Organizational Change and Employee Health *

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Preliminary. Please do not quote.

Abstract

This paper studies the impact of organizational change on employees' health outcomes. Starting in 2000, the organization of the state-owned electricity and gas utilities EDF-GDF has been modified following the transposition of the European legislation that aimed at increasing competition in the energy market. The reform induced exogenous and asymmetric changes in the working environment within the firm: distribution activities were externalized in newly created companies while the other services remained in EDF and GDF. We use a unique intra-firm panel dataset (GAZEL, Inserm, Paris) that contains detailed, individual and longitudinal information about health status and job-related variables. Using differences-in-differences, we document the effects of the organizational changes on workers' health. We show that the organizational changes caused a deterioration of workers' health outcomes. Workers report more pathologies, especially related to mental health. While the total number of days in sick leave is not significantly affected, the number of workers in sick leave for depression is increased by about 1 percentage point (e.g. 20%).

Keywords: organizational change, mental health, stress, difference-in-differences.
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1 Introduction

Does organizational change in companies affect workers' health status? As a result of technological progress, firms have to permanently update their organizational structure (Brynjolfsson and Hitt, 2000; Bresnahan, Brynjolfsson, and Hitt, 2002). If changes in working organization were to deteriorate workers' health, for instance by leading to an increasing number of illness or sick leave, this would constitute a negative externality supported by other actors than the firms. Measuring the magnitude of such effects is crucial for policy makers to understand the cost in terms of social welfare of organizational change. In this paper, we bring two contributions to the literature of the evaluation of the effects of organizational changes on workers' health. First, we take seriously the endogeneity issue and use the massive reform of the energy sector that started in France in 2000 and was induced by changes in the European legislation. Second, we use a unique individual panel dataset in which both detailed health and work-related variables are measured during a period of 20 years.

The economic literature about intra-firm organizational change has mostly focused on the impact on economic performance and productivity (Black and Lynch, 2001), on the skill composition of labor demand (Caroli and Van Reenen, 2001), on working conditions (Askenazy and Caroli, 2002) and on turnover (Bauer and Bender, 2004). Why would organizational change affect workers' health? The introduction of new forms of work organization has lead to an increasing level of responsibility but also to a growing intensification of work pressure which could affect worker's health. The relationship between stressful workplaces and the possible development of pathologies was mainly analyzed with two theoretical frameworks aiming at measuring stress: the effort-reward imbalance model developed initially and tested by Siegrist (1996) and the demand-control-support model of Karasek (1979). In their study conducted in Belgium, Godin and Kittel (2004) underline the role of macroeconomic conditions which could, through an increase of psychosocial stress and instability, have negative effects on worker's health. Using the context of the 1997 financial crises in South Korea, Kim, Muntaner, Khang, Paek, and Cho (2006) show that the development of adverse working conditions caused by the introduction of labor market flexibility lead to an increase of mental disorders among women. Several studies use absence behavior as a proxy for health to evaluate the impact of the working environment. In her model based on the Shapiro and Stiglitz efficiency wage model, Ose (2005) finds a relationship between absence behavior and working conditions. Even closer from our work, Dahl (2011) shows, using a large Danish dataset, that stress-related medicine prescriptions increased more in firms in which organizational changes are reported by em-

ployees. Finally, in their recent systematic review, Bamberger, Vinding, Larsen, Nielsen, Fonager, Nielsen, Ryom, and Oyvind (2012) conclude about the lack of evidence on the association between organizational change and elevated risk of mental health problems.

Understanding the relationship between organizational changes and workers' health is not without facing complex methodological problems (Gollac and Volkoff, 2006). First come the issues relating to endogeneity. Organizational changes can rarely be thought as exogenous, as they are often pulled by external factors (intensive competition, macroeconomic shocks...). A related literature uses plant closures as a quasi-experimental design in order to evaluate their impact on health outcomes. For example, Hamilton, Broman, Hoffman, and Renner (1990) use the exogeneous variation provided by the large-scale 1987 General Motors plant shutdowns and find that affected workers suffer from a more distressed mental health. Kuhn, Lalive, and Zweimüller (2009) finds that job loss has a detrimental impact on stress-related health measures, using plant closures in Austria.[1]

Another difficulty of this kind of analysis is to correctly measure health. Because health is multidimensional (Fuchs, 2004) and because health data are expensive and difficult to collect, many studies use subjective proxies as health, which are often endogeneous and measured with error. In their literature review on the measurement of health, Strauss and Thomas (1998) underline that self-evaluations of health, which are the most used indicator, suffers from weaknesses. Respondents, who have traditionally to rate their health on a scale, do not necessarily have the same definition of what means "good health". Their responses reflect their perception of health status which is correlated with values, beliefs and socioeconomic outcomes. These subjective self-assessments of mental and physical health status lead to a biased measure of the relationship between health and work (Dwyer and Mitchell, 1999; Butler, Burkhauser, Mitchell, and Pincus, 1987). Moreover, Chirikos and Nestel (1984) underline a phenomenon referred as "justification hypothesis" when workers tend to report bad health as a justification for an early retirement.

In this paper, we use the important changes in the European legislation on energy utilities as a source of exogenous variation in the organization of the state-owned electricity and gas utilities *EDF-GDF*. Since 2000, the organization of this firm has been deeply modified following the transposition of the European legislation that aimed at increasing competition in the energy market. The reform induced exogenous and asymmetric changes in the working environment within the firm: distribution services were externalized in other

[1]This result is at odds with Browning, Moller Dano, and Heinesen (2006), who find no effect of displacement on stress-related health outcomes. However, the latter paper uses matching on observables to identify the causal impact.

companies (*ErDF*, *GrDF*, *RTE* and *GRT*) while the production services remained in *EDF* and *GDF*. This exogenous shock provides a credible identification strategy to measure the effect of organization changes on worker's health status. We use difference-in-differences to identify the impact of the organizational change, comparing the department in charge of the distribution of gas and electricity versus the other departments of the firm, before and after 2000. We rely on an unique dataset, the GAZEL Cohort Study (INSERM, Paris), which contains precise information on several relevant dimensions. Workers' job histories come from the personnel management dataset. Health status can be precisely measured by pathologies, the number of days in sick leaves and their medical motives.

We find that the organizational changes brought about a significant deterioration of workers' health. Two aspects are especially worth of interest. The impact of organizational changes on health seems to be concentrated on the psychological dimension. Moreover, women are more affected than men by organizational changes.

The remainder of the paper is organized as follows. Section 2 provides background information on the reform and its consequences. Section 3 presents our data and provides some descriptive statistics. Section 4 presents the empirical approach and the main results. Section 5 discusses the results as well as robustness checks.

2 Institutional background

In the months following the end of the Second World War, the French government has supported the creation of a public vertically integrated monopoly in charge of operating the generation and the distribution of energy: *Électricité de France - Gaz de France (EDF-GDF)* (Serrallés, 2006). The organization of the company has remained mostly unchanged until the late nineties. Following the idea that was already present in the Single European Act of 1986, two directives, adopted in 1996 and 2003, established common rules for a competitive electricity market. These directives were implemented in the French law from 2000 to 2004.[2] The main objective of these legislative changes was to establish competition in the energy industry.

A first consequence was to allow new entrants in the energy market, what was achieved gradually. In 1999, entrants were allowed to contract with all industrial firms consuming

[2] A first Directive (96/92/CE) was adopted the 19 December 1996 by the European Parliament and the Council; it was updated by a second one (2003/54/CE) adopted the 26 June 2003. The Directives on the electricity market were transposed in the three legal acts in France: laws 2000-108 (10th of February 2001), 2003-108 (3th of January 2003) and 2004-804 (9th of August 2004).

more than 100 GWh/year. The threshold was decreased to 16 GWh/year in 2000, then to 7 GWh/year in 2003. All customers but residential ones could be served from 2004. Finally, the sector was totally open to competition in 2007. In practice, if these reforms were aimed at increasing competition in the energy sector, the historical utility companies still hold most of the market. In its 2009 annual report, EDF reported that its main competitors held a 4% market share for the residential consumption and 13% for the non-residential one.

Another consequence of the new laws was to split EDF-GDF into several structures. Most importantly for our identification strategy, one of the main changes was to isolate the activities of distribution and transport from the other activities (production, equipment...). Starting in 2000, distribution and transport activities were accounted separately from the rest of the company. Independent management, accounting or decision-making process between the distributor and generators are implemented. Distribution activities are grouped under the name "EDF GDF Services" while electricity transportation activities are gathered in a new firm "Reseau Transport d'Electricité (RTE)". From 2004 on, this separation was legally enacted: RTE becomes a company while the distribution activities are renamed "EDF Gaz de France Distribution". In 2005, the gaz transport activities are grouped in a separate company named "GRTgaz". In 2008, the situation is stabilized with the creation of "ERDF" and "GrDF" as the result of the separation of the electricity and gaz distribution activities. Meanwhile, in the other departments of the firm, the situation evolved more slowly. In 2004, EDF and GDF acquire the status of companies. In 2005, the government announces that it was willing to open the capital of both companies. In 2007, GDF was merged with Suez. In 2010, the government still owned 84% of the stock of EDF.

Beside the uncertainty that is inherent to these periods of organizational change, how was work affected? One of the most important change implied by the reform was the new non-discriminatory policy implemented in the distribution and transport departments. Before 2000, distributors interacted with one unique supplier who belonged to the same firm. After 2000, distributors had to be able to communicate with all producing companies in the same way and to guarantee the same quality of access to their networks (Eising, 2002). The implementation of this principle was not possible without a deep restructuration of these departments. To ensure a fair competition, distribution activities were strictly separated from the vertically integrated company in a splitting process known as "unbundling" (Eising, 2002).

The decision-making process was radically changed in the distribution and transport departments in their way to become the new entities. Starting from 102 centers spread over

French territory, the management of the distribution services were gathered in 8 operational directions. While before the reform, most decisions (investments...) were made locally, the new management system drastically increased the physical distance between operators and managers. The new company adopts a vertical logic instead of the former local one. Anecdotal evidence also suggests that this transformation induced a significant share of workers to either accept to relocate or to change job, if they chose to stay in the same location (we explore these outcomes in the section dedicated to results). If the organization of the distribution department was transformed in the years following the reform, the other departments of EDF-GDF, mainly the department in charge of energy production, were not subject to immediate changes, at least not before 2005, when capital was opened.

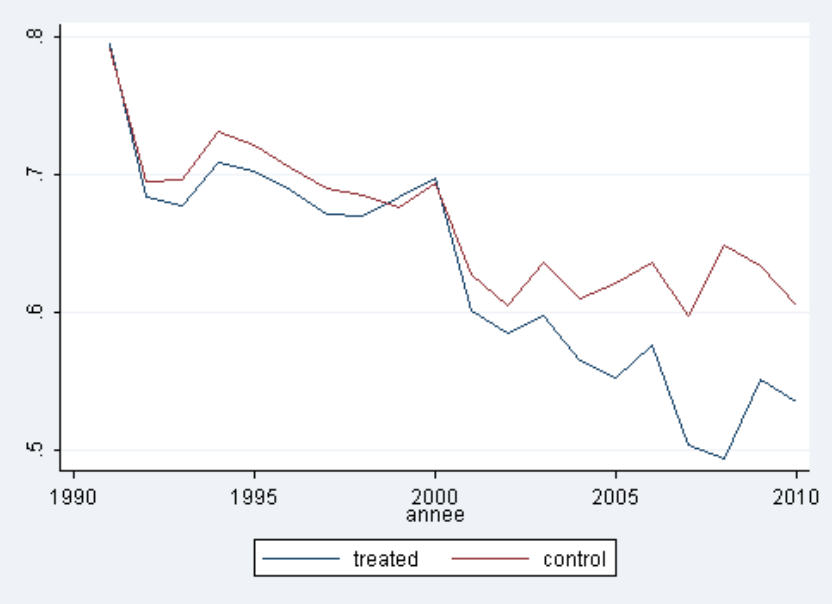
Importantly, for the workers hired before 2000 (which is the case of the sample of this study, who were all in EDF-GDF in 1989), the reform has no effect on wages. Moreover, their contract was not affected: everyone remained civil servant.

To sum up, we consider in the remainder that the reform of the French utilities lead to deep changes in the working environment in EDF-GDF. During the period 2000-2005, employees from all departments arguably suffered from the uncertainty brought about by the reform. However, we argue that employees of the distribution and transportation departments were especially affected by the reform, as job processes were modified to accomodate the new non-discriminatory policy, decision-making were modified by the geographical concentration of managers, and institutional entities were redefined (and renamed) many times along this period. The treatment we evaluate using a difference-in-differences strategy will only capture the impact of the asymmetric changes that affected the workers in the distribution and transport departments, but not the potential uncertainty-related stress that might have affected all workers in EDF-GDF. In that sense, our results will only be lower bounds of the global impact of the organizational change that occurred in EDF-GDF during this period.

Figure 1 displays the evolution of job satisfaction for active workers in the firm between 1990 and 2010, for workers in the distribution/transport (treated) departments and the other (control) departments. The curves illustrate quite well our hypothesis. Both curves are really close until 2000. Then both suffer a sharp drop in 2001 but the drop is stronger in the treated departements. The gap between the two curves tend to increase across time. Most figures will display this pattern. We can hypothesize that the initial drop is the consequence of the symmetric impact of the organizational change (stress related to

uncertainty) but cannot formally prove it (as it might be due to any other phenomenon, observed or not, occurring at the same time). However, in the diff-in-diff framework, we will interpret the gap in the curve after the reform, as the consequence of the shocks that asymmetrically affected the treated departments.

Figure 1: Evolution of the job satisfaction



Source: GAZEL database (INSERM).

3 Data and descriptive statistics

3.1 The GAZEL database

In this study, we use the GAZEL database. These data are collected by a research unit at *INSERM* (French National Institute for Health and Medical Research), in association with the utility firm *EDF-GDF*. The main purpose was to develop a longitudinal dataset mainly oriented towards epidemiological research and health-related issues (Goldberg, Leclerc, Bonenfant, Chastang, Schmaus, Kaniewski, and Zins, 2007).

The dataset was created in 1989 and was initially composed by 20,624 voluntary workers who accepted to participate in the long-term health study.[3] People are followed up each

[3] All male employees aged 40-50 and female employees aged 35-50 were invited to participate to the cohort. The acceptance rate was 45%. Only 0.6% of the sample were lost to follow-up after 10 years. See Goldberg, Chastang, Leclerc, Zins, Bonenfant, Bugel, Kaniewski, Schmaus, Niedhammer, Piciotti, Chevalier, Godard, and Imbernon (2001) for details.

year by responding to a postal questionnaire, from 1989 to 2010, which contains information on personal characteristics, perceived working conditions and perceived health, and pathologies. The dataset was then merged with several files collected by the Occupational Health and Human Ressources departments of *EDF-GDF*. This second category of data provides information on sick leave (and diagnosis).

The assets of this dataset are plenty. Beside being longitudinal, health status is measured by many variables: self-reported health and tiredness, description of pathologies, number of days in sick leave associated with its medical motive. Finally, employee's careers can be precisely tracked, including job title, department, compensation, etc., from the hiring year (or 1989) to the exit year (or 2010).

Descriptive statistics of the sample of 1995 are presented in the Table 1. Year 1995 is chosen as reference: this date is five year before the beginning of the reform, but also one year before the first European directive, ruling out anticipation effects. Column (1) shows the proportion/mean of each variable for the distribution department and column (2) for the other departments. Socio-demographic, occupation, as well the number of days of sick leave and the number of pathologies, by type, are reported in the table.

The individuals of the sample are relatively old in both groups at the date of the reform; their average age is about 50 in 1995. This feature should be taken into account in the interpretation of the results. About 70% are male. The two groups mostly differ in terms of occupation, with more blue-collar workers in the distribution group. In terms of health outcomes, the number of pathologies is quite similar across groups, the main pathologies being articular, cardiovascular and psychological ones.

Figure 2 displays the evolution of the number of active workers in both groups in our dataset. It shows the important attrition across time: some individuals may decide to stop taking part in the survey, but most attritions are due exit from the firm (and quasi exclusively from retiring). In 1997, there were still more than 15,000 individuals. In 2000, they year in which the organizational change starts to be enforced, less than 10,000 individuals are still employed. In 2005, the sample contains less than 4,000. For these reasons, we will stop interpreting the results after 2005. We discuss this issue and its implications in the last section.

Table 1: Summary Statistics (in 1995)

Variable	Distribution department	Other departments
Response	0.65	0.68
Women	0.3	0.27
Age	49.47	49.56
Low occupation	0.61	0.36
Sick leave (1991-1995)	15.47	11.35
Reported pathologies	3.67	3.49
Psy pathologies (positive)	0.36	0.34
Psy pathologies (number)	0.44	0.41
Bone/joint pathologies (positive)	0.67	0.62
Bone/joint pathologies (number)	1.25	1.13
Depression pathology	0.1	0.1
Days in sick leave	18.46	13.78
Sick leave, psy (days)	5.37	3.06
Sick leave, bone/joint (days)	3.2	2.24
Sick leave, depression (days)	2.84	1.41
Sick leave, psy (positive)	0.04	0.03
Sick leave, bone/joint (positive)	0.08	0.05
Sick leave, depression (positive)	0.03	0.02
Job change	0.07	0.1
Force moved (reported)	0.03	0.04
Restructuration (reported)	0.18	0.16
Residential move	0.03	0.06
N	10,143	7111

Source: GAZEL database (INSERM)

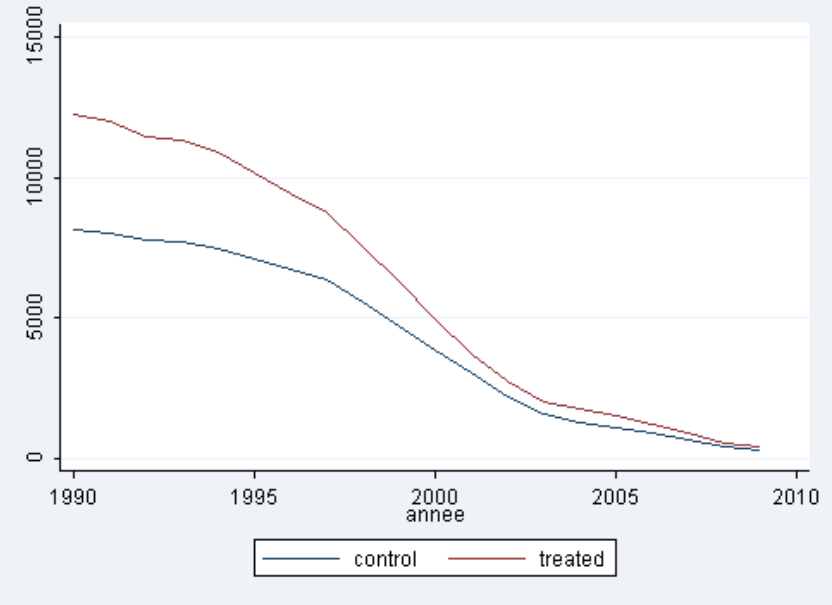


Figure 2: Evolution of the number of workers in the distribution and production departments
Sources: GAZEL database (INSERM).

4 Results

4.1 Identification strategy

We take advantage of the reform to identify a causal effect of a substantial change in the organization of the utility on workers' health. The idea is to compare the outcome in the distribution and transports departments to the other departments, before and after 2000. Because our data is an individual panel, we are able to introduce individual fixed effects to account for unobserved heterogeneity.

We estimate the following equation:

$$Y_{it} = \delta_i + \delta_t + \beta T_i \mathbb{1}\{t \geq 2000\} + \varepsilon_{it}$$

where Y_{it} is the outcome for individual i in year t. δ_i and δ_t are respectively individual and time indicators. T_i is a dummy variable indicating whether worker i belonged to the treated department in 1995. The coefficient of interest, assumed to capture the causal impact of the organizational change on the outcome, is β.

The identification assumption is that the treatment variable $T_i \mathbb{1}\{t \geq 2000\}$ is independent from the error term ε_{it} conditional on δ_i and δ_t.

Note that we use T_i defined as the department in 1995 and not the current department T_{it}. This is because, even if these workers hardly even move across departments, it is in principle possible to do so. As this move are potentially endogenous, we prefer to estimate a reduced-form that is immune from the kind of bias. The corresponding estimate is expected to be conservative, yet not very much so, as 98% of workers employed in the treated department in 2000 belonged to the same department in 1995.[4]

The model is estimated by panel ordinary least squares, considering δ_i as fixed effects, with data between 1990 and 2009, on the workers that were still active. In the section dedicated to discussion, we discuss the issue of potentially endogenous attrition.

4.2 Mechanisms

The dataset allows us to test some of the mechanisms that we highlighted in the section dedicated to the description of the organizational change. Managerial changes are not directly testable. However, we can test for two kinds of outcomes: administrative data on the job occupied as well as information on job and residence locations. The postal questionnaire also contains two informative self-reported measures: the worker reports whether, during the last year, she was forced to change job or whether organizational change was affecting her workplace. Difference-in-differences results are reported in Table 2. We find that, on average, the probability to experience a job change is increase by 1.5 percentage point, a 20% increase with respect to the level in the distribution department before 1995. Forced mobility is increased by 0.7 percentage point (25% increase), organizational change by 0.8 percentage point (5% increase), residential mobility by 0.8 percentage point (25% increase) and work geographic mobility by 1.1 percentage point (70% increase). Even if the impact seems to be small in absolute terms, the magnitude is high in relative terms, compared with the pre-reform situation. The organizational change seems to have particularly increased the geographical mobility of workplaces, consistently with the anecdotal elements presented earlier. There is also an important increase in the proportions of job changes, forced or not. Except from the organization change outcome, there is no significant difference across gender.

4.3 Impact on health

We use three categories of outcomes to assess the impact of organizational change on health.

[4] As expected, results obtained instrumenting the current department by the department in 1995 are very close from these reduced-form ones.

Table 2: Work and life events

	All	Men	Women
Job change	0.015^{***} (0.004)	0.011^{**} (0.006)	0.019^{***} (0.006)
Forced mobility	0.007^{***} (0.003)	0.006 (0.004)	0.008^{**} (0.004)
Organization change	0.008^{*} (0.005)	-0.003 (0.007)	0.018^{**} (0.007)
Residential mobility	0.008^{***} (0.002)	0.008^{**} (0.003)	0.005^{*} (0.003)
Work geographic mobility	0.011^{***} (0.004)	0.008 (0.005)	0.012^{**} (0.005)

First, we use the answers to five questions from the postal questionnaire, in which the worker has to describe his health situation. The worker is asked: (i) to assess his general health situation, (ii-iii) whether she feels physically/nervously tired, (iv-v) whether she thinks that her work is physically/nervously tiring. Answers are coded in 8 positions. For simplicity, we dichotomized each variable: 1 if the answer is greater or equal to the whole-sample median, 0 otherwise. Table 3 provides the diff-in-diff estimates for all five outcomes, for every active worker, men, and women. While the organizational does not have a significant overall impact on general health, workers tend to report more often that they are more tired, especially when a reference is made to their work. Compared to the baseline pre-treatment situation, the relative causal impact of the organizational change is between 5 and 10% in self-reported health. Women look slightly more affected than men, yet not systematically and not to a large extent.

Table 3: How-do-you-feel questions

	All	Men	Women
General health	-0.006 (0.006)	0.014^{*} (0.008)	-0.024^{***} (0.009)
Physically tired	0.031^{***} (0.007)	0.021^{**} (0.009)	0.039^{***} (0.010)
Nervously tired	0.020^{***} (0.007)	0.020^{**} (0.009)	0.006 (0.010)
Physically tiring work	0.040^{***} (0.007)	0.044^{***} (0.009)	0.019^{*} (0.010)
Nervously tiring work	0.036^{***} (0.007)	0.01 (0.009)	0.052^{***} (0.010)

The second category of outcomes are more precise self-reported measures of health. These are the pathologies that the workers reports to have suffered from during the last 12 months. We consider five outcomes of particular interest: the total number of patholo-

gies reported, the number of nervous/psychological or bone/joint pathologies, whether the worker reported having sleeping disorder, or being depressed. Table 4 displays the diff-in-diff estimates on these outcomes. Overall, organization change caused an increase of 0.1 (3%) on the number of pathologies reported. The relative increase is about as important on the number of bone/joint disorders (4%) but much more important on nervous and psychological pathologies (11%). The treatment also has a 7% effect on the probability of reporting sleeping disorders and a spectacular 40% effect on the probability of reporting being depressed. Mental health looks the most affected dimension. Table 4 also shows notable differences across gender: the vast majority of the overall effect is driven by women, while the impact on men is overall not significant.

Table 4: Reported pathologies

	All	Men	Women
Number of pathologies	0.123^{***}	0.007	0.150^{***}
	(0.026)	(0.032)	(0.046)
Nervous/psy pathologies	0.047^{***}	0.014	0.055^{***}
	(0.008)	(0.010)	(0.014)
Bone/joint pathologies	0.050^{***}	-0.005	0.088^{***}
	(0.014)	(0.018)	(0.023)
Sleeping disorder	0.019^{***}	0.01	0.019^{**}
	(0.006)	(0.008)	(0.009)
Depression	0.038^{***}	0.013^{***}	0.043^{***}
	(0.005)	(0.005)	(0.009)

Finally, the third class of outcomes is related to sick leave. We keep the same categories as with reported pathologies: overall sick leave, sick leave with a psychological, bone/joint, or depression diagnosis. Then, because the distribution of the number of days in sick leave has a long tail and a large weight on zero, it is very sensitive to outliers. Although the average number of days in sick leaves is a relevant outcome for the firm, it may fail to capture small changes on the extensive margin (workers switching from 0 to 7 days, for instance). We use an alternative measure to remedy this issue: the share of workers with a non-zero number of days in sick leave over the last year. Table 5 reports the diff-in-diff estimates relating to these outcomes. We find no significant effect on the number of days in sick leave, whether overall or decomposed by motive. Likewise, we find no increase in the share of workers calling sick overall or for joint/bone motives. However, we find an increase of 0.4 percentage point of the share of working calling sick with a psychological diagnosis and 0.8 percentage point for depression. These effects might seem small in absolute terms, but they are large in relative terms. Compared with the pre-reform period, this represents a increase of 10% for sick leave with psychological motives and 35% for depression. Like reported pathologies, the impact is concentrated on women and is not significantly different

from zero for men.

Table 5: Sick leave

	All	Men	Women
Sick leaves (days)	−1.53	−1.885	−2.062
	(1.250)	(1.525)	(2.179)
Sick leaves, psy diagnosis (days)	−0.402	−0.608	−0.697
	(0.803)	(0.914)	(1.485)
Sick leaves, bone/joint diagnosis (days)	−0.65	−1.038*	−0.438
	(0.447)	(0.532)	(0.796)
Sick leaves, depression diagnosis (days)	0.705	0.849	−0.006
	(0.600)	(0.647)	(1.161)
Sick leaves (share)	0.004	−0.004	0.018**
	(0.005)	(0.008)	(0.008)
Sick leaves, psy diagnosis (share)	0.004*	−0.001	0.009**
	(0.002)	(0.002)	(0.005)
Sick leaves, bone/joint diagnosis (share)	0.003	−0.002	0.005
	(0.003)	(0.004)	(0.005)
Sick leaves, depression diagnosis (share)	0.008***	0.002	0.012***
	(0.002)	(0.002)	(0.004)

4.4 The heterogeneity of the effects

Aside from gender, there are several dimensions of heterogeneity that one might wish to investigate. First, one might suspect organizational change to affect differently blue-collar and white-collar workers. Second, even our sample is quite homogenous in terms of age (with a standard deviation of only 2.7 years), we can split to compare the youngest and the oldest. On the one hand, the oldest are expected to be more fragile and less flexible, on the other hand, they are closer to retirement and are therefore less prone to be psychologically affected by the reform. Finally, as we know the sick-leave behavior of each worker before the reform, we may distinguish the impact between those who were sick every year, those who never called sick, and those who were sick some but not all years. In practice, we expect the effect to be more visible on the last category, that are the marginal workers, those with the highest variance on calling sick during the pre-reform period.

Table 6 presents the impact of the organizational of these subpopulation, pooling men and women.

Table 6: Heterogeneity of the impact

	All	Blue-collar	Younger	High SL variance
Nervously tiring work	0.040***	0.012	0.033***	0.034***
	(0.007)	(0.010)	(0.008)	(0.008)
Nervous/psy path	0.047***	0.019	0.055***	0.042***
	(0.008)	(0.013)	(0.010)	(0.011)
Osteo path	0.050***	0.072***	0.048***	0.030*
	(0.014)	(0.022)	(0.017)	(0.018)
Sick leaves (share)	0.004	0.015*	0.004	0.024***
	(0.005)	(0.008)	(0.006)	(0.008)
SL, depression (share)	0.040***	0.012	0.033***	0.034***
	(0.007)	(0.010)	(0.008)	(0.008)

5 Discussion

5.1 Robustness

In order to assess the robustness of our results, we perform several exercises. First, most of the individuals in our sample retire during the observation period. Aside from external validity issues, one potential concern is that the decision to retire might itself be endogenous. A simple Roy model would predict that individuals that would suffer the most from the treatment would select themselves out of work. Given that the model is estimated on employees that remain active, this endogenous retirement decision would induce a downward bias on the estimated impact of organizational change.

Figure 3 displays the proportion of active workers in a given year that will retire within the following 12 months, in the treated and control departments. Most of the variability is driven by composition effects and the two curves appear to be closely related.
A regression analysis confirms this graphical argument. We estimate the following model by OLS.

$$A_{it} = \alpha Z_{it} + X_{it}\beta + \delta_t + u_{it}$$

where A is a dummy variable equal to 1 when the worker is still active. Among the covariates X, we introduce dummies for the department, for the skill level, for the highest degree obtained, for the employee's age, as well as the average number of sick leave days before the treatment period. Time dummies δ_t are also included. Z_{it} is defined as previously. The point estimate is equal to -0.003 with a standard error of 0.004. We cannot reject the hypothesis that the organizational change had no impact on the probability to remain active. This is consistent with the empirical observation that nearly all exit are due to retirement and the anecdotal elements that suggest that employees do not have much to choose when they could retire.

Figure 3: Share of active workers retiring within a year

Another potential concern with our analysis is that our panel is not-balanced and that individuals remaining active after the age of 55 are special. First, we conduct the same empirical analysis on the subsample of individuals still active in 2002 (removing nearly two thirds of the sample). We find very similar results. Second, we remove all observations after 2005. We also find very similar results. Table 7 shows the detailed results of these two exercises.

Table 7: Sub-samples

	All	Balanced panel	Before 2005
Nervously tiring work	0.040***	0.036***	0.044***
	(0.007)	(0.008)	(0.007)
Nervous/psy path	0.047***	0.052***	0.045***
	(0.008)	(0.010)	(0.009)
Osteo path	0.050***	0.048***	0.032**
	(0.014)	(0.017)	(0.015)
Sick leaves (share)	0.004	0.003	0.003
	(0.005)	(0.006)	(0.006)
Sick leaves, depression diagnosis (share)	0.008***	0.008***	0.008***
	(0.002)	(0.003)	(0.002)

As the European legislation was voted in 1996, one might think that the treatment should be defined since 1996 and not since 2000. We estimate an alternative model to attempt to capture anticipation effects.

$$Y_{it} = \delta_i + \delta_t + \alpha T_i \mathbb{1}\{96 \leq t < 2000\} + \beta T_i \mathbb{1}\{t \geq 2000\} + \varepsilon_{it}$$

In this model, α will capture anticipation effects, while β is the same coefficient as previ-

ously. Table 8 provides the estimates for both α and β for the main outcomes of interest. We find some evidence of anticipation indeed. Reporting a tiring job or a bone/joint pathology seems to be more frequent in the treated department between 1996 and 1999 than before 1995. If anything, incorporting these anticipation effects seem to increase the magnitude of the coefficients β. However, most estimates are not significantly different from the specification in which anticipation are absent.
Finally, we run a placebo exercise in which we remove the observations of the treated department, and assign another (non-treated) department to treatment. We run the same estimation with this new treated group and find that the "treatment" has no significant causal impact on the same set of outcomes.

5.2 Conclusion

In this paper, we provide evidence that the reform of the French energy utilities sector affected the working environment as well as workers' health outcomes. Workers' health status was affected by the organization change. We provide evidence of an increase of psychological disorders, in particular among women. The proportion of employees taking sick leave in a given year is increased by 20%. We find also a positive impact on pathologies related to work. The number of psychological pathologies significantly increases in the treated group after the reform.

Taking advantage of a reliable dataset and a credibly exogenous reform, the internal validity of our results seems to be granted. However, one could raise question about the external validity of our findings. There is no evidence that our sample is representative of workers who are likely to suffer from organizational changes: most were old at the time of the reform and have been working in the firm for several decades.

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Table 8: Anticipation effects

	All	Men	Women
Nervously tiring work			
≥ 2000	0.051^{***}	0.054^{***}	0.028^{***}
	(0.007)	(0.009)	(0.011)
1996-1999	0.028^{***}	0.027^{***}	0.024^{**}
	(0.005)	(0.006)	(0.010)
Nervous/psy path			
≥ 2000	0.043^{***}	0.013	0.042^{***}
	(0.009)	(0.010)	(0.015)
1996-1999	-0.011^{*}	-0.002	-0.034^{**}
	(0.007)	(0.007)	(0.014)
Bone/joint path			
≥ 2000	0.063^{***}	0.003	0.107^{***}
	(0.015)	(0.019)	(0.025)
1996-1999	0.032^{***}	0.020^{*}	0.050^{**}
	(0.011)	(0.012)	(0.023)
Sick leaves (share)			
≥ 2000	0.004	-0.004	0.019^{**}
	(0.006)	(0.008)	(0.009)
1996-1999	0.000	0.001	0.003
	(0.004)	(0.005)	(0.008)
Sick leaves, depression diagnosis (share)			
≥ 2000	0.009^{***}	0.004^{*}	0.011^{***}
	(0.002)	(0.002)	(0.004)
1996-1999	0.002	0.004^{***}	-0.002
	(0.002)	(0.001)	(0.004)