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ERUDITE

ÉQUIPE DE RECHERCHE SUR L'UTILISATION DES DONNÉES INDIVIDUELLES EN LIEN AVEC LA THÉORIE ÉCONOMIQUE

Sous la co-tutelle de :
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An evaluation of the 1987 French Disabled Workers Act: Better paying than hiring*†

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Abstract

The French Disabled Workers Act set up a legal quota of disabled workers in more than 20 employees companies. This law decreed financial penalties for non-compliance. We evaluate the impact of this law on the employment of disabled people. We use a triple difference approach combined with dynamic exact matching and weighting methods in order to disentangle the pure effect of the legislation by controlling for both observable and unobservable correlated heterogeneities. Using a panel data set built from the "Sante et itineraire professionnel" ("Health and Labour Market Histories") survey, we investigate whether disabilities have a significant impact on people's employment, by distinguishing between the public and private sectors. We compare the labour trajectories of disabled people before and after the implementation of the law. Our findings highlight a negative impact of the Disabled Workers Act on the employment of disabled people. By enabling firms to abide by the legal employment obligation without hiring any disabled workers, this measure has probably had a counterproductive impact on the employment of disabled people. Nevertheless, this negative effect is restricted to the private sector; we find that the public sector shelters the disabled workers.

JEL: C33, C52, I10, J20, J31.

Keywords: disability, employment policy, triple difference, matching, weighting

1 Introduction

The aim of this paper is to evaluate the impact of the Disabled Workers Act of July 10th 1987 on the employment of disabled people. It concerns workers in the private sector. In a wide range of

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EU countries, public policies using a combination of quotas and taxes aiming at increasing the employment rate of disabled workers, were adopted (OECD, 2003). Yet, in each country, quotas are different according to the size of the financial penalty, the types of employment subsidies and the characteristics of the social welfare system. Moreover, quotas can also vary depending on the type of employer (and thus the tax base). In Italy, for instance, contrary to Spain and Belgium, a mix of quota and huge financial penalties has been implemented. In Germany, the employment obligation, set up at the beginning of the twentieth century, has consisted in the implementation of quotas (5% both for the public and private sectors since the 1974 Law), and represents the main component of the policy promoting the integration of disabled workers in the labour market. In the UK, the Disabled Persons Employment Act of 1944 introduced a quota system of 3% for companies employing over 20 employees, joint with protective measures against dismissal of disabled people and a policy of reserved jobs for disabled persons. As in Germany, the law was little applied and, in 1995, a new law implementing the principle of non discrimination against disabled people has taken place (the Disability Discrimination Act or DDA). This DDA forbids employers in establishments over 20 employees to treat differently workers on the grounds of disability without any justified reasons. This law notably implies that employers have to set up the necessary arrangements that promote employment for disabled individuals (for instance, changes in working conditions, job adaptation...). In addition, specific discriminations are justified in case of high level of physical or mental skills required in specific jobs (such as firemen, policemen...). Finally, the State implements technical standards to improve access to facilities and public services for disabled people and displays a high level of information to parents and students to facilitate access to education for disabled persons.[1]. In France, the implementation of a quota system of disabled workers (expressed as a percentage of total employment) combined with financial penalties in case of non-compliance can influence the labour demand of both disabled and non-disabled workers. Indeed, employers are likely to adopt strategic hiring behaviours to cope with quotas and escape fines. In this study, we focus on the French law of 1987. This law promoted the employment of people with disabilities, which has been extended with the 2005 Law. It imposed hiring quota for disabled people in direct relation with the legal obligation of employment of disabled workers (the French OETH). The 1987 Disability Employment Act targeted both part-time and full-time jobs and applied to all establishments, whatever public or private, employing at least 20 employees. It fixed a hiring quota of 6% of disabled workers in total employment[2]. In practice, only private establishments were concerned by the obligation to administratively report the number of job filled by disabled people eligible to the OETH and, thus, had to pay financial penalties to the French institution dealing with the professional insertion of disabled people in the private sector (the AGEFIPH) when they did not reach the quota.

According to the law, employers can meet the legal employment obligation (OETH) through different ways: either by direct and indirect employment of disabled workers (as partnership contracts with institutions specialised in sheltered employment for disabled people or providing training placement for disabled people), or by paying a financial contribution in proportion to the gap between the current employment rate and the quota of 6%. Disabled people are defined with regard to their eligibility to the legal employment obligation (OETH) and to the administrative recognition by the relevant institution (the disabled people's rights and auton-

[1] See Demuijnck et al. 2005 for a comparison of policies promoting employment to disabled people in different EU countries.

[2] Let's notice that the scalability of the device was progressive, from 3% in 1988 to 4% in 1989 and finally 6% in 1991.

omy commission - CDAPH), including beneficiaries of disability pension and victims of work injuries or professional diseases.

Some papers attempt to evaluate policies promoting the employment of disabled people (recruitment or job retention). Labour market supply side policies tend to focus on the limitation of threshold effects and moral hazard problems due to disability insurance programs (Campolieti and Ridell, 2012). Based on Canadian data, Campolieti and Riddell (2012) analyse the impact of two public disability compensation policies on the probability of disabled individuals obtaining employment (but also on their maintaining or exiting the compensation measures) with moral hazard logic. The authors study the Disability Insurance programs in Canada, which are not unified. Indeed, the Province of Quebec has its own compensation policy, which allows to observe the impact of the introduction of some public policies in Quebec, considering other Canada's regions as a control group. They identify a significant positive effect of the introduction of a minimum wage threshold, below which the individuals can concurrently receive a disability allowance, on returning to work for insured people with a long-term and severe disability (i.e. lasting at least one year). They also observe that the effect is more pronounced for women than for men. They do not, however, test the existence of a the common trend assumption in the control and test groups.

Labour market demand-side policies are dedicated to the reduction of discrimination against disabled people (Acemoglu and Angrist, 2001; Beegle and Stock, 2003; Jolls and Prescott, 2004; Jolls, 2004; Bell and Heitmueller, 2009) either by using economic incentives such as labour cost deductions (Vall Castello, 2012) or by combining hiring quotas for disabled workers and financial penalties in case of non-compliance (Wagner et al., 2001; Lalive et al., 2013).

The literature estimates the elasticity of employment to the disability compensation. Staubli (2011), for example, examines on Austrian data the effect of the strengthening of eligibility criteria in disability insurance on labour force participation. He identifies a statistically significant positive effect on the participation in the labour market in the private sector concerning disabled men over 55 years-old, with an increase from 1.6 to 3.4 points. The main observable individual characteristics used to match the treated group with the control group are the nature of the job (blue / white collars), experience, the number of years of financial compensation of the disability, past annual incomes and the living area (at regional level).

Marie and Vall-Castello (2012) studies the impact of the implementation of a more generous disability insurance on the participation rate in the labour market. They focus on people suffering from a partial disability (who can cumulate the allowance for disability and an activity income) for individuals of 55 years-old and more (only eligible to this increase in the generosity of the allowance). Based on Spanish data, the authors find that the increase of 36% in the level of disability pensions reduces the probability to be employed by 8%.

Vall-Castello (2012) evaluates the effects of the policy promoting employment among disabled women in Spain. The author studies the impact of reducing social security contributions for employers who hired disabled women. The study uses a difference-in-differences method to evaluate the existence of changes in trends for the employment of females in relation to that of males due to the policy, conditional on any pre-existing trends. The study shows a significant effect of the labour cost deductions.

Finally, based on South African data, Mitra (2009) shows that a loosening in the administrative control of the truthfulness of the disability to work, that allows individuals to benefit from a compensation for their disability, implied an increase in the non employment rate by 8.6% for the 45-64 years-old men.

Closer to our study, Wagner et al. (2001) and more recently Lalive et al. (2013) evaluate the

impact of a quota policy with financial penalties on the employment of disabled workers. Both articles examine whether there is a discontinuity in the vicinity of the legal employment thresholds between firms concerned with the quota of disabled workers. They rely on the employment dynamics of disabled workers within companies (hiring of disabled and non-disabled workers, increase in working hours, capital / labour substitution).

On West German panel data on 400 establishments, Wagner et al. (2001) analyse the impact of macroeconomic shocks on the labour demand of companies that are located just at the legal limit of the quota (target of 6% of disabled workers in the total workforce). They show that there are no significant differences in labour demand between companies where the quota applies and others, even though they face the same demand shock.

On the basis of Austrian panel data over the period 1996-2003, Lalive et al. (2013) study the hiring behaviour of firms subject to the legal quota of disabled workers. They analyse the threshold effects that could potentially occur due to the discontinuity in the relative labour cost of disabled versus non-disabled individuals. They use the regression discontinuity design method to take into account the endogeneity of firm size. The objective is to estimate the impact of the treatment (the quota and penalty) on the employment of disabled workers by comparing the hiring behaviour of firms which are just below and just above the drop-off window. This method allows to identify a local treatment effect on the employment of disabled workers and to estimate an upper/lower limit of this causal effect. They manage to show that the quota policy positively influences the employment of disabled workers for companies located in the vicinity of the discontinuity, the impact being greater for larger firms. This result is explained by the fact that more than a third of companies in the vicinity of the threshold have little or no financial incentive to hire disabled workers. In addition, they show that increasing the amount of the financial penalty for non-compliance with the quota improves the impact on employment of disabled workers. But when the non-compliance tax is combined with bonuses granted to companies that exceed the quota, it tends to reduce the positive effect of the penalty on the employment of disabled workers.

Our goal is to evaluate the impact of the 1987 Disabled Workers Act on the employment of disabled by building a panel which allows for identifying the exact onset and length of disability. To comply with the perimeter of the law, we restrict the definition of disability to officially recognised disabilities. Finally, we use a triple difference methodology, with matching and weighting methods, in order to disentangle the specific effect of the law by comparing the employment trajectories of comparable disabled people before and after the implementation of the law. Our study contributes to the applied literature on the four following points. First, we provide the first economic evaluation of the French Disabled Workers Act. Second, we account for the differences between the public and private sectors. Third, we apply a triple difference innovative method, which decomposes the variation of the ATT before and after the reform, in order to account for changes in the disabled population structure. The remainder of the article proceeds as follows. In the next parts, we present the data and the methodology, then the results and a discussion.

2 Data and methodology

2.1 Data

The SIP (Health and Labour Market Histories) Survey was designed within the framework of a partnership between the Ministry of Health and the Ministry of Labour, with scientific sup-

port from the Center for Employment Studies. The implementation thereof was carried out by the National Institute of Statistics and Economic Studies. The first wave, in 2006, retrospectively questions 14,000 persons aged between 20 and 74 and living in ordinary households in France on their life paths (family, professional and health status) and provides a detailed description of these different dimensions at the time of the survey. It provides an individual/year panel specifying, for each period, individual, professional and health information while controlling for individual and temporal heterogeneity. A retrospective calendar allows to identify the exact date of disability onset, the length of disability and the evolution of labour market status (including public and private sector employment) to examine how an individual's career is affected by a health shock through a rigorously constructed counterfactual. The SIP Survey mainly aims at two objectives:

1. to better understand health determinants, by defining health status in regard with employment status and career path;

2. to measure both the incidence of health status, in the broad sense, on people's career paths, career risks and the potential discrimination they may face.

Our performance variables describe the employment of individuals for each observed year. We use dummy variables for employment in the public sector and employment in the private sector. In order to estimate the effect of a disability on the employment status, for example the year following its occurrence, we analyse whether the distribution of the treated according to these four dummies has been differently altered from that of the non-treated. The decomposition between public and private employment is motivated by the differences in the context of professional integration of disabled persons. Nevertheless, the effect of a disability on total employment can be obtained by performing the sum of the effect on public employment and the effect on private employment. We observe people's performance in the labour market during the five years following the reform in order to consider the progressive increase in employment quotas from 3% in 1988; to 4% in 1989 and finally 6% in 1991.

In the SIP Survey, individuals can self-report disabilities and their potential links to changes in their professional situations. Disabilities are identified in various ways in the SIP questionnaire and along with the retrospective calendar (submitted with the questionnaire) and are self-reported regardless of whether they are explicitly related to professional events. For example, the respondent might declare whether a disability occurred during his or her childhood or prevented the completion of education or job training. When describing professional trajectories, the respondent might declare whether a disability was disruptive. For a complete employment period (1-5 years), people were asked whether a disability resulted in a loss of employment, caused impairments or important changes in working conditions. For the current job, individuals were only asked whether a disability resulted in loss of employment. For an unemployment period, people were asked whether a disability resulted in the end of job search. For a period of non employment, people were asked whether a disability caused or extended it. In the health part of the survey, respondents who had already disclosed a life disturbance were asked whether a disability occurred and whether other periods of disability had been experienced.

In this survey, 2095 respondents experienced at least one disability since early life until 2006. The SIP Survey inquired as to the origin of the disability, which, through a meticulous study of the clearly formulated responses (verbatim data), made it possible to correct the raw data encoded as "other". We finally identify the causes of disability for 98% of the sample: accidents explain the origin of 41% of disabilities and a third of them are due to an illness or health

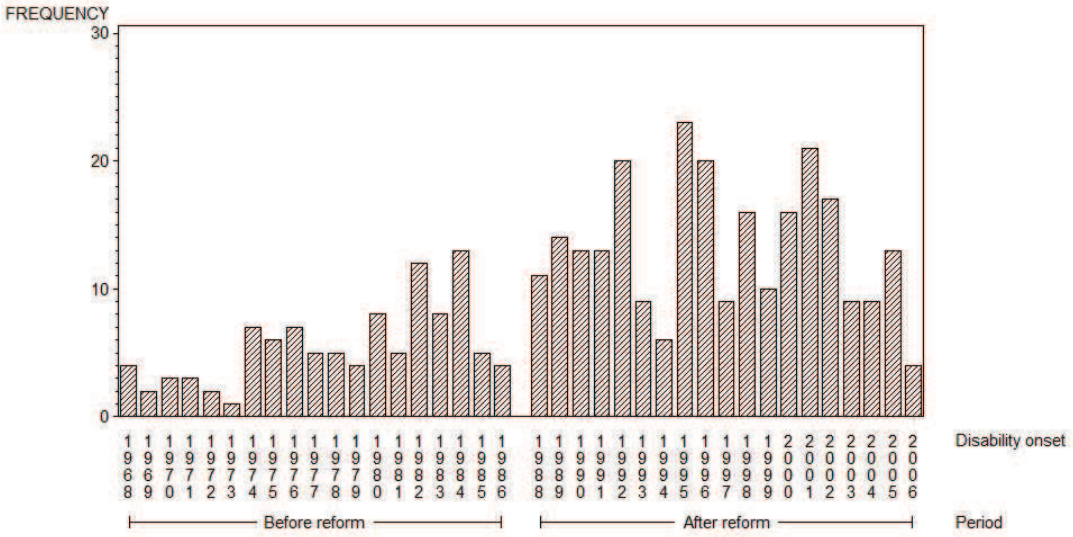

Figure 1: Disability year, by period

problem. To study the effect of the occurrence of disability on the labour market status, we only consider individuals who have completed their initial education. Among them, 1777 have experienced at least one disability after their initial education.

Insofar as the SIP Survey does not have administrative data but only self-reported variables, we focus on a restrictive definition of disability : the first officially recognised disability (i.e. disability officially recognised by the COTOREP, the institution coping with the vocational rehabilitation of disabled person, or health problems having resulted in a disability confirmed by the statutory health insurance (Sécurité Sociale) physician. 324 people have experienced at least one officially recognised disability during their lifetime (Figure 1).

The Figure 2 provides a naïve comparison of the labour market outcomes before and after the reform. The left part of the figure provides the employment rate before the onset of the disability. The pre-reform line is above the post-reform line because the situation is better in the labour market in the first period. We see that the lines are parallel before the onset of the disability (date 0 on the plot). This suggests that, if we control for the time trend (here related to the business cycle), there should be no significant difference between the pre-reform and post-reform employment outcome before the onset of the disability. The picture is quite different after the onset of the disability, on the right part of the figure. While the pre-reform line shows an expected decrease in the employment rate and then a stabilization at a lower activity rate, the post-reform line shows a strongly decreasing employment rate. The gap between the pre-reform and the post-reform employment rates after the onset of the disability is called the naïve reform effect estimator. Our methodology aims at controlling for all the elements that could have created this gap in order to measure the true effect of the reform.

2.2 Methodology

The first part of the methodology consists in applying a difference-in-differences with matching estimation. We apply an estimator similar to Heckman et al. (1997) separately over the two periods before 1987 and after 1987. We kept 19 years of data before and after 1987. These esti-

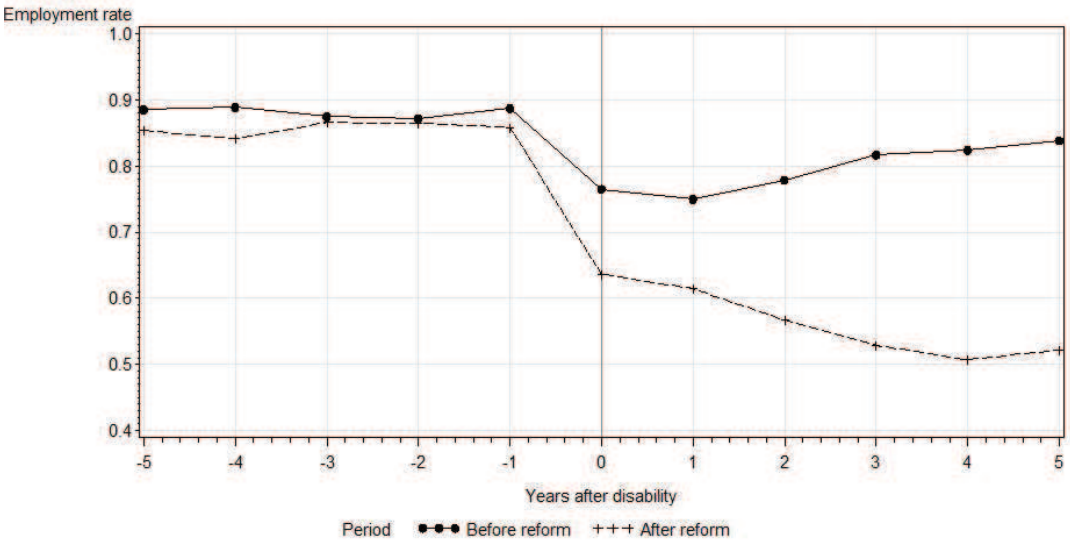

Figure 2: Employment rate among disabled workers, by period

mates can be considered as the one we would have obtained by evaluating the effect of a disability on the labour market outcomes. This difference-in differences part aims at eliminating the individual and time correlated effects (similar to panel data), and the matching part aims at controlling for lagged time varying variables (occupation, type of labour contract, working time) and time-constant individual variables (gender, education level, having been raised by one's parents, problems during childhood). In the case of these time constant variables, applying matching and differencing together is equivalent to allow for a cross effect of individual variables with time effect. It also allows for relaxing the common trend assumption between the treated and the control, since the trends are assumed common only among individuals with similar values of the matching variables.

However, these first estimates are not always sufficient to evaluate the effect of the policy. We have shown in other papers (Duguet and Le Clainche, 2014) that the effect of illness depends on observable variables. One robust result is that the effect of illnesses or accidents is decreasing with the education level. Therefore, if our population of interest has a different average education level before and after 1987, we could observe difference in the average effect of the treatment on the treated (ATT) that does not come from the introduction of a new policy. More generally, if the disabled population changes before and after the reform, the difference in performance may come from both the population change an the policy change. We introduce a method which disentangles these effects. We perform a correction in order to account for the differences stemming from three variables: gender, the education level and the age the person had when the disability occurred. Notice that the last variable cannot be accounted for in the standard difference-in-differences estimator because the not treated do not have an age at disability by definition. We apply a double matching method: one the one hand, we match the treated with the not treated and, on the other hand, we match the treated before the reform with the treated after the reform.

Difference-in-differences. In this first stage, we consider each period separately. We perform an exact matching between individuals suffering from a disability and their twins who never experienced a disability at the disability date of their match. First, we consider among matching variables some socio-demographic characteristics: gender, education level (three levels) and the birth date (maximal distance of three years with twins). Second, we take into account the living conditions during childhood: having been raised by their parents, whether having encountered problems in childhood (trauma, war, and violence at school or in their neighbourhoods, hard living conditions), whether having had problems affecting a relative during childhood (family conflict, death of a family member, a relative with serious health problems, long separation from a family member). Among the matching variables, we also consider variables that may vary over time such as variables describing the type of labour contract of individuals before the disability: permanent versus fixed-term contract and part-time job versus full-time job. Workers with temporary contract before the disability who have experienced a disability may be unemployed or non employed after the disability because the contract ends and not because of the disability itself.

Consider the individuals with a disability, denoted $i \in I$, where I stands both for the index set of the disabled people and their number. An individual $i \in I$ is observed between the years t_i^- and t_i^+ and a disability happens on year $t_i \in (t_i^-, t_i^+)$. In order to evaluate the effect of the disability, we compare the occupation of individual i in $t_i - 1$ to the occupational choice k years after the health event, in $t_i + k \leq t_i^+$. In what follows, we take employment as example but any other occupation can be dealt with in the same way. The employment probability of individual i during year t, denoted $p_{i,t}$, depends on a vector of individual explanative variables X_i, an unobservable individual effect α_i, potentially correlated with X_i, a time effect $\beta_{0,t}$ and a joint effect of the explanative variables with the time effect $\beta_{1,t}(X_i)$. The employment dummy variable $d_{i,t}$ follows a Bernoulli process with mean $p_{i,t}$ given by:

$$\begin{aligned} d_{i,t} &= p_{i,t} + \epsilon_{i,t} \\ p_{i,t} &= f_i(X_i) + \alpha_i + \beta_{0t} + \beta_{1,t}(X_i) + \gamma_i(t - t_i) \times T_{i,t} \end{aligned}$$

where $f_i(.)$ is an unknown function relating X_i to the employment probability $p_{i,t}$, γ_i is the effect of the disability on the probability to be employed and $T_{i,t}$ a dummy variable equal to 1 if there is a disability ($t \geq t_i$), 0 otherwise ($t < t_i$). The γ_i terms depend on how much time has passed since the disability occurred $t - t_i$. The $\epsilon_{i,t}$'s are idiosyncratic error terms with $\mathrm{E}\left(\epsilon_{i,t} \middle| X_i, \alpha_i, \beta_{0t}, \beta_{1t}(X_i), T_{i,t}\right) = 0$. Henceforth, we consider the effect of the disability between $t_i - 1$ and $t_i + k$, so that we wish to estimate an average value for $\gamma_i(k)$, $k \geq 1$.

The estimation proceeds through the elimination of all the components of the previous equation but $\gamma_i(k)$. The techniques used to achieve this goal are based on differencing (for α_i and $\beta_{0,t}$), matching (for X_i and $\beta_{1,t}(X_i)$) and averaging (for $\epsilon_{i,t}$). In the first step, we will match the people facing a disability ($i \in I$) with their twins defined as:

$$J(i) = \left\{ j : t_j^- \leq t_i - 1, t_i + k \leq t_j^+,\ t_j > t_i + k \text{ and } X_j = X_i \right\}$$

The two first inequalities simply impose that twins should be present at least over the same period than individual i. The third inequality defines dynamic matching: the twins $J(i)$ should experience their disability (if they have any) after the end of the comparison period of individual i. This implies that we match i with, on the one hand, people that will neither experience a disability and, on the other hand, people that will experience a disability at a later date. When somebody does not experience a disability, we use the convention $t_j = \{+\infty\}$. Eventually, twins

should have the same individual characteristics. The notation $J(i)$ will also be used to indicate the number of twins of individual i. Notice that two individuals can share common twins, since we make use of all of them for each individual. The outcome variable of the twins does not include the effect of the disability by definition, so that their outcome variable is given by:

$$\begin{aligned} d_{j,t} &= p_{j,t} + \epsilon_{j,t} \\ p_{j,t} &= f_j(X_j) + \alpha_j + \beta_{0t} + \beta_{1,t}(X_j) \end{aligned}$$

and the average outcome of i's twins is given by:

$$\frac{1}{J(i)} \sum_{j \in J(i)} d_{j,t} = \beta_{0t} + \beta_{1,t}(X_i) + \frac{1}{J(i)} \sum_{j \in J(i)} \left(f_j(X_i) + \alpha_j + \epsilon_{j,t} \right)$$

Consider first the difference between individual i and all the twins $j \in J(i)$ before the health event, we eliminate the terms in β_{0,t_i-1} and $\beta_{1,t_i-1}(X_i)$ and get:

$$\begin{aligned} D_{i,t_i-1} &= d_{i,t_i-1} - \frac{1}{J(i)} \sum_{j \in J(i)} d_{j,t_i-1} \\ &= f_i(X_i) + \alpha_i + \epsilon_{i,t_i-1} - \frac{1}{J(i)} \sum_{j \in J(i)} \left(f_j(X_i) + \alpha_j + \epsilon_{j,t_i-1} \right) \end{aligned} \tag{1}$$

and when we take the difference after the disability date we also eliminate the β components:

$$\begin{aligned} D_{i,t_i+k} = &= d_{i,t_i+k} - \frac{1}{J(i)} \sum_{j \in J(i)} d_{j,t_i+k} \\ &= f_i(X_i) + \alpha_i + \gamma_i(k) + \epsilon_{i,t_i+k} - \frac{1}{J(i)} \sum_{j \in J(i)} \left(f_j(X_i) + \alpha_j + \epsilon_{j,t_i+k} \right) \end{aligned} \tag{2}$$

the difference in the differences (2) and (1) therefore leads to:

$$\begin{aligned} DD_i(k) &= D_{i,t_i+k} - D_{i,t_i-1} \\ &= \gamma_i(k) + \epsilon_{i,t_i+k} - \epsilon_{i,t_i-1} - \frac{1}{J(i)} \sum_{j \in J(i)} \left(\epsilon_{j,t_i+k} - \epsilon_{j,t_i-1} \right) \end{aligned}$$

so that $\mathrm{E}(DD_i(k)) = \gamma_i(k) \ \forall i,k$. Our estimator is simply the average of these individual health effects. We define:

$$\hat{\gamma}(k) = \frac{1}{I} \sum_{i \in I} DD_i(k)$$

so that:

$$\mathrm{E}\left(\hat{\gamma}(k)\right) = \frac{1}{I} \sum_{i \in I} \gamma_i(k).$$

In practice, we cannot match exactly on the age of the individuals due to the lack of twins. Therefore we use calliper matching, by allowing for a maximum difference of three years between an individual and his/her twins.

Table 1: Disabled sample structure variation between 1968-1986 and 2006-1988

The weights are given for the evaluation between $t_i + 1$ and $t_i - 1$.

Variables	1968-1986	1988-2006	Difference
Women	27.6%	52.1%	24.5%
Primary education	40.2%	24.7%	-15.6%
Secondary education	43.7%	46.1%	2.4%
Higher education	16.1%	29.3%	13.2%
More than 30 at handicap	56.3%	81.9%	25.5%

Evaluating the effect of the reform (triple difference step) . This part corrects the estimations for the distribution variations between the pre-reform and the post-reform periods. We perform two estimations: one before the reform, denoted $\hat{\gamma}(k,0)$ and one after the reform denoted $\hat{\gamma}(k,1)$. One cannot use the difference between these two estimations because they depend on the distribution of the observable Z variables, which can be different before and after the reform. The Z variables can include some previous X variables, and additional variables that are specific to the treated population. The table 1 gives the distribution of the treated variables. We clearly see that the post reform disabled sample includes more women, more educated people and people which were older at the onset of the disability. Since all these variables influence the labour market outcomes, we need to control for this distributional variation. This is the purpose of our methodology.

More precisely, we can rewrite these two estimators under the following form:

$$\hat{\gamma}(k,r) = \frac{1}{I_r} \sum_{i \in I_r} DD_i(k,r)$$

where r denotes the reform dummy ($r = 0$ before the reform, $r = 1$ after), I_r the corresponding number of treated and $DD_i(k,r)$ the double difference of the individual contribution to the ATT k years after the disability occurrence. In order to evaluate the reform, we first group individuals according to the value of their individual variables Z_i. For the period r, let G denote the number of groups, common to both periods, each including N_g^r individuals, different for the two periods. By construction, we have $I_r = \sum_{g \in G} N_g^r$. The ATT estimate can be rewritten by group in the following way:

$$\begin{aligned} \hat{\gamma}(k,r) &= \frac{1}{I_r} \sum_{i \in I_r} DD_i(k,r) \\ &= \frac{1}{I_r} \sum_{g \in G} N_g^r \times \frac{1}{N_g^r} \sum_{i \in g} DD_i(k,r) \end{aligned}$$

defining the group g average contribution to the $\hat{\gamma}(k,r)$ as:

$$\hat{\gamma}_g(k,r) = \frac{1}{N_g} \sum_{i \in g} DD_i(k,r)$$

we get

$$\hat{\gamma}(k,r) = \sum_{g \in G} w_g^r \hat{\gamma}_g(k,r)$$

with $w_g^r = N_g^r / I_r$. The difference in differences estimators can be written :

$$\hat{\gamma}(k,0) = \sum_{g \in G} w_g^0 \hat{\gamma}_g(k,0)$$
$$\hat{\gamma}(k,1) = \sum_{g \in G} w_g^1 \hat{\gamma}_g(k,1)$$

therefore, the difference of these estimators does not only depend on differences in γ terms, but also from differences in weights (i.e. explanative variables distributions). Consider the following decomposition:

$$\begin{aligned}
\hat{\gamma}(k,1) - \hat{\gamma}(k,0) &= \sum_{g \in G} w_g^1 \hat{\gamma}_g(k,1) - w_g^0 \hat{\gamma}_g(k,0) \\
&= \sum_{g \in G} w_g^1 \hat{\gamma}_g(k,1) - w_g^1 \hat{\gamma}_g(k,0) + w_g^1 \hat{\gamma}_g(k,0) - w_g^0 \hat{\gamma}_g(k,0) \\
&= \sum_{g \in G} w_g^1 \left(\hat{\gamma}_g(k,1) - \hat{\gamma}_g(k,0)\right) + \left(w_g^1 - w_g^0\right) \hat{\gamma}_g(k,0)
\end{aligned}$$

the only term that is influenced by the reform is :

$$\hat{\rho}(1) = \sum_{g \in G} w_g^1 \left(\hat{\gamma}_g(k,1) - \hat{\gamma}_g(k,0)\right)$$

where 1 refers to the weight structure that has been used. The second term refers to the variation of the ATT estimations that has been caused by a variation in the distribution of the explanatory variables:

$$\hat{\delta}(1) = \sum_{g \in G} \left(w_g^1 - w_g^0\right) \hat{\gamma}_g(k,0)$$

In this case we take the post reform structure as a reference. It means that we evaluate the difference between the effect of the disability after the reform and the effect it would have had if it happened before the reform.

But we could use the pre-reform convention. By including a term in $w_g^0 \hat{\gamma}_g(k,1)$, we would have got the following effect of the reform:

$$\hat{\rho}(0) = \sum_{g \in G} w_g^0 \left(\hat{\gamma}_g(k,1) - \hat{\gamma}_g(k,0)\right)$$

and the following effect of the explanatory variables:

$$\hat{\delta}(0) = \sum_{g \in G} \left(w_g^1 - w_g^0\right) \hat{\gamma}_g(k,1)$$

the difference between the effect that the disability would have had after the reform and the one it had before the reform. This will give us two evaluations: the effect of the reform for a population with the before-reform distribution, and the effect it had for a population with a post-reform structure.

3 Results

In Table 2, we provide a step by step presentation of our findings depending on the different estimation strategies (difference-in-differences without matching, that we provide for comparison, DiD with matching (that we use in the evaluation) and the triple difference decomposition. For each of the three estimations, we present the ATT of a disability on employment (with a decomposition between public and private employments) during the five years following the disability.[3] All the results are in percentage points (pp.).

The standard (without matching) DiD analyses before and after the law show that a disability has a strong detrimental effect on private employment and a weak effect on public employment during the five years following the onset of disability. The employment rate of employees who have experienced a disability in t_i decreases by 12.7 percentage points (pp.) at $t_i + 1$ compared to $t_i - 1$ for pre-reform subsample and 24.5 pp. for post-reform sample. A naive estimator of the reform effect is simply the difference of these two effects. By comparing outcomes, for both samples, during the five years following the disability, the adverse effect is higher for post-reform sample. The difference in ATT by sub-sample reaches -11.8 pp in $t_i + 1$ and increases over time, with a peak of -28.8 pp. in $t_i + 4$.

The second set of findings allows to account for the lagged time-varying variables (occupation, type of labour contract, working time) and time-constant individual variables (gender, education level, having been raised by one's parents, problems during childhood) by adding an exact dynamic matching. The gap between both sub-samples is always reduced, in all time horizons. This results show that the ATT obtained from the DiD is overestimated when no matching is performed. The differences in observable variables between disabled and non-disabled people at each sub-period explain between 12% and 22% of the ATT gap (whether the DiD is made with or without matching). On the short run ($t_i + 1$), the difference in performance before and after the reform is reduced after matching estimation and much less significant, from -11.8 pp (significant at 5%) to -9.2 (significant at 10%). Then, the use of a matching method in addition to double difference method reduces the gap between both sub-samples.

Nevertheless, as shown in Table 1, the population structure before and after the law is very different in terms of level of education, women's proportion and age at disability onset. The higher level of education could protect the post-reform population against the negative effect of disability on labour outcomes. Yet, contrary to this first assumption, the highest proportion of women in the post-reform could increase the detrimental effect of disability on employment. Indeed, the disabilities which affect women more often, like chronic diseases, are more penalising for the professional paths than those related to men, such as accidents (Barnay et al., 2015). We know that chronic diseases are especially damaging for employment. Moreover, work disutility following a health shock is greater for women (Paringer, 1983).

The effect of the reform is measured through a decomposition of the difference in the ATTs before and after the reform.There are two ways in order to separate the net effect of the reform from the structure effect. The first one is $\hat{\gamma}(1) - \hat{\gamma}(0) = \hat{\delta}(0) + \hat{\rho}(0)$. We consider that the two sub-populations have the same characteristics that the pre-reform group. In $t_i + 1$, the -9.2 pp difference comes, on the one hand, from a reform effect of $\hat{\rho}(0) = -11.4$ pp and, on the other hand, from a distributional change (in gender, education and age at disability onset) of $\hat{\delta}(0) = +2.2$ pp. Overall, the effect of the reform is not significant. Therefore, the population that had the same gender, level of education and age at disability onset's distribution as the pre-reform population has experienced a more important decrease in their employment rate after

[3] By construction, the effect on employment is the sum of the effects on public and private employments

the reform than a direct comparison would suggest. But we could also consider the distribution of post-reform population main characteristics. We use the decomposition $\hat{\gamma}(1) - \hat{\gamma}(0) = \hat{\delta}(1) + \hat{\rho}(1)$ and find that, for this population, the reform reduced their employment rate by 10 pp. From $t_i + 4$, the reform effect is always reduced, with two weighting methods, compared to DiD with matching but without weighting.

To conclude, we find that the 1987 Law had a detrimental effect on the employment of disabled people. After decomposing by sector (public vs private), we find that this results holds only for the private sector. The reform is neutral in the public sector (it does not promote or reduce the employment of disabled people), except two years after the onset of disability and with a lower level of significance (10%).

4 Discussion

The year following the onset of disability is not characterised by significant differences of performance between potential beneficiaries and non beneficiaries of the 1987 Law. Our results indicate that, from the second year, the potential beneficiaries of the 1987 Law have been disadvantaged in the labour market compared to the disabled people who did not benefit from it. Besides, this disadvantage is increasing over time; the employment rate decreases by 13 pp. (points of percentage) during the second year, and by 19 pp. on the fifth year.

At first sight, these results look surprising. The reform had been counterproductive in the private sector and neutral in the public sector. The failure of this reform to improve on the employment of disabled people may be interpreted as a windfall effect both for employers and disabled people. Besides, our period of evaluation is situated at the time of the set up of the law, which can entail strategic wait-and-see behaviours from employers.

We can assume that a large majority of private companies gave priority to the payment of a contribution at the expense of the direct and indirect hiring of disabled people. By enabling firms to abide by the legal employment obligation without hiring any disabled workers, this reform has probably had a counterproductive impact on the employment of disabled people. Private firms' reaction was thus binary: either a weak disposition to hire disabled people or a preference for the payment of a financial compensation. For instance, in 2005, according to the French Ministry of Labour, approximately 100 000 establishments had to comply with the law, among which 31.1% directly employed disabled people and 27% paid the financial contribution.

The matching performed in this study concerns the periods 1988-2006 for the estimation "after" and 1968-1986 for the estimation "before" and deals with disabled people over 50 years-old (indeed, permanent disability occurs on average at 50 years). Potentially, these people are eligible to early retirement plans, quite particularly in $t_i + 3$.

In France, early retirement plans for the 55 years old and more have existed since 1980 with the implementation of the special allowances of the National Employment Fund dedicated to dismissed people over 55 years-old. The law of 1982 allows the opening of the right to full retirement at 60 years-old as well as the implementation of contracts of solidarity, conditioning early retirement plans to the hiring of young people or unemployed people. This dynamics of early retirement affects the populations "before" and "after". However early retired persons and people exempted from job search are more numerous over the period 1988-2006 than over the period 1968-1986, which can explain more frequent exits from the labour market for the disabled people eligible to the 1987 Law and, thus, weaker performances in the labour market.

If the method can build a rigorous counterfactual and compare employment trajectories

Table 2: Effect of the reform on the probability to be employed (officially recognized disabilities)

The $\hat{\rho}$ estimators are re-weighted. The weights are computed according to the joint distribution of gender, education (3 levels) and the age at handicap (2 classes). *: significant at 5%. †: significant at 10%.

Years after disability	Statistic	DiD without matching (not used)			DiD with matching					Triple difference decomposition			
		Difference Before	Difference After	Difference in differences	$\bar{d}_{i,t_i-1}$	$\hat{\gamma}(1)$ Before	$\bar{d}_{i,t_i-1}$	$\hat{\gamma}(0)$ After	$\hat{\gamma}(1)-\hat{\gamma}(0)$ Difference	$\hat{\delta}(0)$ Structure	$\hat{\rho}(0)$ Reform	$\hat{\delta}(1)$ Structure	$\hat{\rho}(1)$ Reform
t_i+1	Number of treated	89	229			87		215					
	Employment	-0.127*	-0.245*	-0.118*	0.885	-0.133*	0.865	-0.225*	-0.092†	0.022	-0.114	0.008	-0.100
	Std error	0.042	0.030	0.052		0.043		0.031	0.053	0.048	0.073	0.031	0.061
	Private	-0.150*	-0.218*	-0.069	0.724	-0.134*	0.721	-0.205*	-0.071	0.032	-0.103	0.015	-0.086
	Std error	0.044	0.030	0.054		0.046		0.030	0.055	0.047	0.075	0.034	0.059
	Public	0.022	-0.027*	-0.049*	0.161	0.001	0.144	-0.020†	-0.021	-0.010	-0.011	-0.007	-0.014
	Std error	0.018	0.012	0.022		0.025		0.012	0.028	0.008	0.029	0.018	0.017
t_i+2	Number of treated	84	220			82		207					
	Employment	-0.123*	-0.292*	-0.169*	0.890	-0.123*	0.865	-0.272*	-0.148*	-0.017	-0.131†	0.028	-0.176*
	Std error	0.043	0.032	0.054		0.043		0.034	0.055	0.050	0.075	0.028	0.060
	Private	-0.155*	-0.256*	-0.101†	0.720	-0.137*	0.720	-0.240*	-0.102†	0.008	-0.110	0.037	-0.139*
	Std error	0.047	0.032	0.057		0.049		0.033	0.059	0.050	0.079	0.033	0.059
	Public	0.032	-0.036*	-0.068*	0.170	0.014	0.145	-0.032*	-0.046	-0.026*	-0.021	-0.009	-0.037†
	Std error	0.023	0.016	0.028		0.029		0.015	0.033	0.012	0.035	0.021	0.019
t_i+3	Number of treated	73	209			71		196					
	Employment	-0.087†	-0.334*	-0.247*	0.873	-0.109*	0.867	-0.318*	-0.208*	-0.012	-0.196*	0.001	-0.209*
	Std error	0.052	0.036	0.063		0.049		0.035	0.060	0.058	0.084	0.038	0.078
	Private	-0.121*	-0.296*	-0.175*	0.704	-0.126*	0.724	-0.286*	-0.160*	0.014	-0.174*	0.008	-0.168*
	Std error	0.055	0.036	0.065		0.054		0.034	0.064	0.058	0.087	0.041	0.068
	Public	0.035	-0.037*	-0.072†	0.169	0.017	0.143	-0.031†	-0.048	-0.026*	-0.022	-0.007	-0.041
	Std error	0.032	0.018	0.037		0.039		0.017	0.043	0.012	0.044	0.030	0.044
t_i+4	Number of treated	66	199			65		187					
	Employment	-0.065	-0.353*	-0.288*	0.877	-0.099*	0.871	-0.336*	-0.237*	-0.009	-0.228*	-0.011	-0.226*
	Std error	0.055	0.035	0.065		0.049		0.035	0.060	0.056	0.082	0.042	0.079
	Private	-0.087	-0.310*	-0.223*	0.708	-0.103†	0.727	-0.299*	-0.196*	0.013	-0.209*	-0.017	-0.179*
	Std error	0.061	0.034	0.070		0.058		0.034	0.068	0.056	0.089	0.048	0.071
	Public	0.022	-0.043*	-0.064	0.169	0.004	0.144	-0.038*	-0.041	-0.022†	-0.019	0.006	-0.047
	Std error	0.039	0.020	0.044		0.046		0.017	0.049	0.013	0.050	0.033	0.047
t_i+5	Number of treated	56	187			55		174					
	Employment	-0.058	-0.338*	-0.280*	0.891	-0.092†	0.874	-0.312*	-0.220*	-0.029*	-0.192*	-0.004	-0.217*
	Std error	0.059	0.038	0.070		0.050		0.034	0.061	0.056	0.082	0.047	0.087
	Private	-0.084	-0.299*	-0.215*	0.709	-0.092	0.718	-0.279*	-0.187*	-0.001	-0.186*	-0.015	-0.172*
	Std error	0.065	0.036	0.074		0.065		0.033	0.073	0.056	0.092	0.055	0.073
	Public	0.026	-0.039†	-0.065	0.182	0.001	0.155	-0.033†	-0.033	-0.028†	-0.006	0.012	-0.045
	Std error	0.046	0.021	0.051		0.055		0.019	0.058	0.015	0.060	0.042	0.059

Reading example. Consider the evaluation of the effect of a disability two years after its appearance (t_i+2 panel). In the before-reform sample, there are 84 treated. The DiD estimator of the disability effect is -12.3% on the employment rate. After the reform, there are 220 treated. The DiD estimator of the disability effect is -29.2% on the employment rate. The DiD estimation of the reform is a reduction of 29.2% − 12.3% = 16.9% of the employment rate. Now, consider matching estimators. 82 treated in 84 can be matched in the before-reform sample (97.6% matching rate). Their employment rate one year before the disability ($\bar{d}_{i,t_i-1}$) is 89%. The reform reduces it by 12.3% so that it reaches 76.7% two years after the disability. After the reform, the employment rate of the 207 matchable disabled was equal to 86.5% one year before the disability. The effect of the disability is to reduce it by 27.2%. According to the DiD with matching estimation, the reform reduced the disabled employment rate by 14.8%. This latter figure can be decomposed in two ways. For a population with the same characteristics as the pre-reform disabled, -1.7% can be attributed to the variation of the disabled characteristics over time and -13.1% to the reform (significant at 10%). If we consider the characteristics of the post reform disabled, we can attribute +2.8% to the characteristics variation and -17.6% to the reform (significant at 5%).

before and after the reform, some limits have to be underlined. The evaluation of the 1987 Law using data from the 2006 wave of the SIP survey raises some issues. There could be a selection bias because the survey questions people who, in 2006, live at home with a disability which first occurred between 1968 and 1986 (for the disabled population before the reform) and between 1988 and 2006 (for the disabled population after the reform). Individuals who answered the survey are thus more likely to be people eligible to the 1987 Law whose health status was the best (we cannot estimate the effect of the reform of 1987 on the dead beneficiaries). Moreover, we do not control for the memory bias which can potentially affect the self reporting of individuals 40 years after disability onset. However, such a recognised disability is likely to deeply mark the personal life of individuals; we consequently consider that the reported date of the onset of disability is reliable. It is however difficult to disentangle strategic behaviours and moral hazard behaviours between supply and demand sides in the labour market. Firms' behaviours do not seem to have been influenced by economic incentives (confirming legislator's decision in 2005 to strengthen financial penalties for firms not complying with the quota of 6%). We could suppose as well, following the example of Gneezy and Rustichini (2000), that the introduction of a tax reveals information in situation of uncertainty. The introduction of the tax creates a market-oriented frame in which moral obligation (to hire disabled people) is replaced by a financial compensation, which could be interpreted as the price to pay by firms to the community to escape their social role of integrating into the labour market persons with disabilities who are costly for them (loss of productivity, cost of job or workplace arrangements...).

Finally, our study is not able to estimate the effects of non-employment trap; if the recognised situation of disability provides better financial compensation than the situation of employment, it can generate disincentives to work. It would then be necessary to compare over the studied period, the activity income relatively to transfer incomes for disabled workers and to estimate whether the allowances granted to disabled workers have progressed between both periods around the law of 1987.

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