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Katja Goerlitz

The Development of Employers' Training Investments Over Time

A Decomposition Analysis Using German Establishment Data

#87



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ISSN 1864-4872 (online) ISBN 978-3-86788-098-5 Katja Goerlitz*

The Development of Employers' Training Investments Over Time – A Decomposition Analysis Using German Establishment Data

Abstract

Using establishment data covering the time period 1997 to 2007, this paper investigates trends of employer-sponsored further training in Germany, with a focus on the share of establishments that undertake training investments. I find an increasing trend for West and East German establishments alike. Applying Oaxaca-Blinder decomposition techniques shows that this increase is unrelated to compositional changes of average establishment characteristics. As the characteristics considered in the analysis represent the most commonly used variables in the literature on the determinants of training, this raises some questions for future research.

JEL Classification: J24

Keywords: Continuous training, employers, time trends, decomposition analysis

February 2009

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1. Introduction

Access to and improvement of training are on the top of the political agenda in many countries. For instance, European policy makers aim for increasing adults' participation in life long learning and for improving the quality of training programs and institutions (Lisbon Strategy, Education and Training 2010 Work Programme). A similar target is also declared in the recent Qualification Initiative (*Qualifizierungsinitiative*) designed by the German government. Although it is fairly unexplored whether market failures in the training market exist, political interventions could be justified e.g. on grounds of equity issues or because poaching or other externalities exist. Training issues touch upon the decisions of workers and employers alike, since individuals' training participation seems to be strongly related to their employers' training investments.

It is a well established fact that substantial financial resources are spent by employers for continuous training in the US and Europe (Frazis et al. 2000, Bassanini et al. 2007). This also hold true for Germany. In 2007, firms spent around 27 billion Euros on training (Leske and Werner 2009) and approximately 80% of employees' training is at least co-financed by employers (Pischke 2001). There is only little evidence on the extent of training activities of firms and their underlying sources. Using Swiss data, Schweri and Mueller (2007) explain why the number of firms investing in apprenticeship training declined in the last years. To my knowledge, no comparable study exists for Germany that focuses on continuous training activities and analyzes possible determinants for recent trends.

Using the IAB-Establishment Panel, this paper documents the development of further training activities in German private sector establishments from 1997 to 2007 for West and East Germany. Employers are viewed as active in training when they decide to finance further training of their workforce. Moreover, I ask whether changes in average establishment characteristics might be responsible for the observed training trends. In particular, the characteristics I consider in the analysis are the provision of apprenticeship training, the existence of a work council, coverage by a collective wage agreement, investments into physical capital, the state of the technical equipment, the fraction of skilled, female and part-time employees, the export share, innovations, R&D and organizational change. In contrast to results from other German employer data, I find an upward trend in the average fraction of establishments engaged in training. Applying a Blinder-Oaxaca decomposition shows that this trend can not be explained by changes in the establishment characteristics considered in the analysis. The remainder of this paper is structured as follows. The next section provides an overview of the previous literature. In the third section, the data is described and descriptive statistics on training trends are shown. The fourth section reports the results of a decomposition analysis. In the last section, a discussion of the findings and concluding remarks are contained.

2. Previous Literature

Within the framework of the human capital theory, training is an investment that increases labor productivity (Becker 1964). Two types of training are distinguished that differ in the potential to increase productivity in other firms after a job change. *General training* increases marginal productivity in many firms. *Specific training*, by contrast, is only applicable in the firm where it was acquired. If labor markets are perfectly competitive, cost sharing between employers and employees depends crucially on the type of training. For example, employers have no incentive to invest in general training because they are unable to recoup their training investments if workers are poached by other firms after participating in training. However, the predictions of this theory were found to be at odds with the empirical evidence because firms do invest substantial amounts in general training (Loewenstein and Spletzer 1999, Barron, Berger and Black 1999, Pischke 2001, Booth and Bryan 2007).

The finding that employers sponsor general training is in accordance with the new training literature that assumes labor markets to be imperfect (Katz and Ziderman 1990, Chang and Wang 1996, Acemoglu and Pischke 1998). Labor market imperfections can endow employers with monopsony power which in turn can lead to a compressed wage structure, i.e. trained workers are paid below their marginal productivity. The larger the difference between wages and productivity, the higher are training rents and hence training incentives for employers. However, the empirical literature testing the wage compression theory provides inconclusive results (Bassanini et al. 2007). Other theories predict a relationship between product market competition and training based on different assumptions on labor and product market imperfections and on training type (Stevens 1994, Autor 2001, Gersbach and Schmutzler 2006). Yet empirical results on the effect of product market competition on training are mixed (Bassanini et al. 2007, Goerlitz and Stiebale 2008).

Although there are a variety of different training theories, the major reasons why firms undertake training investment are not yet well understood. Within the large literature on the determinants of training, several correlations between firm characteristics and training were found. For the case of Germany, a number of studies have derived a stable set of results regarding employers' determinants of training incidence using different data sets. The main results from a selected number of papers are summarized in Table 1. Investments in physical capital are positively related to training; especially IT investments were identified as training determinant in a variety of studies. Moreover, a higher standard of technical equipment is associated on average with a higher probability to sponsor training. Product and process innovations also turn out to be positive correlates of training, although the correlations appear to be less robust across different data sets. Furthermore, the existence of a work council, coverage by a collective wage agreement and employer size are positively associated with training. Besides employer characteristics, the average characteristics of the workforce turn out to be important. The share of skilled employees and apprentices is positively associated and the share of part-time employees is negatively associated with training. Less frequently incorporated is information on R&D, export activities (Kuckulenz and Meyer 2006) and organizational change (see Zwick 2004). R&D was found to be positively correlated with training expenditures and organizational change with training incidence. Training determinants found in German data mostly coincide with findings from other countries.1

Determinants of Training	Kuckulenz and Meyer (2006)	Gerlach and Jirhahn (2001)	Zwick (2004)	Bellmann et al. (2001)
Employer characteristics				
Investments in information technology (y/n)	+	not included	+	+
New production technology/ technological				
equipment	not included	+	+	+
Product innovation	0	+	not included	not included
Process innovation	+	0	not included	not included
Work council	not included	+	not included	+
Collective wage agreement	not included	0	+	+
Employee size	+	+	+	+
Employee characteristics				
Share of part-time employees	-	0	not included	not included
Share of skilled employees	+	+	+	+
Share of apprentices	+	+	+	+

	Table 1:	: Determinants	of training	incidence usin	ıg German e	employer data
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Notes: "+" indicates a positive correlation that is statistical significance at the 5% level, "-" indicates a negative correlation, respectively and 0 no statistical significant results. For reasons for comparison, only determinants are incorporated that are contained in least two of the studies. Kuckulenz and Meyer (2006) exploit the MIP, Gerlach and Jirhahn (2001) the Hannover Firm Panel (2001) and Zwick (2004) and Bellmann et al. (2001) use the IAB-Establishment Panel.

¹ For instance, the skill level of the workforce, size (Lynch, Black 1998) and the proportion of part-time workers (Frazis et al. 2000) are positively associated with firms' training activities in the US. There is also evidence of a positive correlation between the introduction of information technology (Bresnahan et al. 2002) and the introduction of high performance work organizations (Osterman 1995). Using British data, there is a positive association between size and high performance workplaces such as teamworking or briefing groups (Whitfield 2000). Moreover, exporting plants and R&D active establishments provide on average more training and undertake higher training expenditures in Ireland (Barry et al. 2004).

3. Data and Summary Statistics

The analysis is based on the IAB-Establishment Panel that is conducted annually by the Institute for Employment Research since 1993 for West Germany and 1996 for East Germany.² The panel is representative for all German establishments having at least one employee who is covered by the social security system. This population corresponds to 80% of the German labor force. Weights are provided in the data that allows me to account for oversampling of large establishments. For a definition and description of the variables used in this paper, see Table A-1 in the Appendix. Most importantly for this paper, the IAB-Establishment Panel contains training information that is collected in a regular two-year cycle since 1993. Establishments are asked whether they have contributed financially to any kind of worker training in the last six months either by sharing direct costs or by releasing employees from work. This information is used to create a binary variable for training incidence.

The data also contains a large set of establishment characteristics. Specifically, it can be distinguished whether the establishment is located in West or East Germany, whether a work council exists and if the company is covered by a collective wage agreement. Additionally, information is available on investments in real capital (e.g. IT- information technology, real estate, machines, logistics) and apprenticeship training. Furthermore, establishments report if the technical equipment is up to date. The export share, i.e. the share of sales generated abroad, is also reported.³ Employee characteristics cover the average skill level of employees and the fraction of female and of part-time workers. There is also information on employer size, industry (at the 1-digit level) and on whether the establishment is an independent firm, a headquarter or a subsidiary. The age of the establishment is introduced in the regression in five categories. All of these variables are available on a yearly basis. Every third year since 1998, the data also contains questions on product innovations (i.e. improved or newly developed products), R&D and the introduction of organizational change such as team-work, reorganization of departments, introducing units with own cost accounting. The reference period for these questions is two years. Comparison and in-

² See Kölling (2000) for a description of the data.

³ Unfortunately, the export share is missing for establishments that do not document their total revenue as business volume but rather as balance sheet total, total premiums paid or budget volume. For instance, this is the case for establishments operating in the banking and insurance sector. Therefore, the results might not be representative for all industries. However, when re-estimated the results without incorporating the export share, results remain virtually unchanged. This is why I conclude that my results are not sensitive to the exclusion of these establishments.

corporation of the variables in a training regression is only possible in 2001 and 2007.

Non-profit organizations and public administrations are excluded from the analysis because they might exhibit distinct training patterns. Because East German establishments are only surveyed since 1996, the main analysis comprises the time period 1997-2007. Including additional control variables is only possible in 2001 and 2007. When using data from 1997 to 2007, there are 43800 observations for West and 29421 observations for East Germany. When using data for 2001 and 2007, 23272 observations are left for West Germany and 19379 observations for the East.

There is a positive time trend in the fraction of establishments engaged in training (Table 2) which increased by roughly 7.6 percentage points in West Germany and by 9.9 percentage points in East Germany between 1997 and 2007. According to the appropriate t-tests the differences in training incidence between West and East Germany are statistical significant at the 5% level in 1999, 2003, 2005 and 2007. Apart from these differences in the training level, the time trends for West and East German establishments exhibit a similar pattern. Both increase substantially from 1997 to 2007, with a temporary trough in 2001. The low training incidence in 2001 might reflect the economic downturn that was starting in the second half of 2001. However, the sparse evidence on the relationship between cyclical trends and training suggests training to be countercyclical (Sepulveda 2004, Bassanini et al. 2007).

		1997	1999	2001	2003	2005	2007
WestGermany	Mean	0.37	0.37	0.36	0.41	0.42	0.44
	Standard D eviation	0.48	0.48	0.48	0.49	0.49	0.50
	O bservation s	3710	3920	8905	9163	9186	8814
East G erm any	Mean	0.38	0.41	0.37	0.44	0.44	0.48
	Standard D eviation	0.49	0.49	0.48	0.50	0.50	0.50
	O bservation s	4008	4519	5048	5159	5176	5492

Table 2: Average fraction of establishments with training investments, weighted results

As shown before, the share of employers undertaking training investments is mostly significantly higher in East Germany which could be due to higher training subsidies, a greater demand for skill upgrading or differences in the kind of training that is sponsored (e.g. formal courses vs. informal learning activities). I find some support for the latter hypothesis. The fraction of establishments sponsoring at least informal training (regardless of whether they also invest in formal training) is much higher in East Germany but there is no severe regional difference in training incidence when focusing on formal training (see Appendix Table A-2). Applying a t-test show that the West-East differences are never statistically significant for formal training but they are significantly different on a 5% level for informal training since 2003. The training trends documented in the IAB-Establishment Panel are different from those observed in other data sets such as the *Continuous Vocational Training Survey* (CVTS) II and III and the *IW Training Survey*. According to the CVTS II and III, the fraction of enterprises (with more than 10 employees) with training investments declined from 75% in 1999 to 70% in 2005 (Egner 2002, Statistisches Bundesamt 2007). A decreasing trend was also found in the IW Training Survey. Compared to 1998, there was a decrease by 2.6% from 99.7% to 97.1% in 2001 (Weiß 2003). In 2004, the share was even lower but remained at this low level in 2007 (Leske and Werner 2009). However, these data sets differ not only in terms of the definition of training and the reference period but also in the sample design and unit of surveying. The IAB-Establishment Panel is representative for all establishments having at least one employee covered by social security.

Panel A: Comparison of variables b	etwe en 19	97 and 20	007						
		West	Germany			East	Germany		
	1997	2007	$\Delta_{07,97}$	t -va lue	1997	2007	$\Delta_{07,97}$	t -value	
Apprenticeship	0.25	0.25	0.00	0.25	0.23	0.20	-0.04	2.96 ***	
Work council	0.09	0.07	-0.02	3.07 ***	0.07	0.07	-0.001	0.19	
Collective wage agreem ent	0.59	0.37	-0.22	13.7 ***	0.41	0.23	-0.19	11.45 ***	
Investments in IT	0.31	0.35	0.04	2.78 ***	0.32	0.29	-0.03	1.90	
In vestments in real estate	0.09	0.07	-0.02	2.04 **	0.13	0.08	-0.06	5.40 ***	
Investments in machines	0.34	0.33	-0.01	0.37	0.37	0.30	-0.07	4.32 ***	
Investments in transport system s	0.18	0.18	-0.004	0.33	0.20	0.16	-0.04	2.97 ***	
Excellent state of techn.equipm.	0.22	0.18	-0.04	3.07 ***	0.22	0.16	-0.05	3.90 ***	
Fraction of skilled em ployees	0.69	0.77	0.08	8.82 ***	0.80	0.87	0.08	8.25 ***	
Fraction of female employees	0.47	0.47	0.00	0.08	0.46	0.46	-0.004	0.37	
Fraction of part-time employees	0.25	0.29	0.04	4.35 ***	0.15	0.21	0.06	6.79 ***	
Export share (in percent)	2.65	3.46	0.81	2.11 **	0.85	1.95	1.10	4.43 ***	
Log employee size	1.84	1.83	-0.01	0.50	1.69	1.69	-0.003	0.10	
Panel B: Comparison of selected va	riables be	tween 20	01 and 2	007					
		West	Germany			East	Germany		
	2001	2007	$\Delta_{07.01}$	t -va lue	2001	2007	$\Delta_{07,01}$	t -value	
Product inn ovation	0.28	0.40	0.13	9.95 ***	0.29	0.36	0.07	4.54 ***	
R&D	0.05	0.05	-0.004	0.66	0.03	0.05	0.02	2.67 ***	
R&D in other parts of the enterprise	0.01	0.01	0.00	0.43	0.01	0.01	-0.01	1.87	
Organizational change	0.30	0.33	0.04	3.07 ***	0.31	0.37	0.06	3.37 ***	

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<u>Notes</u>: The t-test for independent samples is used. Significance level: *** 1%, ** 5%. – Although these samples are not exclusively independent due to the panel design of the data, looking at a long time period (in this case of ten/six years) is regarded as being associated with less strong dependence. In addition, using a paired t-test would lead to considerable data reduction and it would ignore that changes in the composition of firm characteristics could also be driven by newly established firms.

Table 3 documents how important establishment characteristics have changed over time. Panel A documents changes of key establishment characteristics over the last decade. The fraction of establishments that set wages based on collective wage agreements and that invest in real estate declined in West and East Germany. In West Germany, the percentage of establishments with work councils decreased. In East Germany, the proportion of employers that offer apprenticeship training decreased. The share of skilled and part-time workers as well as the export share increased in both parts of Germany. For establishment characteristics which are only available in the survey in 2001 and 2007, time trends are shown in Panel B. The proportion of establishments with innovations and with organizational change increased significantly. East German establishment also display increased R&D activity. Thus, it is important to consider compositional changes of establishment characteristics when explaining the positive training trend.

4. Explaining the Trend: A Decomposition Analysis

Since both training incidence and establishment characteristics vary substantially over time, only a multivariate analysis can tell whether the positive training trends should mainly be attributed to changes in establishment characteristics. To this end, I provide first of all some time trends conditional on establishment characteristics. Therefore, a pooled Probit model is estimated:

$$P(Y_{irt} = 1 | x_{irt}, T_{irt}) = \Phi(x_{irt}\beta_r + \delta_r T_{irt})$$
(1)

where Y is a binary variable capturing training incidence, the vector x comprises the relevant establishment characteristics and a vector T collects all time dummy variables. Establishments are indicated by *i*, *t* represents the time period (t = 97,99,01,03,05,07) and *r* the region (r=West,East). $\Phi(.)$ denotes the cumulative density function of the standard normal distribution. The establishment characteristics included in the vector x were already described in the previous section.

The results are documented in Table 4.4 All in all, the results confirm previous findings for Germany (see e.g. Kuckulenz and Meyer 2006, Hempell 2003, Gerlach and Jirhahn 2001, Zwick 2004). Although the magnitude and significance of the marginal effects differ between West and East Germany, the sign of the coefficients is similar in general. Having at least one apprentice is positively correlated with training investments. On average, establishments with a collective wage agreement tend to be more likely to invest in continuous training. Establishments' investment activity in real capital and an excellent state of technical equipment are in most instances positively associated with training. I also find highly significant positive coefficients for the shares of skilled workers and for the fraction of females. In West Germany, the share of part-time employees has a negative marginal effect. There is no statistical significant result for the export share. The estimates suggest that the propensity to undertake training investments increases with establishment size. For ease of exposition, coefficients of the type of the firm, age and industry dummies are not presented in the table. On average, independent firms and headquarters display a lower training

⁴ A Chow-test supports the assumption that training determinants differ between West and East establishments which justifies running separate regressions by region. The null hypothesis of no differences between the two regions is rejected at a significance level of 1% (F(31, 28189)=2.11).

probability. The marginal effect of age is only statistically significant in East Germany where younger establishment tend to undertake lower training investments compared to establishments that are older than five years.

The estimated coefficients of the year dummies for 2003, 2005 and 2007 are statistically significant for both East and West Germany, even though the Probit regressions control for a comprehensive set of establishment characteristics. Compared to 1997, the share of establishments providing training in West Germany is 5 percentage points higher in 2003, 6 percentage points higher in 2005 and 8 percentage points higher in 2007. In East Germany, the difference is 8 percentage points in 2003, 9 percentage points in 2005 and even 13 percentage points in 2007. These differences are even more accentuated than in the comparison of raw means (Table 2).

Table 4: Marginal effects	of the propensity	to invest in wor	rker training, ful	l sample: 1997-2007,
weighted estimates				

	Training incidence							
Establishment characteristics	West	Germany	East Germany					
	Marg.Eff.	Std. Err.	Marg.Eff.	Std.Err.				
App rentices hip training	0.21 ***	0.014	0.17 ***	0.016				
Work council	0.02	0.021	0.0 2	0.031				
Collective wage agreement	0.08 ***	0.013	0.09 ***	0.016				
Investments in IT	0.17 ***	0.012	0.18 ***	0.015				
Investments in real estate	0.02	0.021	0.07 ***	0.022				
Investments in machines	0.06 ***	0.013	0.06 ***	0.015				
Investments in transport systems	0.03	0.014	0.0 2	0.017				
Excellent state of techn.equipm.	0.10 ***	0.015	0.08 ***	0.019				
Fraction of skilled employees	0.37 ***	0.023	0.30 ***	0.033				
Fraction of female employees	0.11 ***	0.023	0.14 ***	0.027				
Fraction of part-tim e employees	-0.05 **	0.025	-0.04	0.033				
Export share	0.00	0.000	0.0 0	0.001				
Log employee size	0.13 ***	• 0.006	0.1 1 ***	8 00.0				
1997	Bas	e Group						
1999	-0.01	0.020	0.06 **	0.023				
2001	-0.01	0.019	-0.0 1	0.022				
2003	0.05 **	0.019	0.08 ***	0.022				
2005	0.06 ***	0.019	0.09 ***	0.021				
2007	0.08 ***	0.019	0.13 ***	0.021				
Controls for type of firm , age and industry		Yes	Y	es				
Observations	3	34966	2 46	696				
Log-pseudolikelihood	- 18	36 58.61	-1417	71.64				
Pseudo R ²		0.19	0.	15				

<u>Notes</u>: A Probit regression was used for estimation. The dependent variable represents a binary variable whether the establishment financed further training. Marginal effects are estimated at the vector of mean characteristics. Standard errors are clustered at the establishment level. Type of firm indicates whether a single firm, headquarter or subsidiary is observed. Significance level: *** 1%, ** 5%.

Table 5 documents the results that emerge in Probit regressions incorporating additional control variables, with only the 2001 and 2007 survey waves serving as the data base. Both the sign and in most instances also the significance of the coefficients are similar to the results presented above. Product innovation and organizational change is significantly correlated with training in West and East Germany alike. Conducting R&D at the establishment level or at other parts of the enterprise tends to be associated with higher training investments in West German establishments. As before, the year dummy for 2007 exhibits a positive sign after controlling for an even larger set of establishment characteristics.

	Training incidence							
Establishment characteristics	Wes	t Germ	nany	East Ge	ermany			
	Marg. Eff	í. S	td. Err.	Marg. Eff.	Std.Err.			
Apprentiœship training	0.20 **	**	0.020	0.17 ***	0.026			
Work council Collective wage a greement	0.03 0.08 **	k#	0.033 0.017	-0.02 0.11 ***	0.039 0.024			
Investments in IT Investments in real estate Investments in machines Investments in transport systems Excellent state of techn. equipm.	0.14 ** 0.00 0.05 ** 0.06 ** 0.08 **	⊧* ⊧ **	0.019 0.030 0.019 0.022 0.022	0.15 *** 0.04 0.07 *** 0.05 0.08 ***	0.024 0.036 0.023 0.027 0.029			
Fraction of skilled employees Fraction of female employees Fraction of part-time employees	0.39 ** 0.14 ** -0.03	r#	0.034 0.031 0.037	0.29 *** 0.13 *** 0.00	0.056 0.038 0.048			
Export share	0.00		0.001	0.00	0.001			
Log employee size	0.11 **	**	0.010	0.11 ***	0.011			
Product inn ovation	0.10 **	**	0.019	0.12 ***	0.023			
R&D R&D in other parts of the enterprise No R&D activity	0.10 ** 0.17 ** Ba	, se Gro	0.042 0.074 oup	0.07 0.07 Base	0.050 0.104 Group			
Organizational change	0.12 **	**	0.019	0.06 ***	0.022			
2001 2007	Ba 0.07 **	se Gro	up 0.016	0.12 ***	0.019			
Controls for type of firm, age and industry		Yes		Ye	es			
Observations Log-pseudolkelhood Pseudo R ²	-7	14033 7246.1 0.22	33 8854 .16 -4909.77 2 0.18					

Table 5: Marginal effects of the propensity to invest in worker training, 2001 and 2007, weighted estimates

Notes: See notes in Table 4. Significance level: *** 1%, ** 5%.

To provide a more comprehensive analysis of the role of observable establishment characteristics, I also estimate a less parsimonious variant of the multivariate model which allows all coefficients to differ across survey waves, not just the intercept. Building on this more general model variant, I then conduct a decomposition analysis. Decomposition analyses can disentangle to which extent differences between two groups can be ascribed to either observable characteristics or estimated coefficients (Blinder 1973, Oaxaca 1973). For this application, differences in training investments between 1997 and 2007 are separated into a characteristics effect, i.e. a part explained by changes in those establishment characteristics considered in the analysis and into a coefficients effect, i.e. a part that is explained by changing coefficients.⁵ As training incidence is a binary variable, a Blinder-Oaxaca decomposition for non-linear models has to be used (Fairlie 2003, Bauer and Sinning 2008). The decomposition is implemented as:

$$\hat{P}(Y_{r07}) - \hat{P}(Y_{r97}) = \left[\sum_{i=1}^{N_{eff}} p_{ir07} \Phi(x_{ir07}, \hat{\beta}_{r07}) - \sum_{i=1}^{N_{eff}} p_{ir97} \Phi(x_{ir97}, \hat{\beta}_{r07})\right] + \left[\sum_{i=1}^{N_{eff}} p_{ir97} \Phi(x_{ir97}, \hat{\beta}_{r07}) - \sum_{i=1}^{N_{eff}} p_{ir97} \Phi(x_{ir97}, \hat{\beta}_{r07})\right]$$
(2)

or, alternatively, as

$$\hat{P}(Y_{r07}) - \hat{P}(Y_{r97}) = \left[\sum_{i=1}^{N_{r07}} p_{\mu 07} \Phi(x_{\mu 07}, \hat{\beta}_{r97}) - \sum_{i=1}^{N_{r07}} p_{\mu 97} \Phi(x_{\mu 97}, \hat{\beta}_{r97})\right] + \left[\sum_{i=1}^{N_{r07}} p_{\mu 07} \Phi(x_{\mu 07}, \hat{\beta}_{r07}) - \sum_{i=1}^{N_{r07}} p_{\mu 07} \Phi(x_{\mu 07}, \hat{\beta}_{r97})\right]$$
(3)

where N_{rt} represents the size of the sample in t=97,07 and $p_{trt} = w_{trt} \sum_{i=1}^{N_{rt}} w_{trt}$ is the

establishment-specific weight (w_{irt}) related to the overall number of establishments per region *r* in time *t*. See Sinning, Hahn and Bauer (2008) for details on how the estimation is accomplished.

In expressions (2) and (3), respectively, the first term in brackets is the characteristic effect and the second term represents differences in estimated coefficients. Equations (2) and (3) only differ in terms of which year is used to create the counterfactual, i.e. the combination of the coefficients of 2007 and the characteristics of 1997 or of the coefficients of 1997 and the characteristics of 2007, respectively. Following Fitzenberger et al. (2006), I will provide estimates of both decompositions as a sensitivity check.

The decomposition results are depicted in Table 6.⁶ These results are in concordance with the previous findings based on the Probit results. The establishment characteristics cannot account for the increase of training incidence, regardless which counterfactual is used. A similar result emerges when comparing 2001 with 2007 and incorporating additional controls, specifically innovations, R&D and organizational changes (see Table 7). The coefficients effect could reflect many underlying sources, e.g. changes in the preferences for training or in the experiences with training. However, it would also capture any changes in determinants that are left out of the analysis due to data limitations, for instance the stock and use of new technologies or the attitude of the workforce towards further training.

⁵ Of course, trends in other years could be compared as well. However, I will follow Fitzenberger et al. (2006) and report only results for one period (1997 versus 2007) in order to maintain clarity.

⁶ The mean and the predicted value of training incidence are compared as a sensitivity check separately for West and East Germany. It can be shown that the values are very similar in magnitude (see Figure A-1 in the Appendix).

Table 6: Decomposition results (1997/ 2007)

Characteristics of 1997 are		Characteristics of 2007 are		
combined with coefficients of 2007*		_combined with coefficients of 19		
West Germany	East Germany	WestGermany	East Germany	
0.076 ***	0.091 ***	0.076 ***	0.091 ***	
(0.017)	(0.018)	(0.017)	(0.018)	
0.018	-0.010	0.006	-0.019	
(0.010)	(0.011)	(0.012)	(0.012)	
23.8	-10.9	8.0	-20.7	
0.058 ***	0.101 ***	0.070 ***	0.110 ***	
(0.016)	(0.018)	(0.017)	(0.019)	
	Characteristic combined with co West Germany 0.076 *** (0.017) 0.018 (0.010) 23.8 0.058 *** (0.016) 76.2	Characteristics of 1997 are combined with coefficients of 2007* West Germany East Germany 0.076 *** 0.091 *** (0.017) (0.018) 0.018 -0.010 (0.010) (0.011) 23.8 -10.9 0.058 *** 0.101 *** (0.016) (0.018) 76.2 110.9	Characteristics of 1997 are combined with coefficients of 2007* Characteristic combined with coefficients of 2007* West Germany East Germany West Germany 0.076 *** 0.091 *** 0.076 *** (0.017) (0.018) (0.017) 0.010 (0.011) 0.006 (0.010) (0.011) 0.012 23.8 -10.9 8.0 0.058 *** 0.101 *** 0.070 *** (0.016) (0.018) (0.017) 76.2 110.9 92.0	

Notes: Bootstrapped standard errors with 1000 repetitions are shown in parentheses. * The calculation is based on equation 2 and ** on equation 3. Significance level: *** 1%, ** 5%.

Table 7: Decomposition results considering innovation, R&D and organizational change (2001/2007)

	Characteristic combined with co	cs of 2001 are efficients of 2007*	C haracteristics of 2007 are _combined with coefficients of 2007			
	West Germany	East Germany	WestGermany	East Germany		
Change	0.077 *** (0.014)	0.110 *** (0.018)	0.077 *** (0.014)	0.110 *** (0.018)		
Characteristics effect	0.019 ** (0.008)	0.008 (0.010)	0.017 (0.009)	0.008		
in %	24.8	7.6	21.9	7.4		
Coefficients effect	0.058 ***	0.102 ***	0.060 ***	0.102 ***		
in %	75.2	92.4	78.1	92.6		

<u>Notes</u>: Bootstrapped standard errors with 1000 repetitions are shown in parentheses. * The calculation is based on equation 2 and ** on equation 3. Significance level: *** 1%, ** 5%.

5. Conclusion

Using the IAB-Establishment Panel, this paper investigates how the fraction of establishments investing in training developed between 1997 and 2007 in the German private sector. Furthermore, it asks whether changes in establishment characteristics can account for recent training trends. The results indicate that the proportion of establishments investing in continuous training increased by approximately 8 percentage points in West Germany and by around 10 percentage points in East Germany. Applying decomposition techniques shows that the rising tendency found in the IAB panel cannot be explained by compositional changes of those characteristics that represent the standard covariates in the literature of the training determinants. To the extent that collective wage agreements represent employers' monoposony power (see e.g. Dustmann, Schönberg 2004), there is no evidence that the wage compression hypothesis is responsible for increasing training investments. A similar interpretation also holds for the introduction of technological and organizational change. Rising the share of skilled workers, ex-

ports and R&D do not seem to be responsible either. Finally, an increasing trend was also found for establishments of different size and industry.

While the statement is undisputed that, in terms of this study, the coefficients effect accounts for recent training trends, a topic for future research should be to explore the importance of other factors as determinants of training. Yet fairly unexplored are several alternative candidate determinants such as demographic factors, skill shortages or product market competition. It will be even more difficult to account for strategic aspects of managerial decision making and unobservable worker and firm characteristics. In addition, there is also little evidence on how the balance between firmspecific and general training tends to shift as a reaction to new technologies or reorganizations.

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Appendix





Table A-1: Variable description and sample means (1997-2007)

Variables	Description	WestG	iermanv	East Germany	
		Obs.	Mean	Obs.	Mean
Training	Dummy: 1 if establishment invest in training, 0 else	43698	0.64	29402	0.60
Apprenticeship training	Dummy: 1 if at least one apprentice at establishment, 0 else	43785	0.51	29416	0.46
Work council	Dummy: 1 if work council exists, 0 else	42513	0.37	28839	0.28
Collective wage agreement	Dummy: 1 if covered by collective wage agreement, 0 else	43676	0.60	29348	0.43
Investments in IT	Dummy: 1 if investments in information technologies, 0 else	43546	0.55	29297	0.46
Investments in real estate	Dummy: 1 if investments in real estate, 0 else	43546	0.18	29297	0.19
Investments in machines	Dummy: 1 if investments in machines, 0 else	43546	0.49	29297	0.47
Investments in transport systems	Dummy: 1 if investments in logistic or transport systems, 0 else	43546	0.25	29297	0.25
Excellent state of techn. equipm.	Dummy: 1 if technical equipment is up to date, 0 else	43523	0.19	29318	0.18
Fraction of skilled employees	Share of workers holding an apprenticeship or university degree	43606	0.72	29302	0.82
Fraction of female employees	Share of female employees	43679	0.42	29400	0.40
Fraction of part-time employees	Share of employees working part-time	43462	0.21	29302	0.14
Export share (in percent)	Share of sales with exports (in percent)	37210	8.69	25678	4.24
Log employee size	Logarithm of the number of employees	43800	3.50	29421	3.09
Productinnovation	Dummy: 1 if (improved or new) product innovation, 0 else	22978	0.51	19249	0.49
R&D	Dummy: 1 if R&D is conducted in the establishment, 0 no R&D	23090	0.14	19300	0.13
R&D in other parts of the enterprise	Dummy: 1 if R&D in other parts of the firm 0 no R&D	23090	0.03	19300	0.03
Organizational change	Dummy: 1 if organizational change introduced, 0 else	22999	0.52	19167	0.49
1997	Dummy: 1 if year is 1997. 0 else	43800	0.08	29421	0.14
1999	Dummy: 1 if year is 1999. 0 else	43800	0.09	29421	0.15
2001	Dummy: 1 if year is 2001. 0 else	43800	0.20	29421	0.17
2003	Dummy: 1 if year is 2003, 0 else	43800	0.21	29421	0.18
2005	Dummy: 1 if year is 2005, 0 else	43800	0.21	29421	0.18
2007	Dummy: 1 if year is 2007, 0 else	43800	0.20	29421	0.19
Type of firm					
Separate enterprise	Dummy is 1 if separate enterprise/ single firm, 0 else	42886	0.69	29086	0.78
Headquarter	Dummy is 1 if headquarter, 0 else	42886	0.11	29086	0.05
Subsidiary	Dummy is 1 if subsidiary (or equivalent), 0 el se	42886	0.20	29086	0.17
Control variables for age of the establish	ment				
Age: 1 year	Dummy: 1 if establishment is younger than 1 year, 0 else	43800	0.01	29421	0.02
Age: 2 years	Dummy: 1 if establishment is 1-2 years old, 0 else	43800	0.03	29421	0.03
Age: 3 years	Dummy: 1 if establishment is 2-3 years old, 0 else	43800	0.03	29421	0.04
Age: 4 years	Dummy: 1 if establishment is 3-4 years old, 0 else	43800	0.02	29421	0.04
Age: more than 5 years	Dummy: 1 if establishment is 5 and more years old, 0 else	43800	0.91	29421	0.87
Industry					
Agriculture & forestry	Dummy: 1 IT industry is agriculture & forestry (NACE 1-14, 40/41)	43800	0.04	29421	0.06
Manutacturing	Dummy: 1 if industry ismanutacturing (NACE 15-37)	43800	0.26	29421	0.32
Construction	Lummy: 1 IT industry is construction (NACE 45)	43800	0.09	29421	0.12
Irade	Dummy: 1 if industry istrade (NACE 50-52)	43800	0.16	29421	0.12
Communication & information	Lummy: 1 if industry is comm. & inform transmission (NACE60-64)	43800	0.05	29421	0.04
Banking and insurance	Durniny, Thi industry is parking and insulance (NACE 65- 67)	43800	0.04	29421	0.02
Service sector	Lummy: Thindustry is service sector (NACE 55, 70-90, 92/93)	43800	0.36	29421	0.32

<u>Notes</u>: Information on innovation, R&D and organizational change is only available in 2001 and 2007. The export share is only available for establishments that document their total revenue as business volume and not as balance sheet total, total premiums paid or budget volume.

		1997	1999	2001	2003	2005	2007
Formal training	West Germany East Germany	0.34 0.33	0.34 0.34		0.37 0.36	0.39 0.39	0.42 0.44
Informal training	West Germany East Germany	0.26 0.28	0.27 0.30		0.27 0.32	0.30 0.32	0.34 0.39

Table A-2: Average fraction of establishments with formal and informal training investments

Notes: Formal training covers all "class-room"-type training, e.g. courses, seminars or lectures. Informal training contains on-the-job training, participation in presentations/ expositions, job-rotation and alike. Multiple answers were possible.