Cost of Inclusion? - Intended and Non-intended Effects of the Employment Quota for Disabled Workers*

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Abstract

This paper analyses whether financial disincentives affect firms' demand for disabled workers. In Germany, firms have to pay a compensation fee if they do not meet the quota for disabled workers. I exploit a threshold regulation of the employment quota: Firms with less than 40 employees have to employ one disabled worker, whereas firms with 40 and more employees have to employ two disabled workers. Using administrative firm data, preliminary results suggest that firms respond to the threshold regulation and employ on average 0.388 more disabled workers when they are located just above the threshold. The effect is upward biased by bunching firms which purposely stay below the threshold to avoid the fee. Taking this bunching into account, I estimate a lower bound of the effect which is still positive albeit considerably smaller.

JEL Classification: J15, J21, J23, J71, J78
Keywords: disability, employment quota, compensation fee, administrative data

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1 Introduction

Individuals with disabilities face many disadvantages on the labour market compared to the non-disabled (Baert, 2016). In 2018, the unemployment rate of the disabled in Germany was more than twice higher than the one of other workers (11.7% compared to 5.7%). Furthermore, about 27 per cent of private employers in Germany with 20 and more employees preferred paying a compensation fee instead of hiring any disabled worker. In addition to discrimination tendencies and prejudices, firms may anticipate higher costs when considering to hire a (severely) disabled individual. A disabled individual may need a special workplace equipment, is often subject to special employment protection regulations, has higher vacation claims and on average higher rates of sickness absence.

To promote a better integration of the disabled into the labour market despite these costs, many OECD countries have undertaken policy reforms, often in form of a mandatory employment quota combined with a financial fee in case of non-compliance. Even though employment quotas and non-compliance fees are widely used policy instruments for integrating severely disabled individuals into the labor market, surprisingly little is known about their effectiveness so far.

This paper attempts to analyse intended and non-intended effects of the employment quota for disabled workers. I exploit a threshold regulation of the German labour law for the mandatory employment quota: Below the threshold of 40 employees, firms with 20 and more employees are obliged to employ at least one disabled individual. Above this threshold, firms have to employ at least two disabled individuals. My empirical analysis consists of two parts. First, I analyse whether firms manipulate employment and purposely stay - bunch - below the threshold to avoid the tax. I refer to this as the *non-intended* effect of the quota. Second, I estimate the *intended* effect of the quota, that is the threshold effect on the number of disabled workers in a firm. For this, I adapt a threshold design which is closely related to a regression discontinuity design Lalive et al. (2013). However, as I find evidence for bunching, the naive threshold effect is potentially biased. Quantifying the bunching effect helps me to assess this bias and to bound the threshold effect.

Understanding the intended and non-intended effects of an employment quota is crucial for two reasons. First, the two most important policies for integrating disabled workers into the labor market are antidiscrimination legislation and employment quotas. While the effects of antidiscrimination policies are quite well understood, there is a remarkable paucity of research with regard to effects of employ-

ment quotas on firms' demand for disabled workers. This is striking as mandatory employment quotas are used in many OECD countries. Second, my study helps to better understand the role of financial incentives in labour demand in general. The threshold regulation of the employment quota implies sharp changes in the relative labour costs for different firms at the threshold. Thus, the policy allows me to study firms' behaviour facing this discontinuity. In doing so, I explicitly address non-intended effects of the employment quota such as adaption of the (non-disabled) workforce composition or changes of firm dynamics near the threshold. I further differentiate between firms which face different costs at the threshold depending on their degree of compliance with the quota.

Few studies have addressed the impact of an employment quota on firm dynamics and on firms' demand for disabled workers so far. A large number of studies have either looked at the effects of antidiscrimination legislation with respect to disabled workers (see for example Acemoglu and Angrist, 2001) or at the impact of disability policies on the employment of disabled workers from a labour supply perspective (see for example Verick (2004) and Lechner and Vazquez-Alvarez (2011) for Germany or Barnay et al. (2019) for France). However, to the best of my knowledge only three studies evaluate the effect of the disability quota on employment decisions from a labour demand perspective. Lalive et al. (2013) examine whether there is a discontinuity in disabled employment between firms below and above the Austrian employment quota which kicks in at a firm size of 25 non-disabled workers. The authors find that firms react to the quota in two ways: First, firms' demand for disabled workers increases above the threshold. Second, some firms manipulate employment and purposely stay below the threshold to avoid the noncompliance tax. Similar to this study, Wagner et al. (2001) and Koller et al. (2007) examine firm dynamics at quota thresholds in Germany. While Wagner et al. (2001) do not find any evidence for an effect on employment growth at the first threshold of the employment quota, Koller et al. (2007) find evidence that employment growth slows slightly just before the second threshold. Wagner et al. (2001) conclude that according to their results the (first) threshold in the German disability law "(...) does not seem to have the kind of strong negative influence on job dynamics in small firms that is often attributed to it in public debates" (p. 10).

I extend the scarce literature on employment quotas and labor demand and study the German case in more detail. I contribute to the existing literature in two ways: *First*, I challenge the findings by Wagner et al. (2001) and Koller et al. (2006) and analyse the German employment quota with a high-quality data set that has

more precise information on the firm size according to the disability law and the number of disabled workers in a firm. The Employment Statistics of the Severely Disabled is the data base that the German Federal Employment Agency uses to determine compliance with the employment quota. Thus, this data set contains firm size information which is consistent with the definition of firm size stipulated in the German disability law.[1] Combined with a further administrative data set of the Federal Employment Agency, namely the Establishment History Panel (BHP), I am able to describe firms around the thresholds and the firms' workforce in great detail. *Second*, while being closely related to the study of Lalive et al. (2013), I shed more light on the firms' bunching behavior below the threshold and investigate whether firms adapt their (non-disabled) employment in face of the threshold. As labour costs arise at the threshold, firms just below the threshold may avoid crossing the threshold. Such avoiding strategies may include, for example, extending the number of hours worked per employee or substituting workers who are not considered for the quota (e. g. marginal employed workers) for workers who are considered for the quota. While Lalive et al. (2013) find that firms below and above the threshold are quite similar in the Austrian case, my results for the German case suggest considerable differences between those firms with regard to firm dynamics, the firms' workforce and the firms' productivity. I further systematize potential bunching firms along the costs these firms face at the threshold. In doing so, I differentiate between *Non-Complier*, which face the highest costs at the threshold, *Exact-Complier* and *Over-Complier*, which do not face any additional costs at the threshold. Analyzing the extent of bunching for these different types of firms helps to better understand the role of (additional) labour costs.

Previewing my preliminary results, I find that firms above the threshold do in fact employ more disabled workers than firms below the threshold. Further, I find clear evidence of firms bunching just below the threshold. Firms purposely stay below the threshold and adapt their workforce accordingly to avoid the (increase of the) non-compliance tax. The bunching is particularly pronounced for *Non-Complier*, i. e. firms which face the highest increase of costs at the threshold. Taking the bunching into account, I assess the bias of the threshold effect and find that even though firms manipulate employment, the lower bound of the threshold effect is still positive.

[1] Note that the definition of firm/establishment size is inconsistent in the German labour law. Depending on the law, the (i) reference point (e. g. establishment, firm or employer), (ii) considered employee groups (e. g. freelancers, marginal employed or apprentices) and (iii) weighting of employees (e. g. per capita or full-time-equivalents) differs considerably.

The remainder of the paper is structured as follows: Section 2 illustrates the German institutional setting and closes with some theoretical considerations drawn from the German employment quota. Section 3 presents the data set and the empirical strategy. Section 4 provides the empirical results for the intended and non-intended effects and Section 5 concludes.

2 The German Institutional Background

2.1 The Situation of the Disabled

The integration offices (*Integrationsämter*) acquire a disability status once a medical expert assesses a physical, mental or psychological disorder which is not typical for the respective age. This disorder lasts (probably) longer than six months and impairs the ability to participate in social life. Depending on the extent of the impairment, the medical expert evaluates the degree of disability ranging from 20 to 100, graduated in steps of ten. "Severe disability" is defined when the degree of disability exceeds 50.[2] In the labour market, individuals with a degree of disability between 30 and 50 can be treated as severely disabled when the disability restricts the possibilities to find or hold a job. The decision to have a disability acquired is voluntary.

In 2011, about 7.3 million people (8.9 per cent) in Germany were considered severely disabled. Since then, the number has continued to increase to over 7.9 million in 2019 (9.5 per cent). Data from the Federal Statistical Office from 2011 show that disabilities occur mainly in older people. 53.4 per cent of the severely disabled in Germany in 2011 were 65 years and older. The vast majority of disabilities - about 85 per cent - are caused by illness. Hence, only a small share of disabilities are congenital or due to war damage, accidents or other causes.

With regard to the degree of disability, almost a quarter (24.3 per cent) of the severely disabled individuals had the highest degree of disability (100), while 31.4 per cent had a degree of disability of 50. Physical causes - in particular organ disorders - account for the majority of disabilities (about 62.3 per cent). 11.1 per cent of the disabled had mental or emotional disabilities, 9.0 per cent suffered from cerebral disorders. For the remaining fraction (17.6 per cent), the type of the most severe disability is not indicated.

[2] An example of a degree of 50 is voicelessness or a lip-jaw cleft until closure of the jaw cleft.

2.2 The German Disability Law

The legal framework to promote the integration of people with disabilities in the labour market in Germany is laid down in part 3 of Book IX of the Social Code 'Integration and Rehabilitation of Disabled People (SGB IX, 2001)', the so-called disability law (*Schwerbehindertenrecht*). Enacted in 2001, it built upon the People with Severe Disabilities Act (PSDA) which was originally implemented in 1974. One key element of the disability law is the *employment obligation* for public and private employers to fill at least 5 per cent of positions with severely disabled workers. Many other OECD countries like Austria, France, Italy and Spain, use similar quota systems to enforce the employment of workers with severe disabilities.[3]

Key to my analyses is that the quota systems applies only to firms exceeding a stipulated firm size. Small firms with less than 20 employees are exempt from the employment obligation. Firms with 20 to less than 40 employees have to employ at least one severely disabled individual, whereas firms with 40 to less than 60 employees have to employ at least two disabled individuals. Firms with 60 or more employees have to meet the 5 per cent quota. Firms that do not comply with this obligation have to pay a graduated compensation fee (*Ausgleichsabgabe*). Figure 1 provides an overview of the German quota regulation and the corresponding compensation fees. The purpose of this non-compliance fee is to compensate the costs incurred for firms which fulfil the employment obligation.[4][5] Such costs may arise, for example, due to a special workplace equipment for the disabled worker. Further costs may arise as employees with a recognised status of being severely disabled are institutionally better protected. First, they are subject to special dismissal protection: If the employee has been working longer than six months in a firm, the employer needs permission for a dismissal from the local integration office. Second, a severely disabled worker has higher vacation claims of additionally five days per year.

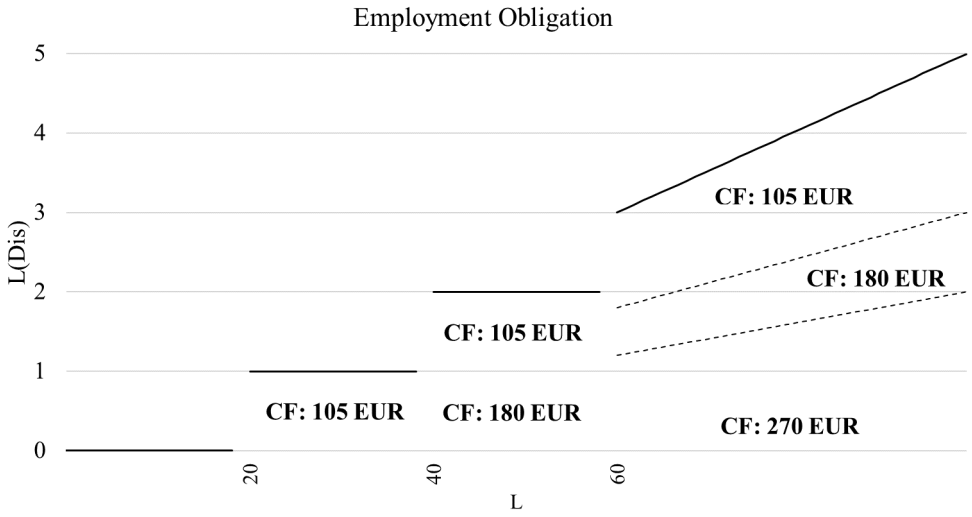
As in almost all countries with quota systems, the 5 per cent quota is generally not met in Germany. In 2011, 110,039 (77.0 per cent) out of 142,847 employers subject to the employment obligation did not fulfill the prescribed quota. Further, about one quarter (26.2 per cent) did not employ any severely disabled worker.

[3]For an overview of the countries with similar quotas, see Table xy in the Appendix.

[4]Note that paying the compensation fee does not remove the employment obligation. Thus, employers can be fined in addition to the compensation fee if they culpably fail to comply with the employment obligation.

[5]The fee has to be paid to the integration offices and is mainly used to finance assistance for occupational rehabilitation for severely disabled people.

Figure 1: Employment Obligation and Compensation Fees in Germany



Notes: The figure shows the legal regulations concerning the German employment quota and compensation fees (CF) according to §159 SGB IX during the observation period (2004-2011). L(Dis) is the number of disabled workers according to the employment obligation; L represents the number of employees in a firm (=firm size). For details on the calculation of the firm size, see Table A.1 in the Appendix. The compensation fees were increased in 2012, 2016 and 2021. The current fees are 140, 245 and 360 EUR/month, respectively.

These shares have essentially not changed since then. In general, public employers are better in fulfilling the quotas. The share of disabled workers is particularly low in the hospitality industry and the agricultural sector.

2.3 Some Theoretical Considerations

The aim of the German employment quota combined with a non-compliance fee is to increase the demand for disabled workers. A firm which is subject to an employment quota will hire a disabled worker when the utility of employing a disabled worker (e. g. in form of a lower or non-due compensation fee) exceeds the costs (e. g. in form of additional costs for workplace equipment, a potential lower productivity or a better institutional protection of disabled workers). Thus, I expect that an employment quota leads to a higher demand for disabled workers.

However, a quota may not only affect the demand for disabled workers but also for non-disabled workers (Lalive et al., 2013; Koller et al., 2006; Wagner et al., 2001). The decision to hire an additional non-disabled worker is particularly relevant for firms just below a firm size threshold as additional costs arise when crossing the threshold.[6] Hiring one more (non disabled) worker would increase firms' costs by

[6]Of course the additional costs arise only for firms which do not have more disabled workers

the labour costs of this employee plus the (additional) compensation fee due for firms above the threshold. Thus, a firm being just below a threshold and aiming to expand its production due to a positive product demand shock has several options to avoid the (increase of the) compensation fee: First, as spelled out above, it may hire a disabled worker for a non-disabled worker to meet the employment quota. I refer to this a the *intended effect* of the threshold regulation.

However, to avoid additional costs, firms may try not to cross the threshold at all, i. e. to bunch below the threshold. For this, outsourcing would be a second option. Third, a firm may substitute capital (e. g. machines) for labour. Thus, a firm would expand through capital intensification without crossing the threshold. Fourth, a firm may extend the number of hours worked per employee. Note, however, that this could also be costly due to overtime bonuses. A fifth option to circumvent threshold crossing includes substituting workers who are not considered for the quota (e. g. marginal employed workers) for workers who are considered for the quota. This substitution would result in a different employment and wage structure in a firm as the share of not considered working groups would rise. Note that this would only be the case when the productivity of these working groups is sufficient to meet the product demand. I refer to the last three options as the *non-intended effect* of the threshold regulation as it slows down employment growth (options (3) and (4)) and promotes the creation of precarious employment relationships (option (5)). In sum, I expect intended and non-intended effects of the employment quota for firms near the threshold.

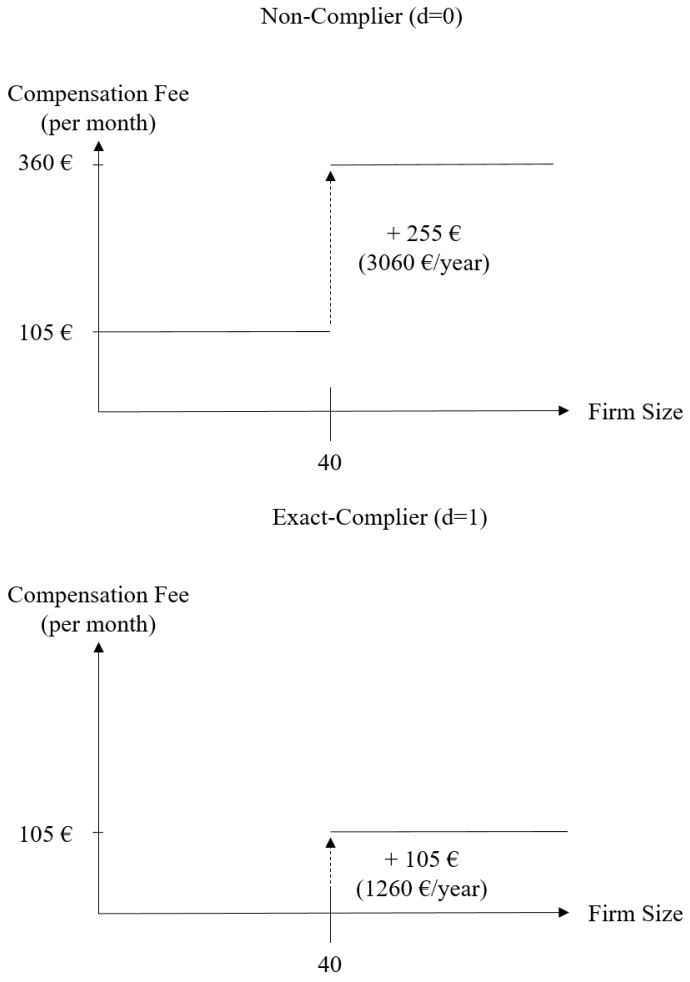
Note that the incentives to bunch depends on the costs which arise when crossing the threshold. For the second and the third threshold (e. g. 40 and 60 employees), these costs vary for firms depending on their initial disabled employment (see Figure 1). As I focus on the second threshold, I distinguish three types of firms below this threshold[7]: First, some firms do not employ *any* disabled worker and already pay the compensation fee. When crossing the threshold, the compensation fee would increase provided that they do not hire a disabled worker when crossing. I refer to those firms as *Non-Complier*. Second, some firms below the threshold comply with the employment quota and employ exactly *one* disabled worker. When crossing the threshold, these firms would be obliged to pay the compensation fee, again provided that they do not hire another disabled worker when crossing. I refer to those firms as *Exact-Complier*. Third, some firms below the threshold may already employ *two*

than required by law.

[7]Of course, this typing in principle generalizes to the threshold of 60 employees.

or more disabled workers and thus do not face any additional costs at the threshold. I refer to those firms as *Over-Complier*. Figure 2 illustrates the change of costs for *Non-Complier* and *Exact-Complier* at the second threshold. It shows that the costs and thus the incentives to stay below the threshold are higher for *Non-Complier*. Therefore, I expect a more pronounced bunching effect and bunching behaviour for *Non-Complier* than for *Exact-Complier*. As *Over-Complier* do not face any additional costs at the threshold, I do not expect any bunching effects for this group of firms.

Figure 2: Costs for Firms at Threshold 40



Notes: The figure illustrates the costs for firms when crossing the threshold of 40 employees. *Exact-Complier* are firms below the threshold of 40 employees which already employ one disabled worker, *Non-Complier* are firms which do not employ any disabled worker. The compensation fees refer to the observation period (2004-2011).

3 Empirical Strategy, Data and Variables

3.1 Data

My empirical analysis is based on several administrative data sets of the German Federal Employment Agency. The *Employment Statistics of Severely Disabled People* (BsbM) is an annual statistic which has been available since 2003 and which includes information on the employment of disabled workers in firms. Firms with 20 and more employees must declare annually (i) how many individuals they employ and (ii) how many of them are severely disabled. Thus, the information on firm size and disabled workers stems directly from the notifying procedure used to determine compliance with the disability quota. As a consequence, the BsbM has the great advantage of providing information on firm size that is consistent with the legal definition stipulated in the disability law.[8] Note that many studies which analyse firm size regulations, e. g. in the context of dismissal protection, try to recalculate the firm size stipulated in the respective law (see for example Wagner et al., 2001; Bauer et al., 2007; Bauernschuster, 2013; Hijzen et al., 2017). Thus, these analyses often suffer from a considerable measurement error, which can be ruled out in my case. Besides some basic information about the firm such as region and industry, the BsbM contains an identifier of the main establishment.

This identifier allows me to merge further information from establishment data of the Federal Employment Agency, namely the *Establishment History Panel* (Schmucker et al., 2018). Since I only consider small businesses up to a maximum of 80 employees, I can assume that in most cases a firm consists of one establishment.[9] The Establishment History Panel provides annually detailed information on the establishments' workforce such as the skill or employment structure on the reference date 30th June.

3.2 Empirical Strategy

The employment obligation for firms which vary according to firm size thresholds provides a natural application for a "threshold design" (Lalive et al., 2013).[10] I use

[8] For details on the definition of firm size according to the disability law, see Table A.1 in the Appendix.

[9] According to the establishment panel - a representative survey of establishments in Germany -, a large majority of establishments is an independent company without any other places of business. This is particularly true for small establishments. Thus, it is justified to assume establishment=firm for small establishments. For details see Figure A.1 in the Appendix.

[10] Being closely related to a regression discontinuity design (RDD), the threshold design has a slightly different set-up than the RDD as the running variable - firm size in my case - is a

the second threshold and contrast the number of disabled workers just below and just above the threshold of 40 employees.[11] The key assumption for identifying effects is that firms' demand for disabled workers is continuous in absence of the employment obligation. This assumption is reasonable as no rules - other than the disability quota - kick in when firms change employment around the thresholds. However, as the noncompliance costs rise at the thresholds, firms may indeed manipulate employment in the presence of the disability quota and purposely stay below the threshold to avoid this additional tax.

Following Lalive et al. (2013), my empirical analysis therefore consists of two parts: First, I estimate the intended threshold effect which is the (naive) effect of the threshold regulation on the number of disabled workers. Second, I report the non-intended bunching effect which is the effect of the threshold regulation on the firm size. The bunching effect thus indicates the maximum of firms at the threshold that manipulate their firm size. Taking the potential bunching effect into account, I am able to bound the threshold effect.

To estimate the *threshold effect*, I rely on graphical analyses as a first intuition. For this, I plot the local averages of the number of disabled individuals per firm size category. In my case, firm size categories are classified according to the whole number of employees in a firm. I complement the non-parametric analysis with an ordinary least square regression using the following (basic) equation:

$$Y_i = \beta_0 + \beta_1 D_i + \beta_2 c_i + \beta_3 X_i + \epsilon_i \tag{1}$$

Where Y_i is the outcome variable, i. e. the number of disabled workers in firm i. D is a treatment dummy indicating whether a firm is above the critical threshold of 40 employees and thus has to employ one more (i. e. two) severely disabled worker. c is the running variable the cutoff is based on. In my case, c refers to the whole number of employees in a firm. X represents a vector of control variables capturing observable predetermined firm characteristics. Including

endogenous variable. The estimation techniques are, however, very similar.

[11] Due to data limitations, I cannot exploit the first threshold of 20 employees as the BsbM data set only covers firms being affected by the employment obligation, i. e. firms with 20 and more employees. Further, I do not focus on the third threshold of 60 employees (or higher thresholds) for two reasons: First, the assumption establishment=firm (see Section 3.1) is more plausible for smaller firms. Second, there are further labour law threshold rules (apart from the disability quota) at a firm size of 60 employees. Thus, I cannot ensure that the effects I find are solely due to the disability quota for this threshold.

these predetermined characteristics helps to reduce the sampling variability of the estimator. ϵ_i reflects the error term.

The discrete support of the running variable c - the firm size - implies that I have to extrapolate in order to predict the counterfactual for threshold firms, i. e. the number of disabled workers threshold firms employ in the absence of the compensation fee. Regarding the bandwidth, i. e. the window of relevant observations around the threshold, I choose a mean square error (MSE) optimal bandwidth for each side of the threshold (Calconico et al., 2020). The baseline model presented above assumes a linear functional form which can be mis-specified. To assess the sensitivity of the functional form, I add higher order polynomials to the linear model. In doing so, I additionally use polynomials of the running variable of order 2, 3 and 4.

To estimate an unbiased effect I have to assume that firms do not manipulate their firm size and purposely stay below the threshold. However, as (non-complying) firms face an increase of labour costs at the threshold due to the increased compensation fee, this assumption may possibly be violated (see Section 2.3). Thus, I explicitly address the question how manipulating employment may bias the estimated naive threshold effect. For this, I first check whether manipulating is present by inspecting the firm size density graphically. The intuition behind this test is that bunching should be reflected in a discontinuity in the firm size distribution at the threshold (see McCrary, 2008). Due to the increased labour costs at the threshold, I expect a negative discontinuity in the firm size density at the threshold. I also check for the presence of bunching formally (Cattaneo et al., 2020). Further, again following Lalive et al. (2013), I quantify the effect on the firm size density - the *bunching effect* - to assess the bias of the estimated naive threshold effect. For this, I use a similar equation as equation (1) but with firm size density (in per cent) as outcome variable. Again, I perform different specifications including different polynomials.

To shed more light on the bunching behavior of firms, I further inspect alternative outcome variables by replacing the dependent variable in equation (1) by each of the alternative outcome variables. These variables include characteristics of the firms' workforce with regard to employment and wage structure and firm dynamics. Manipulating firms just below the threshold may substitute regular (full-time) employed workers by workers who do not count for the quota, such as marginal employed, part-time workers (<18 hours/week) or apprentices. Such substitution effects would be reflected in differences of the workforces' composition below and

above the threshold. Another alternative outcome variable is the growth probability as manipulating firms may have a lower probability to grow just below the threshold.[12] As I expect a different bunching behavior for different types of firms below the threshold, I always distinguish between *Non-Complier*, *Exact-Complier* and *Over-Complier* (see Section 2.3).

Taken together, my empirical approach explicitly takes a violation of the key assumptions of a standard RDD/threshold design into account. More specifically, I am aware that observations just below and above the threshold may indeed be different with regard to their employment and wage structure and their growth probability. However, with regard to *predetermined covariates* such as region, industry and firms' age, the observations should not differ substantially below and above the threshold. In a first step, I report these predetermined covariates on firms located around the threshold of 40 employees and formally check for discontinuities at the threshold. Again, I replace the dependent variable in equation (1) by each of the predetermined covariates. Testing for local balancedness of predetermined covariates is important to ensure that firms just below the threshold represent an appropriate control group for treated firms just above the threshold. Further, I include those predetermined covariates as control variables in my main estimations.

3.3 Sample and Descriptives

Since the probability that a firm consists of only one establishment is more likely for small firms, I focus on the first threshold of 40 in my main analyses. For my baseline sample, I choose a bandwidth of 12.[13] Thus, my sample consists of firms with 29 to 51 employees (according to the BsbM) in the years 2004 to 2011 resulting in 319,939 firm-year observations.

Table 1 reports predetermined firm characteristics (firm age, region and industry) for firms around the threshold of 40. It shows that there are differences between firms below and above the threshold. Treated firms have, by construction, more employees than control firms and are, on average, older. Significant differences are also observable in the industrial and geographical distribution. However, note that even though all differences are statistically significant at the 1 per cent level, most of the differences are small in size. The mean differences between firms below and above

[12] I define "growth probability" as the probability of having more employees (according to the BsbM) in t+1 compared to t.

[13] Note that this bandwidth is only relevant to describe the predetermined characteristics of the firms. In the analyses, I choose the MSE optimal bandwidth on each side of the threshold. Thus, the sample differs in each estimation.

the threshold may also reflect heterogeneous firm size distributions across different industries and regions. Thus, I formally test for discontinuities of these characteristics at the threshold of 40 for polynomial order 1 and 4 with an optimal bandwidth. Column (4) and Column (5) of Table 1 report the estimated coefficients. The results show that there are only a few statistically significant and sufficiently large coefficients. In particular, the share of firms operating in other services and in public administration is significantly different for firms below and above the threshold in general and there is also a significant (and quite large) discontinuity exactly at the threshold. Hence, I exclude those two industries in a robustness check to analyse whether my main results are sensitive to this exclusion. Altogether, the inspection of the predetermined characteristics suggests that firms below the threshold basically represent an appropriate control group for firms above the threshold.

Table 1: Descriptive Statistics of Firm Characteristics

	Below threshold 28-39 Employees Mean	Above threshold 40-51 Employees Mean	Difference t-test	Discontinuity at Threshold 40 p = 1	p = 4
Firm size	33.64	45.18	11.53***		
Age of establishment	18.80	19.17	0.370***	0.531***	0.981*
Region: East Germany	0.171	0.171	-0.001***	-0.006	0.023
Industry					
Agriculture	0.022	0.016	-0.006***	-0.001	0.004
Energy/Mining	0.009	0.012	0.003***	0.001	0.002
Manufacturing	0.245	0.270	0.025***	0.013*	0.039*
Construction	0.096	0.082	-0.014***	-0.010***	-0.029*
Wholesale	0.182	0.172	-0.009***	0.006	0.005
Traffic/Communication	0.066	0.062	-0.004***	-0.013***	0.024*
Banking/Insurance	0.010	0.014	0.004***	0.007***	0.015*
Other services	0.188	0.175	-0.013***	-0.021***	-0.020
Public administration	0.137	0.158	0.021***	0.025***	0.036**
Public sector	0.045	0.039	-0.005***	-0.001	-0.009
# of Firm-Year Observations	202,583	117,356	319,939		

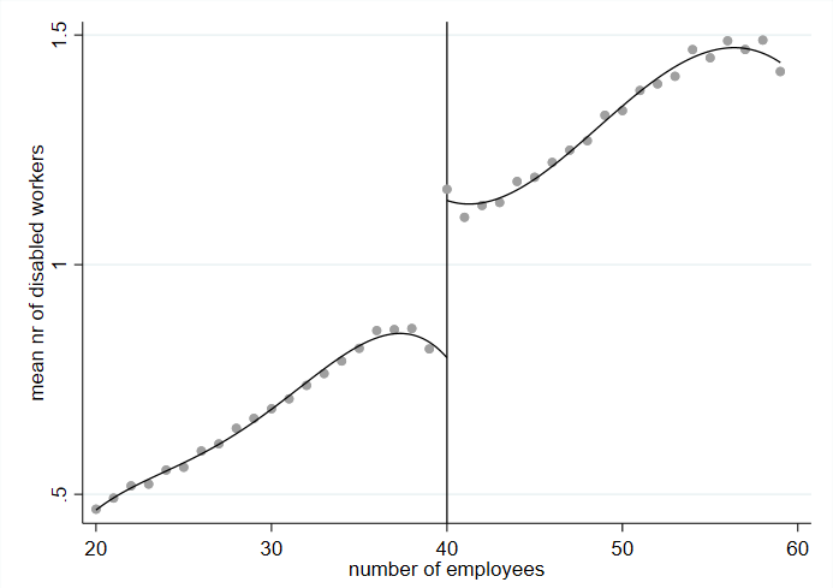
Notes: The table shows descriptive statistics of firm characteristics around the threshold of 40 employees. *, ** and *** denote statistical significance at the 10%, 5% and 1% level.
Source: BsbM and BHP 2004-2011, own calculations.

4 Results: Intended and Non-Intended Effects

4.1 Demand for Disabled: Graphical Illustration

Let us now turn to the graphical illustration of a potential discontinuity at the second threshold of 40 employees. Figure 3 displays the mean number of disabled workers by firm size for the threshold of 40 employees. It shows that the number of disabled workers employed by firms increases with firm size in a quite linear relationship. Firms at the lower edge - i. e. firms with 20 employees - employ on average 0.47 disabled workers, whereas firms at the top edge - i. e. firms with 59 employees - employ on average 1.42 disabled workers. The plot shows a considerable discontinuity in the number of disabled workers at the threshold. While firms just below the threshold - i. e. firms with 39 employees - employ on average 0.817 disabled workers, firms just above the threshold - i. e. firms with 40 employees - employ 1.164 disabled workers. However, the figure also illustrates that the (linear) increase of disabled workers decreases shortly before the threshold, which can be interpreted as a first indication of a bunching behaviour: Those firms which do not employ enough disabled workers may purposely stay below the threshold.

Figure 3: Nr of Disabled Workers



Note: The graph plots the mean average of disabled workers according to firm size around the thresholds of 40. The black line approximates the functional form of the running variable (here with polynomial order fit p=4).
Source: BsbM and BHP 2004-2011, own calculations.

4.2 Demand for Disabled: Naive Effects

Table 2 reports the econometric results of the estimated (naive) threshold effects. I estimate five models with different modifications of bandwidths and polynomial order. The first model in column (1) shows the result for the basic econometric model with an optimal bandwidth on each side of the threshold, a linear functional form and incorporating predetermined firm characteristics as control variables. The estimated discontinuity at the threshold is 0.316. This discontinuity is statistically different from zero at the 1 per cent level. Column (2), column (3) and column (4) use higher order polynomials by again estimating the optimal bandwidth below and above the threshold. The results show that the model is sensitive to the functional form. Higher order polynomials lead to considerable larger threshold effects. This is not surprising as a more flexible functional form takes the (non-linear) developments near the threshold into account (see Figure 3). Column (5) also uses very flexible functional form but with a fixed bandwidth of h(below)=8 and h(above)=9 based on the optimal bandwidth in Column (4).[14] The estimated coefficient of column (4) and column (5) are very similar. I therefore adopt the model of column (5) with a threshold effect of 0.388 as my *baseline specification* for the remainder of the paper.

In quantifying the magnitude of the naive effect, the estimate suggests that the employment obligation leads to 0.388 more disabled workers holding a job in threshold firms. Given that the mean of disabled workers just below the threshold is 0.817, the effect represents an increase of 47% disabled workers. This effect is considerably larger than the effect of 12% Lalive et al. (2013) found in their analysis for the Austrian case. However, Lalive et al. (2013) also found relatively small bunching effects. Given the graphical hints in this section that bunching may be an issue in the German case, the large threshold effect of this naive analysis may be upward biased. Therefore, I shed more light on potential bunching effects and bunching behavior in the following section.

[14] For the choice of the bandwidths in this specification, I take the optimal estimated bandwidths of column (4) as benchmark estimations and round them to the next whole number. Thus, I gain predefined and uniform bandwidths which I can use for calculating the bunching effects. Uniform bandwidths that refer to a fixed number of firms are important for calculating the lower bound of the threshold effect (see Section 4.4).

Table 2: Threshold Effects (Dep. Var.: Number of Disabled Workers)

	Threshold 40				
	(1)	(2)	(3)	(4)	(5)
Effect	0.316***	0.389***	0.386***	0.394***	0.388***
Robust CI	[0.280; 0.329]	[0.319; 0.476]	[0.323; 0.466]	[0.305; 0.489]	[0.186; 0.667]
Bandwidth h	1.72; 2.76	3.84; 4.80	6.34; 7.23	8.19; 9.20	8; 9
Polynomial order p	1	2	3	4	**4**
Covariates included	yes	yes	yes	yes	yes
# of Observations	49,851	102,669	182,727	238,306	210,306

Notes: The table shows estimation results of the threshold effects on the number of disabled workers in a firm (threshold = firm size of 40 employees). The bandwidths in columns (1)-(4) reflect the optimal bandwidth calculated with the *rdrobust*-command in Stata. Basic covariates include age of firm, regional characteristics (federal state) and industry. *** denotes statistical significance at the 1% level.
Source: BsbM and BHP 2004-2011, own calculations.

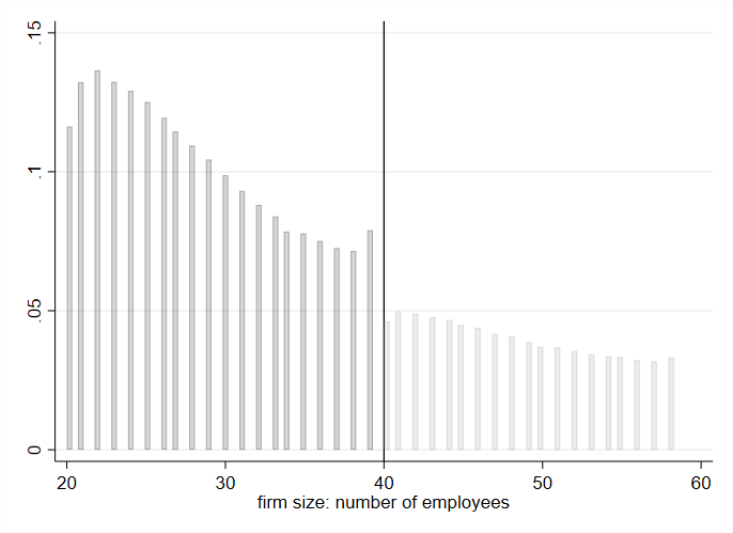
4.3 Non-Intended Effect: Bunching Below

This section analyses a potential bunching effect which results from firms purposely staying below the threshold. The histogram shown in Figure 4 gives a further indication of the importance of manipulation. It shows that the firm size density drops at the threshold indicating that manipulation may indeed be an issue. I also test for the presence of a discontinuity in the firm size distribution formally (Cattaneo et al., 2020). The test rejects the null that there is no bunching at the 1 per cent level (see Table B.1 in the Appendix). To quantify the extent of bunching, I calculate the share of firms for each firm size category and run local regressions around the threshold with the calculated firm size density as outcome variable. I again use different polynomial orders (2, 3 and 4) to check for sensitivity of the functional form.[15]

Table 3 shows the results of the bunching effects. The coefficient for the model with a second order polynomial is -1.305. The models incorporating a more flexible functional form suggest higher bunching effects. When using a very flexible functional form, i. e. with a polynomial order of 4 and a fixed bandwidth of h(below)=8 and h(above)=9 - based on my baseline specification in Section 4.2 -, the bunching effect is -2.017. That means that about 2 per cent of the firms around the threshold are bunching firms. Taken together, firms indeed manipulate their firm size due to the (higher) compensation fee which arises at firm size 40. This suggests that the large threshold effect on the number of disabled workers identified in Chapter 4.2 is upward biased.

[15]Note that Stata cannot estimate a linear specification (p=1) with the optimal bandwidth calculation in this case as I have a very small number of observations.

Figure 4: Firm Size Density



Note: Histogram of firm size density around the threshold of 40.
Source: BsbM and BHP 2004-2011, own calculations.

Table 3: Bunching Effects (Dep. Var.: Firm Size Density)

	Threshold 40			
	(1)	(2)	(3)	(4)
Bunching Effect	-1.305***	-1.454***	-2.012***	-2.017
Robust CI	[-2.198; -0.604]	[-2.587; -0.535]	[-4.080; -0.212]	[-5.521; 1.702]
Bandwidth h	6.38; 7.20	8.34; 10.07	7.96; 11.03	8; 9
Polynomial Order p	2	3	4	4
# of Observations	14	19	19	16

Notes: The table shows estimation results of the threshold of 40 on the firm size density (in %). *** denotes statistical significance at the 1% level.
Source: BsbM and BHP 2004-2011, own calculations.

4.4 Bounding the Effect

This section assesses the upward bias of the naive threshold effect and provides bounds again following the strategy of Lalive et al. (2013). For this, I refer to my baseline specification with h(below)=8, h(above)=9 and p=4 for both the bunching and the threshold effect. The identified bunching effect of -2.017 in Section 4.3 informs about the absolute number of bunching firms suggesting that 2.017 per cent of the 210,306 considered firms within the fixed bandwidth manipulate employment. Hence, there are 2,121 (=(0.02017*210,306)/2) employment manipulators in total.[16] As costs at the threshold rise for both *Non-Complier* and *Exact-Complier*, I expect that both types of firm may bunch below the threshold.

To assess how many of the 2,121 bunching firms are *Bunching Exact-Complier*, I restrict my sample on firms which employ at least one disabled worker and estimate the bunching and threshold effect for this subsample of 121,382 observations. The estimation results in a bunching effect of -1.413 and a threshold effect of 0.266 (see also Figure B.1 and Table B.2 in the Appendix). This result suggests that 857 of the 2,121 bunching firms are *Bunching Exact-Complier* and 1,264 firms are *Bunching Non-Complier*.[17]

To bound the threshold effect, I hypothetically reassign all potential bunching firms from firm size 39 to firm size 40 while keeping the number of disabled workers constant (i. e. 1,264 firms would still employ zero disabled workers and 857 firms would still employ one disabled worker). I then recalculate the raw difference in the mean number of disabled workers of firms with 39 employees and 40 employees. This yields a difference of 0.161. The originally raw difference in the mean difference of those firms is 0.348, so the bias amounts to 0.348-0.161=0.187. Using this bias calculation for bounding the threshold effect of 0.388 suggests that the lower bound of the effect is 0.201. Thus, taking potential bunching into account still leads to a positive threshold effect. Taken together, my estimates suggest that the employment quota indeed induces firms to employ more disabled workers, but dependent on the extent of bunching, the real threshold effect may be considerably smaller than the naive effect.

[16] The following calculation example illustrates the reason for the division by two: Imagine 100 firms on each side of the threshold. Now assume that ten firms bunch and purposely stay below the threshold. Now there are 110 firms below and 90 firms above the threshold. The resulting difference in the number of firms amounts to 20 firms - twice the number of bunching firms.

[17] As a robustness check, I restrict my sample on firms which employ at least two disabled workers. As these firms below the threshold (*Over-Complier*) do not face additional costs at the threshold, bunching should not play a role. In fact, Figure B.2 in the Appendix suggests that bunching below is not relevant for *Over-Complier*.

4.5 Bunching Behaviour

To shed more light on the bunching behaviour of firms, I use characteristics of the firms' workforce which may be affected by the bunching as non-intended outcome variables. More specifically, I look at firm productivity, firm dynamics and the workforce composition.

The graphical inspection of selected variables shown in Figures 5, 7 and 6 suggests that there are discontinuities at the threshold: The median wages are considerably lower in firms below the threshold. In addition to wages, I use firm-fixed effects - so-called AKM effects - as a proxy for the firms' productivity provided by Bellmann et al. (2020). The illustration shown in Figure B.3 in the Appendix is very similar to that of wages. Further, the share of regular employed in firms below the threshold is lower, whereas the share of marginal employed workers is higher. Last, firms just below the threshold have a considerably lower probability to grow. Table 4 reports the estimated discontinuities of the considered variables at threshold 40, again with different specifications (p=1 and p=4). The pattern of the results supports the hypothesis that firms bunch below the threshold and adapt their workforce when facing the increase of labour costs. More specifically, firms below the threshold substitute regular employed workers by marginal employed workers who do not count for the calculation of firm size. Further, the significant discontinuities for wages, AKM effects and the workforces' skill structure suggest that in particular low productivity firms bunch below the threshold. In sum, the overall picture suggests that the increase of labour costs due to the compensation fee at the threshold of 40 employees is highly correlated with firm dynamics, the firms' productivity and the firms' employment structure.

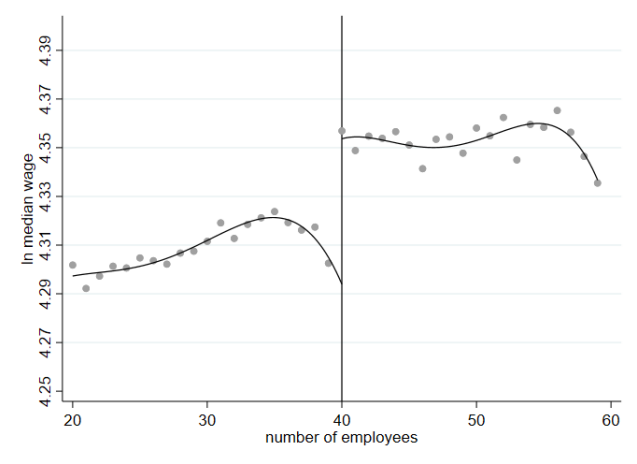
When distinguishing between *Non-Complier*, *Exact-Complier* and *Over-Complier*, the results in Table 4 show that the significant coefficients are mainly driven by *Non-Complier*[18]. For *Over-Complier*, in contrast, the coefficients are not significantly different from zero for any of the alternative outcomes. Taken together, the results suggest that the bunching behaviour is particularly pronounced among those firms below the threshold which face the highest costs at the threshold.

4.6 Robustness Checks: Placebos and Donuts

To assess the credibility of my results, I perform several robustness checks. My first test is the use of placebo thresholds. For this, I estimate discontinuities in

[18]The graphical illustrations for the different types of firm are also shown in Figures B.4, B.6, B.7 and B.8 in the Appendix

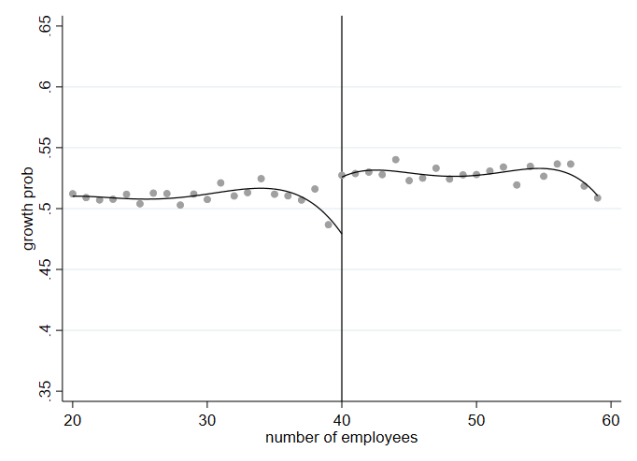
Figure 5: Median Wages



ln Median Wages

Note: The graph plots the ln of median wages according to firm size around the threshold of 40. The black line approximates the functional form of the running variable (here with polynomial order fit p=4). *Source:* BsbM and BHP 2004-2011, own calculations.

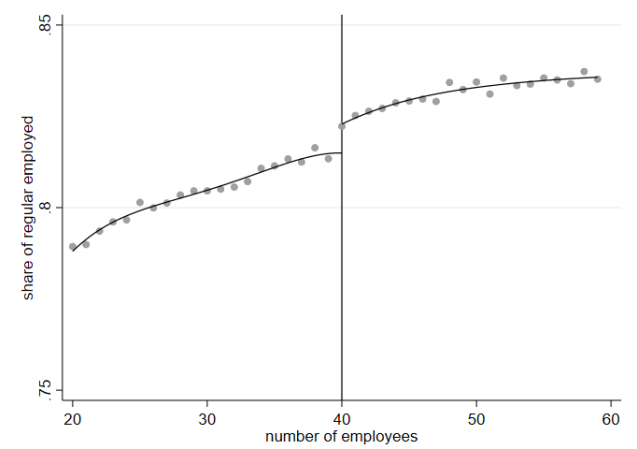
Figure 6: Firm Dynamics



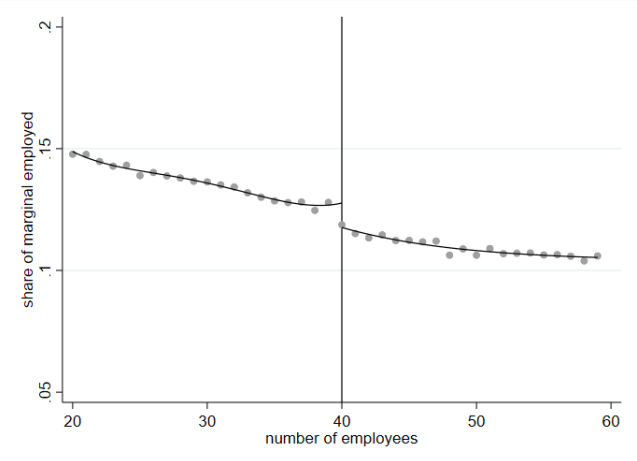
Growth Probability

Note: The graph plots the probability to grow in t+1 according to firm size around the threshold of 40. The black line approximates the functional form of the running variable (here with polynomial order fit p=4). *Source:* BsbM and BHP 2004-2011, own calculations.

Figure 7: Regular and Marginal Employment



(A) Share of Regular Employed



(B) Share of Marginal Employed

Note: The graphs plot the (A) share of regular employed and the (B) share of marginal employed according to firm size around the threshold of 40. The black line approximates the functional form of the running variable (here with polynomial order fit p=4). *Source:* BsbM and BHP 2004-2011, own calculations.

Table 4: Bunching Behaviour

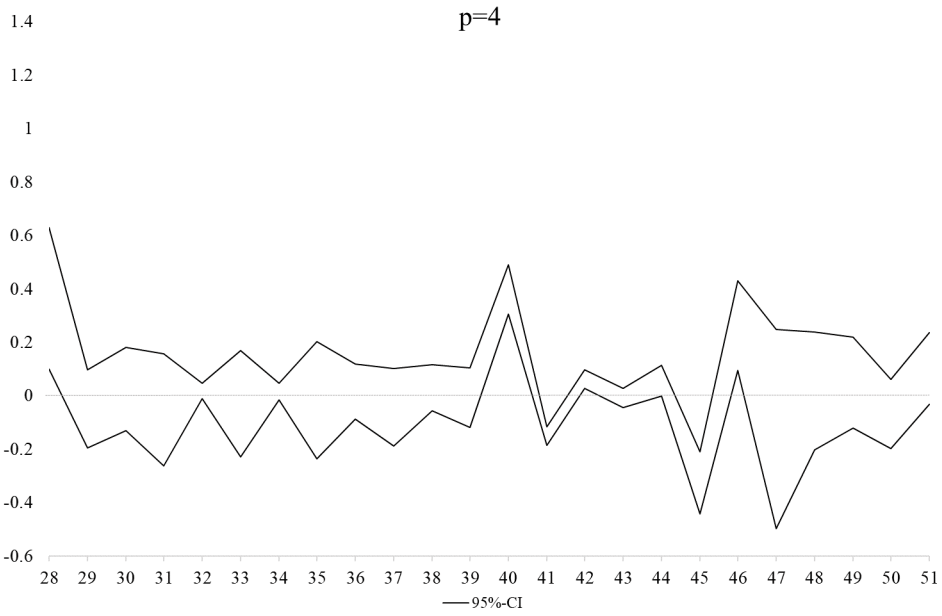
	p = 1	p = 4			
Dependent Variable	Total	Total	Non-Complier	Exact-Complier	Over-Complier
Sociodemographic Structure					
Share of Females	-0.003	-0.011			
Share of Germans	0.005***	0.012*			
Employment Structure					
Median Wages (ln)	0.052***	0.090***	0.100***	0.047*	0.038
Firm-Fixed (AKM) Effects	0.032***	0.057***	0.048***	0.036**	0.022
Share of Regular Employed	0.014***	0.016***	0.019***	0.015*	0.007
Share of Marginal Employed	-0.015***	-0.024***	-0.037***	-0.015	-0.004
Share of Apprentices	0.000	0.002	0.009	-0.003	0.000
Share of Full-Time Workers	0.010***	0.015	0.012	0.022*	0.020
Share of Part-Time Workers	0.002	0.008	0.014	-0.003	-0.005
Skill Structure					
Share of Low-Skilled	-0.005***	-0.010	-0.016*	-0.009	0.002
Share of Medium-Skilled	-0.002	0.005	0.016	0.004	-0.021
Share of High-Skilled	0.009***	0.007	0.004	0.002	0.017
Firm Dynamics					
Growth Probability	0.071***	0.229***	0.353***	0.118*	0.034

Notes: The table shows estimation results of the threshold of 40 employees on alternative outcome variables. *Non-Complier*, *Exact-Complier* and *Over-Complier* are firms below the threshold which employ zero, exact one or more than two disabled worker(s), respectively. All estimations are estimated by using the MSE optimal bandwidth for each side of the threshold. * and *** denote statistical significance at the 10% and 1% level.
Source: BsbM and BHP 2004-2011, own calculations.

the number of disabled workers per firm at firm sizes where there should be no discontinuities. Figure 8 shows the estimated discontinuities for the specification p=4 and an optimal bandwidth for firm sizes 28-51 (including the true threshold at firm size 40). The pattern displays a clear-cut peak at the true threshold. For some placebo thresholds, e. g. firm sizes 28, 41, 42, 45 or 46, the 95%-confidence interval does not include the value of 0, either. This is in contrast to the graphical illustration in Figure 3 which suggests that there are no discontinuities at these firm size categories. However, note that the approximation of the functional form at the placebo thresholds may be biased by the true discontinuity at threshold 40. Specifications with different polynomial order show that although there are also significant discontinuities for some fake thresholds, the robustness of these estimations seems to be low: While the estimated discontinuity for the true threshold is positive and highly significant in all specifications, the significance of the coefficients of the fake thresholds varies considerably depending on the specification. Further, in terms of size, the coefficient for the true threshold is in most cases substantially larger than the coefficients for the placebo thresholds (see Figures B.9, B.10 and B.11 in the Appendix). Taken together, the pattern strongly confirms the credibility of the estimated discontinuity at the true threshold of 40.

In what follows, I perform donut estimations as a further robustness check. Figure 3 suggests that in particular firms with firms size 39 and 40 are violating the

Figure 8: Placebo Thresholds



Note: The graph shows the effects of fake (placebo) thresholds on the mean number of disabled workers for p=4 and an optimal bandwidth on each side of the threshold (including predetermined covariates). All thresholds except threshold 40 are placebo thresholds. The 95% confidence interval refers to the robust CI estimated with the *rdrobust*-command in Stata. As the point estimates could be outside the robust CIs, only the interval boundaries are shown.
Source: BsbM and BHP 2004-2011, own calculations.

otherwise quite linear relationship between firm size and mean number of disabled workers. I therefore exclude those firms (and other combinations of firms near the threshold) and calculate the bunching and threshold effects again for this subsample. Note that I now use a linear specification as the overall relationship between firm size and number of disabled workers - when excluding the non-linear developments near the threshold - suggests a linear form. Table 5 shows the results. Let us first turn to the threshold effects. Compared to the baseline specifications the coefficients of the donut estimations are smaller but still highly significant. This confirms the notion that part of the estimated naive threshold effect is biased by firms bunching below the threshold. With regard to bunching, the estimations show that the bunching effects are considerably smaller than in my baseline estimations indicating that firm size manipulation is mainly driven by firms directly located around the threshold. Overall, the significant threshold effects for the samples without firms near the threshold confirms my main result: Even though bunching is present, the threshold regulation seems to positively affect the number of disabled workers in firms.

Table 5: Donut Estimations

	Baseline Estimation	Donut Estimations: Excluded Firms of Firm Size		
		39	39+40	38+39
		Bunching Effects		
Coefficient	-2.017	-0.608**	-0.521*	-0.568
Robust CI	[-5.521; 1.702]	[-1.459; -0.080]	[-1.364; 0.052]	[-2.396; 0.992]
# of Observations	16	15	14	14
		Threshold Effects		
Coefficient	0.388***	0.203***	0.164***	0.172***
Robust CI	[0.186; 0.667]	[0.239; 0.343]	[0.180; 0.296]	[0.160; 0.362]
Polynomial Order p	4	1	1	1
Covariates included	yes	yes	yes	yes
# of Observations	210,306	192,965	182,616	177,260

Notes: The table shows estimation results of the threshold effects on the number of disabled workers in a firm (threshold = firm size of 40 employees). The bandwidth for all estimations is 8 and 9. Basic covariates include age of firm, regional characteristics (federal state) and industry. *, **, *** denote statistical significance at the 10%, 5% and 1% level. *Source:* BsbM and BHP 2004-2011, own calculations.

4.6.1 Further Tests

Next, I exclude firms operating in other services and in public administration as the share of these industries vary below and above the threshold (see Section 3.3). The estimated coefficients are similar to those of the baseline estimation (see Table B.5 in the Appendix). Thus, I can conclude that firms in these industries do not alter my basic results.

I further estimate the bunching and threshold effects stratified by industry. The results shown in Table 6 illustrate that the bunching and threshold effects are particularly pronounced in the construction and traffic/communication industry as well as in other services and the public sector. Due to a probably high share of physically demanding tasks, the costs of employing (physically) disabled workers may be higher especially in the construction and traffic/communication industry compared to other industries. Thus, the incentives to bunch below the threshold are higher in firms operating in these industries.

4.7 Results for Threshold 60

In this section, I check whether a similar pattern results for the third threshold of 60 employees. Firms with 40 to less than 60 employees have to employ at least two disabled workers while firms with 60 and more employees are obliged to employ at least three disabled workers (=five per cent). Note, however, that there are other threshold rules for threshold 60 in the German labour law.[19] Thus, the following

[19]For example, according to the Protection Against Dismissal Act (*Kündigungsschutzgesetz*), an employer with 60 and more employees has to report a layoff of 10% of the workforce or more than 25 employees to the employment agency.

Table 6: Heterogeneous Effects Stratified by Industry

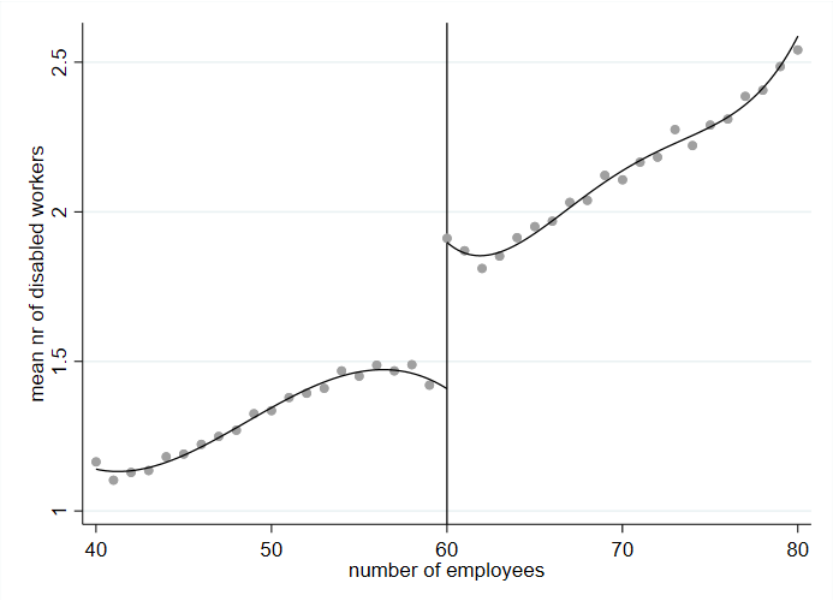
	Threshold Effect T=40		Bunching Effect
	p = 1	p = 4	p = 4
Agrar/Fishery	0.227**	0.601**	-1.194***
Energy/Mining	0.280	0.253	-1.554
Manufacturing	0.337***	0.336	-1.704**
Construction	0.282***	0.537**	-2.517*
Wholesale	0.307***	0.372***	-1.821**
Traffic/Communication	0.372***	0.509***	-2.785*
Banking/Insurance	0.104	0.072	0.187
Other Services	0.436***	0.414***	-2.053**
Public Administration	0.343***	0.397***	-1.191
Public Sector (w/o Public Administration)	0.354***	0.370**	-2.903*

Notes: The table shows estimation results of the threshold effects (dependent variable: mean number of disabled workers in a firm) for threshold 40 and the bunching effects (dependent variable: firm size density in %) stratified by industry. Basic covariates include age of firm and regional characteristics (federal state). ** and *** denote statistical significance at the 5% and 1% level.
Source: BsbM and BHP 2004-2011, own calculations.

analyses are rather exploratory and serve as a robustness check for the results of the 40-threshold.

I restrict my sample to firms around the threshold of 60 employees. For the intended effect, the graphical illustration again shows a considerable discontinuity in the mean number of disabled workers employed in firms below and above this threshold (see Figure 9). The histogram of the firm size distribution suggests that bunching is also present at this threshold (see Figure B.12 in the Appendix and Table B.3 in the Appendix for the formal test). Further, the plots and estimations of selected alternative outcome variables regarding the employment and wage structure as well as firm dynamics are similar to the pattern of threshold 40 (see Figures B.13, B.14, B.15 and Table B.4 in the Appendix). Table 7 gives an overview of the formally estimated bunching and threshold effects for threshold 60. All effects are significantly different from zero at least at the 10%-level. In terms of size, the threshold effects for threshold 60 are larger than for threshold 40 while the size of the bunching effects are similar. This result is consistent with the results of Lalive et al. (2013) who also find larger effects for higher thresholds (albeit they do not find evidence for bunching at higher thresholds). In sum, the analyses for threshold 60 largely confirm the results for threshold 40.

Figure 9: Nr of Disabled Workers



Note: The graph plots the mean average of disabled workers according to firm size around the thresholds of 60. The black line approximates the functional form of the running variable (here with polynomial order fit p=4).
Source: BsbM and BHP 2004-2011, own calculations.

Table 7: Threshold and Bunching Effects for Threshold 60

	Threshold 60 - Bunching Effects			
	(1)	(2)	(3)	(4)
Coefficient	-1.124***	-1.691**	-1.905*	-2.006*
Robust CI	[-2.747; -0.421]	[-3.482; -0.213]	[-4.202; 0.076]	[-4.528; 0.238]
Bandwidth h	8; 9	6.75; 8.79	8.67; 12.53	11.51; 15.53
Polynomial Order p	1	2	3	4
# of Observations	15	15	21	27
	Threshold 60 - Threshold Effects			
	(1)	(2)	(3)	(4)
Coefficient	0.499**	0.503***	0.548***	0.653***
Robust CI	[0.434; 0.609]	[0.425; 0.617]	[0.438; 0.691]	[0.457; 0.896]
Bandwidth h	2.87; 3.09	5.26; 6.32	7.09; 9.34	7.77; 13.28
Polynomial Order p	1	2	3	4
Covariates included	yes	yes	yes	yes
# of Observations	36,406	73,050	101,907	118,537

Notes: The table shows estimation results of the bunching effects (dependent variable: firm size density in %) and the threshold effects (dependent variable: mean number of disabled workers in a firm for threshold 60). Basic covariates include age of firm, regional characteristics (federal state) and industry. ** and *** denote statistical significance at the 5% and 1% level.
Source: BsbM and BHP 2004-2011, own calculations.

5 Summary and Conclusions

In Germany, firms with 40 and more employees are obliged to employ one more disabled worker. This paper analyses the intended and non-intended effect of the German employment quota for disabled workers. The intended effect describes the effect of this threshold regulation on the firms' demand for disabled workers, whereas the non-intended effect describes potential bunching below the threshold. Thus, my paper extends the literature on the effects of a sharp increase in labour costs resulting from a disability quota system.

I use this sharp increase in labour costs and adopt a threshold design, which is closely related to a regression discontinuity design. However, the threshold design accounts for the fact that the running variable - firm size in my case - is endogenous. My results indicate that the employment quota promotes employment of disabled workers in firms located around the threshold. A naive estimate of the *intended* - threshold - effect (when ignoring the bunching) suggests that threshold firms employ on average 0.388 more disabled workers. When analysing the *non-intended* - bunching - effect, the results show that firms indeed manipulate their employment due to the increase in labour costs at the threshold. The existence of bunching violates the identifying assumptions to identify an unbiased effect of the threshold regulation. However, based on the estimates about the extent to which firms manipulate, I am able to provide a lower bound for the threshold effect. When taking the bunching effect into account, the lower bound is still positive - albeit considerably smaller. Thus, it seems that the compensation fee does indeed increase compliance with the quota and promote employment for disabled workers.

However, the quota also seems to have non-intended consequences which can be harmful to overall employment: Firms just below the threshold have a lower probability of building employment and a higher probability of substituting regular employed workers. This is interesting as previous research has found little evidence of firms bunching below labour law thresholds in Germany. In view of the multitude of threshold regulations in German labour law, my findings shed new light on the relevance of such thresholds. Further research should therefore put emphasis on evaluating threshold regulations and firms' adaption to such regulations in other contexts.

Appendix

Appendix A: Definitions and Institutional Details

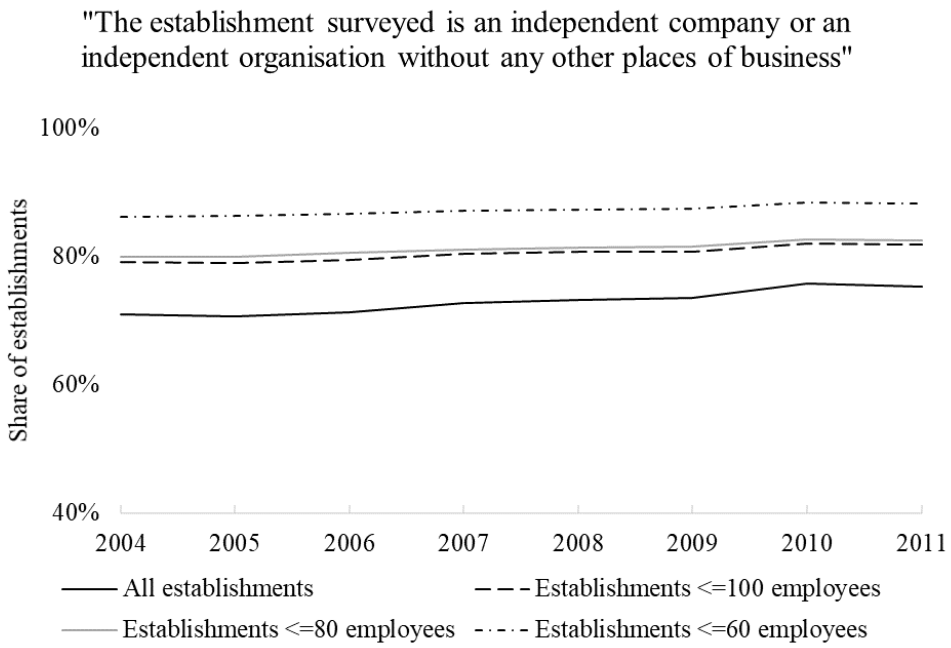
Table A.1: Calculation of Firm Size According to Disability Law

Excluded groups of workers	Apprentices (including special trainee positions for lawyers and teachers) Individuals who work less than 18 hours a week Individuals with a temporary contract of less than eight weeks Individuals whose employment is not primarily for their earning
Temporal frame	The relevant variable for the firm size is the *annual average* of the monthly number of positions.
Calculation details	Fractions of 0.5 and more are rounded down to the nearest whole number for firms with 20 to 59 positions Fractions of 0.5 and more are rounded up to the nearest whole number for firms with 60 and more positions

Table A.2: On the Definitions of Firms/Establishments

Definitions of Firm/Establishment
Legal Definition of "Employer" (Firm) According to Disability Law: Employers can be both natural and legal persons under public or private law as well as companies of any kind. Consequently, all employees of the same employer are counted together, regardless of how many establishments or other locations they are distributed over.
Definition of "Establishment" in the Administrative Data: An establishment is a regionally and economically delimited unit in which employees work. An establishment may consist of one or more branch offices or workplaces belonging to one company (Schmucker et al., 2018).

Figure A.1: Share of Individual Establishments



Notes: The graph shows the share of establishments that are an independent company or an independent organisation without any other places of business. The survey is representative of all establishments in Germany (Ellguth et al., 2014).
Source: IAB Establishment Panel, 2004-2011, own calculations.

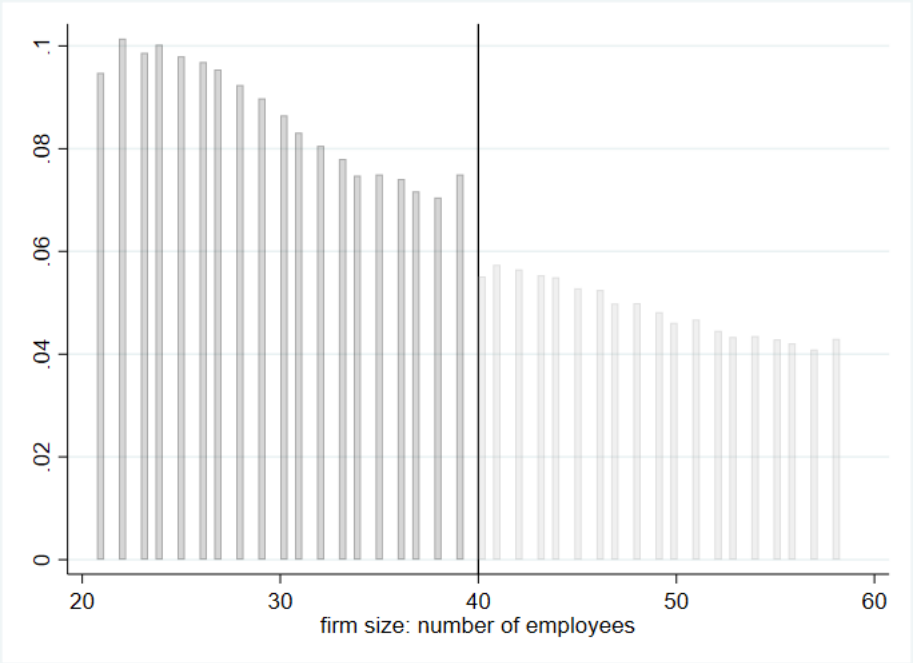
Appendix B: Further Analyses

Table B.1: Cattaneo et al. Estimator Test Statistics

	T	P > —T—
Robust	-21.2550	0.000
# of Observations	625,664	

Source: BsbM and BHP 2004-2011, own calculations.

Figure B.1: Firm Size Density for Firms d>=1



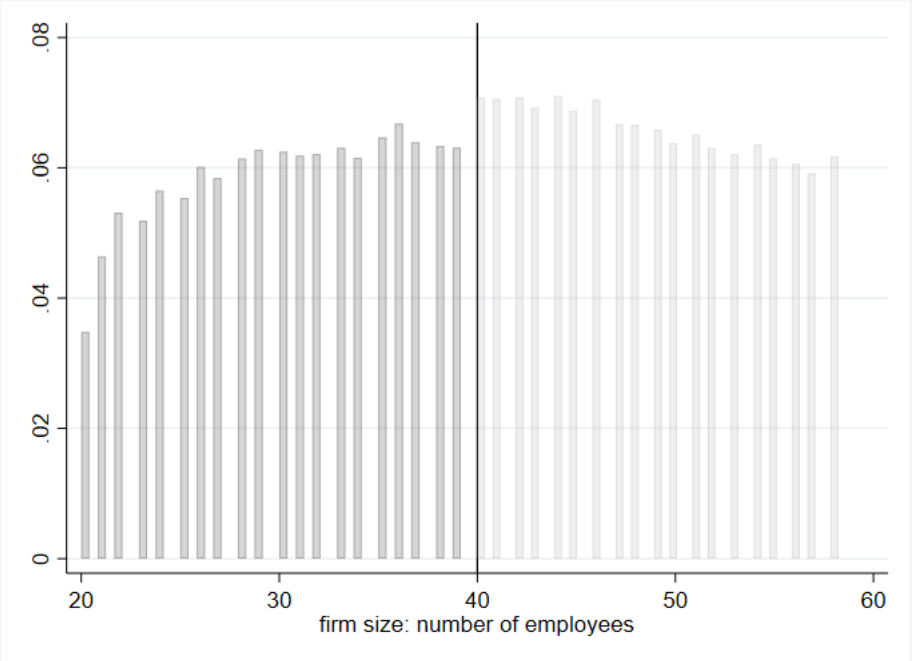
Notes: Histogram of firm size density for firms with at least one disabled worker around the threshold of 40.
Source: BsbM and BHP 2004-2011, own calculations.

Table B.2: Threshold and Bunching Effect for Firms d>=1

	Bunching Effect	Threshold Effect
Coefficient	-1.413	0.266***
Robust CI	[-3.818; 1.240]	[0.103; 0.674]
# of Observations	16	121,382

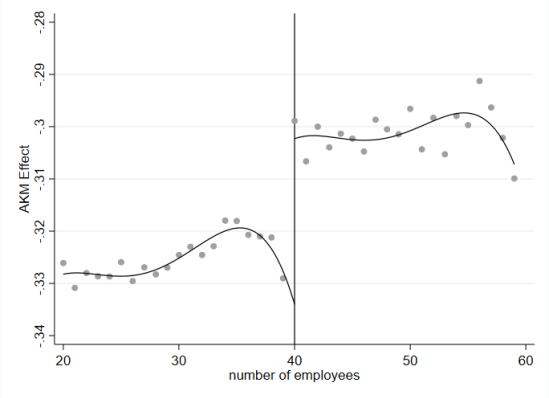
Notes: The table shows estimation results of the threshold effects on the number of disabled workers in a firm only for firms which employ at least 1 disabled worker (h=8;9, p=4). *** denotes statistical significance at the 1% level.
Source: BsbM and BHP 2004-2011, own calculations.

Figure B.2: Firm Size Density for Firms d>=2



Notes: Histogram of firm size density for firms with at least two disabled workers around the threshold of 40. *Source:* BsbM and BHP 2004-2011, own calculations.

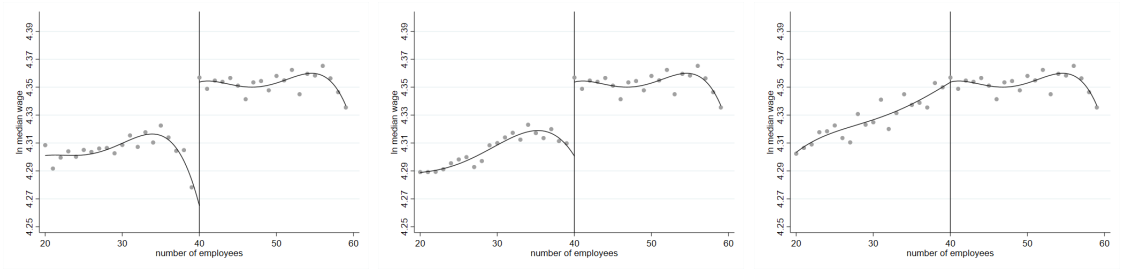
Figure B.3: Firm Productivity



AKM Effects

Note: The graph plots the AKM Effects according to firm size around the threshold of 40. The black line approximates the functional form of the running variable (here with polynomial order fit p=4). *Source:* BsbM and BHP 2004-2010, own calculations.

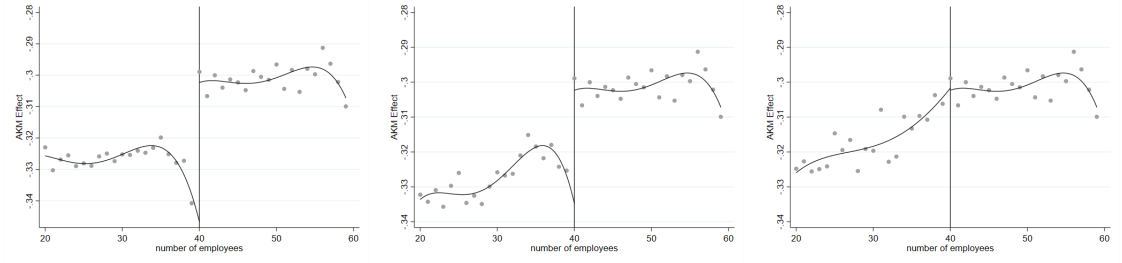
Figure B.4: Median Wages: Non-Complier, Exact-Complier and Over-Complier



Non-Complier *Exact-Complier* *Over-Complier*

Note: The graph plots the ln of median wages according to firm size around the threshold of 40 separately for *Non-Complier*, *Exact-Complier* and *Over-Complier*. The black line approximates the functional form of the running variable (here with polynomial order fit p=4). *Source:* BsbM and BHP 2004-2011, own calculations.

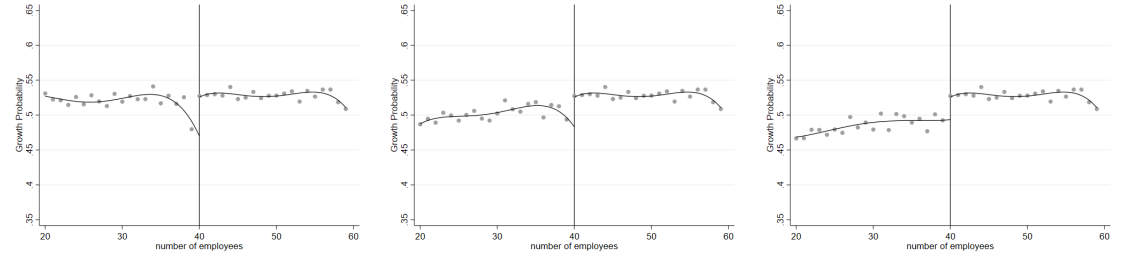
Figure B.5: Firm Productivity: Non-Complier, Exact-Complier and Over-Complier



Non-Complier *Exact-Complier* *Over-Complier*

Note: The graph plots the AKM Effects according to firm size around the threshold of 40 separately for *Non-Complier*, *Exact-Complier* and *Over-Complier*. The black line approximates the functional form of the running variable (here with polynomial order fit p=4). *Source:* BsbM and BHP 2004-2010, own calculations.

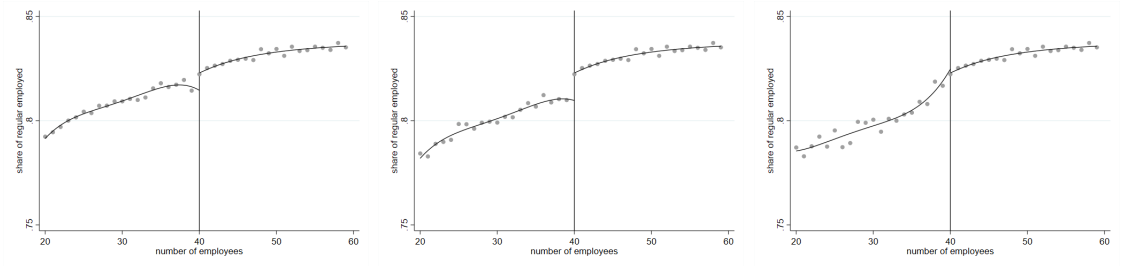
Figure B.6: Firm Growth: Non-Complier, Exact-Complier and Over-Complier



Non-Complier *Exact-Complier* *Over-Complier*

Note: The graph plots the probability of a higher firm size in t+1 according to firm size around the threshold of 40 separately for *Non-Complier*, *Exact-Complier* and *Over-Complier*. The black line approximates the functional form of the running variable (here with polynomial order fit p=4). *Source:* BsbM and BHP 2004-2011, own calculations.

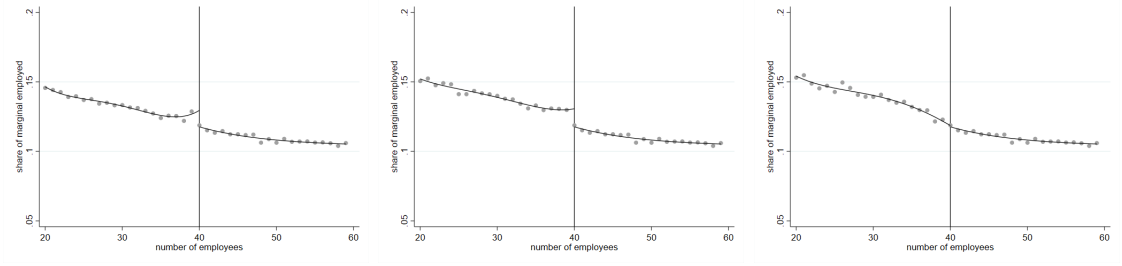
Figure B.7: Share of Regular Employed: Non-Complier, Exact-Complier and Over-Complier



Non-Complier *Exact-Complier* *Over-Complier*

Note: The graph plots the share of regular employed according to firm size around the threshold of 40 separately for *Non-Complier*, *Exact-Complier* and *Over-Complier*. The black line approximates the functional form of the running variable (here with polynomial order fit p=4). *Source:* BsbM and BHP 2004-2011, own calculations.

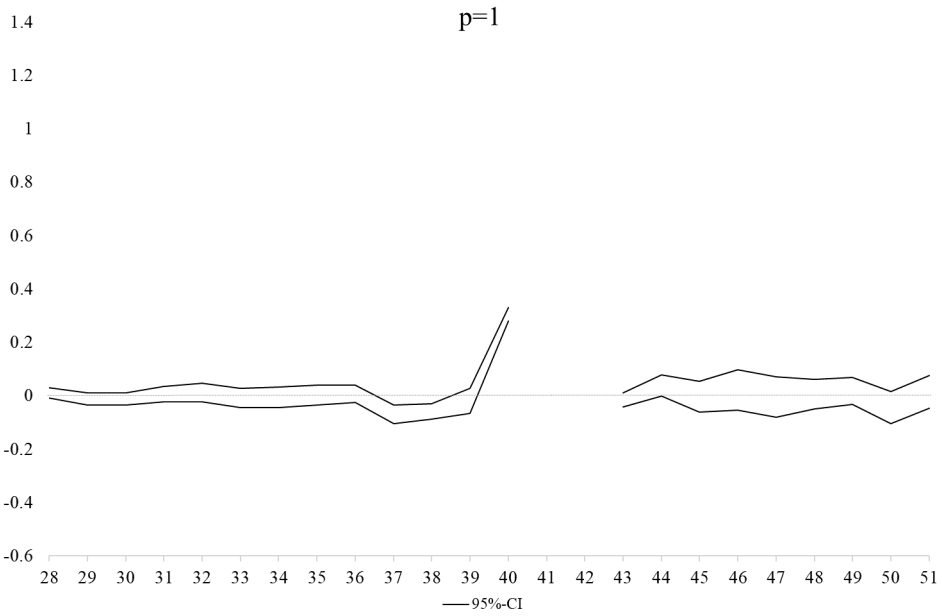
Figure B.8: Share of Marginal Employed: Non-Complier, Exact-Complier and Over-Complier



Non-Complier *Exact-Complier* *Over-Complier*

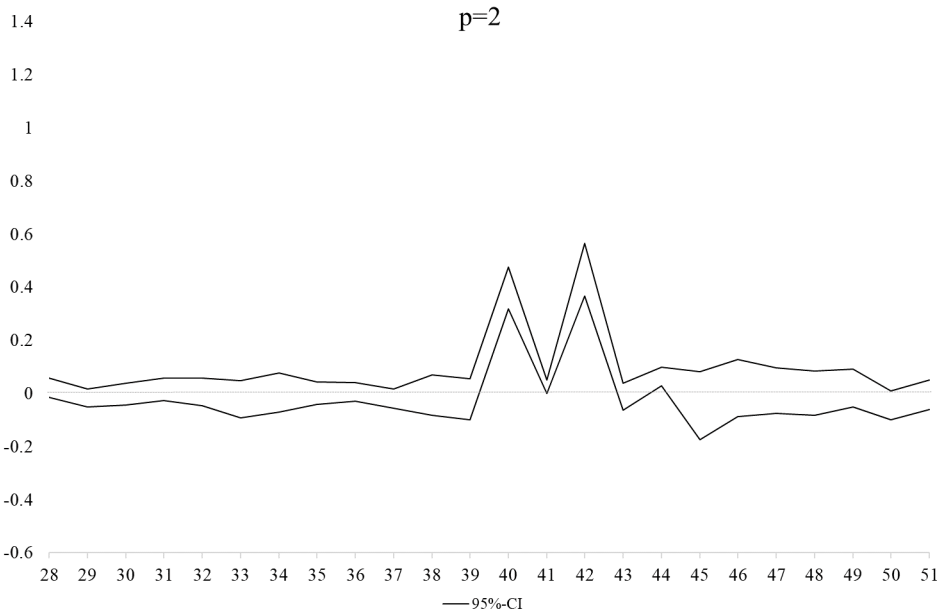
Note: The graph plots the share of marginal employed according to firm size around the threshold of 40 separately for *Non-Complier*, *Exact-Complier* and *Over-Complier*. The black line approximates the functional form of the running variable (here with polynomial order fit p=4). *Source:* BsbM and BHP 2004-2011, own calculations.

Figure B.9: Placebo Thresholds p=1



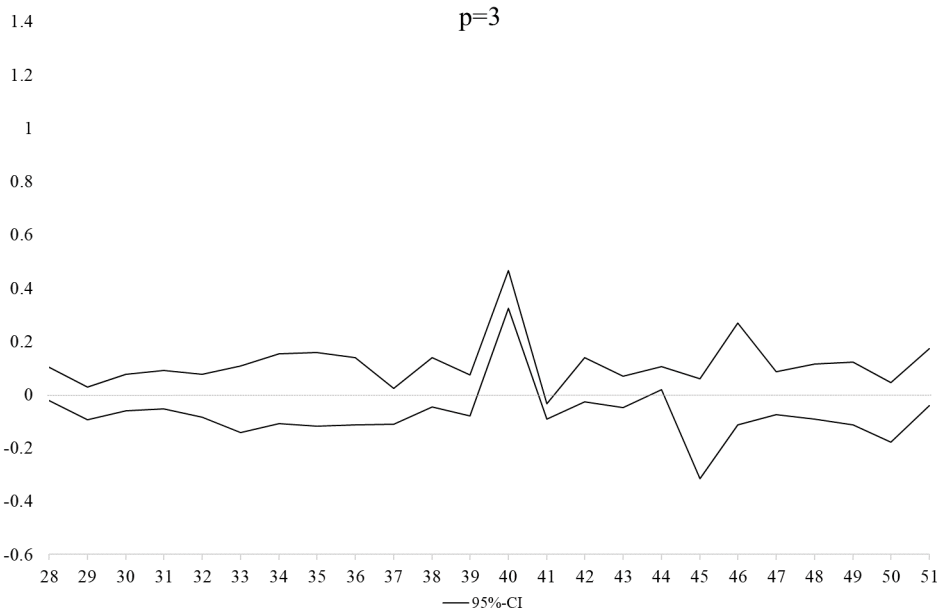
Note: The graph shows the effects of fake (placebo) thresholds on the mean number of disabled workers for p=1 and an optimal bandwidth on each side of the threshold (including predetermined covariates). All thresholds except threshold 40 are placebo thresholds. The 95% confidence interval refers to the robust CI estimated with the *rdrobust*-command in Stata. As the point estimates could be outside the robust CIs, only the interval boundaries are shown. For c=41 and c=42, Stata was not able to perform MSE optimal calculations.
Source: BsbM and BHP 2004-2011, own calculations.

Figure B.10: Placebo Thresholds p=2



Note: The graph shows the effects of fake (placebo) thresholds on the mean number of disabled workers for p=2 and an optimal bandwidth on each side of the threshold (including predetermined covariates). All thresholds except threshold 40 are placebo thresholds. The 95% confidence interval refers to the robust CI estimated with the *rdrobust*-command in Stata. As the point estimates could be outside the robust CIs, only the interval boundaries are shown.
Source: BsbM and BHP 2004-2011, own calculations.

Figure B.11: Placebo Thresholds p=3



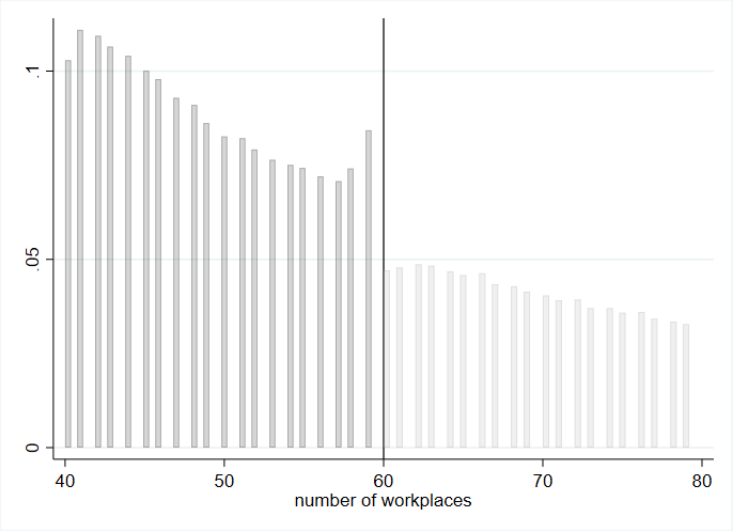
Note: The graph shows the effects of fake (placebo) thresholds on the mean number of disabled workers for p=3 and an optimal bandwidth on each side of the threshold (including predetermined covariates). All thresholds except threshold 40 are placebo thresholds. The 95% confidence interval refers to the robust CI estimated with the *rdrobust*-command in Stata. As the point estimates could be outside the robust CIs, only the interval boundaries are shown.
Source: BsbM and BHP 2004-2011, own calculations.

Table B.3: Cattaneo et al. Estimator Test Statistics - Threshold 60

	T	P > —T—
Robust	-22.5877	0.000
# of Observations	266,486	

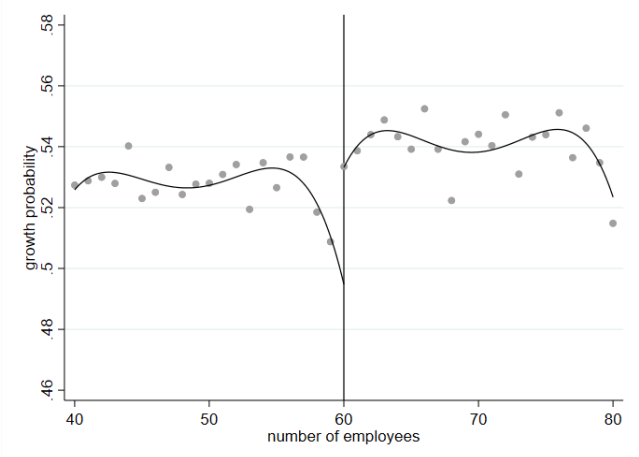
Source: BsbM and BHP 2004-2011, own calculations.

Figure B.12: Firm Size Density at Threshold 60



Note: Histogram of firm size density around the threshold of 60 (h=12).
Source: BsbM and BHP 2004-2011, own calculations.

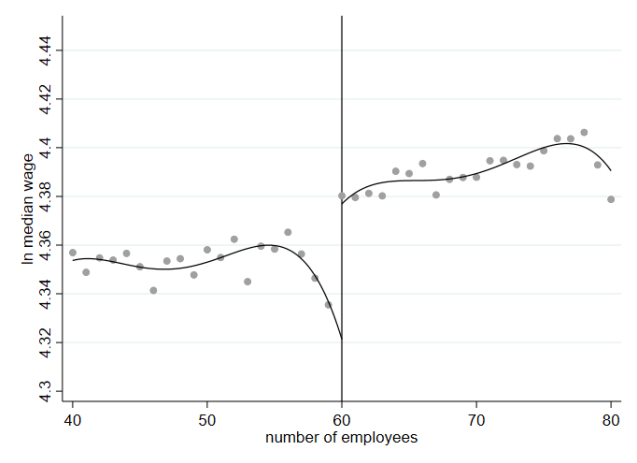
Figure B.13: Firm Dynamics



Growth Probability

Note: The graph plots the probability to grow in t+1 according to firm size around the threshold of 60. The black line approximates the functional form of the running variable (here with polynomial order fit p=4). *Source:* BsbM and BHP 2004-2011, own calculations.

Figure B.14: Median Wages



ln Median Wages

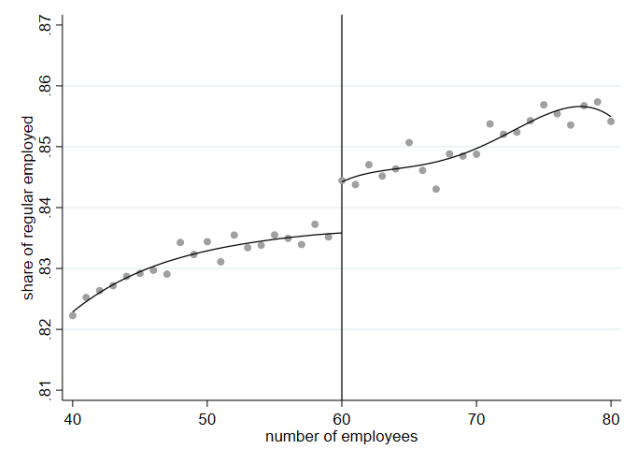
Note: The graph plots the ln of median wages according to firm size around the threshold of 60. The black line approximates the functional form of the running variable (here with polynomial order fit p=4). *Source:* BsbM and BHP 2004-2011, own calculations.

Table B.4: Bunching Behaviour - Threshold 60

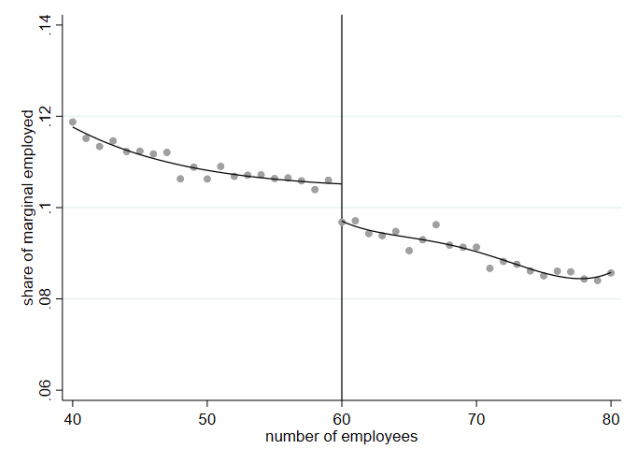
	p = 1	p = 4				
Dependent Variable	Total	Total	Non-Complier	Few-Complier	Exact-Complier	Over-Complier
Sociodem. Structure						
Females	0.001	0.001				
Germans	0.003 *	0.000				
Employment Structure						
Median Wages (ln)	0.050***	0.054	0.094***	0.046	-0.024	0.012
Regular Employed	0.009***	0.012**	0.026*	-0.007	0.039*	0.006
Marginal Employed	-0.009***	-0.015**	-0.033*	-0.008	-0.019	0.001
Apprentices	-0.001	0.000	-0.002	0.007	-0.003	-0.009
Full-Time Worker	0.002	0.008	-0.005	-0.007	0.042	0.023
Part-Time Worker	0.008***	0.002	0.026	0.005	-0.013	-0.018
Skill Structure						
Low-Skilled	-0.007***	-0.007	-0.009	0.000	-0.001	0.008
Medium-Skilled	-0.001	-0.001	0.003	0.005	0.003	-0.005
High-Skilled	0.009***	0.021	0.019	0.017	-0.012	-0.004
Firm Dynamics						
Growth Probability	0.035**	0.031	0.128	0.069*	0.030	-0.315*

Notes: The table shows estimation results of the threshold of 60 employees on alternative outcome variables. *Non-Complier*, *Few-Complier*, *Exact-Complier* and *Over-Complier* are firms below the threshold which employ zero, one, two or more than three disabled worker(s), respectively. All estimations are estimated by using the MSE optimal bandwidth for each side of the threshold. * and *** denote statistical significance at the 10% and 1% level. *Source:* BsbM and BHP 2004-2011, own calculations.

Figure B.15: Regular and Marginal Employment



(A) Share of Regular Employed



(B) Share of Marginal Employed

Note: The graphs plot the (A) share of regular employed and the (B) share of marginal employed according to firm size around the threshold of 60. The black line approximates the functional form of the running variable (here with polynomial order fit p=4). *Source:* BsbM and BHP 2004-2011, own calculations.

Table B.5: Robustness Test Threshold and Bunching Effects

	Threshold 40 - Bunching Effects			
	(1)	(2)	(3)	(4)
Coefficient		-1.376***	-1.578***	-2.056**
Robust CI		[-2.388; -0.593]	[-2.890; -0.519]	[-4.234; -0.139]
Bandwidth h		6.04; 7.26	7.64; 9.22	7.96; 11.18
Polynomial Order p		2	3	4
# of Observations		14	17	19
	Threshold 40 - Threshold Effects			
	(1)	(2)	(3)	(4)
Coefficient	0.303***	0.370***	0.363***	0.407***
Robust CI	[0.265; 0.323]	[0.287; 0.481]	[0.259; 0.482]	[0.328; 0.504]
Bandwidth h	[1.93; 3.08]	3.76; 5.72	5.71; 8.08	9.44; 10.91
Polynomial Order p	1	2	3	4
Covariates included	yes	yes	yes	yes
# of Observations	40,887	75,849	117,395	179,536

Notes: The table shows estimation results of the bunching effects (dependent variable: firm size density in %) and the threshold effects (dependent variable: mean number of disabled workers in a firm for threshold 40) without other services and public administration. Basic covariates include age of firm, regional characteristics (federal state) and industry. ** and *** denote statistical significance at the 5% and 1% level.
Source: BsbM and BHP 2004-2011, own calculations.

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