Do Financial Incentives for Firms Promote Employment of Disabled Workers?

A Regression Discontinuity Approach

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Abstract

The Austrian Disabilities Act obliges firms to hire one severely disabled per 25 non-disabled workers. Firms not obeying this rule have to pay a monthly non-compliance tax equal to € 209 (roughly 10 percent of the median wage) for each non-hired disabled worker. This creates financial incentives for firms to hire disabled workers as firms face a choice between hiring a disabled worker or buying off this obligation. We evaluate the causal effect of these rules on the hiring decisions of firms using administrative data from Austria. Our empirical strategy adopts a regression discontinuity design exploiting the discontinuous changes in financial incentives per (successive) 25 non-disabled workers. We find that a large fraction of firms do not comply but buy off this hiring obligation. More importantly, we find significantly higher employment of disabled workers in firms slightly above thresholds as compared to firms slightly below thresholds. This result is robust and statistically significant. We estimate that roughly 12 percent of disabled workers are hired as a result of financial incentives created by the hiring rule for the severely disabled.

JEL classification: J15, J20, J71, J78

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1 Introduction

Promoting employment of disabled workers is high on the policy agenda in many countries. According to the OECD (2003) the average disability prevalence amounts to 14 percent across the working-age population in the 20 OECD countries in the late 1990s. Thereof one-third are severely disabled meaning that they are severely hampered due to a long-lasting health problem. The employment situation differs tremendously between severely disabled and non-disabled individuals. Figure 1 shows two labor market success indicators of severely disabled relatively to non-disabled individuals in 13 OECD countries. The relative employment rate ranges from poor 26 percent in the U.K. to 55 percent in France. The relative unemployment rate turns out to be even worse, ranging from a 4.8 times higher probability to be unemployed in Germany to still high 1.5 times in Australia. Moreover, disability benefits (including earnings-related benefits) consume 1.52 percent of the GDP of OECD countries in 1999. These figures may explain the marked increase in interest of policy makers in disabled individuals in the past few years. In particular, many countries have undertaken efforts to activate and rehabilitate non-working disabled individuals in order to counteract the poor labor market success as well as to reduce the costs of the disability benefits. For instance, the U.S. Americans with Disability Act (ADA), enacted in 1990 requires firms to offer reasonable accommodation[1] for their disabled workers and bans discrimination against these workers in wage determination, hiring, firing and promotion.

Figure 1 about here

The present paper investigates the consequences of the Disabilities Act in Austria that aims to promote the employment of severely disabled individuals. The most important element of this Act is a hiring rule that obliges firms to hire 1 severely disabled worker per 25 non-disabled workers.[2] This hiring obligation creates financial incentives for firms to hire disabled workers. Essentially, a firm faces the choice between employing a disabled workers and buying off this obligation by paying the non-compliance tax. The rules imply that there is discontinuous change in these financial incentive between firms employing $25x-1$ non-disabled workers and firms employing $25x$ non-disabled workers, where $x \in (1, 2, 3, ...)$ is an integer. Firms not obeying this obligation are charged a monthly non-compliance tax that amounts to € 209 per non-hired disabled worker in 2007. This amounts to roughly 10 percent of the median wage (or 6 percent of the overall labor costs per worker) in the Austrian private sector.

[1] Such as enabling wheelchair access, purchasing special equipment, or restructuring jobs to permit to work part-time.
[2] For instance, Germany has also implemented a comparable Disabilities Act (*Schwerbehindertenrecht*).

We evaluate the implications of these financial incentives using a regression discontinuity design exploiting the discontinuous changes in financial incentives around the successive thresholds. One important assumption that validates such an empirical strategy is that firms do not select themselves below the threshold to avoid becoming subject to the hiring rule. We argue (and provide empirical evidence strongly in favor of this proposition) that employment decisions of non-disabled workers are not governed by the hiring rules for disabled workers created by the disability act. The size distribution of firms does not show any discontinuity at $25x$ thresholds. The most plausible reason for this is that the non-compliance tax is too small (about 0.3 percent of overall labor costs in the considered time period from 1999–2001) to have significant impact on firms overall employment decisions.

Our findings are as follows. First, a larger fraction of firms do not comply with the hiring obligation and do not hire disabled workers (or hire less disabled than required by the law). This suggests that financial incentives of the hiring obligation are too weak for many firms making it worthwhile to pay the non-compliance tax. Second, we find that there are significant differences in employment of disabled workers in firms with $25x$ as opposed to firms with $25x - 1$ non-disabled workers. This suggests that the hiring rule has a significant impact on employment levels of disabled workers. According to our estimates, roughly 12 percent of employed disabled workers are employed as a result of the employment obligation. We perform various sensitivity tests and find that this effect is robust and statistically highly significant. Hence we conclude that the hiring obligation of the Disabilities Act in Austria generates a positive impact on the employment of disabled workers. Of course, the effectiveness of the rule does not necessarily mean that it is welfare-enhancing. The benefits have to be weighed against the costs (administrative costs and deadweight loss). However, since we do not see any major impact on the employment of non-disabled workers and since the costs to administer this rule are small, we think the overall impact is positive.

One particularly attractive feature of our study is a very large and comprehensive data set, the Austrian Social Security Data (ASSD), which is combined with information from the Austrian Federal Welfare Office (*Bundessozialamt*) on the disability status of workers. This is important in the present context, because a disabled worker has to undergo a specific procedure (including medical examinations of the individual's physical and mental health status). Only applicants who pass this procedure get the legal status of a "severely disabled" individual. Our analysis is concentrated on the period 1999–2001. During this period, no major changes in legislation concerning the promotion of disabled individuals took place. Our data set provides us with a sufficiently large sample (involving 510,926 firm-month

observations) to draw sound statistical inferences about the effect of the hiring rule of the Austrian Disability Act on the employment of severely disabled workers.

Our paper is related to a recent literature that studies the impact of employment promotion for disabled workers. With the enactment of the ADA in 1990 and the ADA-like Disability Discrimination Act (DDA) in the U.K. in 1995, labor economists have directed their attention to the effects of labor market regulation aimed at protecting disabled individuals. A first important contribution is DeLeire (2000) who analyzes the effect of the ADA on employment and wages of disabled men. His results suggests that the ADA failed to achieve its goals as the relative employment of disabled men fell by 7.2 percentage points. However, there is no evidence for decreased relative wages. Acemoglu and Angrist (2001) take up this topic studying the employment effects more detailed by age and sex. Their results indicate a post-ADA decline in relative employment of disabled individuals aged 21-39, while there is no negative impact on relative wages. These results are robust with respect to controlling for pre-ADA trends and the increase in the fraction of people that receive disability benefits. They also provide evidence that the driving force behind this negative impact are rather the accommodation costs than the threat of lawsuits due to wrongful termination. Jolls and Prescott (2004) also suggest that the negative employment effects of the ADA are mainly caused by the accommodation costs. However, there are also studies with different conclusions. For instance, Beegle and Stock (2003) do not find a negative relationship between disability discrimination laws and the relative employment rates of the disabled. Moreover, they provide evidence of negative effects on the relative earnings of disabled individuals. Also Kruse and Schur (2003) subscribe this view. They highlight the problem of the accuracy of the disability measures, which were used in the aforementioned studies. They argue that these measures only partially correspond to the target group of the ADA. First, they replicate the results of previous studies. But using a disability measure more closely related to the law entirely changes the results and they find a positive effect on relative employment. Finally, Bell and Heitmüller (2005) examine the DDA in the U.K. with respect to relative employment rates. They suggest that also the DDA has a negative impact on the employment rates of individuals with disabilities. However, there is no literature on a disabilities act, which is similarly comprehensive as the Disabilities Act in Austria.

The paper is organized as follows. Section 2 provides a detailed description of the Austrian Disabilities Act, which promotes employment of disabled individuals. Section 3 presents the main hypothesis derived from a simple labor demand model. Section 4 describes the data. Section 5 details the empirical strategy. Our main results are presented in section 6. Section 7 concludes.

2 The Austrian Case

The obligation of firms to hire severely disabled people is regulated by the Employment of People with Disabilities Act (*Behinderteneinstellungsgesetz*). In the following we will denote this act simply as Disabilities Act. The Disabilities Act was implemented in 1969 and constitutes the main instrument in the Austrian legal system to enhance the labor market opportunities of the severely disabled.[3] The disability status in the context of the Disability Act is strictly defined. In addition, the access to this status is extremely restrictive. In order to get entitled, the disabled individual has to file an application to the Austrian Federal Welfare Office for a legal declaratory procedure.[4] The disabled individual is finally approved if a medical expert of the Federal Welfare Office declares a degree of physical, mental, intellectual or sensuous disorder of at least 50 percent. Note that the disability status can not be recalled unless a new expertise assesses that the degree of disability reduced to less than 50 percent. This protects the disabled worker from being squeezed by her employer to recall the status. In the following "disabled" denotes disabled in the context of the Disabilities Act.

Basically, the Disabilities Act is based on three pillars. The most important pillar is the employment obligation. It requires firms to hire 1 disabled worker per 25 non-disabled workers. If a firm does not comply with this obligation, a non-compliance tax (*Ausgleichstaxe*) incurs for each non-hired disabled worker and month. This tax goes to the earmarked non-compliance tax fund (*Ausgleichstaxfonds*), which is relevant for the below-mentioned second pillar of the Disabilities Act. Throughout the 1990, the non-compliance tax was steadily increased from € 118 to € 148. On July 1, 2001 a unique increase of € 50 took place. In 2007, it amounts to € 209. Another important policy change occurred in this context. Before that, firms that over-complied the hiring obligation were granted a over-compliance tax in the amount of the non-compliance tax. However, this regulation has been abandoned on January 1, 1999. The employment obligation is enforced by the Austrian Federal Welfare Office. First, the firm size of each firm is checked on the first day every month. Note that only non-disabled workers count for the firm size computation, since this obligation demands 1 disabled per 25 non-disabled workers. Second, the number of disabled workers per firm is determined. All disabled count. However, some categories of disabled workers are equivalent to two disabled workers, which include the (i) blind, (ii) disabled individuals at the age less than 19 years, (iii) disabled apprentices, (iv) disabled individuals at

[3] There are two other laws at the federal level that exclusively refer to the disabled: The Federal Disability Act (*Bundesbehindertengesetz*) and the Act on Equal Opportunities for Disabled (*Bundesbehindertengleichstellungsgesetz*). However, the goal of these two acts is the participation free of discrimination of individuals with disabilities in all areas of social life. Therefore, they are only of secondary relevance for the topic in our paper.

[4] Only Austrian nationals or nationals of the European Economic Area can apply. In addition, students and retirees are excluded.

the age of more than 50 years and a degree of disability of at least 70 percent, (v) disabled individuals at the age of more than 55 years and (vi) individuals that are dependent on a wheelchair. Finally, the Austrian Federal Welfare Office calculates the number of disabled workers that firms are short on and charges for each non-hired disabled worker and month the non-compliance tax.

The second and third pillar of the Disabilities Act are financial subsidies and increased protection provisions. The financial subsidies are financed by the non-compliance tax fund. These subsidies, either in form of allowances or loans, support those firms, which employ at least one disabled worker. In particular, these funds are granted for adequate workplace accommodation, wage subsidies, work assistance, occupational retraining or professional development. Thus, the second pillar reallocates resources from non-complying to complying firms in order to compensate the latter for their effort in employing disabled worker. Figure 2 maps the funds of the non-compliance tax fund over time. In 2005, its expenditures amounted to about € 65 Mio. Protection provisions comprehend an increased dismissal protection and protection of remuneration (*Entgeltschutz*). The increased protection against dismissal is twofold. On the one hand, it requires that the termination of the contract takes effect only after a notice period of at least 4 weeks. On the other hand, the dismissal is only valid if a committee for disabled individuals (*Behindertenausschuss*) agrees to it. Any dismissals without the consent of this committee are unlawful. However, the increased dismissal protection comes into effect not until a probation period of six months has elapsed. Originally, the probation period took one month and was extended in two steps, at first from one to three months on January 1, 1999 and finally on July 1, 2001 from three to currently six months. The protection of remuneration ensures that the wage of disabled workers must not be reduced due to their disability.

Figure 2 about here

Figure 3 sketches the number of severely disabled individuals in the context of the Disabilities Act between 1975 and 2005. Whereas between 1975 and 1990 the number of severely disabled slightly decreased from 48,000 to 43,000, the 1990s exhibit a sharp increase in this number to finally 91,000 in 2005. In 1999, the severely disabled accounted for 2 percent of the total workforce in Austria, which is a non-negligible fraction. In order to get a rough sense who these disabled are, we provide a few figures on the composition of this group. 64 percent of these individuals are male, 72 percent older than 40 years and 42 percent just reach the minimum degree of disability of 50 percent. In 1999 there were about 83,000 jobs to be assigned by severely disabled workers according to the hiring obligation.

Interestingly, only about 75,000 severely disabled were available. But as the compliance rate amounts on average to about 65 percent, this is not a binding supply constraint.

Figure 3 about here

3 Financial Incentives to Hire Disabled Workers: A Simple Model

Consider the following simple model of labor demand with adjustment costs inspired by Acemoglu and Angrist (2001). Assume there are N_d disabled and N_a non-disabled workers who (if employed) earn wages w_d and w_a. Within each group, workers are identical. To keep things simple we assume that labor supply N_d and N_a is inelastic (with a reservation wage r_d and r_a). Workers have an infinite time horizon, are risk-neutral, and have a discount factor equal to $\beta < 1$. Following Acemoglu and Angrist (2001) we also assume there are M firms in the labor market that never exit and a large number of potential firms that can enter at cost G. This encompasses the case where the number of firms is fixed, the case when there is free entry ($M \to 0$) and the case where the number of firms is fixed ($M > 0$ and $G \to \infty$).

Firms are indexed by j, are risk-neutral, discount the future also at rate $\beta < 1$, and have access to the production function $F(L_t, e_j \cdot D_t)$ where L_t is the number of non-disabled workers, D_t is the number of disabled workers and e_j is the relative efficiency of disabled to non-disabled workers. Notice that technology is the same for all firms except that the efficiency parameter e_j may vary. $e_j \leq 1$, which implies that the disabled have a lower marginal product than non-disabled workers. We assume that the production function has decreasing returns to scale. Moreover, with probability s every period, a worker is hit by a match-specific shock, by which his or her productivity at the current firm falls to zero (though productivity elsewhere is unaffected). L_t and D_t include only workers who have not (yet) received such an adverse match-specific shock.

Suppose that disabled job applicants who are not hired sue with probability p_d at expected cost υ_d, including damages and legal fees. Rejected non-disabled applicants can also sue, falsely claiming to be disabled; this happens with probability p_a and has cost υ_a. Hence the expected cost of not hiring a disabled worker is $h_d = p_d \upsilon_d$, and the expected costs for not hiring a non-disabled worker is $h_a = p_a \upsilon_a$. We refer to h_a and h_d as hiring costs, though they are actually costs that the firm incurs when it decides *not* to hire an applicant. A disabled worker who is fired sues with probability q_d for damages ϕ_d and a

non-disabled worker who is fired sues with probability q_a for damages ϕ_a, so the expected costs of firing a disabled and a non-disabled worker are $f_d = q_d\phi_d$ and $f_a = q_a\phi_a$.

We assume that $(1-\beta)f_a < w_a$ and $(1-\beta)f_d < w_d$, so firms always lay off the fraction s of their workers who receive a negative match-specific shock. We also assume that there is an excess number of applicants for every job because each worker applies for more than one job. Of the applicants, D_F are disabled and L_F are non-disabled. We treat D_F and L_F as given. Finally, firms can "accommodate" disabled workers at cost C per worker, for example, by purchasing special equipment. This expenditure increases the marginal productivity of disabled workers by an amount B per worker (by raising relative efficiency from e to $\bar{e} > e$). If $C < B$, employers would make these adjustments voluntarily, even in the absence of legal requirements. The fact that government regulation is required suggests that typically $C > B$.

The maximization problem of a firm at time $t = 0$ can be written as

$$\begin{aligned} \max_{\{D_t, L_t\}} \Pi \quad \equiv \quad & \sum_{t=0}^{\infty} \beta^t \cdot F\left(L_t, eD_t\right) - w_{a,t}L_t - w_{d,t}D_t \\ & -cD_t - f_a s L_{t-1} - f_d s D_{t-1} \\ & -h_a\left[L_F - (L_t - (1-s)L_{t-1}\right] \\ & -h_d\left[D_F - (D_t - (1-s)D_{t-1}\right] \end{aligned} \tag{1}$$

where $L_{-1} = D_{-1} = 0$ and where $w_{a,t}$ and $w_{d,t}$ denote wages of the non-disabled and disabled at time t, and $c = C - B$ is the net cost of accommodation. The first line of equation (1) is output minus the wage bill. The second line gives accommodation costs and firing costs. Firms discharge a fraction s of their employees who receive an adverse match-specific shock, incurring a firing cost of f_d for each disabled layoff and f_a for every non-disabled termination. Finally, the third and fourth lines give the "hiring costs" the firm incurs as a function of the number of workers not hired out of the applicant pools, L_F and D_F. When $L_t = L_{t-1}$ and $D_t = D_{t-1}$ so that employment is not changing, the firm hires sL_{t-1} non-disabled and sD_{t-1} disabled workers to replace those who are laid off. As noted above, h_a and h_d act as hiring subsidies because the firm reduces its costs by hiring more workers.

Since adjustment costs are linear and there is no aggregate uncertainty, firms immediately adjust to steady-state employment levels, and $w_{a,t} = w_a$, $w_{d,t} = w_d$, $L_t = L$, and $D_t = D$ in every period (L and D are guaranteed to exist because of the decreasing returns to scale assumption). These equilibrium

employment and wage levels satisfy

$$\begin{aligned}\frac{\partial F(L,eD)}{\partial L} &= w_a + \beta s f_a - [1-\beta(1-s)]\, h_a \\ \frac{\partial F(L,eD)}{\partial L} &= w_d + \beta s f_d - [1-\beta(1-s)]\, h_d + c\end{aligned}$$

Both first-order conditions equate the relevant marginal product to the flow marginal cost, inclusive of firing costs, hiring subsidies, and the net costs of accommodation.

We impose market clearing for non-disabled workers and denote by w_a^* the market clearing wage. w_a^* is determined by the condition

$$\frac{\partial F(N_a, eD^*)}{\partial L} = w_a^* + \beta s f_a - [1-\beta(1-s)]\, h_a$$

where D^* is the equilibrium employment level of the disabled. The equilibrium number of firms m is determined by

$$P \leq G, m \geq M,$$

which holds with complementary slackness. Finally, the wages received by disabled workers are given by

$$w_d = \max\left[w_d^*, \eta w_a^*\right]$$

where w_d^* is the market-clearing wage for disabled workers (i.e. when $D^* = N_d$) which is determined by

$$\frac{\partial F(N_a, eN_d)}{\partial D} = w_d^* + \beta s f_d - [1-\beta(1-s)]\, h_d + c$$

when the disabled are fully employed and equal-pay legislation does not bind. When equal-pay legislation binds so that $w_d = \eta w_a^*$, the equilibrium employment level D^* of the disabled falls short their labor supply and is given by

$$\frac{\partial F(N_a, eD^*)}{\partial D} = \eta w_a^* + \beta s f_d - [1-\beta(1-s)]\, h_d + c.$$

Assume there are critical employment thresholds $\bar{L}, 2\bar{L}, 3\bar{L}, ...$ When employment $L < \bar{L}$ the (marginal) wage of the disabled is w_d; when employment is $\bar{L} \leq L < 2\bar{L}$ the wage a disabled worker is $w_d - T$ for the first disabled worker and w_d for all further disabled workers. When employment is $2\bar{L} \leq L < 3\bar{L}$ the (marginal) wage for a disabled worker is $w_d - T$ for the first and the second worker and w_d for all

further workers.

More generally, when employment is $x \leq L < (x+1)\bar{L}$ the (marginal) wage for a disabled worker is $w_d - T$ for the first x workers and w_d for all further workers. It follows that the non-compliance tax T acts like a hiring subsidy. Incentives are highest for firms who have optimal employment slightly above $\bar{L}$ and lowest for those with optimal employment slightly below $\bar{L}$. Hence we should see a discontinuous change in the employment of the disabled at the threshold. Moreover, we should also see a discontinuous change in the distribution of firm sizes (number of employed non-disabled workers). If factors (such as capital stock, etc.) which determine the size of a firm are continuously distributed, then discontinuity in financial incentive at $N_a = \bar{L}$ should also lead to a bunching of firm at $N_a = \bar{L} - 1$ and a significantly low frequency of firm sizes at $N_a = \bar{L}$. The consequences for the distribution of firm sizes depends, of course, on the strength of financial incentives. It is likely that these incentives are rather small. Consider a firm with 25 employees who pay wages of € 3,500 per worker (wages and non-wage labor costs). This amounts to overall wage costs of € 87,500. This compares to the non-compliance tax of € 209 (or only about 0.23 percent of the overall labor costs). Hence even small adjustment costs in the employment of non-disabled workers will deter firms from fine-tuning the employment level of non-disabled workers to avoid the non-compliance tax. (Below we will provide empirical support for the hypothesis that the employment threshold at successive 25 workers is not affected by the discontinuous incentives of hiring disabled workers at this threshold). While this suggests that the employment decision of non-disabled workers may not be strongly affected by the non-compliance tax, the situation may be quite different for disabled workers. A firm which finds a suitable disabled worker has a strong incentive to hire this worker when the firm is above the threshold (and expects to be above this threshold in the future). Hence we expect that firms slightly above the (successive) 25 non-disabled worker threshold will hire a significantly larger fraction of severely disabled workers than firms that are slightly above the threshold.

To summarize, we assume that disabled workers have a lower work-related productivity compared to their non-disabled counterparts. As Dewa and Lin (2000) propose, lost work days or unproductive hours during the working day due to their disability may account for this productivity penalty. Hiring a non-disabled worker instead of a disabled imposes firms with the non-compliance tax above a threshold. This reduces the productivity gap between disabled and non-disabled worker, since hiring a non-disabled is taxed. Consequently, profit-maximizing firms behave according to the following decision rule: Hire a non-disabled worker if the productivity gap (net of subsidies) outweighs the non-compliance tax.[5] Do

[5]Remember that the taxes of non-complying firms are used to subsidies complying firms. This mitigates the costs incurring by the employment of a disabled worker.

not hire a disabled worker otherwise. Since the (additional) tax only incurs when firms cross a threshold, we expect that the number of disabled workers discontinuously increases at thresholds. Note that the incentives of the hiring obligation remains unchanged at all successive thresholds. Thus, the effect of the employment obligation should not differ across thresholds.

4 Data

To evaluate the impact of the employment obligation, we use data from two different sources. The Austrian Social Security Database (ASSD), which records the complete individual employment history on a daily basis from 1972 to 2003. In addition, it contains several firm and worker characteristics. We know the industry affiliation and the location at state level of firms. The worker are described by their age, sex, worker class (blue or white collar), and daily wage. The other data source is provided by the Austrian Federal Welfare Office (FWO) and contains for each worker in the ASSD information on the official disability status and degree in the context of the Disabilities Act. Note that this is a unique feature.[6] These data sources allow us to accurately assess the firm size and the number of disabled worker per firm according to the Disabilities Act.

Since the end of the 1990s, two policy changes have taken place, which are relevant for the hiring obligation. Before 1999, firms were granted a over-compliance premium in the amount of the non-compliance tax. On January 1, 1999 this regulation has been abandoned. Second, on July 1, 2001 the non-compliance tax has been uniquely increased by € 50. In order to have a clean sample, the data in the empirical analysis is restricted to the time between these two events. Moreover, we exclude the entire public sector, since these firms might differently react to the financial incentives provided by the employment obligation. We also ignore the primary sector and the infrastructure (energy, water, etc.) sector, as the former is highly depended on governmental subsidies and the latter not fully privatized yet. Of main interest in this paper are firms that are located around a threshold $T \in [25, 50, 75, ...]$, above which they have to (additionally) employ a disabled worker. For this reason, only firms with a firm size of $S_i \in [T - 10, T + 9]$ are taken into consideration. This means that 10 firm sizes sit at each side of the threshold. A sufficient amount of firm observations for the empirical investigation is therewith ensured. We finally end up with data with 510,936 firm observations over a period of 30 month. This means that our data contains on average 17,031 firms each month. The biggest firm in our data employs 8,895 non-disabled workers.

[6] Previous studies that investigate the effect of the ADA for instance use a disability measure that does not correspond to the official disability definition. This can result in misleading results (Kruse and Schur, 2003).

Table 1 shows descriptive statistics. 1.05 disabled workers are employed by the average firm. On average, a firm employs 58.09 non-disabled workers who are 35.25 years old and earn a median daily wage of € 62.54. The fraction of female worker in a firm amounts to 35 percent. A firm employs on average 44 percent workers that wear a white-collar. The largest fraction of firms (22 percent) are located in Vienna, whereas Burgenland only accommodates 3 percent. Not surprisingly, the fraction of firms in the service industry is biggest and amounts to 44 percent. The tourism industry with its 9 percent is the least important industry with respect to the number of firms. During the time period of consideration, the non-compliance tax amounted to about € 150. As just pointed out, the median daily wage amounts to € 62.54. Then, the median monthly wage totals € 1876.20. One disabled is required per 25 non-disabled workers according to the employment obligation. Thus, the non-compliance tax (about € 150 in 1999–2001) accounts for 0.3 percent of the total wage sum of all non-disabled workers.

Table 1 about here

5 Empirical Strategy

This paper uses the regression discontinuity design (RDD) to identify the effect of the employment obligation on the number of disabled workers Y_i per firm. The employment obligation requires firms to hire one disabled worker per 25 non-disabled worker. This results in several thresholds $T \in [25, 50, 75, ...]$, above which firms have to (additionally) employ a disabled worker. Treatment D_i thus depends in a deterministic way on the firm size S_i. More precisely, $D_i = f(S_i)$, where $f(S_i)$ is discontinuous at $S_i = T$. In order to pool all thresholds, we also define a normalized threshold $\tilde{T}$ and a normalized firm size $\tilde{S}_i$. $\tilde{T}$ indicates that a firm is located on one of the thresholds T. $\tilde{S}_i$ measures the deviation from the threshold. $\tilde{S}_i < 0$ denotes a firm that is below a threshold and $\tilde{S}_i \geq 0$ denotes a firm that is above a threshold. In this context, the identification takes place in the sharp RDD Hahn *et al.* (2001). Therefore, the average causal effect β_1 is identified by the discontinuity at the threshold, which is the difference of the expected number of disabled per firm just below and just above the threshold, $\beta_1 = \lim_{\epsilon \to 0}[E(Y|S = T + \epsilon) - E(Y|S = T - \epsilon)]$. Figure 4 illustrates our research design graphically.

Figure 4 about here

However, the fundamental identifying assumption of the RDD requires that the number of disabled workers between non-treated firms just below the threshold and non-treated firms just above the threshold is a continuous function at the threshold. Let Y_0 denote the number of disabled in the absence of

treatment. Then this assumption can be stated as $\lim_{\epsilon \to 0} = [E(Y_0|S = T + \epsilon) - E(Y_0|S = T - \epsilon)] = 0$. This assumption can not be empirically tested, which is known as the fundamental problem in causal analysis Holland (1986). We therefore provide two pieces of evidence that assess its validity. First, firms may sort themselves below or above a threshold. Whereas the latter concern can be ruled out due to the complete lack of incentives to do so, the former concern may be important. Firms may avoid crossing a threshold in order not to be obligated to (additionally) hire a disabled worker. We would then expect to observe a noticeable decrease in the number of firms at a threshold compared to the number of firms just below this threshold. However, figures 5 and 6 shows that this is not the case. Second, evidence on balance of firm characteristics, such as worker's age, the fraction of women and white-collar workers and the median daily wage, at thresholds would strengthen the plausibility of this assumption. Table 2 gives evidence for this balance. Around the first and the normalized threshold, these firm characteristics only differ slightly between firm observations below and above the threshold. Figure 7 and 8 graphically document this evidence. In addition, they point out that these firm characteristics do not exhibit discrete jumps at the thresholds. Referring to these two pieces of evidence we conclude that the concern of endogeneity can be ruled out.

Figures 5 and 6 about here

Table 2 about here

Figures 7 and 8 about here

The following linear regression allows to identify the discontinuity in average number of disabled workers per firm at a specific threshold:

$$Y_i = \beta_0 + \beta_1 \cdot D_i + \beta_2 \cdot (S_i - T) + \beta_3 \cdot D_i \cdot (S_i - T) + X_i' \cdot \eta + \epsilon_i$$

The parameter β_1 is the coefficient of main interest and measures the average treatment effect of the employment obligation at threshold T. β_0 delivers the average outcome of non-treated firms at threshold T.[7] β_2 accounts for a linear trend between the outcome variable Y_i and firm size S_i. However, for sensitivity purposes columns 2 and 4 and columns 3 and 6 of table 3 include a polynomial of order 2 and 3 respectively of the term $(S_i - T)$. β_3 allows the regression function to have a different slope

[7]Note that due to the non-continuity of the treatment-determining variable, there are no observations in an arbitrarily small neighborhood for non-treated firms at the threshold. Therefore the outcome of non-treated firms at the threshold has to be parametrically estimated. This introduces a specification error into the above regression model. Clustering on the treatment-determining variable S_i addresses this problem as Lee and Card (2006) propose. Therefore, all following regressions are clustered by the firm size S_i.

in the trend on either side of the threshold. X_i' is a vector of control variables. It includes the above mentioned firm characteristics as well as industry affiliation, firm location at state level and a month dummy variable for each observed month. In regressions considering the normalized threshold X_i' also includes dummies that indicate, around which threshold the firms are located.

6 Results

This section presents the econometric results of the effect of the employment obligation on the number of disabled worker per firm. We first present the results graphically in figure 9. The purpose of this figure is to get a sense of the appropriate fit of the relation between the outcome variable Y_i and the firm size S_i. Panel A shows the linear fit according to our empirical model, which delivers a discontinuity at the threshold of 0.0486 disabled workers. Panel B and C show the same picture, but this time featuring a quadratic and cubic fit. The discontinuities get smaller with 0.0362 and 0.0275 but remain positive. Thus, this sensitivity analysis does not upset our result. Remember that only 10 different firm sizes appear on each side of the threshold. Including quadratic and cubic terms into our model rather seem to over-fit the trend between Y_i and S_i. In addition, the linear fit seems to capture this relation in a very compelling way. This leads us to the conclusion that the linear fit is our best choice.

Figure 9 about here

Table 3 shows the results for the first threshold at firm size 25, which base on 338,884 observations. Note that this table formed the basis for figure 9. Columns (1)-(3) do not include any control variables, while columns (4)-(6) do. The estimate with the linear fit in column (1) indicates that the employment obligation increases the number of disabled workers per firm by 0.0486. Including control variables in column (4), the effect slightly diminishes and amounts to 0.0474. Both estimates are significant at the 1% level. We have already seen in figure 9 that the specification with a polynomial of first order is our best choice. But for sake of completeness, also the estimates of second and third order polynomials are displayed. In columns (2) and (3), they turn out to be smaller with 0.0362 and 0.0275, but remain statistically significant at least at the 5% level. Again, adding controls does not change much. The number of disabled workers is increased by 0.0320 and 0.0257 respectively. We consider the the estimate of column (1) to be the most convincing for above reasons. Its size of 0.0486 does not seem to be very important at first. However, remember from table 2 that the mean number of disabled worker per firm amounts to 0.41 in the firm size bracket of 25-34. Thus, 11.9 percent of the severely disabled in these firms are employed due to the employment obligation.

Table 3 about here

Table 4 presents the results for the second, third and fourth threshold. This time we concentrate exclusively on the specification with a first order polynomial in $(S_i - T)$. Columns (1) and (2) present the estimates for the second threshold at firm size 50. They base on 71,696 observations, which is much less than in table 3. This reflects the fact that the number of firms is steadily decreasing in the firm size. Without controls, the estimate in column (1) suggests that the employment obligation raises the number of disabled workers per firm by 0.0978. Column (2) includes the controls and displays an effect of 0.0936. Both being statistically significant at the 1% level, they are almost double as large as the estimates of the first threshold. The estimates of the third and fourth threshold in column (3) and (5) remain positive in their sign but loose their statistical significance. Adding control variables does not change this finding. We suppose that measurement errors are a likely explanation for the lack of significance. While we are pretty sure at the first threshold that we compute the accurate firm size according to the Disabilities Act, this accuracy diminishes with at higher thresholds. Thus, some firms actually located below a (high) threshold may be classified as treated in our data, and vice versa. This blurs the effect of the employment obligation.

Table 4 about here

We now turn to the analysis of the normalized threshold. Remember that this analysis pools all thresholds. All thresholds are normalized to the value zero. The firm size now measures the deviation from this threshold. Table 5 presents the results. Column (1) computes the treatment effect without including control variables. It suggests that the employment obligation increases the number of disabled workers per firm by 0.0713 at each threshold with a statistical significance of 5%. The estimate slightly decreases with control variables in column (2), but remains significant at the same level. The R^2 appears to be very high compared to the results before. Note that in these two specification 198 threshold dummies are included to account for level differences in the number of disabled worker between thresholds. The inclusion of this vast number of control variables explains the high R^2. However, the specification in columns (1) and (2) may be too restrictive. It assumes that the effect is homogenous across thresholds. Column (3) accounts for effect heterogeneity across thresholds. Firms are grouped into four threshold categories. The first contains firms up to the fourth threshold and serves as the reference group in the regression. The second group comprehends firms around the fifths up to the tenths threshold, while the third includes firms up to the twentieth threshold. The remaining high threshold firms are in group four. We run the regressions in columns (3) and (4) without controls, as

nothing changes therewith. Results indicate that the estimate in column (3) amounts to 0.0506 for the low threshold firms, which is in line with our previous results in table 3 and 4. The estimates of the interaction of the treatment effect by the threshold group dummies reveals that heterogeneity of the treatment effect can be ruled out. This is in line with our hypothesis in section 3. Although not significant, the estimate of the interaction between the treatment effect and the high threshold group dummy is particularly high. This calls for an explanation. Remember that the number of firms steadily decreases with the firm size. Only 5,185 firm observations are available for firms around thresholds of group four. Thus it is no longer guaranteed that the data contains an observation for each firm size around a certain threshold. This explains this high estimate by a lack of sufficient firm observations. In contrast, the highest threshold in the third threshold group still features 500 firm observations. Column (4) now excludes the high threshold firms to get a more reliable estimate for the effect at the normalized threshold. It suggests, that the employment obligation increases the number of severely disabled worker per firm by 0.0587. This estimate is significant at the 5% level and is smaller than that of column (1), which have been artificially inflated by the unprecise values of few high threshold firms. Compared to the effect at the first threshold (0.0486), our final normalized threshold estimate is only slightly bigger. Again, the question arises whether this seemingly small effect of 0.0587 has a noticeable overall impact on the number of severely disabled workers per firm. This time we can not simply divide the estimate by the mean number of disabled worker employed by firms above the different thresholds. Note that firms, which are located around the second or higher threshold, face more than one threshold. Therefore, we take this fact into account and suggest that 11.9 percent of all severely disabled workers are employed due to the employment obligation. This percentage-rate is exactly in line with our findings focusing only on the first threshold.

Table 5 about here

7 Conclusion

In this paper we have analyzed the effect of hiring rules to promote employment of disabled workers. In Austria the Disabilities Act obliges firms to hire 1 severely disabled worker per 25 non-disabled workers. This hiring obligation creates financial incentives for firms to hire disabled workers. Essentially, a firm faces the choice between employing a disabled workers and buying off this obligation by paying the non-compliance tax. The monthly non-compliance tax is non-negligible and amounts to currently € 209 per non-hired disabled worker. This amounts to roughly 10 percent of the median wage (or 6 percent

of the overall labor costs per worker) in the Austrian private sector.

To evaluate the impact of this hiring obligation we use a regression discontinuity design exploiting the discontinuous changes in financial incentives around the successive thresholds of 25 non-disabled workers. One important assumption that validates such an empirical strategy is that firms do not select themselves below the threshold to avoid becoming subject to the hiring rule. We argue (and provide empirical evidence strongly in favor of this proposition) that employment decisions of non-disabled workers are not governed by the hiring rules for disabled workers created by the disability act. Hence the regression-discontinuity design provides a meaningful estimate for the causal impact of the hiring obligation on the employment of severely disabled workers in Austria.

Our findings suggest that, while a larger fraction of firms do not comply with the hiring obligation and do not hire disabled workers (or hire less disabled than required by the law), the hiring obligation generates strong employment effects for severely disabled workers. We find that there are significant differences in employment of disabled workers in firms slightly above the $25x$ non-disabled worker threshold as opposed to firms slightly below this threshold. According to our estimates, almost 12 percent of employed disabled workers are employed as a result of the employment obligation. We perform various sensitivity tests and find that this effect is robust and statistically highly significant. Hence we conclude that the hiring obligation of the Disability Act in Austria generates a positive impact on the employment of severely disabled workers.

Of course, the effectiveness of the rule does not necessarily mean that it is welfare-enhancing. The benefits have to be weighed against the costs (administrative costs and deadweight loss). However, since we do not see any major impact of the employment of non-disabled workers and since the costs to administer this rule are small, we think the overall impact is positive.

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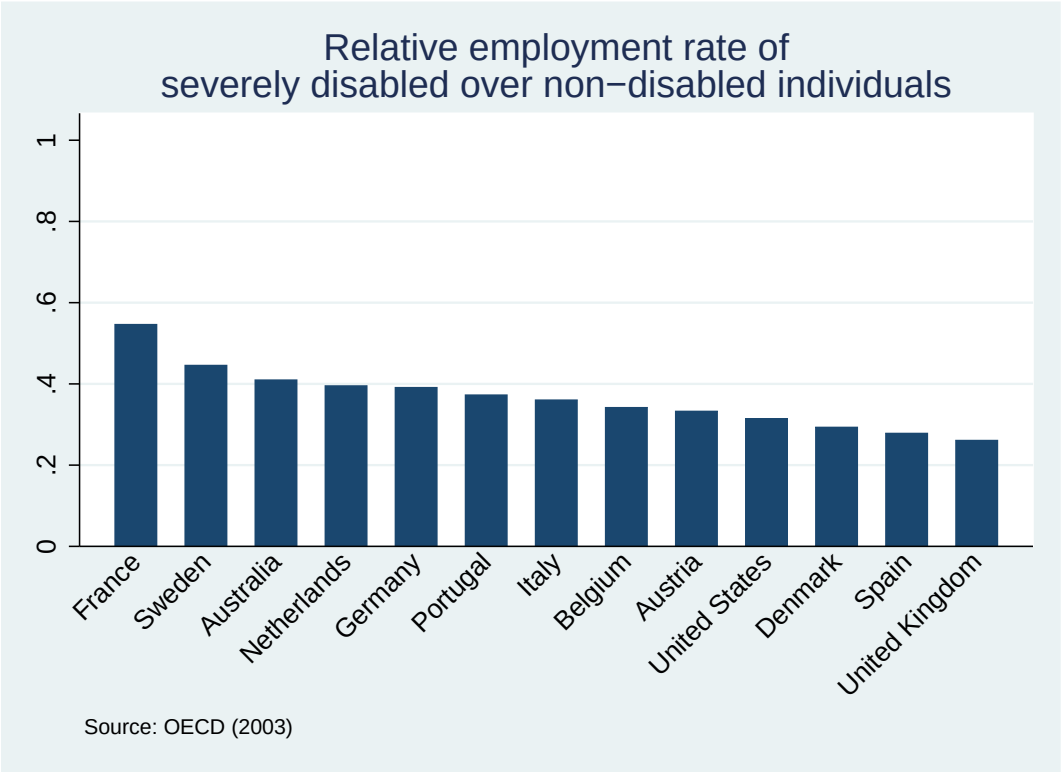
A Figures



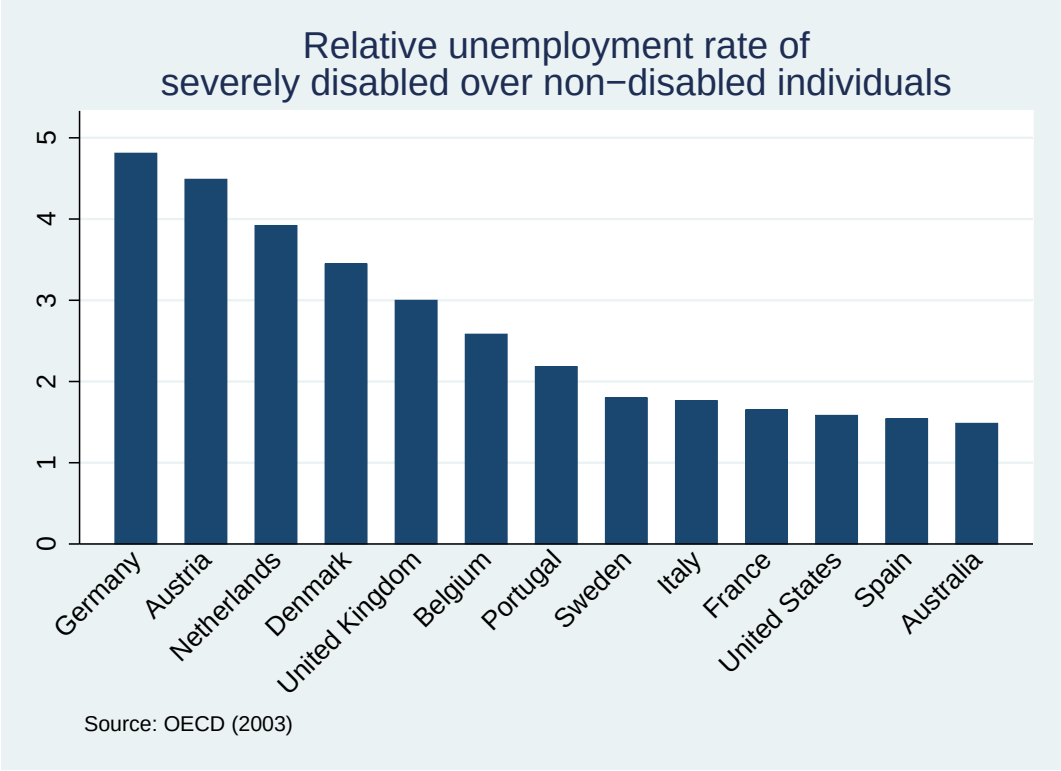


Figure 1: Labor market success of severely disabled versus non-disabled individuals

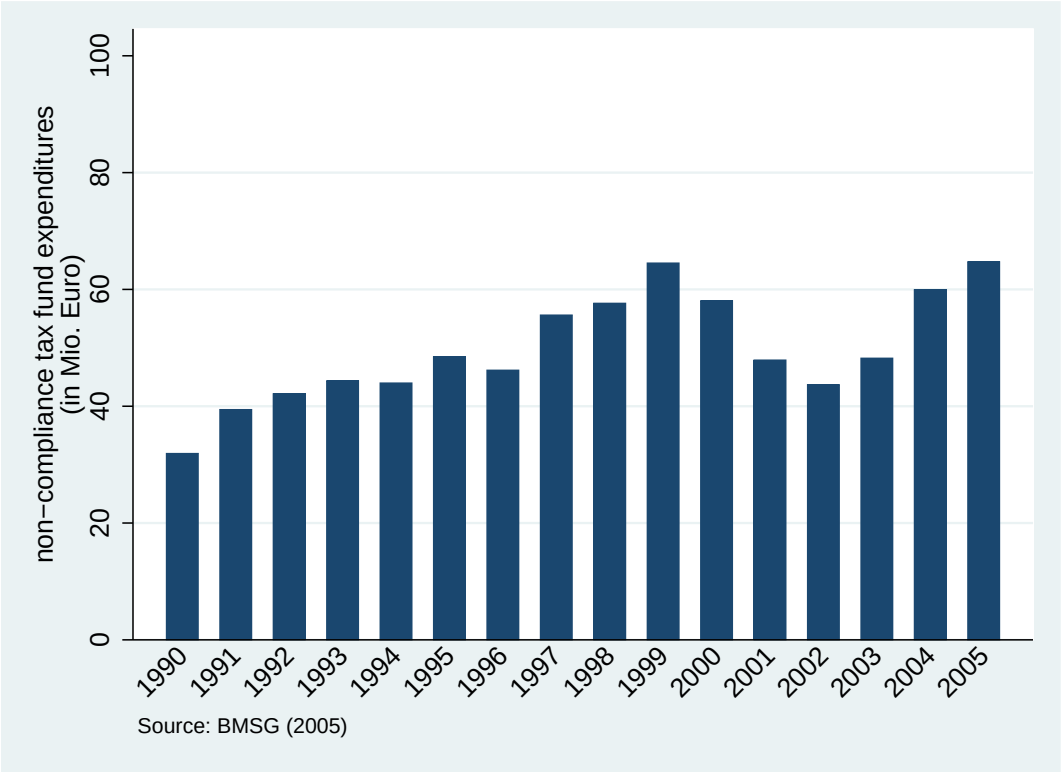


Figure 2: Expenditures of the non-compliance tax fund over time

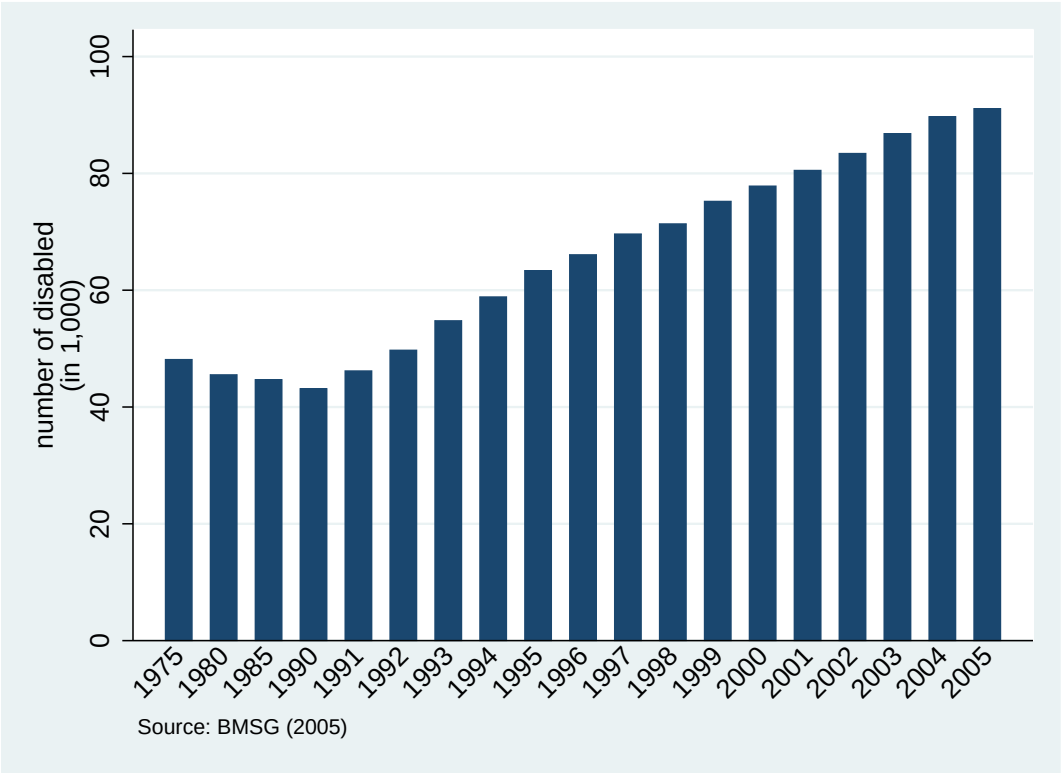


Figure 3: The number of severely disabled over time

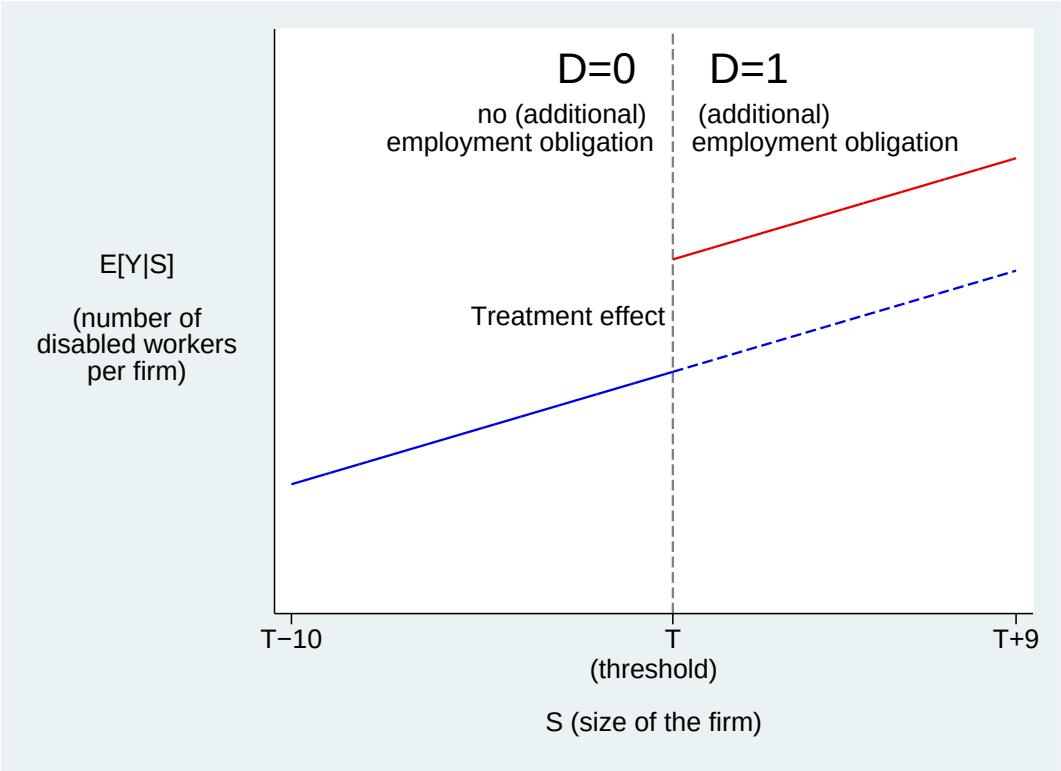


Figure 4: The RDD in the context of this paper

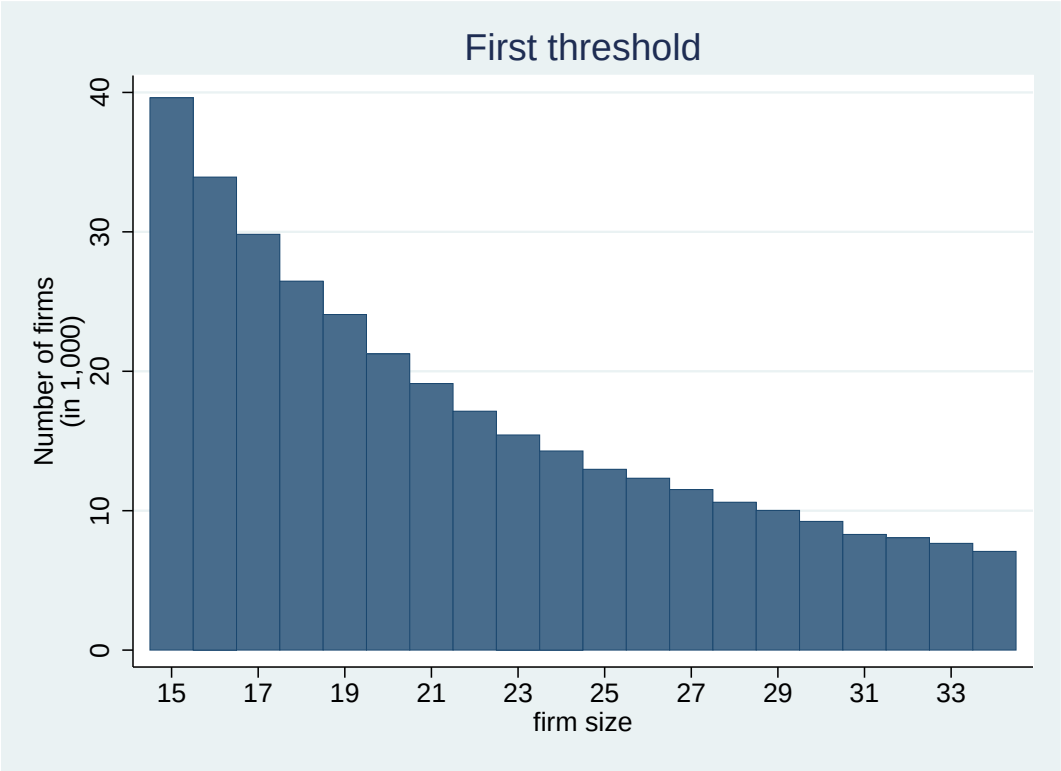


Figure 5: Number of firms around the first threshold

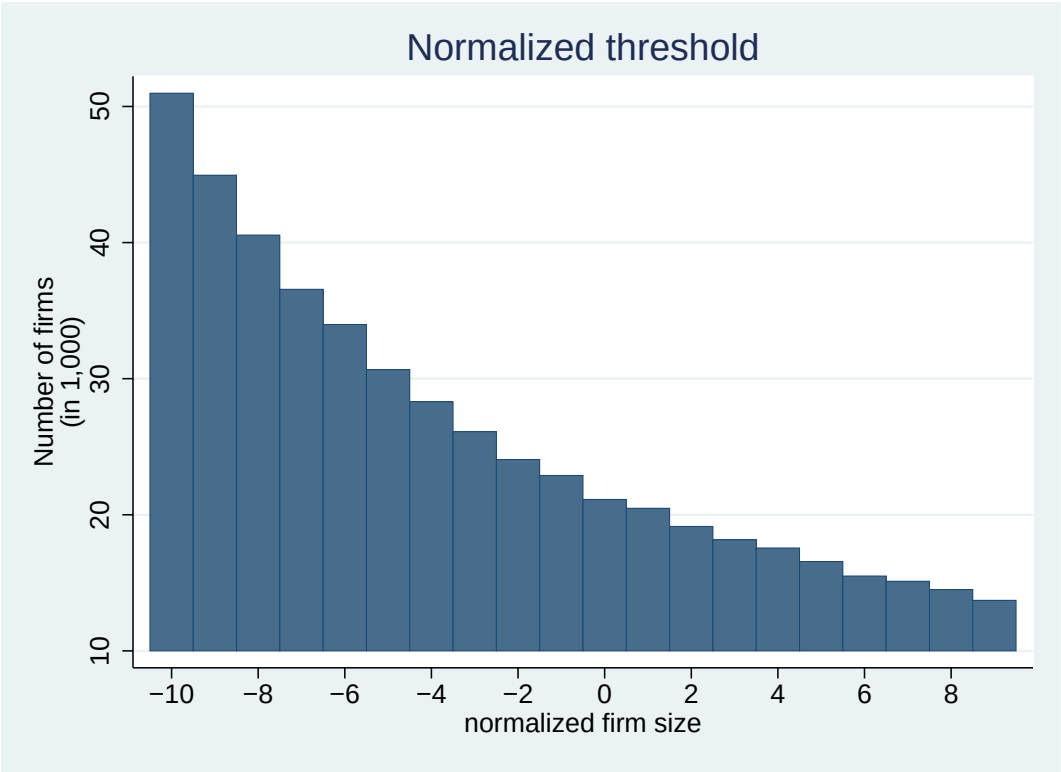


Figure 6: Number of firms around the normalized threshold

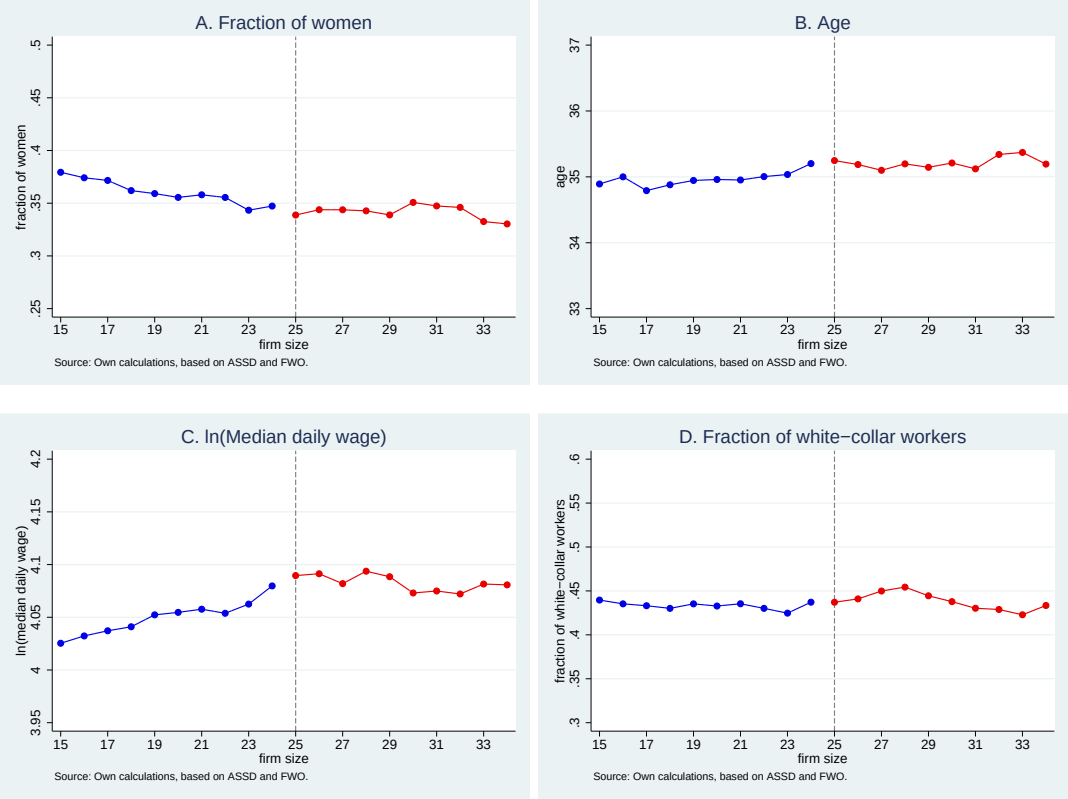


Figure 7: Firm characteristics around the first threshold

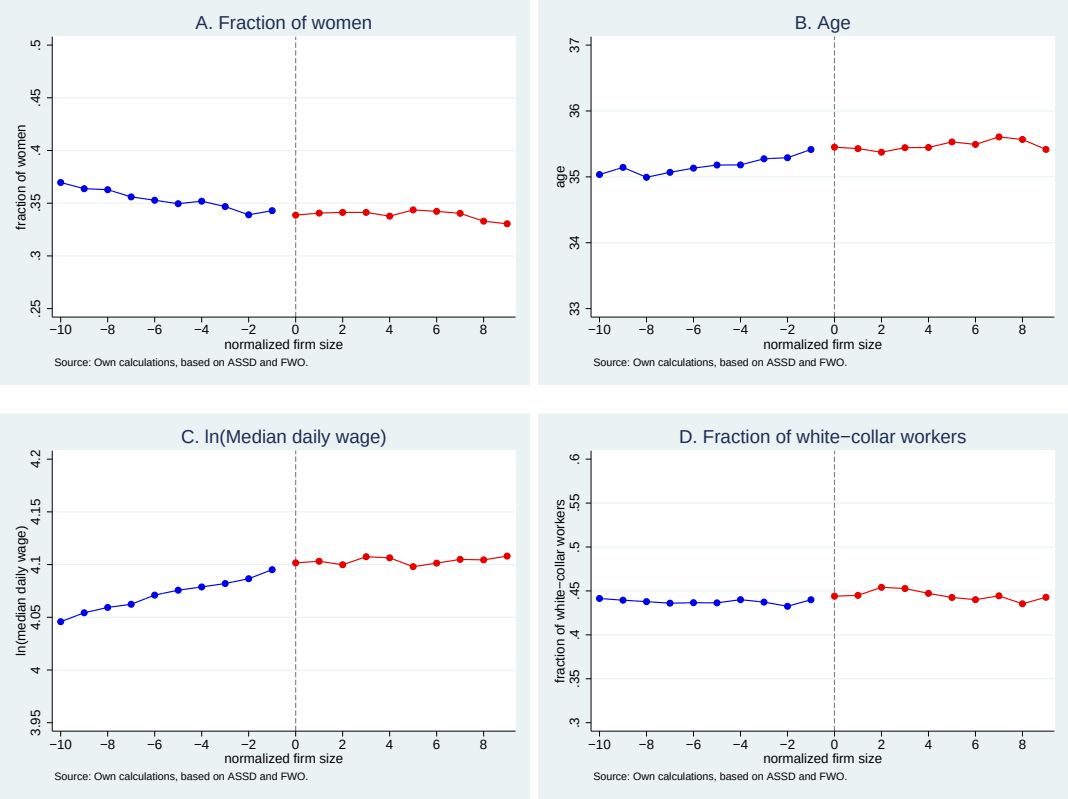


Figure 8: Firm characteristics around the normalized threshold

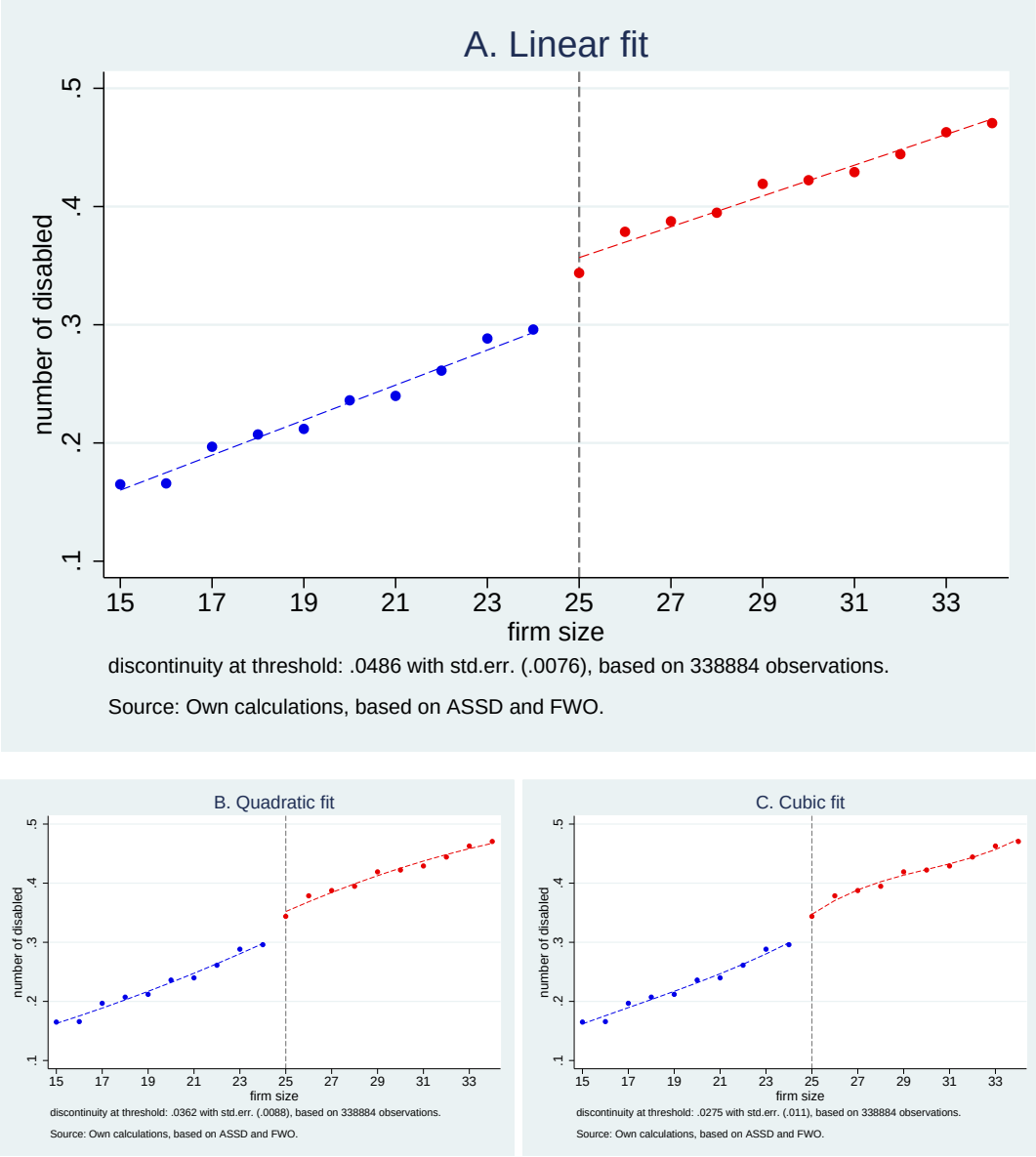


Figure 9: Number of disabled around the first threshold with several fits (dashed line)

B Tables

Table 1: Descriptive statistics

Variable	**Mean**[a]	**(Std. Dev.)**
Firm size	58.09	(146.55)
Number of disabled worker	1.05	(7.07)
Age	35.25	(4.57)
Fraction of women	0.35	(0.26)
Fraction of white-collar workers	0.44	(0.34)
Median daily wage (€)	62.54	(20.83)
Service industry	0.44	(0.50)
Manufacturing industry	0.31	(0.46)
Construction industry	0.16	(0.37)
Tourism industry	0.09	(0.29)
Vienna	0.22	(0.42)
Lower Austria	0.17	(0.38)
Burgenland	0.03	(0.17)
Upper Austria	0.17	(0.38)
Styria	0.11	(0.31)
Carinthia	0.06	(0.24)
Salzburg	0.08	(0.27)
Tyrol	0.09	(0.29)
Vorarlberg	0.05	(0.22)
Number of firm observations	510,926	

[a] Mean denotes unweighted mean across firms.

Table 2: Selected descriptive statistics around the first and the normalized threshold

	mean	(std. dev.)	mean	(std. dev.)
	below		above	
A. First threshold				
Firm size	18.58	(2.81)	28.93	(2.84)
Number of disabled	0.21	(0.58)	0.41	(0.88)
Age	34.95	(4.90)	35.21	(4.58)
Fraction of women	0.36	(0.27)	0.34	(0.26)
Fraction of white-collar workers	0.43	(0.34)	0.44	(0.34)
Median daily wage (€)	60.47	(20.22)	62.71	(20.44)
Number of observations	241,122		97,762	
B. Normalized threshold				
Firm size	47.55	(129.74)	78.84	(171.85)
Number of disabled	0.83	(6.33)	1.50	(8.31)
Age	35.15	(4.68)	35.47	(4.33)
Fraction of women	0.36	(0.26)	0.34	(0.26)
Fraction of white-collar workers	0.44	(0.34)	0.45	(0.33)
Median daily wage (€)	61.81	(20.50)	63.97	(21.39)
Number of observations	339,056		171,870	

Source: Own calculations based on ASSD and FWO.

Table 3: Treatment effect at the first threshold

Columns	(1)	(2)	(3)	(4)	(5)	(6)
	NUMBER OF DISABLED					
Mean	0.269 (0.683)					
Treatment effect	0.0486 (0.0076)***	0.0362 (0.0088)***	0.0275 (0.0110)**	0.0474 (0.0082)***	0.0320 (0.0092)***	0.0257 (0.0123)**
Polynomial order	1	2	3	1	2	3
Control variables	No	No	No	Yes	Yes	Yes
Observations	338,884	338,884	338,884	338,884	338,884	338,884
R^2	0.02	0.02	0.02	0.05	0.05	0.05

Notes: ***, **, * denotes significance at the 1% , 5%, 10% level respectively.
All Regressions are clustered by firm size. Robust standard errors in parentheses.
Mean is the average value of the corresponding dependent variable.
Source: Own calculations, based on ASSD and FWO.

Table 4: Treatment effect at the second, third and fourth threshold

Columns	(1)	(2)	(3)	(4)	(5)	(6)
	NUMBER OF DISABLED					
	Second threshold		*Third threshold*		*Fourth threshold*	
Mean	0.665 (1.07)		1.17 (3.01)		1.81 (7.92)	
Treatment effect	0.0978 (0.0293)***	0.0936 (0.0283)***	0.0022 (0.0554)	0.0038 (0.0549)	0.2035 (0.2405)	0.1422 (0.2176)
Polynomial order	1	1	1	1	1	1
Control variables	No	Yes	No	Yes	No	Yes
Observations	71,696	71,696	32,065	32,065	17,378	17,378
R^2	0.01	0.07	0.00	0.03	0.00	0.02

Notes: ***, **, * denotes significance at the 1% , 5%, 10% level respectively.
All Regressions are clustered by firm size. Robust standard errors in parentheses.
Mean is the average value of the corresponding dependent variable.
Source: Own calculations, based on ASSD and FWO.

Table 5: Treatment effect at the normalized threshold

Columns	(1)	(2)	(3)	(4)
	NUMBER OF DISABLED			
Mean		1.51		0.973
		(12.8)		(4.12)
Treatment effect	0.0713	0.0692	0.0506	0.0587
	(0.0280)**	(0.0286)**	(0.0183)**	(0.0223)**
Treatment effect · threshold (125, ..., 250)			0.0068	
			(0.0517)	
Treatment effect · threshold (275, ..., 500)			0.0993	
			(0.3638)	
Treatment effect · threshold (525, ...)			1.7613	
			(3.3449)	
Control variables	No	Yes	No	No
Threshold dummies	Yes	Yes	No	Yes
Threshold group dummies	No	No	Yes	No
Observations	510,926	510,926	510,926	505,741
R^2	0.77	0.78	0.18	0.23

Notes: ***, **, * denotes significance at the 1% , 5%, 10% level respectively.
All Regressions are clustered by firm size. Robust standard errors in parentheses.
Mean is the average value of the corresponding dependent variable.
Source: Own calculations, based on ASSD and FWO.