mid T_e = 0)]$$

$$(6)\quad DiD^j_{2010/2009} = [E(Y^j_{e2010} \mid T_e = 1) - E(Y^j_{e2009} \mid T_e = 1)] - [E(Y^j_{e2010} \mid T_e = 0) - E(Y^j_{e2009} \mid T_e = 0)]$$

The first difference removes the potential biases due to time-invariant unobservable heterogeneity; the second difference measures the trend differences between the two groups. Figure 3 provides a graphical representation of those estimators. We test the hypothesis that the two DiD coefficients are negative.

Figure 3. Difference-in-differences (DiD)



We provide estimations of DiD using a stratified propensity score-matching methodology, aimed at controlling for observable differences between the control and treatment groups. The stratification is composed of 16 strata based on the interaction of two variables: activity sector and firm size. We have chosen to stratify the matching to ensure that establishments in the treatment groups are matched with establishments in the control groups that belong to the same firm size category and the same activity sector. This aims to avoid mismatching due to incomparability of firm sizes and activities. Then, in each stratum, we calculate a propensity score corresponding to the probability of being treated using a LOGIT regression. Covariates in this LOGIT model are the following variables: activity sector, firm size, firm size evolution, establishment size, establishment size evolution, contribution rate (which reflects the past occupational risk for the years t-2, t-3 and t-4), contribution evolution and establishment seniority. Then, we use kernel matching applied on those scores in each stratum to calculate the DiD coefficients.

The convergence depends on the validity of the conditional independence assumption (CIA), according to which conditional on observables, if the treatment group were not treated, the outcome evolution in the treatment group would have been the same that the evolution observed in the control group. To analyze the validity of this assumption, we retain a "placebo test". We extract from the WCI data the establishments in the regions of interest (North-Picardy, Burgundy Franche-Comté, Brittany, Centre and Alsace-Moselle) with the following characteristics: establishments created in 2007 and those existing before 2007 with fewer than 10 workers. This sample, hereafter called the *placebo test sample*, is composed of 14,519 observations. In North-Picardy, these establishments did not experiment the old system; indeed, the entry of establishments created in 2007 coincides with the regional practice change, and establishments with fewer than 10 workers before 2007 were subject to collective rating. Thus, these establishments have not been treated and are comparable to those with the same characteristics in the control group. If the CIA is true, then in the *placebo test sample*, the region North-Picardy and regions in the control groups should have the same outcome evolution during the period 2008-2010, i.e. DiD estimators should be close to zero.

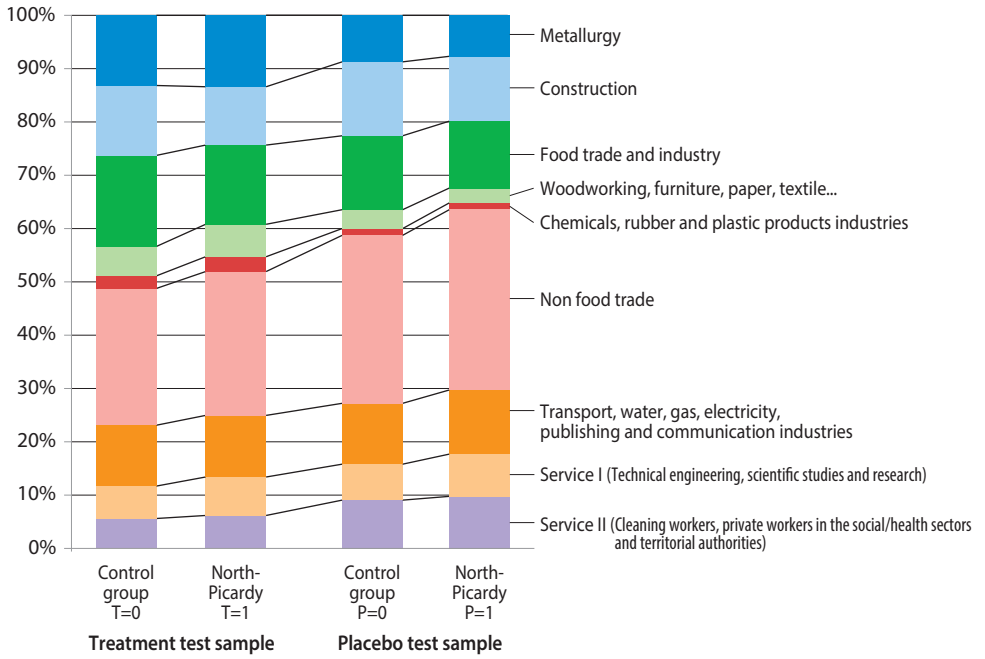
4. Results

4.1. Descriptive statistics

We use the following notations: in the *treatment test sample,* T=1 for establishments localized in North-Picardy and T=0 for establishments in the control group; in the *placebo test sample*, P=1 for establishments localized in North-Picardy and P=0 for controls.

Figure 4 presents the sectorial distributions of those groups. First, the subgroups T=1 and T=0 are slightly different. We note a lower proportion of establishments from construction, food trade and industry in the treatment group T=1 compared with the control group T=0. Small differences are also observed between the subgroups P=1 and P=0: metallurgy and construction are less frequent in P=1. By contrast, the sectorial composition of the *placebo test sample* and of the *treatment test sample* are more different: service II (which is composed of cleaning workers, private workers in the social and health sectors and territorial authorities) and non-food trade sectors are more frequent in the *placebo test sample* than in the *treatment test sample*, and the metallurgy, textile, paper

Figure 4. Sectorial distribution



Source: French WCI information system
Scope: All sectors excluding bank, insurance, administrative activities and specific sectors. Establishments belonging to firms with 10 to 10,000 workers.

Table 1 Establishment size distribution

		2004	2005	2006	2007	2008	2009	2010
Establishment size								
T=0	Mean	32.7	32.8	32.8	33.3	33.5	32.5	32
	d size		0.10%	0.00%	1.40%	0.70%	-3.00%	-1.40%
	5th percentile	1	2	2	2	2	2	1
	1st quartile	5	6	6	6	6	5	5
	Median	14	14	14	14	14	14	14
	3rd quartile	29	29	29	29	30	29	29
	95th percentile	117	117	117	118	119	114	113
T=1	Mean	37.9	38.7	38.1	39.4	39.5	38.2	38.2
	d size		2.20%	-1.60%	3.60%	0.00%	-3.30%	0.10%
	5th percentile	2	2	2	2	2	2	2
	1st quartile	6	6	6	6	6	6	6
	Median	15	15	15	15	15	15	15
	3rd quartile	33	33	33	34	34	33	33
	95th percentile	136	142	137	143	141	134	134
P=0	Mean				18.4	19.5	19	19.2
	d size					6.10%	-2.90%	1.40%
	5th percentile				1	1	1	1
	1st quartile				3	4	3	3
	Median				9	10	10	9
	3rd quartile				16	18	18	18
	95th percentile				62	66	64	65
P=1	Mean				20.7	22.5	22	22.8
	d size					8.80%	-2.10%	3.50%
	5th percentile				1	1	1	1
	1st quartile				3	4	4	4
	Median				10	10	10	10
	3rd quartile				19	20	20	20
	95th percentile				74	82	80	82

Source: French WCI information system
Scope: All sectors excluding bank, insurance, administrative activities and specific sectors. Establishments belonging to firms with 10 to 10,000 workers.
T=0: Establishments localized in the control group from the *treatment test sample*.
T=1: Establishments localized in North-Picardy in the *treatment test sample*.
P=0: Establishments localized in the control group from the *placebo test sample*.
P=1: Establishments localized in North-Picardy in the *placebo test sample*.

and chemical industries are less represented. These differences may be explained by the nature of establishments: The *placebo test sample* is composed of establishments newly created in 2007 and firms with fewer than 10 workers before 2007, where tertiary sectors are more frequent and traditional industries are less represented compared with older and bigger firms.

Table 1 reports descriptive statistics on establishment size. On average, establishments in North-Picardy, *i.e.*, subgroups T=1 and P=1, are larger than establishments in subgroups T=0 and P=0 (controls). The average sizes are growing rapidly between 2007 and 2008 in the subgroups P=1 and P=0; this could be explained by the entry of new establishments into the *placebo test sample* in 2007. Indeed, in newly created establishments, the employment volume grows rapidly in the short term, corresponding to a hiring period. After this starting point, size variations are less pronounced. The negative effect of the recession in 2009 on employment volume, after the 2008 crisis, is observed in each subgroup.

Figure 5 presents the average OMSD outcomes evolution during the whole period 2004-2010. It shows three distinct periods: before 2007, 2007-2008 and 2008-2010. **Before 2007**, the level of the outcomes was very low in the treatment group T=1 compared with the control group T=0 as expected; indeed, this difference is explained by the lower number of OMSDs charged to establishment accounts in North-Picardy compared with the control group. From 2006 to 2007, the strong increase is observed. The level of each outcome in the treatment group T=1 almost reached the level of the control group T=0. However, the outcomes in 2007 remain lower in treatment group T=1 than in control group T=0, which may be explained partly by regional differences in terms of activity sectors in which OMSDs occur more often (food industry at least). **Between 2007 and 2008**, the outcomes grew, in all four groups. The absence outcomes Y^2 and Y^3 grew between 2007 and 2008 more rapidly in the treatment group T=1 than in the control group T=0. We advance a possible reason for this result. As already explained, employers in treatment group T=1 were not aware of the practice change in North-Picardy before the second semester of 2008; thus no reaction from firms in North-Picardy is expected before the second semester of 2008. We may assume that the trend observed between 2007 and 2008 in the treated group corresponds to the trend under inactive incentives. This may explain the more dynamic outcome growth in this group compared with the control group T=0. Firms are not under the incentive, so they control work absences less stringently. **During the period 2008-2010**, we observe graphically an important decrease in the outcomes in treatment group T=1 compared to control group T=0. This difference may be explained by a reaction of firms to the increase in OMSDs charged to their accounts. For instance, this may have consisted in giving more attention to OMSD incidences and related absences and implementing policies to reduce these outcomes.

The trends in placebo group P=1 are similar to the trends in group P=0. An exception is observed for the absence outcomes Y^2 and Y^3 between 2009 and 2010. Graphics indicate an increase in P=1 compared with P=0. When observables are controlled, this difference does not survive, as we will see in the second step results.

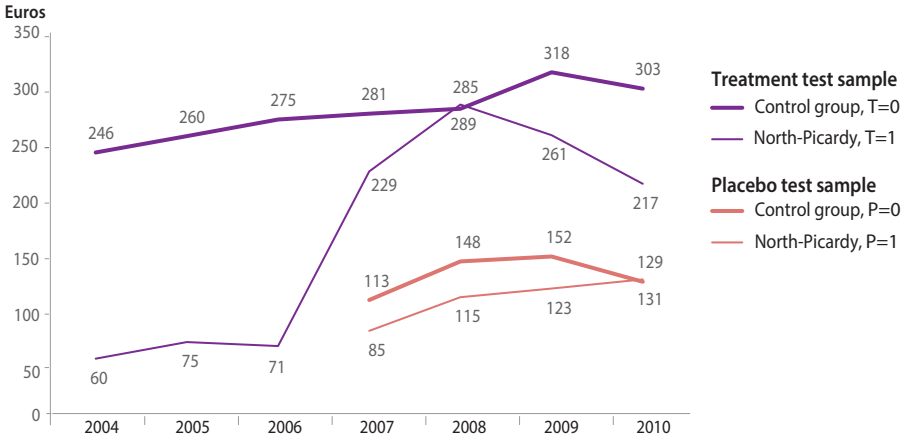
The following paragraphs go deeper into the analysis of those trends: first, by studying the magnitude of the increase between 2006 and 2007 in North-Picardy, and second, by measuring the effect of this increase on OMSD outcomes after 2007.

Figure 5. OMSD evolution from 2004 to 2010

5.1. Average number of OMSDs charged to establishment accounts (Y1)

5.2. Average number of absence days due to OMSDs charged to establishment accounts (Y2)

5.3. Average absence indemnities due to OMSDs charged to establishment accounts (Y3)



Source: French WCI information system
Scope: All sectors excluding bank, insurance, administrative activities and specific sectors. Establishments belonging to firms with 10 to 10,000 workers.

4.2. First step results

The previous graphical results show a strong increase in the number of OMSDs charged to North-Picardy firms' accounts between 2006 and 2007. We used regression discontinuity models to study the intensity of this shock. The outcome of interest is the number of OMSDs charged to establishment accounts (Y^1), which reflects the practice of the North-Picardy insurance office.

Table 2 provides the discontinuity regression results. The estimations show that the magnitude of the practice change in the whole sample was approximately +0.04 OMSDs on average. As the average number of OMSDs per establishment was 0.015 in 2006, it corresponds to an increase of 267%. Regression discontinuity models also confirm the importance of the regional practice change when considering the two aggregated sectors: This increase is approximately +0.055 among the high OMSD-prevalence sectors (*i.e.*, an increase of approximatively 275%) and +0.015 among the low OMSD-prevalence sectors (+300%).

The absolute change is therefore more pronounced in high OMSD-prevalence sectors than in low OMSD-prevalence sectors. This result suggests that the shock in high OMSD-prevalence sectors may have strongly changed the nature of the incentive after 2008. By contrast, in low OMSD-prevalence sectors, the change is less pronounced, thereby it may be less perceived by employers as a signal for implementing measures to reduce OMSD costs.

Those estimations are statistically significant and robust to the specification modifications. Furthermore, the goodness-of-fit tests suggest that all specifications fit the data, considering the different bandwidths.

Table 2 Discontinuity regression results

	Bandwidth:	2004 to 2010				2004 to 2009				2005 to 2008		Average OMSD number in 2006
		Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	
Total sample	Est.	0.041 ***	0.042 ***	0.041 ***	0.039 ***	0.041 ***	0.041 ***	0.041 ***	0.038 ***	0.034 ***	0.038 ***	0.015
	SE	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.005)	(0.004)	(0.003)	
	GOF statistic	5.04753	4.87695	5.03491	3.21334	5.79021	5.42616	5.70490	0.00000	2.75788	0.00000	
	N	102,361	102,361	102,361	102,361	87,738	87,738	87,738	87,738	58,492	58,492	
High OMSD-prevalence sectors (industries, construction, service II and food trade)	Est.	0.055 ***	0.056 ***	0.055 ***	0.054 ***	0.053 ***	0.055 ***	0.053 ***	0.053 ***	0.044 ***	0.052 ***	0.020
	SE	(0.004)	(0.004)	(0.004)	(0.007)	(0.006)	(0.004)	(0.005)	(0.007)	(0.006)	(0.006)	
	GOF statistic	6.85542	6.68941	6.85431	3.42320	7.59054	6.83931	7.35349	0.00000	4.45694	0.00000	
	N	67,309	67,309	67,309	67,309	57,687	57,687	57,687	57,687	38,466	38,466	
Low OMSD-prevalence sectors (non-food trade and service I)	Est.	0.014 ***	0.015 ***	0.015 ***	0.013 ***	0.017 ***	0.016 ***	0.017 ***	0.013 ***	0.017 ***	0.016 ***	0.005
	SE	(0.003)	(0.002)	(0.003)	(0.005)	(0.003)	(0.003)	(0.003)	(0.005)	(0.003)	(0.003)	
	GOF statistic	2.69961	2.48485	1.99406	0.02040	0.60326	0.38926	0.48924	0.00000	0.45348	0.00000	
	N	35,052	35,052	35,052	35,052	30,051	30,051	30,051	30,051	20,026	20,026	

Source: French WCI information system
Scope: All sectors excluding bank, insurance, administrative activities and specific sectors. Establishments in North-Picardy belonging to firms with 10 to 10,000 workers.
Gof: Goodness of Fit; Model 1: linear time functional form; Model 2: linear and interaction before/after 2007; Model 3: quadratic form; Model 4: quadratic form and interaction before/after 2007. Block bootstrapped standard errors (SE) in brackets (100 replications). Significance: *:10%; **:5%; ***:1%. Covariates in regressions: activity sector, firm size, establishment size and contribution rate.
Service I: Technical engineering, scientific studies and research.
Service II: Cleaning workers, private workers in the social and health sectors, territorial authorities.
Reading: In 2006, the average number of OMSDs charged to firm accounts was 0.015. It increased by +0.041 between 2006 and 2007, according to the Model 1 results with the largest bandwidth.

4.3. Second step results

Above all, the stratified propensity score matching reveals good properties. Relatively few observations are "off support": in the *treatment test sample*, the number of treated establishments that are not matched is 116 for the period 2008/2009 and 54 for the period 2009/2010; in the *placebo test sample*, matching excludes 94 "off-support" observations in 2008/2009 and 34 observations in 2009/2010. The score distributions are balanced after matching. This balancing property is illustrated through LOGIT regressions before and after matching. Table A2 in Appendix reports the coefficients of these LOGIT regressions. Before matching, we measure significant differences between the treatment group T=1 and the control group T=0 according to activity sectors, firm seniority, establishment size and contribution rate. Food trade and industry and construction are less frequent in the treatment group than in the control group. Establishments in the treatment group are bigger and older than in the control group. After matching, the treatment and control groups are similar. After weighting the LOGIT regressions using stratified propensity scores, the probability of being treated is not correlated significantly with the observables. The same results are obtained for the *placebo test sample*.

Table 3 presents the estimations of the DiD coefficients after matching in the *treatment test sample* and in the *placebo test sample*. In the *treatment test sample*, estimations indicate a significant decrease in all OMSDs outcomes between 2008 and 2009 in the treated group compared with the control group. We measure a significant decrease of 0.00977 in the average number of OMSDs, corresponding to a 15% drop compared to the 2008 mean level. We measure a decrease of 0.968 in the number of absence days, which corresponds to a decrease of 14% compared to the 2008 average level. We find an average indemnity decrease of 55.31 euros, a decrease of 19% compared to the 2008 average level. Between 2009 and 2010, we measure a significant decrease only in the amount of indemnities: -32.44 euros, that is a decrease of 13% compared to the 2009 level.

The placebo tests indicate coefficients that are close to zero and non-significant, which supports the validity of the CIA.

Then we realize separate estimations for the two aggregated sectors mentioned above: the high and low OMSD-prevalence sectors. In low OMSD-prevalence sectors, the scarcity of OMSDs may induce a weak awareness of employers on OMSD prevention and costs; furthermore, we previously measured a lower shock magnitude in 2007 in these sectors than in high OMSD-prevalence sectors. In these latter sectors, the mag-

Table 3 DiD results after matching

		2008/2009			2009/2010		
		Y1	Y2	Y3	Y1	Y2	Y3
Total sample							
Treatment effect	**DID**	**-0.00977*****	**-0.968****	**-55.31****	-0.00321	-0.656	**-32.44***
(N=47,912)	SE	**(0.00370)**	**(0.428)**	**(22.02)**	(0.00386)	(0.452)	**(18.02)**
Placebo effect	**DID**	-0.00364	0.0339	-9.49	-0.00135	0.705	26.77
(N=14,519)	SE	(0.00388)	(0.562)	(24.91)	(0.00436)	(0.474)	(25.46)

Source: French WCI information system.
Scope: All sectors excluding bank, insurance, administrative activities and specific sectors. Establishments belonging to firms with 10 to 10,000 workers.
Note: Block bootstrapped standard errors (SE) in brackets (100 replications). Significance: *:10%; **:5%; ***:1%.
Note: DiD are estimated on the common support.

Table 4 DiD results after matching in high and low OMSD-prevalence sectors

		2008/2009			2009/2010		
		Y1	Y2	Y3	Y1	Y2	Y3
High OMSD-prevalence sectors (industries, construction, service II and food trade)							
Treatment effect	DID	-0.0124**	-1.423**	-80.20***	-0.00813	-1.046*	-48.49*
(N=32,342)	SE	(0.00554)	(0.701)	(29.75)	(0.00528)	(0.566)	(28.97)
Placebo effect	DID	-0.00384	0.498	3.60	-0.00609	0.848	30.67
(N=8,925)	SE	(0.00584)	(0.921)	(37.86)	(0.00744)	(0.960)	(41.65)
Low OMSD-prevalence sectors (non-food trade and service I)							
Treatment effect	DID	-0.00475	-0.0920	-7.49	0.00623*	0.0935	-1.63
(N=15,570)	SE	(0.00355)	(0.448)	(17.49)	(0.00325)	(0.407)	(15.87)
Placebo effect	DID	-0.00337	-0.613	-27.75	0.00540*	0.502	21.21
(N=5,594)	SE	(0.00325)	(0.779)	(25.74)	(0.00286)	(0.429)	(14.36)

Source: French WCI information system.
Scope: All sectors excluding bank, insurance, administrative activities and specific sectors. Establishments belonging to firms with 10 to 10,000 workers.
Service I: Technical engineering, scientific studies and research.
Service II: Cleaning workers, private workers in the social and health sectors, territorial authorities.
Note: Block bootstrapped standard errors (SE) in brackets (100 replications). Significance: *:10%; **:5%; ***:1%.
Note: DiD are estimated on the common support.

nitude of the increase in firms' contributions to OMSD costs between 2006 and 2007 is more important and may result in an effective signal perceived by employers. Table 4 provides results for those two subgroups. The results are coherent with our hypothesis. We find that in high OMSD-prevalence sectors, OMSD outcomes decreased significantly between 2008 and 2009 and between 2009 and 2010 in the treatment group (T=1) compared with the control group (T=0). No significant relationships appear for the low OMSD-prevalence sectors, except for the outcome Y^1 for the period 2009/2010. We observe a "treatment effect" on Y^1 of +0.00623* and a "placebo effect" on Y^1 of +0.00540*; this may be explained by characteristics that are specific to the low OMSD prevalence sectors in North-Picardy. Both estimations are quite similar, indicating that the third difference ($DiD_{\text{Treatment effect}}$ - $DiD_{\text{Placebo effect}}$) is close to zero. It suggests the absence of treatment effect in the low OMSD prevalence sectors.

5. Conclusion

This article brings new empirical insights on ER applied in the area of workers' compensation insurance. It provide results on whether firms respond to an exogenous increase in their experience-rated contribution to OMSD health costs by reducing the incidence of these diseases and related absences. This increase corresponds to an incentive shock. We exploit this natural experiment. The data we use are exhaustive administrative longitudinal microdata on establishments extracted from the WCI information system. It is of importance that these data provide enough observations for studying OMSD incidence and also for focusing on high OMSD-prevalence sectors.

In line with previous empirical literature, our results are consistent with the hypothesis that an increase in firms' contribution to their occupational health costs intensifies their efforts toward reducing these costs. Especially, this effect holds for establishments from

high OMSD-prevalence sectors. These sectors identified in the data are industries, construction, food trade, cleaning workers, social, health and territorial sectors. By contrast, we do not find any effect in low OMSD-prevalence sectors, which are non-food trade, engineering and research. Firms from high OMSD prevalence sectors were subject to a higher increase of their contribution compared with firms from low OMSD prevalence sectors. That is why the signal may have been more acutely perceived in high OMSD prevalence sectors.

The effect may be interpreted as the result of a purely financial incentive provided by the increase in firms' contributions to their occupational health costs. A second interpretation should be advanced. As employers are informed of the increase in their contribution, they are also informed of the detailed listing of OMSD incidence and costs they have to bear. This listing may be a means through which they become aware of the importance of OMSD costs, not only insurance costs but also other economic and non-economic costs.

The main substantial effect concerns absence outcomes. We measure an important decrease in the number of absence days due to OMSD and related wage indemnities following the shock. This result suggests that employer reactions target mainly the duration of work absences, which may reflect secondary prevention investment by adapting working conditions and making worker return-to-work easier. The diminution of the duration of work absences drives mechanically a diminution of related wage indemnities. Both measures allow for assessing the avoided cost of work absence in high OMSD prevalence sectors: a decrease of 2.5 absence days per establishment between 2008 and 2010, which corresponds to an avoided amount of €4,000,000 for the region North-Picardy.

The results presented in this article hold for the region North-Picardy that we study. Thus a limit of the study is that the scope is restricted to establishments localized in this region. Another shortcoming of this study is that it provides measurements of short-term effects only. Indeed it concerns a period of two years after the shock. In order to study the effects on a longer period, we will extract additional data. Furthermore, deeper analyses are also needed to identify the mechanisms underlying the relationships that we have measured: Do these relationships reflect an improvement in occupational health and safety? Do they reflect incentives at least to control aggressively claims and absences, to induce underreporting or practice worker selection by ousting workers having long absences or OMSD prone workers? ER may be an effective incentive tool if it reduces occupational social costs, but it may be detrimental if it leads to these practices. We are currently investigating these questions, using an alternative longitudinal database providing more detailed data on employees and establishments for the period 2005-2012.

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7. Appendix

Table A1 Number of establishments according to the year and the region

	2004	2005	2006	2007	2008	2009	2010
Burgundy-Franche-Comté	16,930	17,330	17,471	17,790	18,113	17,951	17,904
Brittany	17,516	17,974	18,652	19,077	19,645	19,753	19,906
Centre	15,246	15,444	15,675	16,171	16,535	16,566	16,587
North-Picardy	31,450	31,730	32,152	33,012	33,391	33,157	33,015
Alsace-Moselle	17,246	17,606	17,718	18,067	18,414	18,360	18,372

Source: French WCI information system.

Table A2 LOGIT results before and after matching

	2008/2009				2009/2010			
	Treatment test sample Prob. T=1 vs T=0		Placebo test sample Prob. P=1 vs P=0		Treatment test sample Prob. T=1 vs T=0		Placebo test sample Prob. P=1 vs P=0	
	Before matching	After matching	Before matching	After matching	Before matching	After matching	Before matching	After matching
Metallurgy (*ref.*: food trade and industry)	0.161 **	-0.0273	0.00663	0.000904	0.170 **	-0.0304	-0.0146	-0.00656
	(0.0701)	(0.0683)	(0.183)	(0.195)	(0.0702)	(0.0684)	(0.185)	(0.195)
Construction	0.113	-0.0102	0.0743	0.0202	0.124	-0.00831	0.0532	0.00778
	(0.0781)	(0.0783)	(0.185)	(0.196)	(0.0780)	(0.0783)	(0.187)	(0.206)
Transports, water, gas, electricity, publishing and communication industries	0.167 *	0.0181	0.169	0.00212	0.173 **	0.0245	0.162	0.0153
	(0.0857)	(0.0783)	(0.183)	(0.193)	(0.0858)	(0.0783)	(0.185)	(0.193)
Chemical industry	0.226 **	0.0157	0.0716	0.107	0.231 **	0.0191	0.0540	0.0468
	(0.0928)	(0.0909)	(0.325)	(0.317)	(0.0929)	(0.0909)	(0.331)	(0.308)
Wood, paper, textile industries	0.337 ***	0.0208	-0.0386	-0.0149	0.348 ***	0.0145	-0.0496	-0.0414
	(0.130)	(0.120)	(0.229)	(0.228)	(0.130)	(0.119)	(0.227)	(0.226)
Non-food trade	0.189 **	-0.00761	0.183	-0.00928	0.193 **	-0.00266	0.176	-0.001000
	(0.0866)	(0.0814)	(0.193)	(0.202)	(0.0866)	(0.0810)	(0.197)	(0.196)
Service I	0.258 ***	0.0992	0.341 *	-0.00483	0.255 ***	0.0764	0.323 *	0.0205
	(0.0858)	(0.0869)	(0.181)	(0.193)	(0.0851)	(0.0862)	(0.185)	(0.191)
Service II	0.168 *	0.00657	0.144	-0.00786	0.165 *	0.0210	0.109	0.00175
	(0.0944)	(0.0913)	(0.307)	(0.273)	(0.0939)	(0.0907)	(0.296)	(0.358)
Firms seniority	17.58 ***	2.661	15.74 ***	1.870	17.49 ***	2.437	16.35 ***	-0.455
	(2.416)	(2.389)	(4.766)	(4.057)	(2.410)	(2.385)	(4.534)	(4.823)
Establishment size in t	0.106 ***	0.0120	0.108 **	0.00941	0.105 ***	0.00816	0.112 **	0.00531
	(0.0166)	(0.0160)	(0.0451)	(0.0307)	(0.0163)	(0.0155)	(0.0437)	(0.0488)
d Establishment size between t and t+1	0.0319	0.000136	0.0282	-0.0369	0.0387	0.0238	0.0330	0.0202
	(0.0563)	(0.0607)	(0.0741)	(0.0869)	(0.0500)	(0.0527)	(0.0658)	(0.0808)
Firm size in t	-2.66e-05	0.00359	0.0652 **	-0.000460	4.52e-05	0.00311	0.0641 *	0.00277
	(0.0143)	(0.0133)	(0.0316)	(0.0238)	(0.0142)	(0.0133)	(0.0339)	(0.0295)
d Firm size between t and t+1	0.0759	0.000927	0.498 ***	0.0688	0.105	-0.0471	0.0342	-0.137
	(0.138)	(0.144)	(0.176)	(0.167)	(0.114)	(0.131)	(0.158)	(0.249)
Contribution rate in t	-0.146 ***	0.0220	-0.00371	-0.0298	-0.143 ***	0.0230	-0.0244	-0.00748
	(0.0328)	(0.0345)	(0.0602)	(0.0664)	(0.0325)	(0.0344)	(0.0589)	(0.0658)
d Contribution rate between t and t+1	-0.0457	-0.00213	-0.504 **	-0.0420	0.239 ***	0.0324	-0.281	0.0181
	(0.0955)	(0.101)	(0.209)	(0.189)	(0.0753)	(0.0788)	(0.184)	(0.173)
Constant	-134.0 ***	-20.38	-120.9 ***	-14.07	-133.3 ***	-18.67	-125.4 ***	3.471
	(18.37)	(18.16)	(36.34)	(30.91)	(18.32)	(18.13)	(34.57)	(36.79)
Correctly classified	69%		66%		69%		66%	
Observations	47,912	47,796[a]	14,135	14,135	47,912	47,465[a]	14,135	14,041[a]

[a] **Common support.**
Source: French WCI information system.
Scope: Manufacturing sectors and services, excluding bank, insurance, administrative activity and specific sectors. Establishments in firms with 10 to 10,000 workers.
Note: Block bootstrapped standard errors (SE) in brackets (100 replications). Significance: *:10%; **:5%; ***:1%.
T=0: Establishments localized in the control group in the treatment test sample.
T=1: Establishments localized in North-Picardy in the treatment test sample.
P=0: Establishments localized in the control group in the placebo test sample.
P=1: Establishments localized in North-Picardy in the placebo test sample.
Service I: Technical engineering, scientific studies and research.
Service II: Cleaning workers, private workers in the social and health sectors and territorial authorities.

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Experience Rating, Incidence of Musculoskeletal Disorders and Related Absences

Results from a Natural Experiment

Tarification à l'expérience, incidence des troubles musculo-squelettiques et arrêts de travail

Pascale Lengagne, Anissa Afrite (Irdes)

In many countries, the cost of workers' compensation insurance is borne by firms. The contributions paid by a given firm are linked to its past health costs of occupational injuries and illnesses. This experience rating scheme should encourage firms to invest in occupational prevention, thereby reducing the social costs of adverse occupational exposures. This paper provides results on whether firms respond to an increase in their contribution to occupational musculoskeletal disorder health costs by reducing the incidence of these diseases and related absences. Our identification strategy exploits a natural experiment in the French context in 2007. We use administrative data on establishments for the years 2004 to 2010. Estimations are based on a Difference-in-differences model. The key result is that in activity sectors with a high prevalence of occupational musculoskeletal disorders, which have experimented the highest contribution increase, this increase has induced a substantial diminution of the incidence of those diseases, related absence days and wage indemnities.

* * *

Dans un grand nombre de pays, l'assurance des risques professionnels est financée par les entreprises qui versent des contributions modulées selon leur sinistralité passée. En France, pour une entreprise de plus de 10 salariés, plus le nombre et la gravité des accidents et maladies professionnels sont importants, plus le montant de sa contribution sera élevée. Ce mode de tarification devrait contribuer à sensibiliser les employeurs à l'intérêt de développer des démarches préventives (primaires ou secondaires), afin de réduire leur coût d'assurance, et ainsi contribuer à minimiser le coût social des accidents du travail et maladies professionnels. À partir d'une expérience naturelle observée en 2007 dans le contexte français, nous étudions l'influence d'une augmentation exogène de la contribution des entreprises au coût des troubles musculo-squelettiques (TMS) sur l'incidence de ces maladies et les arrêts de travail associés. Nous estimons un modèle de différence-de-différences, à partir des données administratives de tarification des risques professionnels pour la période 2004-2010. Selon nos résultats, cette augmentation a entraîné une diminution substantielle de l'incidence des TMS, du nombre de jours d'arrêt de travail et du montant des indemnités journalières associés.

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