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The Effect of Subsidizing Continuous Training Investments

Evidence from German Establishment Data

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Katja Görlitz[1]

The Effect of Subsidizing Continuous Training Investments – Evidence from German Establishment Data

Abstract

This paper evaluates the impact of a training voucher program on establishments' investments in further training. The voucher program that was implemented in the German federal state of North Rhine-Westphalia increased training incentives for employees in small and medium-sized establishments by reducing training costs by 50%. The estimation is based on a quasi-experimental research design exploiting variation across time, regions and establishment size. Using establishment data, I find that the share of establishments that invest in training increased by approximately 5 percentage points. Training intensity and the educational structure of participants remained unaffected among those establishments investing in training.

JEL Classification: J24, H25

Keywords: Continuous training, employers, training voucher, subsidies, difference-in-difference

October 2009

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1. Introduction

Demographic change, skill gaps and the depreciation of human capital by technological change might be the reason why further training is on the top of the political agenda in many countries. For instance, European policy makers aim for increasing adults' participation in lifelong learning and for improving the quality of training programs and institutions (Lisbon Strategy, Education and Training 2010 Work Programme). Although it is fairly unexplored whether market failures exist in the training market, political interventions could also be justified on grounds of equity issues by allocating resources to disadvantaged groups. Furthermore, poaching externalities and credit market constraints are seen as likely (Bassanini et al. 2007). There are different ways how politicians can provide training incentives, e.g. by offering training subsidies or tax deductions.[1]

According to human capital theory, the decision to invest in continuous training is determined by comparing the discounted present value of training returns with training costs (Becker 1964). The provision of training subsidies aims to stimulate training by reducing the cost component of the investment decision. However, the effectiveness of such programs is not clear in advance. While financial assistance could increase training investments especially if there is under-provision in the training market, there might be no impact of subsidies on training in the presence of windfall gains, i.e. if they fully substitute private with public spending.

Previous evaluation studies find mixed results on the effect of financial grants on training. This is not surprising because the design and the details of the training programs differ across countries. Holzer et al. (1993) provide evidence that training subsidies increase hours of training in manufacturing firms in the US. Using Irish firm data, Görg and Strobl (2006) find positive effects of government subsidies on training expenditures for domestic plants, while there is no effect in foreign-owned plants. By contrast, Leuven and Oosterbeek (2004) find no direct effect of the introduction of a Dutch tax law reducing training costs for workers over the age of 40. If the design of a program determines its success, gaining insights which programs are most effective helps to improve future programs.

In this paper, I will evaluate the short-term effect of a specific training policy that was implemented in one of the federal states of Germany in January 2006. In particular, the state government of North Rhine-Westphalia (NRW) implemented a training voucher system (*Bildungsscheck*) that reduced direct training costs per course by the substantial amount of 50%. The voucher was targeted to increase training participation of employees working in establishments with fewer than 250 employees. Receiving a voucher was also restricted to employees who did not participate in training in the previous and in the current year. Although the program is not only available for a particular socio-economic group, low qualified workers might still be more likely to obtain a voucher because they are more likely to meet the restriction on no previous participation. Attendance in the program was enormous. In the first 1.5 years almost 140,000 vouchers were issued. Both employees and establishments could obtain vouchers. In this paper, I will concentrate on establishments, i.e. the impact of the voucher on training activities of German establishments will be analyzed.

[1] Another possibility is to impose training levies for non-training firms. Since this study focuses on the effectiveness of programs that subsidize training by co-financing training costs, they will not be investigated any further.

Even though it would be interesting to analyze how individuals' training participation changed, I have no data to answer this question. However, focusing on establishments is interesting as well given the fact that continuous training is mostly financed by firms rather than by employees (Pischke 2001). Therefore, increasing firms' investments in training will also affect training participation of employees.

Using data from the IAB Establishment Panel, I investigate how the NRW voucher affects training activities of establishments operating in the private sector. Training is measured as: (i) the decision to undertake training investments (training incidence), (ii) the fraction of employees participating in training in relation to all employees within establishments investing in training (training intensity), (iii) the fraction of participants with no vocational degree again conditional on training establishments. Three empirical strategies are applied in order to make sure that the results are robust. First, I use a difference-in-difference estimator utilizing variation across time and federal states. Secondly, the same estimator is applied exploiting variation across time and establishment size. Finally, a difference-in-difference-in-difference method is estimated using all of the three dimensions (i.e. temporal, regional and size-specific variation). Since I am using data from 2001 to 2007, I can also test for anticipation effects (Ashenfelter 1978), i.e. whether establishments decreased training the year before the voucher was implemented. The results show that the NRW training voucher increased the proportion of establishments investing in training by approximately 5 percentage points which represents a remarkable increase. Among training establishments, there is no evidence that training intensity and the skill structure of participants were affected. There is no evidence for anticipation effects which is not surprising as the program was announced at short notice.

The paper is organized as follows. The next section presents the voucher program in detail. The data and empirical specification are shown in section 3. Section 4 provides regression results and the last section concludes the study.

2. Background: The Introduction of the Training Voucher

In January 2006, the state government of NRW implemented the training voucher (*Bildungsscheck*) that is co-financed by the European Social Fund (ESF). The voucher reduced training costs by 50% per course up to a maximum of 750 Euro, i.e. the subsidy per voucher was limited to 750 Euro at most. The program represents a sizable training incentive by reducing training costs by a substantial amount. All employees who work in an establishment with fewer than 250 employees, who live in NRW and who did not participate in training during the year of application and the previous year could obtain the voucher.[2] Firms that meet the size requirement and that are located in NRW could also get training vouchers for their workers. Again, they have to assure that these workers did not attend training in the current and previous year. The number of vouchers employees or establishments could receive was unlimited.

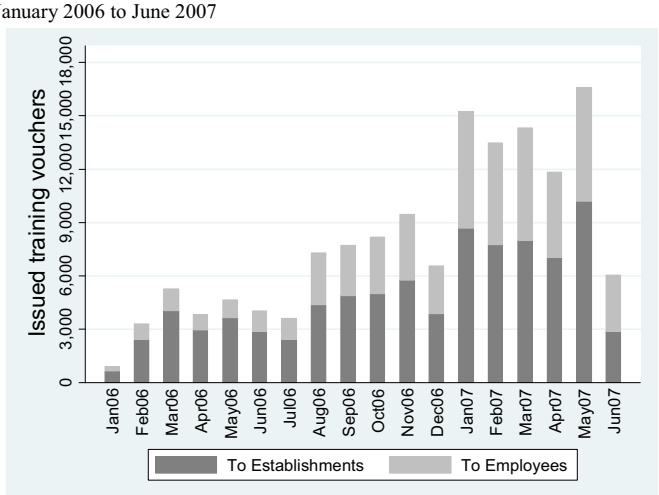
The voucher is issued at information centers which are mainly chambers of commerce and industry or other organizations promoting economic development. These agencies are also responsible for verifying voucher requirements. There are around 200 agencies widely spread throughout NRW**.** Each voucher can be used for a single course only by a single person. The

[2] Some individuals are excluded such as employees working in the public sector or apprentices as well as recipients of unemployment or social welfare benefits.

voucher contains information on the content of training, three potential training institutions and an expiry date. Only work-related courses organized and held by accredited training institutions are subsidized. Establishments can only use the vouchers to cover direct training costs in the form of fees for participation of workers in external training courses, while expenses for internal courses conducted by firm's staff and indirect training expenses (e.g. for releasing employees from work) are not covered by the voucher. The program was announced on January 13, 2006 and introduced just ten days later. There was little information concerning the program in the media beforehand.[3]

Figure 1 depicts the monthly development of vouchers issued by the agencies to establishments and employers. From January 2006 to June 2007, 142,248 vouchers were issued, of whom establishments received more than 60%. The program became increasingly popular during the first 1.5 years after its introduction. While vouchers were already well demanded shortly after introduction, the peak of vouchers issued per month was in the first half of 2007.[4] Not only was there a large demand for these vouchers, but they were also frequently used for training. The average redemption rate of the vouchers issued to establishments was almost 70% in the period under investigation. However, it is questionable whether redeemed vouchers represent merely windfalls because the training investments would have occurred also in the absence of the program. This paper addresses this question, analyzing whether the financial assistance provided by the voucher actually stimulated training investments of German establishments.

Figure 1: Training vouchers issued to employees or establishments from January 2006 to June 2007



Source: BISAM Verwaltungsdaten[5]

[3] For more information on details of the vocher program see Moraal (2007).
[4] The decline in June 2007 is due to tightened entitlement requirements. However, the new regulations are not of importance for this paper as training in the first half of 2007 is examined.
[5] I would like to thank the G.I.B. in NRW for providing me with statistics on the number of issued vouchers from the process data of the voucher program.

3. Data and Empirical Strategy

3.1 Difference-in-Difference Estimator

A difference-in-difference approach (DD) is applied to answer the question whether the introduction of the voucher increased employers' training investments. In general, this approach compares the development of an outcome variable across time between a treatment and a well-defined comparison group. The concrete choice of the comparison group is crucial for the validity of the estimation technique. For the DD estimator, two different treatment-comparison groups are used: First, I exploit the fact that training vouchers were introduced only in the federal state NRW in January 2006. In this case, the DD estimator compares the training development of establishments in NRW across time with the development of other German federal states (in the following referred to as DD1). Second, there is some variation by firm size because only firms with fewer than 250 employees had access to the voucher. The second DD estimator (henceforth referred to as DD2)[6] compares the training development before and after the introduction of the reform between small and large establishments.

(1) When using ***variation across time and regions*** for calculating the DD1, it has to be assumed that training investments of establishments located in NRW would have changed in a similar way as training investments of establishments out of the states used as a comparison group in the absence of the reform. Which of the other states most likely fulfill this assumption and represent therefore an appropriate comparison is not clear-cut a priori. NRW is the largest German state in terms of population and the second largest in terms of area. It is located in West Germany on the Dutch and Belgian border. East German federal states do not represent an appropriate comparison group because training levels and training determinants differ compared to West Germany (Goerlitz 2009). City states are also not taken into consideration because firms' training activities might underlie different mechanisms in areas where firm density is high and poaching externalities might be a more serious problem (Mühlemann and Wolter 2007).

From the seven remaining states, I have compared the pre-reform development of the fraction of establishments that undertake investments in training.[7] A similar development of training incidence across time was found between NRW and the federal states Lower Saxony, Hesse and Baden-Wuerttemberg (see Figure 2 and Figure 3). In these states, training incidence increased between 1997 and 1999, dropped sharply in 2001 and increased again in 2003. Between 2003 and 2005, the tendencies develop differently between the states. However, these differences are not statistically significant from each other causing no estimation problems. In conclusion, Lower Saxony, Hesse and Baden-Wuerttemberg will be used as comparison group. They rank among the West German states with the highest population, area and number of establishments.

Even if training investments evolved similarly within federal states before the reform, contemporaneous shocks might limit the validity of the identification strategy. For

[6] A regression discontinuity design, which is an alternative technique to exploit the variation by firm size for identification, could not be applied additionally because of too low sample sizes in the group of establishments that have exactly 300 employees or just a little more than this threshold.

[7] For ease of exposition, I do not show additionally the development of the other outcome variables, i.e. of training intensity and of the skill structure of participants, because they look fairly similar.

instance, various other training programs were financed within the framework of the ESF on the federal level. However, there seems to be no program comparable to the NRW training voucher in terms of accessibility to a wide range of employees and firms as well as in terms of its demand. Anyway, to check the robustness of the results, I run a variety of sensitivity analyses such as looking at different reference years, applying placebo-tests and using every of the three federal states as comparison in separate regressions.

Figure 2: Pre-reform development of training incidence in NRW and in states used as comparison group; small and medium-sized establishments only

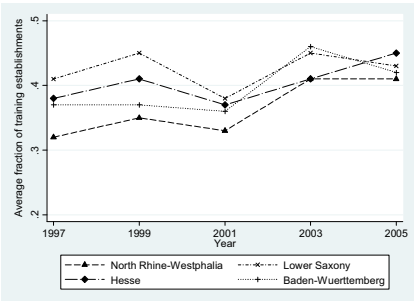
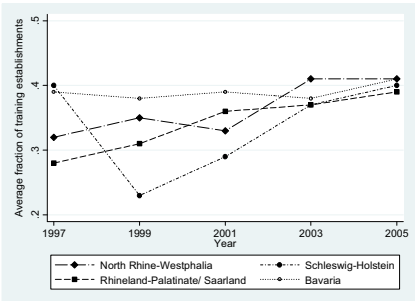


Figure 3: Pre-reform development of training incidence in NRW and in states not used as comparison group; small and medium-sized establishments only



Using the chosen federal states as comparison, the effect is estimated by pooled OLS:

$$Y_{it} = \alpha + t'\gamma_{DD1,t} + \eta_{DD1} NRW_i + \sum_{t}^{T} \delta_{\mathrm{DD1},t}(t * NRW_i) + X_{it}'\beta_{DD1} + \varepsilon_{it} \quad (1)$$

where Y indicates the outcome variable, t is a vector of time dummies (t=01, 03, 05, 07) and NRW is a dummy variable that is 1 if the establishment i is located in NRW and 0 if it is located in Lower Saxony, Hesse or Baden-Wuerttemberg.[8] α is a constant and $\varepsilon_{i,t}$ is an idiosyncratic error term. The outcome variables are measured at the extensive and intensive margin, in particular as a binary variable indicating (i) whether an establishment sponsored training and (ii) as the fraction of trained employees related to all employees (conditional on training investments), respectively. Furthermore, (iii) the skill structure of training participants conditional on investment is also used as an outcome to find out which workers are induced to participate in training by the voucher program.[9] Of course, each of the three outcomes is considered in separate regressions. The vector X contains a set of establishment characteristics that will be introduced in detail in the data section. The vector $\delta_{DD1,t}$ contains time trends of training between NRW and the comparison states, with $\delta_{DD1,07}$ representing the causal effect of the training voucher. If establishments anticipated the reform and postponed training investments (Ashenfelters' Dip), it would

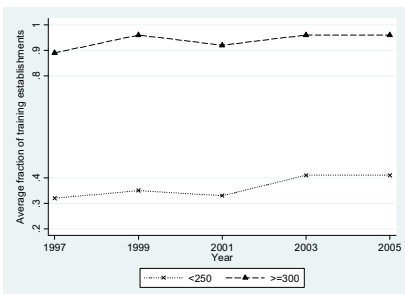
[8] The advantage of including a vector of time dummies (rather than including only one binary variable distinguishing the pre- and post-reform period) is to check directly whether there are also statistically significant effects in other years. If there are indeed significant results, this could point at the existence of contemporaneous shocks that could bias my results.

[9] In the literature, training activities of firms are also measured as training expenditures which is not possible in this paper because this information is not available in the data. For this study, training expenditures might not be the best outcome anyway because it does not show whether the aim of the program of increasing the fraction of training participants is fulfilled or whether the voucher leads to visiting more expensive courses.

be observed that $\delta_{DD1,05} < 0$ is statistically significant. Only establishments with fewer than 250 employees are considered for the analyses.

(2) When ***defining the comparison group by establishment size*** to estimate the DD2, the identification assumption for this estimator requires that training activities would have exhibited the same tendency in small and medium-sized as well as in large establishments, if the voucher had not been introduced. I define small and medium-sized establishments as establishments having fewer than 250 employees and large establishments are defined as those having more than 300 employees.[10] I use the cutoff point of 300 because the information on size refers to the end of June of the previous year in the data. However, voucher applicants must fulfill the size restriction at the time of application. Using more than 250 employees as the comparison group contains therefore the hazard of having treated establishments in the comparison group. Figure 4 contains the time trends in training incidence by establishment size. Although there are extensive differences in the level per year, time trends look fairly similar.

Figure 4: Development of training incidence by establishment size in NRW



The empirical implementation of the DD2, that is also estimated by OLS, is:

$$Y_{it} = \alpha + t'\gamma_{DD2,t} + \eta_{DD2} S_i + \sum_{t}^{T} \delta_{\mathrm{DD2},t}(t * S_i) + X_{it}'\beta_{DD2} + \varepsilon_{it} \qquad (2)$$

where one difference compared to equation (1) is that the variable *NRW* is exchanged by a dummy variable *S* that is set to 1 if establishment size is smaller than 250 and 0 if it is larger than 300. Furthermore, the analysis is restricted to establishments that are located in NRW. The coefficients of interest are now denoted as $\delta_{DD2,07}$ (for the voucher effect) and as $\delta_{DD2,05}$ (for the anticipation effect). Since establishment characteristics are very likely to differ to a large extent between smaller and large establishments, inserting control variables *X* is of particular importance for this specification.

3.2 Difference-in-Difference-in-Difference Estimator

Finally, variation by time, states and size is used to estimate a difference-in-difference-in-difference estimator (henceforth DDD).[11] The DDD estimator is calculated as the difference of the development of training activities before and after the reform between small and

[10] Size is calculated as the number of employees excluding apprentices because the firm size requirement for voucher recipients does not count apprentices either.

[11] For an application of this model see Gruber (1994), Gruber and Poterba (1994), Hamermesh and Trejo (2000).

medium sized establishments located in NRW and small and medium sized establishments located in other states from its counterpart of larger establishments.

The DDD is implemented empirically by the following specification:

$$Y_{it} = \alpha + t'\gamma_{DDD,t} + \eta_{DD1}NRW_i + \eta_{DD2}S_i + \eta_{DDD}(NRW_i * S_i) + \sum_t^T \delta_{DD1,t}(t * NRW_i) + \sum_t^T \delta_{DD2,t}(t * S_i) + \sum_t^T \delta_{\mathrm{DDD},t}(t * NRW_i * S_i) + X_{it}'\beta_{DDD} + \varepsilon_{it} \quad (3)$$

where all variables were already described in equation (1) and (2). Again, three different training outcomes are considered. The causal effect of the program is now $\delta_{DDD,07}$, it is obtained by the third-level interaction of the time dummy for 2007 with the binary variable for NRW and the size dummy. Note that the vector of interactions of NRW with time ($\delta_{DD1,t}$) and the vector of interactions of size with time ($\delta_{DD2,t}$) do no longer contain the causal effect. They need to be introduced, however, to obtain the causal effect $\delta_{DDD,07}$.

Even though the outcome variables are calculated differently (e.g. as binary or fractional variable), estimation is accomplished for each of the three identification strategies by Ordinary Least Squares (OLS). Results of sensitivity analysis using more appropriate estimation techniques are provided as well. In all empirical specifications, standard errors are clustered at the establishment level to take serial correlation into account that is caused by multiple observations of a single establishment across time.

It should be kept in mind that the estimated effect might not only be due to the introduction of the training voucher, but it could also encompass other education or training reforms targeted at small and medium-sized establishments that were implemented in NRW after 2005. However, since the voucher program was substantial in terms of its demand, I will interpret the estimated effect as the causal effect of the voucher in the following. This is because it is very likely that the estimated effect is driven fully or at least to a large extent by the voucher program. Anyway, it should be noted that some part of the effect might also be the result of other reforms.

3.3 Data

The empirical investigation is based on the Establishment Panel that is conducted annually by the Institute for Employment Research (IAB) in Nuremburg.[12] The panel covers the time period from 1993 to 2007 in West Germany and from 1996 to 2007 in East Germany. It is representative of all German establishments having at least one employee in receipt of social security which are approximately 80% of the German workforce. In a regular two-year cycle detailed training questions referring to the last six months are asked. A variable for training incidence is generated indicating whether establishments financed employee training either by covering direct costs of training or by providing training during working hours. Furthermore, establishments indicate how many employees were trained which is used to create a measure of training intensity, i.e. by relating the number of trained employees to the size of the

[12] See Kölling (2000) for a more detailed description of the data.

establishment.[13] The skill structure of participants is analyzed by a variable for low-skilled participants relating the number of participants with no vocational degree to the overall number of participants.[14]

The data contains a variety of establishment characteristics that were used frequently in the literature on the determinants of training (Lynch and Black 1998, Frazis et al. 2000, Zwick 2004). Dummy variables for the provision of apprenticeship training, investments in physical capital (e.g. information technology, logistics, machines and other equipment, real estate), having newest technological equipment and for the existence of a works council and collective wage agreement are introduced in the regression. Furthermore, the share of workers with vocational degree, the fraction of females and part-time employees are included as additional controls. Establishment size is introduced in logarithmic form. Seven 1-digit industry dummies and three dummies indicating whether the establishment is a single firm, an headquarter or a subsidiary of another company are incorporated.

The analysis comprises data from the time period 2001-2007. This restriction was imposed because sample sizes were increased in 2001 allowing representative calculations on the level of federal states. Non-profit organizations and public administrations are excluded from the analysis as their reasons and conditions to train are assumed to differ from private sector establishments. 17,315 year-establishment observations remain for the analysis of whom 5,614 observations belong to NRW. Approximately 82% have small and medium size and 18% are larger than 300 employees. All in all, the sample consists of more than 8,100 establishments. For a definition and description of the variables used in the analysis, see Table A-1 in the Appendix.

4. Results

The impact of training vouchers on training incidence is presented in Table 1. For ease of exposition, no control variables are depicted in the following tables but they are shown in the Appendix in Table A-2. The signs of the control variables are in line with the literature on the determinants of training and will therefore not be discussed in detail.[15] When applying the DD1 and the DD2 estimator, there is a statistically significant increase in training incidence in 2007 compared to 2001 on the amount of 5-6 percentage points. The coefficient on the DDD is not statistically significant, however, the coefficient is positive and has an amount of 3 percentage points. There is no evidence of an anticipation effect because δ_{05} is not statistically significantly negative and the size of the coefficient is close to zero. When applying difference-in-difference methods, running placebo-tests is often used to check the sensitivity of the results. The idea is to find out whether there are also statistically significant results in other years than the year of treatment. Results of such tests can already be identified in Table 1. Comparing 2001 with the placebo year 2003 or 2005 shows no statistically significant results.

[13] This information is not available for all training establishments because establishments have to choose whether they report the number of employees participating in training or the overall number of participants. I use the number of trained employees because more than ¾ of establishments report this information.

[14] I also estimated results for the fraction of high-skilled participants as dependent variable. Since these results are identical to those when using the fraction of low-skilled participants, albeit with opposite sign, I omitted them from the paper. It should be noted, however, that my results are valid for both skill groups.

[15] For a more detailed discussion of the results see e.g. Zwick (2004) or Goerlitz (2009).

Table 1: The effect of the training voucher on training incidence

	DD1[+]		DD2[++]		DDD[+++]	
	Marg. Eff.	Std. Error	Marg. Eff.	Std. Error	Marg. Eff.	Std. Error
$\delta_{DD1,01}$	Reference Year		$\delta_{DD2,01}$	Reference Year	$\delta_{DDD,01}$	Reference Year
$\delta_{DD1,03}$	-0.003	0.020	$\delta_{DD2,03}$	0.009	0.026	$\delta_{DDD,03}$	-0.021	0.030
$\delta_{DD1,05}$	-0.008	0.020	$\delta_{DD2,05}$	0.018	0.026	$\delta_{DDD,05}$	-0.029	0.031
$\delta_{DD1,07}$	0.051 **	0.020	$\delta_{DD2,07}$	0.062 **	0.026	$\delta_{DDD,07}$	0.030	0.032
N	13,534		*N*	5,138		*N*	15,960	
R^2	0.30		R^2	0.35		R^2	0.34	
F-stat	250.82 ***		F-stat	113.92 ***		F-stat	238.97 ***	

Notes: The standard errors are clustered at the establishment level. The control variables are apprenticeship, works council, collective wage agreement, investments in physical capital, the state of the technical equipment and the fraction of females, workers with vocational degree and with part-time contract. Furthermore, size is introduced in logarithmic form and seven dummies for industry and three dummies indicating if the establishment is a single firm, subsidiary or headquarter are incorporated.

Significance level: *** 1%, ** 5%., * 10%. [+] DD-estimates, treatment group: NRW, comparison group: other federal states (Lower Saxony, Hesse and Baden-Wuerttemberg); [++] DD-estimates, treatment group: employer size<250, comparison group: employer size>300; [+++] DDD-estimates using variation in size and across federal states.

As using 2001 as reference category is arbitrary, I also run sensitivity regressions replacing 2001 with 2003. Results when comparing 2007 with 2003 instead of 2001 are shown in Table 2. Each of the three estimation techniques now produce statistically significant results of around 5 percentage points which is why I conclude that my results are robust to using a different reference year. As an additional sensitivity check, Table 3 contains estimation results when comparing NRW separately with each of the three comparison states. Statistically significant results on the amount of 5 to 6 percentage points emerge which reinforces the main results once again.

Table 2: The effect of the training voucher on training incidence, reference year: 2003

	DD1[+]		DD2[++]		DDD[+++]	
	Marg. Eff.	Std. Error	Marg. Eff.	Std. Error	Marg. Eff.	Std. Error
$\delta_{DD1,03}$	Reference Year		$\delta_{DD2,03}$	Reference Year	$\delta_{DDD,03}$	Reference Year	
$\delta_{DD1,05}$	-0.005	0.020	$\delta_{DD2,05}$	0.009	0.025	$\delta_{DDD,05}$	-0.008	0.030
$\delta_{DD1,07}$	0.054 ***	0.020	$\delta_{DD2,07}$	0.051 **	0.025	$\delta_{DDD,07}$	0.052 *	0.031
N	10,446		*N*	3,886		*N*	12,193	
R^2	0.30		R^2	0.34		R^2	0.33	
F-stat	207.77 ***		F-stat	86.7 ***		F-stat	207.8 ***	

Notes: Year 2001 is dropped from the regression. For further details see notes in Table 1.
Significance level: *** 1%, ** 5%., * 10%

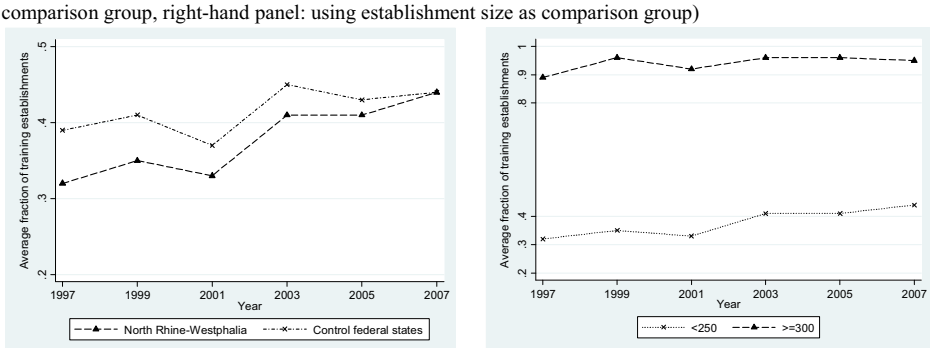
Table 3: Results for training incidence using each state as comparison in separate regressions, DD1 estimation

	Lower Saxony		Hesse		Baden-Wuerttemberg	
	Marg. Eff.	Std. Error	Marg. Eff.	Std. Error	Marg. Eff.	Std. Error
$\delta_{DD1,01}$	Reference Year		Reference Year		Reference Year	
$\delta_{DD1,03}$	0.034	0.026	0.003	0.026	-0.040	0.025
$\delta_{DD1,05}$	0.020	0.026	-0.032	0.027	-0.009	0.025
$\delta_{DD1,07}$	0.056 **	0.026	0.054 ***	0.027	0.046 *	0.026
N	7,378		7,081		7,559	
R^2	0.30		0.30		0.31	
F-stat	141.57 ***		135.8 ***		150.88 ***	

Notes: For further details see notes in Table 1. Significance level: *** 1%, ** 5%., * 10%

Again for reasons of sensitivity, Figure 2 and Figure 3 already presented in Section 3 are depicted once again, now extended by the post-reform year 2007. The development of training incidence by states is contained in Figure 5 (left-hand panel) and it is contained by establishment size in Figure 5 (right-hand panel). Although these figures can only be interpreted in a descriptive manner, they provide some indication that training incidence indeed increased in both establishments located in NRW and in smaller establishments.

Figure 5: Descriptive results in graphical form for training incidence (left-hand panel: using other states as comparison group, right-hand panel: using establishment size as comparison group)



To sum up, all of the three identification strategies yield positive coefficients that are in most cases statistically significant. Training vouchers increased establishments' probability to invest in continuous training on average by 5 percentage points. This represents an increase of 12% when comparing it to the average fraction of training establishments in NRW in 2005 (41%). It should be noted that I cannot distinguish whether this increase reflects that previously non-training establishments are now induced to train or whether establishments train more frequently. This is because training is measured only at the first half of each year, not encompassing all training activities during the year.

To find out which establishments were induced to train by the voucher, I have also estimated heterogeneous effects for the DD1 by establishment size and the fraction of workers with a vocational degree (see Table 4). For establishments having fewer than 50 employees, there is no statistically significant effect while there is a large impact for medium-sized establishments of 7.5 percentage points. This finding is consistent with the fact that establishments with medium size were more likely to be informed about the program compared to establishments with smaller size (Moraal 2007). Separating establishments by the skill level of their workforce shows that the effect is more pronounced when the average

fraction of employees with a vocational degree exceeds 50%. However, the difference is less pronounced.

Table 4: The effect of the training voucher on training incidence, heterogeneous effects

	Establishment size					Percentage of skilled employees			
	0-49		50-250			0-49		50-100	
	Marg. Eff.	Std. Error	Marg. Eff.	Std. Error		Marg. Eff.	Std. Error	Marg. Eff.	Std. Error
$\delta_{DD1,01}$	Reference Year		Reference Year		$\delta_{DD1,01}$	Reference Year		Reference Year	
$\delta_{DD1,03}$	-0.015	0.026	0.021	0.031	$\delta_{DD1,03}$	0.037	0.045	-0.016	0.023
$\delta_{DD1,05}$	-0.012	0.026	-0.007	0.032	$\delta_{DD1,05}$	0.024	0.047	-0.019	0.023
$\delta_{DD1,07}$	0.039	0.026	0.075 **	0.031	$\delta_{DD1,07}$	0.040	0.047	0.050 **	0.023
N	9,527		4,007		*N*	2,673		10,861	
R^2	0.25		0.11		R^2	0.32		0.30	
F-stat	141.26 ***		14.01 ***		F-stat	64.37 ***		185.69 ***	

Notes: For further details see notes in Table 1. Significance level: *** 1%, ** 5%., * 10%

Table 5 reports regression results for training intensity conditional on training establishments (for the full estimation results see Table A-3 in the Appendix). There are no statistically significant effects when using other federal states as a comparison group or applying the DDD method. However, when comparing training intensity of establishments with different sizes in NRW (DD2), a positive and statistically significant coefficient appears. To find out whether this result may represent the causal effect on training intensity, I run a variety of sensitivity checks. When using 2003 as the base category, there are also no statistically significant results at the 5% level. The result also holds when using each of the comparison states in separate regressions. As most of the estimators yield coefficients that are not statistically different from zero, I conclude that there is no impact of the voucher on training intensity. In Table 6, results are shown for the fraction of participants with no vocational degree. Table A-4 in the Appendix contains full regression results including all control variables. None of the three estimation methods suggest that there is any effect of the introduction of the training voucher on the dispersion of participants with respect to their education.

Table 5: The effect of the training voucher on training intensity conditional on the investment decision

	DD1^{+}		DD2^{++}		DDD^{+++}	
	Marg. Eff.	Std. Error	Marg. Eff.	Std. Error	Marg. Eff.	Std. Error
$\delta_{DD1,01}$	Reference Year		$\delta_{DD2,01}$ Reference Year		$\delta_{DDD,01}$ Reference Year	
$\delta_{DD1,03}$	0.031 *	0.017	$\delta_{DD2,03}$ 0.016	0.030	$\delta_{DDD,03}$ 0.030	0.037
$\delta_{DD1,05}$	0.012	0.016	$\delta_{DD2,05}$ 0.035	0.027	$\delta_{DDD,05}$ 0.016	0.034
$\delta_{DD1,07}$	0.015	0.016	$\delta_{DD2,07}$ 0.074 ***	0.028	$\delta_{DDD,07}$ 0.029	0.029
N	7,111		2,624		8,485	
R^2	0.23		0.21		0.22	
F-stat	65.67 ***		21.77 ***		52.26 ***	

Notes: For further details see notes in Table 1. Significance level: *** 1%, ** 5%., * 10%

Table 6: The effect of the training voucher on the share of workers with no vocational degree that participate in training conditional on the investment decision

	DD1+		DD2++		DDD+++	
	Marg. Eff.	Std. Error	Marg. Eff.	Std. Error	Marg. Eff.	Std. Error
$\delta_{DD1,01}$	Reference Year		$\delta_{DD2,01}$	Reference Year	$\delta_{DDD,01}$	Reference Year
$\delta_{DD1,03}$	0.013	0.016	$\delta_{DD2,03}$	0.058 *	0.027	$\delta_{DDD,03}$	0.057 *	0.033
$\delta_{DD1,05}$	0.007	0.015	$\delta_{DD2,05}$	0.032	0.029	$\delta_{DDD,05}$	0.043	0.035
$\delta_{DD1,07}$	0.000	0.014	$\delta_{DD2,07}$	0.017	0.029	$\delta_{DDD,07}$	0.022	0.035
N	7,033			2,572			8,347	
R^2	0.29			0.30			0.28	
F-stat	36.54 ***			17.3 ***			36.6 ***	

Notes: For further details see notes in Table 1. Significance level: *** 1%, ** 5%., * 10%

Some additional sensitivity checks were applied that did not affect the estimation results. First, I deleted large establishments with more than 2000 employees from the sample. Second, I estimated the impact on training incidence with a Probit-model which is the more appropriate model when looking at a binary dependent variable. For ease of exposition, I have generated a dummy-variable differentiating only the pre- and the post-reform period (t_{Reform}) which was interacted with the regional dummy *NRW* (i.e. the results should be equivalent to DD1) and with the size dummy *S* (i.e. the results should be equivalent to DD2). The marginal effects of the interaction terms t_{Reform}*NRW and t_{Reform}*S are calculated as suggested by Norton et al. (2004) to obtain an estimate of the causal effect of the reform. The marginal effects are close to the results already presented. When using other federal states as comparison, the marginal effect is 5 percentage points and it is statistically significant. When using size as the comparison group, the results are not statistically significant but the coefficient has a sign of 4 percentage points which is similar to the previous results.

In conclusion, my results suggest that the voucher introduced in NRW had a positive impact on training incidence, while it has no effect on training intensity and on the fraction of participants with no vocational degree. Several reasons could be suggested for this finding. First, one explanation might be that vouchers represent mere windfalls in training active establishments, i.e. they are used to finance training that would have occurred anyway. Second, those establishments that are induced to offer training by the voucher system might have a lower intensity. In this case, the average training intensity would remain constant, even though there was an increase in the training intensity of establishments that already invested before the voucher was introduced. As the fraction of new establishments is relatively small with about 5 percentage points compared to establishments that trained already in 2005 (41%), this can hardly fully explain my findings.

Third, it might be that participation of employees eligible for training are now preferred to employees not eligible for training in establishments already engaged in training. In this case, the voucher would merely lead to an exchange of participants. This is not corroborated by the evidence, though, since it does not suggest that the educational structure of participants is affected by the voucher. As the voucher can only be used for external training, it might be that internal training or informal training measures are displaced. Unfortunately, distinguishing between these explanations remains a topic for future research because the data set at hand does not allow such an analysis, although it would be of political interest. Fourth, another explanation could be that the training voucher is an instrument particularly attractive to establishments that invested less frequently in training of their workforce. This explanation

also appears reasonable because of the eligibility criteria. Employees were only eligible for the voucher if they did not participate in training in the previous and current year. Therefore, establishments with no or only little training investments the time before the voucher was introduced were more often eligible as well.

5. Conclusion

This paper evaluates the effectiveness of a training policy that was implemented in the German federal state NRW. Using a quasi-experimental research design that exploits variation across time, regions and establishment size, it explores the short-term causal effect of the NRW training voucher program on training investments of establishments. The estimation results suggest that the training voucher increased the fraction of establishments investing in training by approximately 5 percentage points. This could indicate either that training investments occur more frequently due to the voucher program or that the fraction of firms generally willing to invest in training increased, or both. Especially establishments of medium size are induced to invest in training. There is only weak evidence that training intensity and the educational structure of participants within training establishments were affected by the training policy. There is no evidence of an anticipation effect.

From these results, some conclusions can be drawn. The program was not only successful in terms of its demand because more than 140,000 vouchers were issued within the first 1.5 years. Vouchers issued to establishments also increased the share of establishments sponsoring training. Based on these results, introducing this program in other federal states should actually be effective in increasing firms' training investments in the short-run. However, it is important to emphasize that long-run effects are not yet explored. If firms decrease their training investments in consequence of the subsidy and therefore only account for lower training investments in their budget, long-run effects might even be negative especially when the program once ended. Therefore, long-run effects need to be investigated further in future research.

Another interesting topic for future research would be the investigation of the impact on individuals. Using data from a natural field experiment, Messer and Wolter (2009) evaluate the impact of adult education vouchers on training participation of individuals in Switzerland. They show that vouchers actually increased training participation, even though the deadweight loss is high. Training decisions of firms and individuals might differ to a large extent and therefore also the effectiveness of training programs. For instance, the poaching risk is only a problem for firms. In contrast, firms might have better information concerning training returns because they know first about the introduction of new technologies, new machines or organizational change that all might require learning activities.

Estimating the returns of voucher-financed training for establishments is an interesting topic in itself. Returns for establishments are usually measured in terms of productivity increases. Even though it was found that continuous training tends to increase establishment productivity in Germany (Zwick 2006), it is ambiguous whether there is also a positive impact of voucher-sponsored training. No effect would result if vouchers are used for less effective training. It could also represent a selection effect, if firms induced to train by the voucher have lower returns.

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Appendix

Table A-1: Description of variables and sample means

Variables	Description	NRW		Comparison states	
		Obs.	Mean	Obs.	Mean
Training incidence	Dummy is 1 if training investments were undertaken	5,606	0.65	11,690	0.68
Training intensity	Fraction of trained employees to all workers (cond. on train.)	2,858	0.31	6,355	0.31
Low-skilled participants	Fraction of participants with no vocat. degree (cond. on train.)	2,800	0.11	6,254	0.10
Investments in ICT	Dummy is 1 if investments in ICT	5,579	0.55	11,650	0.58
Investments in real estate	Dummy is 1 if investments in real estate	5,579	0.18	11,650	0.19
Investments in machines	Dummy is 1 if investments in machines	5,579	0.50	11,650	0.53
Investments in logistics	Dummy is 1 if investments in logistics	5,579	0.25	11,650	0.26
Excellent state of techn.	Dummy is 1 if technical equipment is excellent	5,584	0.18	11,659	0.18
Apprenticeship	Dummy is 1 if at least one apprentice at establishment	5,614	0.53	11,696	0.53
Work council	Dummy is 1 if work council at establishment	5,465	0.42	11,405	0.40
Collective wage agreement	Dummy is 1 if covered by collective wage agreement	5,610	0.64	11,688	0.60
Fraction skilled workers	Share of workers with vocational degree	5,605	0.72	11,687	0.72
Fraction females	Share of female workers	5,599	0.40	11,682	0.42
Fraction part-time workers	Share of workers with a part-time contract	5,582	0.20	11,646	0.22
Establishment size	Logarithm of size of establishment	5,614	3.68	11,701	3.59
Type of firm					
Separate enterprise	Dummy is 1 if separate enterprise/ single firm	5,544	0.69	11,521	0.67
Headquarter	Dummy is 1 if headquarter	5,544	0.11	11,521	0.12
Subsidiary	Dummy is 1 if subsidiary (or equivalent)	5,544	0.20	11,521	0.21
Industry					
Agriculture & forestry	Dummy: 1 if agriculture & forestry (NACE 1-14, 40/41)	5,614	0.04	11,701	0.04
Manufacturing	Dummy: 1 if manufacturing (NACE 15-37)	5,614	0.28	11,701	0.30
Construction	Dummy: 1 if construction (NACE 45)	5,614	0.08	11,701	0.08
Trade	Dummy: 1 if itrade (NACE 50-52)	5,614	0.17	11,701	0.16
Communic. & information	Dummy: 1 if comm. & inform. transmission (NACE 60-64)	5,614	0.05	11,701	0.04
Banking and insurance	Dummy: 1 if banking and insurance (NACE 65- 67)	5,614	0.04	11,701	0.04
Service sector	Dummy: 1 if service sector (NACE 55, 70-90, 92/93)	5,614	0.34	11,701	0.34

Table A-2: Full estimation results for training incidence

	DD1[+]		DD2[++]		DDD[+++]	
	Marg. Eff.	**Std. Error**	**Marg. Eff.**	**Std. Error**	**Marg. Eff.**	**Std. Error**
Apprenticeship	0.108 ***	0.010	0.109 ***	0.016	0.110 ***	0.009
Work council	0.016	0.012	0.028	0.019	0.034 ***	0.011
Collective wage agreement	0.050 ***	0.009	0.067 ***	0.016	0.047 ***	0.009
Investments in ICT	0.136 ***	0.009	0.127 ***	0.015	0.134 ***	0.009
Investments in real estate	0.009	0.010	0.010	0.014	-0.002	0.008
Investments in machines	0.047 ***	0.009	0.059 ***	0.014	0.048 ***	0.008
Investments in logistics	0.006	0.009	0.030 **	0.013	0.007	0.008
Excellent state of techn.	0.076 ***	0.010	0.051 ***	0.015	0.069 ***	0.008
Fraction skilled workers	0.234 ***	0.016	0.230 ***	0.025	0.196 ***	0.015
Fraction females	0.113 ***	0.018	0.045	0.030	0.106 ***	0.017
Fraction part-time workers	-0.087 ***	0.020	-0.033	0.035	-0.104 ***	0.019
Establishment size	0.111 ***	0.004	0.096 ***	0.007	0.100 ***	0.004
Separate enterprise	-0.113 ***	0.011	-0.083 ***	0.017	-0.107 ***	0.009
Headquarter	-0.127 ***	0.015	-0.079 ***	0.019	-0.107 ***	0.011
Subsidiary	Base Group		Base Group		Base Group	
Industry controls	Yes		Yes		Yes	
NRW	-0.031 **	0.016	---		-0.036 **	0.018
S	---		0.146 ***	0.026	0.141 ***	0.016
*NRW*S*	---		---		0.006	0.024
2001	Base Group		Base Group		Base Group	
2003	0.044 ***	0.011	0.030	0.020	0.015	0.012
2005	0.050 ***	0.011	0.026	0.020	0.013	0.012
2007	0.032 ***	0.012	0.021	0.021	0.007	0.013
$\delta_{DD1,01}$	Base Group		---		Base Group	
$\delta_{DD1,03}$	-0.003	0.020	---		0.017	0.023
$\delta_{DD1,05}$	-0.008	0.020	---		0.019	0.024
$\delta_{DD1,07}$	0.051 **	0.020	---		0.020	0.024
$\delta_{DD2,01}$	---		Base Group		Base Group	
$\delta_{DD2,03}$	---		0.009	0.026	0.031 *	0.017
$\delta_{DD2,05}$	---		0.018	0.026	0.040 **	0.017
$\delta_{DD2,07}$	---		0.062 **	0.026	0.028 *	0.017
$\delta_{DDD,01}$	---		---		Base Group	
$\delta_{DDD,03}$	---		---		-0.021	0.030
$\delta_{DDD,05}$	---		---		-0.029	0.031
$\delta_{DDD,07}$	---		---		0.030	0.032
N	13,534		5,138		15,960	
R^2	0.30		0.35		0.34	
F-stat	250.82 ***		113.92 ***		238.97 ***	

Notes: The standard errors are clustered at the establishment level. The finding that there is a positive coefficient of the dummy variable *S* (indicating smaller establishments) might be confusing at first sight because larger establishments tend to train more frequently as it also confirmed in the variable establishment size. Anyway, using other specifications such as size and a squared term of size does not lead to different results of the causal effect. In addition, omitting the continuous variable on establishment size from the regression does also not affect the main results. In this case, however, the coefficient of *S* is now negative confirming indeed a positive relationship between establishment size and training. Therefore, I conclude that the positive coefficient of *S* is due to some non-linearities in the relationship between size and training and it should, thus, not be interpreted. Significance level: *** 1%, ** 5%., * 10%. [+] DD-estimates, comparison group: other federal states (Lower Saxony, Hesse and Baden-Wuerttemberg); [++] DD-estimates, comparison group: employer size>300; [+++] DDD-estimates using variation in size and across federal states.

Table A-3: Full estimation results for training intensity (conditional on training)

	DD1[+]		DD2[++]		DDD[+++]	
	Marg. Eff.	**Std. Error**	**Marg. Eff.**	**Std. Error**	**Marg. Eff.**	**Std. Error**
Apprenticeship	-0.025 ***	0.007	-0.049 ***	0.013	-0.033 ***	0.007
Work council	0.028 ***	0.009	-0.001	0.016	0.022 ***	0.008
Collective wage agreement	-0.002	0.007	0.000	0.014	-0.001	0.007
Investments in ICT	0.008	0.008	-0.008	0.013	0.008	0.007
Investments in real estate	0.013	0.008	0.009	0.012	0.013 *	0.007
Investments in machines	0.002	0.007	0.028 **	0.011	0.004	0.007
Investments in logistics	0.011	0.007	0.017	0.012	0.010	0.006
Excellent state of techn.	0.040 ***	0.008	0.059 ***	0.013	0.034 ***	0.007
Fraction skilled workers	0.132 ***	0.016	0.117 ***	0.026	0.126 ***	0.014
Fraction females	0.112 ***	0.017	0.067 **	0.027	0.094 ***	0.016
Fraction part-time workers	-0.037 *	0.020	-0.004	0.036	-0.043 **	0.019
Establishment size	-0.070 ***	0.004	-0.057 ***	0.006	-0.067 ***	0.003
Separate enterprise	-0.067 ***	0.010	-0.054 ***	0.015	-0.068 ***	0.008
Headquarter	-0.038 ***	0.013	-0.035 *	0.018	-0.036 ***	0.010
Subsidiary	Base Group		Base Group		Base Group	
Industry controls	Yes		Yes		Yes	
NRW	-0.015	0.012	---		-0.015	0.020
S	---		-0.106 ***	0.023	-0.124 ***	0.015
*NRW*S*	---		---		0.002	0.024
2001	Base Group		Base Group		Base Group	
2003	0.057 ***	0.009	0.067 **	0.026	0.069 ***	0.020
2005	0.043 ***	0.009	0.016	0.024	0.025	0.019
2007	0.051 ***	0.009	-0.012	0.025	0.009	0.020
$\delta_{DD1,01}$	Base Group		---		Base Group	
$\delta_{DD1,03}$	0.031 *	0.017	---		-0.002	0.033
$\delta_{DD1,05}$	0.012	0.016	---		-0.006	0.030
$\delta_{DD1,07}$	0.015	0.016	---		-0.017	0.032
$\delta_{DD2,01}$	---		Base Group		Base Group	
$\delta_{DD2,03}$	---		0.016	0.030	-0.010	0.022
$\delta_{DD2,05}$	---		0.035	0.027	0.020	0.021
$\delta_{DD2,07}$	---		0.074 ***	0.028	0.045 **	0.022
$\delta_{DDD,01}$	---		---		Base Group	
$\delta_{DDD,03}$	---		---		0.030	0.037
$\delta_{DDD,05}$	---		---		0.016	0.034
$\delta_{DDD,07}$	---		---		0.029	0.029
N	7,111		2,624		8,485	
R^2	0.23		0.21		0.22	
F-stat	65.67 ***		21.77 ***		52.26 ***	

Notes: The standard errors are clustered at the establishment level. Significance level: *** 1%, ** 5%., * 10%.

[+] DD-estimates, comparison group: other federal states (Lower Saxony, Hesse and Baden-Wuerttemberg);

[++] DD-estimates, comparison group: employer size>300; [+++] DDD-estimates using variation in size and across federal states.

Table A-4: Full estimation results for participants with no vocational degree (conditional on training)

	DD1[+]		DD2[++]		DDD[+++]	
	Marg. Eff.	**Std. Error**	**Marg. Eff.**	**Std. Error**	**Marg. Eff.**	**Std. Error**
Apprenticeship	-0.052 ***	0.007	-0.069 ***	0.012	-0.051 ***	0.006
Work council	0.005	0.007	0.023 *	0.013	0.003	0.007
Collective wage agreement	-0.005	0.006	-0.005	0.011	-0.006	0.006
Investments in ICT	0.002	0.006	0.005	0.011	0.002	0.006
Investments in real estate	0.006	0.007	-0.002	0.011	0.003	0.006
Investments in machines	0.001	0.006	0.008	0.010	0.001	0.006
Investments in logistics	0.004	0.006	0.010	0.010	0.002	0.006
Excellent state of techn.	-0.009	0.006	-0.016 *	0.009	-0.010 *	0.005
Fraction skilled workers	-0.531 ***	0.019	-0.539 ***	0.029	-0.517 ***	0.017
Fraction females	-0.007	0.013	0.003	0.023	-0.007	0.013
Fraction part-time workers	-0.012	0.017	0.020	0.032	-0.009	0.017
Establishment size	-0.001	0.003	-0.006	0.005	-0.001	0.003
Separate enterprise	-0.005	0.007	-0.012	0.012	-0.009	0.007
Headquarter	-0.004	0.010	0.003	0.017	-0.013 *	0.008
Subsidiary	Base Group		Base Group		Base Group	
Industry controls	Yes		Yes		Yes	
NRW	0.001	0.011	---		0.028	0.021
S	---		-0.055 **	0.022	-0.022	0.015
*NRW*S*	---		---		-0.027	0.024
2001	Base Group		Base Group		Base Group	
2003	0.028 ***	0.009	-0.016	0.023	0.025	0.018
2005	0.009	0.008	-0.015	0.026	0.020	0.018
2007	0.003	0.008	-0.013	0.027	0.007	0.018
$\delta_{DD1,01}$	Base Group		---		Base Group	
$\delta_{DD1,03}$	0.013	0.016	---		-0.043	0.029
$\delta_{DD1,05}$	0.007	0.015	---		-0.037	0.032
$\delta_{DD1,07}$	0.000	0.014	---		-0.023	0.032
$\delta_{DD2,01}$	---		Base Group		Base Group	
$\delta_{DD2,03}$	---		0.058 *	0.027	0.003	0.020
$\delta_{DD2,05}$	---		0.032	0.029	-0.011	0.020
$\delta_{DD2,07}$	---		0.017	0.029	-0.004	0.019
$\delta_{DDD,01}$	---		---		Base Group	
$\delta_{DDD,03}$	---		---		0.057 *	0.033
$\delta_{DDD,05}$	---		---		0.043	0.035
$\delta_{DDD,07}$	---		---		0.022	0.035
N	7,033		2,572		8,347	
R^2	0.29		0.30		0.28	
F-stat	36.54 ***		17.3 ***		36.6 ***	

Notes: The standard errors are clustered at the establishment level. Significance level: *** 1%, ** 5%., * 10%. [+] DD-estimates, comparison group: other federal states (Lower Saxony, Hesse and Baden-Wuerttemberg); [++] DD-estimates, comparison group: employer size>300; [+++] DDD-estimates using variation in size and across federal states.