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Continuing Vocational Training in Germany: A Comparative Study Using 3 German Data Set

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in Germany –
A Comparative Study
Using 3 German Data Set**

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Zentrum für Europäische
Wirtschaftsforschung GmbH

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Non-technical summary

Empirical work on continuing training in Germany provides surprisingly divergent evidence on the incidence of training. This makes comparison of econometric analyses of the impact of training on labour market outcomes difficult. Econometric results on the impact of training on labour market outcomes often differ tremendously and these differences may not be exclusively due to different econometric methods used. For example, the wage effect has been estimated to be significantly positive (e.g., Pannenberg, 1997; Pannenberg, 1998; Pfeiffer and Reize, 2001; Schömann and Becker, 2002; Kuckulenz and Zwick, 2003 or Büchel and Pannenberg, 2004) or insignificant (e.g., Jürges and Schneider, 2005) and coefficients vary widely (for a comparison of training returns in international studies, see Leuven, 2005).

Several data sets are used here to study training incidence, determinants of training and the correlation between continuing vocational training and wages. Results are compared in order to analyse the extent to which differences in the estimated wage effects of continuing vocational training are due to the data set used and how the training variable is defined.

This exercise provides important help for two problems. It helps to find the data set that fits best in answering certain research questions on continuing training and it provides hints on the degree of caution we need to employ when interpreting empirical results from different sources.

In more detail, the data set used and the way in which the training variable is set up in various large data sets are explored and the relevant differences are explained in this paper. The focus is on determining the magnitude of the impact of these differences on estimated results of, first, the determinants of training on the one hand and, on the correlation between training and wages on the other. I use the three individual data sets that are most often used by economists to study labour market impacts of continuing vocational training in Germany. This allows me to compare how training variables are set up and study how this difference in framing the training question influences the incidence of training reported in a data set. Additionally, I single out the impact of differences in set up and definition of training on the econometric results when estimating determinants of training and the impact of training on earnings. It is shown that what is captured by continuing training in the data sets varies remarkably and makes comparisons of studies using different data sets difficult.

Continuing Vocational Training in Germany - A Comparative Study using 3 German Data Sets*

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Abstract

Empirical work on continuing training in Germany provides surprisingly divergent evidence on the incidence of training. This makes comparison of econometric analyses of the impact of training on labour market outcomes difficult. Three large German data sets are used here to bring to light the data issue concerning continuing training. Differences in the definition and consequences for economic research are discussed. In detail, training incidence, determinants of training and the correlation between continuing vocational training and wages are examined. Results are compared in order to analyse in how far differences in estimated wage effects of continuing vocational training are due to the data set used and to how the training variable is set up.

JEL classification: C31, J24, J31

Key words: continuing vocational training, determinants of training, correlation of training with wage

1 Introduction

Labour economists have focused on continuing vocational training for many years and recent work provides new theoretical and empirical insights. Becker and Mincer laid the groundwork for human capital theory, which is the standard model for analysing continuing training (Becker, 1962 and Mincer, 1974). In this framework, continuing training is considered as an investment in human capital which is undertaken by firms in order to raise worker productivity. This increase in productivity represents a rent that can either result in higher profit or in higher wage. Empirical work on training with German data has mainly focussed on the determinants of training and on the impact of training on labour market outcomes. The participation in training (including formal and informal kinds of training¹) reported varies, depending on the source: e.g., according to the Second Continuing Vocational Training Survey (CVTS 2) 31 percent of employees took part in continuing training in 1999. Kuwan et al. (2003) report that 48 percent of all employees participated in training. The findings of Garloff and Kuckulenz (2006) indicate that participation in training in 1998 was 22 percent. These examples underline the differences in the definition of training.

Econometric results are often surprisingly divergent. For example, the wage effect has been estimated to be significantly positive (e.g., Pannenberg, 1997; Pannenberg, 1998; Pfeiffer and Reize, 2001; Schömann and Becker, 2002; Kuckulenz and Zwick, 2003 or Büchel and Pannenberg, 2004) or insignificant (e.g., Jürges and Schneider, 2005) and coefficients vary widely (see Table 22 in the appendix for a summary of the empirical literature where wage effects of training are estimated with German data and for a comparison of training returns in international studies, see Leuven, 2005).

One possible reason for this divergence in results is the econometric method used. This has been suggested by Kuckulenz and Maier (2006). The authors find a small positive impact of training on wages with OLS estimation and a large positive impact when using instrumental variables (IV) estimation. Local instrumental variables (LIV) estimation, in contrast, reveals no impact of training on wages. The data set used might also be important given that there is no standard definition of training and survey questions on continuing training differ tremendously. As shown by Bartel (2000) for the U.S., the type of data set has an important influence on the results. She compares studies that use large samples of firm-level or establishment-level data collected through mail or phone surveys with studies that use data from one or two companies and with company-sponsored case studies.

In this paper, three German data sets that include information on training are compared in order to bring to light the data issue concerning continuing training. The data set used and the way in which the training variable is set up in various large data sets are explored. I investigate how differences in framing the training question influence the incidence of training reported in a data set. Additionally, I single out the impact of differences in set up and definition of training on the econometric results. It is shown that what is captured by continuing training in the data sets varies remarkably and makes comparisons of studies using different data sets difficult. This paper is set up as follows.

¹Formal training is training that has a structured, formal, and defined curriculum; it may be conducted by supervisors, company training centres, businesses, schools, associations, or others. Formal training includes classroom work, seminars, lectures, workshops, and audio-visual presentations.

Informal training is training that is unstructured, unplanned, and easily adapted to situations or individuals. Examples include having a co-worker showing how to use a piece of equipment or having a supervisor teaching a skill related to the job.

First, the three main individual data sets which are used to study continuing training in Germany are introduced. Second, the incidence of training is compared and reasons for differences in the data sets are discussed. Third, the determinants of various training measures are estimated. Fourth, the correlation of the training with wages is calculated. Finally, results are compared to discuss the influence of the definition of the training measure in empirical research.

2 Data

German data sets that include information on continuing training can be divided into official statistics provided by governmental institutions, survey data provided by (economic) institutes, and other statistics of responsible departments. The survey data that includes information on training provided by institutes can be further split in establishment and individual data. Table 17 in the appendix lists available data sets with a training variable. In this paper, three large survey data sets conducted with individuals are used: the German Socio-Economic Panel (GSOEP), the Micro-Census (MZ) and the Qualification and Career Survey (BiBB/IAB). These are the main sources used by economists to analyse the impact of training participation on earnings.² Here, data for 1998/1999 are used to make results comparable since the latest wave of the Qualification and Career Survey (BiBB/IAB) is from this year. The data sets are described in the following sections and Table 18 in the appendix compares means and standard deviations of all variables used for the three data sets.³

To ensure that the samples in all three data sets are comparable I consider samples with employees only – individuals that are out of work and the self-employed are excluded. Civil servants, pensioners, and those who did not reveal their professional status are also excluded. I include only individuals aged between 25 and 65 to ensure that individuals are of working age and have finished their primary education. The sample size is highest in the Micro-Census with more than 100,000 observations, second highest in the BiBB/IAB data with around 18,000 observations, and lowest in the GSOEP with about 6,200 observations (see Table 18).⁴ Table 18 shows that, in terms of covariates, the samples in the GSOEP, the MZ and the BiBB/IAB data are comparable.⁵ The outcome variable is problematic since net income is only included in the MZ data, and gross income only in the BiBB/IAB data, while both measures of income are included in the GSOEP. Average gross income is higher in the GSOEP than in the BiBB/IAB data even after controlling for income from other jobs. The training variable, which is the key variable here, will be comprehensively discussed below.

²Other German data sources available, which are frequently used that include information on training are the IAB-company panel and the Continuing Vocational Training Survey. Both surveys are conducted among firms, not individuals. Hence, individual wage effects cannot be estimated with these data sets.

³Numbers of observations decrease significantly in the regressions owing to gaps in the data. The wage variable, in particular, is unavailable for many individuals in the survey.

⁴Due to missing variables (especially income), the number of observations is lower in the estimations in the next section.

⁵Worth to mention is the difference in the share of women in the data set. I suspect that less women are included in the BiBB/IAB sample because the survey is only geared towards employees, while the other surveys include all individuals living in Germany. When defining the samples, I may define some women as being employed who would not be included in the BiBB/IAB survey.

2.1 German Socio-Economic Panel (GSOEP)

The German Socio-Economic Panel Study (GSOEP) is a wide-ranging representative longitudinal study of private households in Germany that provides information on all household members.⁶ In 2004, nearly 12,000 households and about 22,000 people were sampled. The same private households, persons, and families have been surveyed annually since 1984, and the survey has since been expanded to include various new samples. One special feature of the GSOEP data is that it is longitudinal in nature and can be used as a panel. Some of the many topics include household composition, occupational biographies, employment, earnings, health, and satisfaction indicators as well as subjects covered in topical modules of the survey. One of the modules cover the topic “education and training”.

As has been pointed out by Pischke (2001), the GSOEP mainly includes formal training in this supplementary data. In the GSOEP, training is not necessarily directly related to the employer. To account for this, I take the training information from the so-called calendarium, which includes monthly information. This allows us to consider only those training spells which occurred “on-the-job”, i.e. an individual took part in training and was employed in the same month. I use the survey that was undertaken in 2000 and include information about income, training participation, and all the covariates used in the regressions for 1999. All GSOEP variables (except for training) that are used in the estimations are listed in Table 18.

2.2 Micro-Census (MZ)

The Micro-Census provides official representative statistics of the population and the labour market, involving 1% of all households in Germany every year (continuous household sample survey).⁷ The total number of households participating in the Micro-Census every year is about 370,000 (in total including about 820,000 individuals). I use the wave from the year 1999.

All households have the same probability of selection for the Micro-Census. A one-stage stratified area sample is conducted, i.e. within the territory of the Federal Republic of Germany areas are selected in which all households and persons are interviewed. Every year, a quarter of all households included in the sample are exchanged. This means that every household stays in the sample for four years. Household numbers are not included in the scientific use file and therefore the Micro-Census cannot be used as a panel.

The purpose of the Micro-Census is to provide statistical information on the economic and social situation of the population as well as on employment, the labour market, and education. The annual scientific use files of the Micro-Census include characteristics on persons, family and household context and – important for this study – information on employment, job search, unemployment, non-employment, general and vocational level of qualification, as well as data on the level of the individual net incomes. Net income is given in 24 intervals. I take midpoints of the categories. The problem of earnings information given in categories is less severe than may first appear because categories are quite small. In addition, individuals do not usually know their exact monthly income and the measurement error should therefore not be much higher than in other data sets. The Micro-Census combines two advantages: huge sample size and a reasonable number of covariates. Unfortunately, the waves cannot be connected on an individual level and I can only use

⁶For more detailed information, see <http://www.diw.de/english/sop/index.html>.

⁷For more detailed information, see <http://www.gesis.org/Dauerbeobachtung/GML/Daten/MZ/index.htm>.

cross-section information. The variables from the Micro-Census used in the estimations are listed in Table 18 (excluding the training variable).

2.3 Qualification and Career Survey (BiBB/IAB)

The German Qualification and Career Survey (BiBB/IAB) is a rich and representative German data set with information on 0.1 percent of all individuals employed. The surveys are conducted jointly by the Federal Institute for Vocational Education and Training (BiBB) and the Institute for Employment Research (IAB), operating as the Federal Employment Services' research institution. The surveys have been funded by the Federal Ministry for Education and Research. The survey gathered detailed information on qualification profiles and occupational developments, as well as the organisational, technological, and qualification framework at the workplace. The BiBB/IAB-Survey comes somewhere between the large surveys which provide a huge number of observations but limited survey content (example: Micro-Census), and selective surveys conducted with a specific spectrum of questions among a subset of individuals.

Earlier waves contain data gathered in 1979, 1985/1986 and 1991/1992. The most recent wave from 1998/1999, which sampled about 34,000 employees, is used here. The cross-section data allow the impact of training measures in 1994-98 on wages in 1998/1999 to be assessed. The outcome variable is log midpoints of earnings in 1998/1999 from 18 earnings categories in the data.⁸ This variable has the advantage that earnings of highly paid workers are not censored from above, i.e. high earners are also included in the data set. Unfortunately, I do not have information about the exact income and therefore less variation in the outcome variable. An advantage of the BiBB/IAB data is clearly the huge number of covariates that include information on job, firm, and workplace characteristics.

The key explanatory variable I use is participation in training during the years 1994 to 1998. This dummy might stand for quite substantial amounts of training, because employees might participate in various courses over a period of 24 months. In addition, only formal training courses are included in the data set and short training spells are explicitly excluded. Note that apprenticeship training is also excluded. Additionally, I use various definitions of training, either including formal training only or also extending to informal training. I also make use of training indicators such as training in only one or in several years and I separate several informal training forms. See Table 18 in the appendix for the complete list of covariates (except training) with means and standard deviations.

3 Empirical Evidence

The empirical evidence is presented in four steps. First, for all three data sets, the training variables are discussed and descriptive statistics for training are presented. Second, I estimate the determinants of the various training variables. Third, the three samples are used to estimate the same specification of the Mincer equation in order to analyse the correlation of training with earnings. Fourth, results from the descriptive statistics and the econometric analysis are compared to

⁸The problem of earnings information given in categories is less severe than it first seems. First, categories are quite small. Second, individuals do not usually know what their exact monthly income is and measurement error is therefore also included in the other data sets. The highest earnings category is open. Since less than 1 percent of the employees are in this category, it does not influence the results what I choose as a midpoint.

state how large the influence of the data set used and the definition of training is when analysing determinants of training participation and its correlation with earnings. The exact training related questions asked in the surveys are listed in the appendix in Tables 19 to 21.

3.1 Descriptive Statistics

3.1.1 German Socio-Economic Panel (GSOEP)

In the GSOEP, I take the training information from the so called 1999 calendarium which includes monthly information on the professional status. Individuals state in which months during the previous year (1998) they participated in training, which is defined as “company training, further training or retraining”. The definition excludes training not considered relevant by respondents. There is no further help given on what type of training should be concluded. Given this set up, I expect training participation to be underreported in the GSOEP calendarium (see also Jürges and Schneider, 2005). I also have data on the months of the year during which individuals were employed. There is no information available on whether training is firm-related or whether the firm pays for the training. Nevertheless, I am able to proxy on-the-job training by the coincidence of an employment relationship and participation in training in the same month. On average, 1.2 percent of the employees (i.e. only 42 people in the SOEP sample) participated in training while in an employment relationship during the year 1998. Almost 60 percent of those who participated took part in a training course during one month only. The exact hours, days, or weeks that were spent in training are unknown. The extent of training is thus unknown; however, the survey question explicitly asks that only relevant continuing training be taken into account.

Women participate more often than men. Employees in eastern Germany take part in training less often than those in western Germany. Hence, West German women participate most (1.9 percent) and East German men participate least (0.8 percent). There is a difference in values when considering participation in training without taking into account whether individuals were employed at the same time. On average, 2.3 percent participate in training that can be employer-related, government sponsored or other training while not employed. Of course, training participation varies largely by age and by qualification. The incidence of on-the-job training (measured by the proxy variable) split by age and qualification groups is shown in Table 1 and 2.

Table 1: Participation in on-the-job training by age (GSOEP)

Age	On-the-job training	Months on-the-job training
25 to 29	0.03	0.13
30 to 34	0.02	0.05
35 to 39	0.01	0.02
40 to 44	0.01	0.02
45 to 49	0.00	0.01
50 to 54	0.01	0.02
above 55	0.00	0.00

Younger employees participate much more often in training than their older colleagues; for example, while 3 percent of employees in age group 25-29 indicated that they participated, only 0.3 percent of the employees in over-55 age group took part. Highly qualified employees undergo more training than less qualified employees. Although, numbers of mean statistics are not ordered, it is

Table 2: Participation in on-the-job training by qualification (GSOEP)

Qualification	On-the-job training	Months on-the-job training
No professional degree	0.00	0.00
Vocational school	0.02	0.05
Apprenticeship	0.01	0.04
Master craftsman	0.03	0.10
University of applied sciences	0.01	0.03
University	0.01	0.01

not employees with a high school diploma who participate most in training (1.9 percent), but those which passed the entrance examination for universities of applied sciences (3.7 percent). In the second column, the training variable used is an indicator for the number of months during which training took part, ranging from zero to twelve. Here, it is evident that young employees not only have a greater chance of participating in training, they also take part during more months than their older colleagues. The indicator can be interpreted as a proxy for the intensity of training, although the exact time spent in courses and seminars is unknown. For highly skilled employees, training intensity is higher than for low skilled. For employees with an entrance examination for university of applied sciences, training intensity is exceptionally high, even much higher than for employees with a high school diploma, who seem to take part less frequently and in shorter training.

3.1.2 Micro-Census (MZ)

Several variables providing information on training are included in the 1999 Micro-Census. First, there is a variable indicating whether individuals have taken part in training while the survey is conducted and another variable stating whether individuals took part in firm-related continuing training during the last 4 weeks. Information is also provided to indicate whether this training is part of an internship or apprenticeship, both of which types I exclude.⁹ Unfortunately, there is no information on when exactly (during which months) training took place. On average, 5.8 percent of the employees participate in continuing training in one month (4 weeks). Women participate more often than men and employees in eastern Germany take part in training more often than those in western Germany. Hence, West German women participate most (7.2 percent) and East German men participate least (4.7 percent). This first measure contains only firm-related training.

Second, another training variable includes general training (not firm-related) during employment. Specifically, the MZ includes information on whether individuals participated in general training while in an employment relationship during the last four weeks. On average, 0.8 percent of the employees took part in general training during the last four weeks. Women in western Germany form the group which participates most in general training (1.4 percent) and West German men participate least (0.5 percent). Information is also included on the location of general training. The incidence of on-the-job training split by age and qualification groups is shown in Table 3 and 4.

Training participation is broken down into age groups in Table 3. Younger workers take part in firm-related training more often than older workers. In contrast, participation in general training does not differ for age groups and only workers aged 55 and older appear to participate less than

⁹There is complementary information on the purpose of training which is not used here. The location and duration of training is also indicated.

Table 3: Participation in firm-related continuing training by age (MZ)

Age	Continuing training	General training
25 to 29	0.09	0.01
30 to 34	0.07	0.01
35 to 39	0.06	0.01
40 to 44	0.06	0.01
45 to 49	0.05	0.01
50 to 54	0.04	0.01
above 55	0.03	0.00

Table 4: Participation in firm-related continuing training by qualification (MZ)

Qualification	Continuing training	General training
No professional degree	0.02	0.00
Vocational school	0.08	0.02
Apprenticeship	0.05	0.01
Master craftsman	0.09	0.01
University of applied sciences	0.11	0.01
University	0.12	0.02

others. Regarding qualification, Table 4 indicates that highly skilled workers participate much more often in work related continuing training than low skilled. The highly skilled also participate more in general training than the low skilled, but the difference in participation is less significant.

3.1.3 Qualification and Career Survey (BiBB/IAB)

The BiBB/IAB data set from 1998/1999 contains detailed information on training participation during the last 5 years. I use several training variables. First, a dummy variables indicating whether individuals took part in training courses or seminars during the last year, the last two years, or the last three years. On average, 21 percent of the employees participated in training courses or seminars in the previous year, 30 percent participated over the previous two years, and 43 percent participated during the previous three years. Alternatively, the incidence of training may have increased over the years. These numbers suggest that individuals are likely to take part in training again when they have participated in the past.

Second, in addition to this formal training, the data also captures more informal training types. I use dummy variables for whether individuals attended lectures or fairs, whether they read technical literature, took part in on-the-job training or other company training measures, whether they did an internship or took over special tasks for the purpose of training.

- 20 percent and more of the employees took part in the following training types in the two year period prior to the survey: technical literature, specialised lectures, on-the-job training, trade fairs.
- Around 15 percent took on special tasks, took part in company training measures or in other

training.

- Only 3 percent undertook an internship.
- Based on all informal types of training, I generate a dummy variable indicating whether individuals took part in any type of informal training during the last two years. The share of employees that participated in some informal training is 63 percent.

A much wider definition of training includes both formal and informal training forms and combines this last measure of informal training with the dummy indicating whether individuals took part in training courses and seminars during the last two years. Taking this wide definition, 65 percent of the employees in this data set participated in training in the last two years. Hence, almost all employees taking part in formal training, i.e. training courses or seminars, also participate in some informal training. Tables 5 and 6 show the incidence of training within two years split by age and qualification group for training courses and seminars and for all training types.

Table 5: Participation in formal and informal continuing training by age (BiBB/IAB)

Age	Formal and informal training	Formal training
25 to 29	0.63	0.20
30 to 34	0.67	0.23
35 to 39	0.67	0.22
40 to 44	0.68	0.22
45 to 49	0.64	0.21
50 to 54	0.64	0.20
above 55	0.60	0.16

Table 6: Participation in continuing training by qualification (BiBB/IAB)

Qualification	Formal and informal training	Formal training
No professional degree	0.36	0.08
Vocational school	0.63	0.23
Apprenticeship	0.61	0.18
Master craftsman	0.82	0.31
University of applied sciences	0.87	0.36
University	0.89	0.41

In Table 5, participation is shown for age groups. There is no difference in participation in continuing training when all types of training (formal and informal training) are used, nor when only formal training (courses and seminars) is considered. In contrast, when training participation is split up by skill group (Table 6), differences between groups are huge. While about 50 percent of low skilled workers participate, around 85 percent of highly skilled workers participate in training comprising formal and informal training. Differences are even more severe when only formal training courses are considered: participation in training courses and seminars among the highly

skilled is more than twice as high as participation among low skilled.

3.2 Determinants of Training

The descriptive statistics above suggest that certain individuals have a higher probability of participating in training than others. This will be analysed in this section using training variables from all three data sets. Since the response variable training T is binary, with values 0 and 1, I estimate by means of the probability of taking part in training p by probit

$$\begin{aligned} p &= \Pr(T = 1) \\ &= \Pr(a'_1 \cdot S + a_2 \cdot age + a_3 \cdot age^2 + a_4 \cdot sex \\ &\quad + a_5 \cdot white + a'_6 \cdot L\ddot{a}nder \geq 0), \end{aligned} \tag{1}$$

where a are the coefficients of explanatory variables that are to be estimated. I include the same explanatory variables as below in the Mincer regression: a schooling vector S , where schooling consists of dummies indicating highest completed schooling and professional degree (schooling degree: without school leaving certificate, lower secondary school, intermediate secondary school, entrance examination for university of applied sciences, high school diploma; professional degree: no professional degree, vocational school, apprenticeship, master craftsman, university of applied sciences, university). The other regressors are age and age^2 and dummies for sex , for $white$ collar workers, and for the German $L\ddot{a}nder$.

3.2.1 GSOEP

In the GSOEP, the training variable is on-the-job training in the last year and I use both, a dummy variable and the number of months during which an individual took part in on-the-job training in the previous year (I estimate this equation by simple OLS). Table 7 shows that participation in on-the-job training is mainly determined by schooling. Highly qualified employees have a higher probability of taking part in training than low qualified (the reference category includes workers without a school degree). The dummies indicating the professional degree (without professional degree, vocational school, apprenticeship on-the-job, apprenticeship at school, master craftsman, university of applied sciences, university) are almost all insignificant. Only master craftsman are more likely to participate in on-the-job training. Age does not play a significant role and neither does the sex of the worker, nor whether they are blue or white collar or the region in which they live. Comparing the determinants of the training dummy with the results from the OLS estimation using the number of training months, there are only few differences evident. The schooling variables are also the main determinants of training. Additionally, age and age^2 are significant. Results suggests that age is negatively correlated with the number of training months and age^2 is positively correlated, meaning that older employees take part in less training than younger employees.

3.2.2 MZ

In the MZ, I use a variable for training participation in the last four weeks. This variable only includes continuing vocational training. The probit estimation is only able to explain a small part of the variation in the probability of taking part in training, see Table 8. Also for this training

Table 7: Determinants of training (GSOEP)

	On-the-job training		Months on-the-job training			
	coef.	z-value	coef.	t-value		
Age	-0.02	(-0.26)	-0.02	(-2.27)	**	
Age squared	-0.00	(-0.35)	0.00	(2.17)	**	
Female	0.11	(0.72)	0.02	(0.73)		
White-collar worker	0.22	(1.23)	0.01	(0.25)		
No schooling degree			Reference			
Lower secondary school	4.44	(3.91)	***	-0.00	(-0.26)	
Intermediate secondary school	4.72	(4.01)	***	0.03	(1.51)	
Entrance examination for university of applied sciences	5.12	(4.23)	***	0.25	(2.04)	**
High school diploma	5.06	(4.28)	***	0.11	(2.37)	**
No professional degree			Reference			
Vocational school	0.41	(1.68)	*	0.03	(1.29)	
Apprenticeship	0.11	(0.53)		0.03	(1.94)	*
Master craftsman	0.62	(2.27)	**	0.09	(1.81)	*
University of applied sciences	-0.26	(-0.71)		-0.11	(-2.11)	**
University	-0.38	(-1.09)		-0.07	(-1.61)	
Hessen			Reference			
Schleswig-Holstein	-0.02	(-0.06)		0.01	(0.53)	
Hamburg				-0.03	(-1.85)	*
Niedersachsen	0.11	(-0.37)		0.05	(1.16)	
Bremen	0.54	(1.09)		0.27	(1.02)	
Nordrhein-Westfalen	-0.21	(-0.74)		0.02	(0.58)	
Rheinland-Pfalz	0.12	(0.36)		0.02	(0.92)	
Baden-Württemberg	-0.00	(-0.00)		0.04	(1.04)	
Bayern	-0.15	(-0.50)		0.04	(1.20)	
Berlin	-0.25	(-0.57)		-0.01	(-0.57)	
Mecklenburg-Vorpommern	0.37	(1.11)		0.02	(0.77)	
Brandenburg	-0.18	(-0.52)		-0.02	(-0.98)	
Sachsen-Anhalt	-0.17	(-0.46)		-0.01	(-0.66)	
Thuringen	-0.16	(-0.43)		0.01	(0.32)	
Sachsen	-0.39	(-1.11)		-0.01	(-0.39)	
Log likelihood	-192.92					
R-Squared			0.02			

Number of observations is 3,511 in the first column and 3,554 in the second column.

In the first column Hamburg was dropped and 43 observations were not used.

Significance levels : * : 10% ** : 5% *** : 1%

variable, determinants of training are qualification and the dummy for white collar workers (see first column, Table 8).

Highly qualified and white collar workers take part more often than less qualified (the reference categories are no schooling degree and no professional degree) and blue collar workers. Age and

Table 8: Determinants of training (MZ)

	Formal and informal training			General training		
	coef.	z-value		coef.	z-value	
Age	0.00	(0.80)		-0.01	(-0.28)	
Age squared	-0.00	(-2.32)	**	-0.00	(-0.39)	
Female	-0.01	(-0.29)		0.22	(5.06)	***
White-collar worker	0.40	(13.36)	***	0.34	(5.67)	***
No schooling degree			Reference			
Lower secondary school	0.27	(1.28)		-0.29	(-1.11)	
Intermediate secondary school	0.42	(1.96)	**	-0.19	(-0.73)	
Entrance examination for university of applied sciences	0.48	(2.20)	**	-0.02	(-0.09)	
High school diploma	0.49	(2.22)	**	-0.12	(-0.45)	
No professional degree			Reference			
Vocational school	0.36	(5.82)	***	0.40	(3.47)	***
Apprenticeship	0.17	(3.34)	***	0.16	(1.64)	
Master craftsman	0.40	(6.84)	***	0.35	(3.11)	***
University of applied sciences	0.39	(5.88)	***	0.30	(2.36)	**
University	0.40	(6.04)	***	0.41	(3.17)	***
Hessen			Reference			
Schleswig-Holstein	0.11	(1.61)		-0.04	(-0.25)	
Hamburg	0.01	(0.07)		-0.21	(-1.07)	
Niedersachsen	-0.17	(-3.10)	***	-0.18	(-1.66)	*
Bremen	0.05	(0.53)		-0.06	(-0.35)	
Nordrhein-Westfalen	-0.03	(-0.75)		-0.08	(-0.92)	
Rheinland-Pfalz	0.01	(0.22)		0.10	(1.02)	
Baden-Württemberg	0.07	(1.50)		0.09	(0.96)	
Bayern	0.11	(2.41)	**	0.04	(0.51)	
Berlin	0.01	(0.11)		0.13	(1.16)	
Mecklenburg-Vorpommern	-0.06	(-0.67)		-0.05	(-0.29)	
Brandenburg	-0.02	(-0.27)		0.16	(1.40)	
Sachsen-Anhalt	-0.35	(-5.25)	***	-0.09	(-0.84)	
Thuringen	-0.31	(-3.77)	***	-0.36	(-2.13)	**
Sachsen	0.07	(1.30)		0.13	(1.30)	
Log likelihood		-7737.13			-1967.29	

Number of observations is in the first column 44,981, in the second column 43,382.

Significance levels : * : 10% ** : 5% *** : 1%

sex are insignificant in determining training. Some of the Länder dummies have an influence. In particular, workers living in poorer regions (in eastern Germany) are less likely to take part in training.

A second variable in the MZ indicates whether individuals took part in general training during the last four weeks. Results of the probit estimation are shown in the second column of Table 8. The main difference in the determinants of continuing vocational training and general training is

that the professional degree indicators have a stronger positive influence on continuing vocational training than on general training. The schooling dummies are also significant in determining continuing vocational training but have no influence on general training. Females seem to take part more often in general training, while the indicator is insignificant in the probit regression explaining work related continuing training. The regional indicators have more explanatory power in the first column than in the second. Workers in eastern Germany (poorer regions) participate less often in continuing training.

3.2.3 BiBB/IAB

In the BiBB/IAB survey, there is more detailed information on continuing vocational training and I use dummy variables indicating participation in courses and seminars over the last 5 years. I also know whether individuals took part in eight other types of continuing training. In Table 9, the determinants of participation in training courses and seminars in the last two and five years are documented, respectively.

In the probit estimation, almost all of the variables included are significant (mainly due to the large sample size). Older employees have a higher chance of taking part in training than younger ones (although this positive impact decreases with age) and women participate less than men. White collar workers have a much higher probability of participating than blue collar workers. Highly skilled workers participate more often than low skilled workers and both schooling and professional degree are relevant. Most of the German Länder dummies are also significant, indicating that workers in poorer regions (mainly in eastern Germany) participate less than workers in richer regions. There are very few differences in the determinants of training if account is taken of the last five years instead of just the last two.¹⁰ The determinants of the eight other types of continuing training are shown in Tables 10 and 11.

It is striking that for some types, the variation in participation is much better explained than for others. In particular, whether individuals attend lectures or fairs and whether they read technical literature is explained best by the control variables. In these types of training, highly qualified workers participate much more often than low qualified, older workers more often than younger workers, white collar more than blue collar workers and women less than men. Schooling plays no role at all and age a very minor role in determining on-the-job training, internship, the taking over of special tasks for the purpose of training, quality circles, and other company training measures. Again, women participate less often (except for internship) and white collar more than blue collar workers (except for on-the-job training).

¹⁰I estimated probit equations also for training participation in the last year and in the last three years. Results are very similar to the ones presented here.

Table 9: Determinants of training (BiBB/IAB)

	Training last 2 years			Training last 5 years		
	coef.	z-value		coef.	z-value	
Age	0.07	(7.57)	***	0.08	(8.72)	***
Age squared	-0.00	(-7.89)	***	0.00	(-8.86)	***
Female	-0.13	(-5.31)	***	-0.16	(-6.91)	***
White-collar worker	0.55	(20.40)	***	0.55	(22.30)	***
No schooling degree			Reference			
Lower secondary school	-0.23	(-2.80)	***	-0.28	(-3.66)	***
Intermediate secondary school	0.03	(0.38)		0.01	(0.09)	
Entrance examination for university of applied sciences	0.26	(2.78)	***	0.23	(2.66)	***
High school diploma	0.20	(2.34)	**	0.13	(1.65)	*
No professional degree			Reference			
Vocational school	0.41	(5.66)	***	0.47	(6.91)	***
Apprenticeship	0.35	(7.97)	***	0.39	(9.83)	***
Master craftsman	0.63	(12.34)	***	0.71	(14.76)	***
University of applied sciences	0.62	(9.96)	***	0.64	(10.90)	***
University	0.60	(10.04)	***	0.63	(11.08)	***
Hessen			Reference			
Schleswig-Holstein	-0.07	(-1.09)		-0.04	(-0.66)	
Hamburg	-0.09	(-1.08)		-0.06	(-0.77)	
Niedersachsen	0.01	(0.10)		0.05	(1.03)	
Bremen	0.28	(2.70)	***	0.32	(3.11)	***
Nordrhein-Westfalen	0.04	(0.98)		0.05	(1.11)	
Rheinland-Pfalz	0.15	(2.58)	***	0.05	(0.87)	
Baden-Württemberg	0.06	(1.11)		0.09	(1.96)	*
Bayern	-0.02	(-0.48)		-0.05	(-1.01)	
Berlin	-0.19	(-3.14)	***	-0.12	(-2.04)	**
Mecklenburg-Vorpommern	-0.26	(-3.44)	***	-0.10	(-1.43)	
Brandenburg	-0.15	(-2.29)	**	-0.04	(-0.67)	
Sachsen-Anhalt	-0.17	(-2.54)	**	-0.07	(-1.11)	
Thüringen	-0.12	(-1.73)	*	0.09	(1.38)	
Sachsen	-0.15	(-2.64)	***	-0.01	(-0.11)	
Log likelihood		-9824.10			-11015.75	

Number of observations is in the first column 17,625, in the second column 17,815.

Significance levels : * : 10% ** : 5% *** : 1%

Table 10: Determinants of training (BiBB/IAB)

	Trade fair		Lectures		On-the-job		Company measures			
	coef.	z-value	coef.	z-value	coef.	z-value	coef.	z-value		
Age	0.01	(1.23)	0.03	(3.29)	***	0.01	(1.09)	0.08	(7.34)	***
Age squared	-0.00	(-1.36)	-0.00	(-2.92)	***	-0.00	(-2.66)	-0.00	(-7.02)	***
Female	-0.46	(-16.97)	-0.22	(-9.08)	***	-0.03	(-1.30)	-0.20	(-7.32)	***
White-collar worker	0.59	(19.31)	0.66	(23.35)	***	-0.01	(-0.41)	0.32	(10.67)	***
No schooling degree					Reference					
Lower secondary school	-0.19	(-2.18)	-0.29	(-3.55)	***	-0.09	(-1.04)	-0.10	(-1.07)	
Intermediate secondary school	-0.00	(-0.02)	-0.02	(-0.25)		-0.05	(-0.55)	0.06	(0.62)	
Entrance examination for university of applied sciences	0.22	(2.24)	0.29	(3.16)	***	-0.01	(-0.07)	0.16	(1.52)	
High school diploma	0.18	(1.96)	0.21	(2.48)	**	0.01	(0.09)	0.14	(1.38)	
No professional degree					Reference					
Vocational school	0.30	(3.29)	0.43	(5.58)	***	0.17	(2.41)	0.40	(4.86)	***
Apprenticeship	0.45	(8.07)	0.45	(9.39)	***	0.15	(3.56)	0.37	(7.03)	**
Master craftsman	0.83	(13.54)	0.77	(13.89)	***	0.15	(2.94)	0.52	(8.68)	**
University of applied sciences	0.88	(12.50)	0.83	(12.83)	***	0.17	(2.74)	0.42	(6.02)	***
University	0.95	(13.67)	0.95	(15.00)	***	0.16	(2.60)	0.32	(4.57)	***
Hessen					Reference					
Schleswig-Holstein	-0.02	(-0.30)	-0.06	(-0.88)		0.01	(0.10)	-0.11	(-1.46)	
Hamburg	-0.13	(-1.27)	-0.16	(-1.72)	*	-0.22	(-2.26)	-0.30	(-2.76)	***
Niedersachsen	0.03	(0.51)	0.00	(0.08)		0.06	(1.13)	-0.00	(-0.01)	
Bremen	0.13	(1.15)	0.13	(1.15)		0.22	(2.07)	0.05	(0.44)	
Nordrhein-Westfalen	0.16	(3.33)	0.11	(2.31)	**	0.11	(2.37)	0.09	(1.75)	*
Rheinland-Pfalz	0.11	(1.80)	0.12	(2.03)	**	-0.08	(-1.35)	-0.02	(-0.34)	
Baden-Württemberg	0.16	(2.85)	0.19	(3.74)	***	0.11	(2.15)	0.15	(2.70)	***
Bayern	0.08	(1.49)	0.08	(1.49)		-0.04	(-0.71)	-0.05	(-0.83)	
Berlin	-0.13	(-1.96)	-0.24	(-3.70)	***	0.09	(1.50)	0.10	(1.44)	
Mecklenburg-Vorpommern	-0.27	(-3.01)	-0.27	(-3.44)	***	0.46	(6.29)	-0.04	(-0.49)	
Brandenburg	-0.25	(-3.19)	-0.16	(-2.33)	**	0.14	(2.07)	-0.08	(-1.10)	
Sachsen-Anhalt	-0.20	(-2.65)	-0.15	(-2.16)	**	0.17	(2.47)	-0.22	(-2.74)	***
Thüringen	-0.09	(-1.22)	-0.00	(-0.05)		0.35	(5.19)	-0.04	(-0.53)	
Sachsen	-0.08	(-1.20)	-0.03	(-0.51)		0.27	(4.71)	0.01	(0.22)	
Log likelihood		-7729.17		-9112.09			-9236.26		-7315.65	

Number of observations is 17,852; Significance levels : * : 10% ** : 5% *** : 1%

Table 11: Determinants of training (BiBB/IAB)

	Internship		Special assignment		Technical literature		Other training	
	coef.	z-value	coef.	z-value	coef.	z-value	coef.	z-value
Age	-0.03	(-1.93) *	0.04	(3.55) ***	0.01	(1.38)	0.04	(4.31) ***
Age squared	0.00	(1.69) *	-0.00	(-4.10) ***	-0.00	(-0.95)	-0.00	(-4.14) ***
Female	0.06	(1.51)	-0.17	(-6.20) ***	-0.23	(-9.75) ***	-0.12	(-4.50) ***
White-collar worker	0.30	(5.50) ***	0.33	(10.79) ***	0.69	(24.87) ***	0.31	(10.26) ***
No schooling degree			Reference					
Lower secondary school	-0.38	(-2.76) ***	-0.18	(-1.95) *	-0.20	(-2.44) **	-0.19	(-2.14) **
Intermediate secondary school	-0.22	(-1.60)	-0.02	(-0.18)	0.12	(1.39)	-0.06	(-0.63)
Entrance examination for university of applied sciences	-0.12	(-0.77)	0.07	(0.73)	0.37	(4.03) ***	0.06	(0.56)
High school diploma	0.01	(0.06)	0.10	(1.03)	0.40	(4.59) ***	-0.03	(-0.31)
No professional degree			Reference					
Vocational school	0.05	(0.35)	0.27	(3.24) ***	0.36	(4.74) ***	0.29	(3.51) ***
Apprenticeship	0.01	(0.14)	0.35	(6.78) ***	0.46	(10.05) ***	0.26	(5.22) ***
Master Craftsman	0.10	(1.01)	0.54	(9.09) ***	0.87	(16.33) ***	0.35	(6.02) ***
University of applied sciences	0.23	(2.17) **	0.44	(6.27) ***	0.85	(13.39) ***	0.37	(5.38) ***
University	0.45	(4.40) ***	0.41	(5.98) ***	0.98	(15.80) ***	0.35	(5.18) ***
Hessen			Reference					
Schleswig-Holstein	-0.02	(-0.16)	0.10	(1.37)	-0.11	(-1.67) *	-0.03	(-0.43)
Hamburg	0.03	(0.19)	-0.11	(-1.11)	-0.34	(-3.76) ***	-0.37	(-3.47) ***
Niedersachsen	0.09	(0.94)	0.01	(0.16)	-0.08	(-1.60)	-0.10	(-1.79) *
Bremen	0.36	(2.12) **	-0.06	(-0.48)	-0.21	(-1.86) *	-0.22	(-1.73) *
Nordrhein-Westfalen	0.06	(0.66)	0.14	(2.87) ***	0.03	(0.67)	-0.14	(-2.82) ***
Rheinland-Pfalz	-0.11	(-0.91)	-0.06	(-0.88)	-0.10	(-1.62)	-0.04	(-0.57)
Baden-Württemberg	0.07	(0.72)	0.07	(1.17)	-0.01	(-0.18)	-0.04	(-0.78)
Bayern	0.02	(0.21)	0.03	(0.53)	0.00	(0.07)	0.02	(-0.37)
Berlin	0.14	(1.32)	0.08	(1.19)	-0.25	(-4.00) ***	0.10	(1.51)
Mecklenburg-Vorpommern	0.51	(4.46) ***	-0.18	(-2.04) **	-0.09	(-1.25)	-0.23	(-2.67) ***
Brandenburg	0.11	(0.87)	-0.20	(-2.56) **	-0.00	(-0.06)	0.31	(4.45) ***
Sachsen-Anhalt	0.24	(2.10) **	-0.02	(-0.28)	-0.13	(-1.98) **	0.04	(0.54)
Thüringen	0.36	(3.24) ***	0.07	(0.96)	-0.03	(-0.41)	0.13	(1.82) *
Sachsen	0.31	(3.08)	-0.06	(-0.91)	0.01	(0.25)	0.21	(3.38) ***
Log likelihood		-2538.27		-7475.32		-9342.12		-7545.29

Number of observations is 17,852; Significance levels : * : 10% ** : 5% *** : 1%

3.3 Correlation between Training and Wages

In the econometric analysis, I estimate the correlation of training with earnings by extended Mincer equations. The Mincer equation can be derived from human capital theory (as outlined, e.g., by Franz, 2003). The standard equation includes log earnings Y on the left hand side and schooling s , experience ex , experience squared ex^2 , and an unobservable error term ϵ on the right hand side:

$$\ln Y = \beta_0 + \beta_1 \cdot s + \beta_2 \cdot ex + \beta_3 \cdot ex^2 + \epsilon. \quad (2)$$

I use log wages instead of log earnings in order to capture differences in hours worked. Instead of years of schooling I use dummy variables for the highest educational outcome. Given the educational system in Germany, the assumption of linear returns to schooling is unlikely to hold and educational outcome rather than years of schooling fits German data better (Franz, 2003). I have to use an indicator for potential labour market experience because direct information on labour market experience is not available in all data sets. Usually, age minus years of schooling minus six is used as a proxy. I use *age* instead because I am not interested in the interpretation of the coefficient. Additional to the standard variables, I include a training variable T and dummies for *sex*, for *white* collar workers, and for the German *Länder*. Hence, I estimate the hourly wage regression as follows:

$$\ln w = \beta_0 + \beta_1' \cdot S + \beta_2 \cdot age + \beta_3 \cdot age^2 + \beta_4 \cdot T + \beta_5 \cdot sex + \beta_6 \cdot white + \beta_7' \cdot Länder + \epsilon. \quad (3)$$

3.3.1 GSOEP

In the GSOEP, I estimate the impact of on-the-job training over the last year on gross and net wages. Results of the Mincer regressions are shown in Table 12. Strikingly, on-the-job training does not impact gross nor net wages. In the left hand columns, I use a training dummy and the number of months in which individuals report having taken part in training to estimate the correlation with net wages. In the right hand columns, I use the same measures to calculate the correlation with gross wages. The covariates explain around 36 percent of the variation in net wages and around 40 percent in the variation of gross wages. The explanatory power of net wages is lower because I do not include any household information in the wage regression, such as indicators for married status or the number of children in the household. As expected, wages increase with age (this positive correlation decreases with age). Women and people living in eastern Germany earn less and white collar workers and those with high schooling and professional degrees earn more.

Table 12: Correlation of training with wages (GSOEP)

	Net wage			Gross wage		
	On the job	Months on the job	On the Job	Months on the job	On the Job	Months on the job
	coef.	t-values	coef.	t-values	coef.	t-values
Training	0.05	(1.05)	0.01	(0.69)	0.04	(0.68)
Age	0.04	(7.79)***	0.04	(7.80)***	0.03	(6.86)***
Age squared	0.00	(6.46)***	0.00	(6.46)***	0.00	(5.60)***
Female	-0.24	(-19.06)***	-0.24	(-19.09)***	-0.20	(-15.42)***
White-collar worker	0.15	(10.69)***	0.15	(10.67)***	0.18	(12.91)***
No schooling degree				Reference		
Lower secondary school	0.03	(1.24)	0.03	(1.23)	0.06	(2.55)**
Intermediate secondary school	0.09	(3.33)***	0.09	(3.32)***	0.14	(5.58)***
Entrance examination for		***		***		**
university of applied sciences	0.11	(3.08)	0.11	(3.06)	0.15	(4.63)
High school diploma	0.11	(3.80)***	0.11	(3.78)***	0.18	(6.24)**
No professional degree				Reference		
Vocational school	0.11	(4.89)***	0.11	(4.87)***	0.11	(5.03)**
Apprenticeship	0.08	(4.58)***	0.08	(4.58)***	0.08	(4.09)**
Master craftsman	0.11	(4.48)***	0.11	(4.45)***	0.12	(4.35)**
University of applied sciences	0.25	(7.21)***	0.25	(7.19)***	0.27	(7.86)***
University	0.22	(7.16)***	0.22	(7.17)***	0.26	(8.39)***
Hessen				Reference		
Schleswig-Holstein	-0.01	(-0.32)	-0.01	(-0.32)	-0.02	(-0.46)
Hamburg	0.04	(0.84)	0.04	(0.85)	0.05	(1.00)
Niedersachsen	-0.02	(-0.58)	-0.02	(-0.59)	-0.02	(-0.83)
Bremen	-0.04	(0.64)	-0.04	(-0.65)	-0.01	(-0.20)
Nordrhein-Westfalen	-0.02	(-0.87)	-0.02	(-0.86)	-0.02	(-0.74)
Rheinland-Pfalz	-0.02	(-0.62)	-0.02	(-0.63)	-0.01	(-0.20)
Baden-Württemberg	0.03	(1.08)	0.03	(1.08)	0.02	(0.58)
Bayern	0.02	(0.62)	0.02	(0.64)	0.01	(0.36)
Berlin	-0.13	(-3.63)***	-0.13	(-3.62)***	-0.13	(-3.47)***
Mecklenburg-Vorpommern	-0.34	(-9.60)***	-0.34	(-9.62)***	-0.37	(-10.21)***
Brandenburg	-0.27	(-7.67)***	-0.27	(-7.66)***	-0.32	(-8.67)***
Sachsen-Anhalt	-0.32	(-8.75)***	-0.32	(-8.74)***	-0.37	(-9.97)***
Thüringen	-0.38	(-11.45)***	-0.38	(-11.44)***	-0.43	(-12.70)***
Sachsen	-0.34	(-11.32)***	-0.34	(-11.31)**	-0.40	(-12.77)**
F()	(28, 3327) 62.65		(28, 3327) 62.65		(28, 3303) 76.28	
R-Squared	0.36		0.36		0.40	

A constant is included in the estimations

Number of observations is in the first and second column 3,356, in the third and fourth column 3,332.

For all regressions, Prob > F is 0.00; Significance levels: * : 10% ** : 5% *** : 1%

3.3.2 MZ

With the MZ, I analyse the impact of continuing vocational training and of general training over the last four weeks on net wages. I find a positive and significant correlation for both measures (see Table 13). The impact of continuing vocational training on net wages is stronger in comparison to general training. All other determinants of wages are similar in both columns and coefficients have the expected sign.

The wage regressions using the Micro-Census explain the variation in net wages somewhat better than the wage regressions using the GSOEP. In the former, almost all covariates are significant – even the regional indicators which (probably owing to the smaller sample size) were not all significant in the wage regression with the GSOEP. The training variable, which I am interested in, is also significant in the wage regression – no matter whether work related continuing training or general training is used or not. The correlation with wages is higher for general training than for work related continuing training. All other coefficients have the expected signs.

3.3.3 BiBB/IAB

There is a variety of training indicators in the BiBB/IAB data set. The correlation of participation in training courses and seminars in the last two and five years, respectively, with wages are shown in the first two columns of Table 14.

If training took place more recently (in the last two years), the impact on wage is somewhat stronger than if training took over a longer time span (over the last five years). The correlation is positive and highly significant for both indicators. All other coefficients in the wage regression have the expected signs and are similar not only in the first two columns, but also for the regressions using other types of training.

The eight different kinds of training are put separately in wage regressions and results are shown in Tables 15 and 16. The wage regressions using the BiBB/IAB data are able to explain around 34 percent of the variation in gross wages, somewhat less than the variation in gross wages explained by the GSOEP. The indicators for attending lectures, reading technical literature, and company measures such as quality circles seem to have the strongest impact and are highly correlated with wages. The indicator for attendance at fairs, the assumption of special tasks for the purpose of training, other company training measures, and on-the-job training are also positively correlated with wages, but less so than the first three measures. Internship does not influence wages and the coefficient even has a negative sign. All other variables in the hourly wage regression have the expected positive sign, are significant (except for some regional indicators), and do not differ with the training measure used.

Table 13: Correlation of training with wages (MZ)

	Net Wage					
	Continuing training			General training		
	coef.	t-values		coef.	t-values	
Training	0.02	(2.47)	**	0.07	(3.77)	***
Age	0.04	(24.08)	***	0.04	(23.22)	***
Age squared	0.00	(19.67)	***	0.00	(19.00)	***
Female	-0.27	(-64.31)	***	-0.28	(-63.92)	***
White-collar worker	0.16	(36.41)	***	0.16	(36.24)	***
No schooling degree			Reference			
Lower secondary school	0.48	(9.47)	***	0.48	(9.48)	***
Intermediate secondary school	0.54	(10.67)	***	0.54	(10.68)	***
Entrance examination for university of applied sciences	0.58	(11.18)	***	0.57	(11.12)	***
High school diploma	0.59	(11.47)	***	0.59	(11.50)	***
No professional degree			Reference			
Vocational school	0.14	(14.84)	***	0.14	(14.64)	***
Apprenticeship	0.11	(17.06)	***	0.11	(16.96)	***
Master craftsman	0.20	(24.05)	***	0.21	(24.06)	***
University of applied sciences	0.28	(26.41)	***	0.29	(26.24)	***
University	0.32	(27.65)	***	0.32	(27.57)	***
Hessen			Reference			
Schleswig-Holstein	-0.02	(-1.85)	*	-0.02	(-1.85)	*
Hamburg	0.01	(0.65)		0.02	(1.03)	
Niedersachsen	-0.01	(-1.58)		-0.01	(-1.30)	
Bremen	-0.04	(-2.48)	**	-0.03	(-2.04)	**
Nordrhein-Westfalen	0.02	(2.81)	***	0.02	(3.12)	***
Rheinland-Pfalz	-0.02	(-2.27)	**	-0.02	(-1.75)	*
Baden-Württemberg	0.04	(4.26)	*	0.04	(4.67)	***
Bayern	0.01	(1.53)		0.01	(1.84)	*
Berlin	-0.14	(-13.54)	***	-0.14	(-12.82)	***
Mecklenburg-Vorpommern	-0.36	(-26.72)	***	-0.36	(-26.04)	***
Brandenburg	-0.32	(-30.25)	***	-0.32	(-29.82)	***
Sachsen-Anhalt	-0.34	(-36.92)	***	-0.33	(-36.13)	***
Thuringen	-0.37	(-32.27)	***	-0.37	(-31.67)	***
Sachsen	-0.35	(-38.44)	***	-0.35	(-37.47)	***
F()	(28, 43321)	732.75		(28, 41777)	718.80	
R-Squared		0.35			0.35	

A constant is included in the estimations.

Number of observations is in the first column 43,350, in the second column 41,806.

For all regressions, Prob > F is 0.00.

Significance levels : * : 10% ** : 5% *** : 1%

Table 14: Correlation of training with wages (BiBB/IAB)

	Training last 2 years			Training last 5 years		
	coef.	t-Value		coef.	t-Value	
Training	0.12	(18.97)	***	0.11	(18.02)	***
Age	0.02	(9.02)	***	0.02	(8.83)	***
Age squared	0.00	(6.04)	***	0.00	(5.87)	***
Female	-0.21	(-31.75)	***	-0.21	(-31.57)	***
White-collar worker	0.10	(13.89)	***	0.10	(13.49)	***
No schooling degree			Reference			
Lower secondary school	0.00	(0.03)		0.01	(0.30)	
Intermediate secondary school	0.07	(3.22)	***	0.07	(3.38)	***
Entrance examination for university of applied sciences	0.14	(5.77)	***	0.15	(5.96)	***
High school diploma	0.15	(6.45)	***	0.16	(6.72)	***
No professional degree			Reference			
Vocational school	0.11	(5.27)	***	0.09	(4.59)	***
Apprenticeship	0.11	(10.54)	***	0.11	(10.29)	***
Master craftsman	0.21	(15.57)	***	0.20	(15.14)	***
University of applied sciences	0.23	(12.82)	***	0.22	(12.66)	***
University	0.31	(17.87)	***	0.30	(17.57)	***
Hessen			Reference			
Schleswig-Holstein	-0.03	(-1.93)	*	-0.04	(-2.20)	**
Hamburg	-0.03	(-1.43)		-0.04	(-1.58)	
Niedersachsen	-0.01	(-0.66)		-0.01	(-0.83)	
Bremen	-0.02	(-0.84)		-0.02	(-0.92)	
Nordrhein-Westfalen	0.02	(1.97)	**	0.02	(1.94)	*
Rheinland-Pfalz	-0.03	(-2.13)	**	-0.03	(-1.88)	*
Baden-Württemberg	0.03	(2.06)	**	0.02	(1.49)	
Bayern	-0.01	(-1.04)		-0.01	(-0.97)	
Berlin	-0.14	(-8.30)	***	-0.14	(-8.60)	***
Mecklenburg-Vorpommern	-0.37	(-17.91)	***	-0.37	(-18.40)	***
Brandenburg	-0.33	(-17.05)	***	-0.34	(-17.43)	***
Sachsen-Anhalt	-0.40	(-21.24)	***	-0.40	(-21.69)	***
Thuringen	-0.34	(-17.96)	***	-0.35	(-18.53)	***
Sachsen	-0.38	(-25.11)	***	-0.39	(-25.56)	***
F()	(28, 15090)	270.99		(28, 152,40)	274.23	
R-Squared		0.35			0.35	

A constant is included in the estimations.

Number of observations is in the first column 15,119, in the second column 15,269.

For all regressions, Prob > F is 0.00

Significance levels : * : 10% ** : 5% *** : 1%

Table 15: Correlation of training with wages (BiBB/IAB)

	Trade fair		Lectures		On the job		Company measures	
	coef.	t-values	coef.	t-values	coef.	t-values	coef.	t-values
Training	0.09	(11.74)***	0.12	(18.24)***	0.02	(3.11)***	0.12	(16.18)***
Age	0.02	(9.87)***	0.02	(9.63)***	0.03	(9.97)***	0.02	(9.23)***
Age squared	0.00	(6.92)***	0.00	(6.72)***	0.00	(7.00)***	0.00	(6.32)***
Female	-0.20	(-30.43)***	-0.20	(-31.23)***	-0.21	(-32.17)***	-0.21	(-31.66)***
White-collar worker	0.11	(15.14)***	0.10	(13.77)***	0.12	(16.83)***	0.11	(15.80)***
No schooling degree				Reference				
Lower secondary school	0.00	(0.00)	0.00	(0.20)	0.00	(0.13)	0.00	(0.09)
Intermediate secondary school	0.08	(3.44)***	0.07	(3.41)***	0.08	(3.43)***	0.07	(3.30)***
Entrance examination for university of applied sciences	0.15	(6.09)***	0.14	(5.78)***	0.16	(6.32)**	0.15	(6.08)**
High school diploma	0.16	(6.79)***	0.15	(6.57)***	0.16	(6.94)**	0.16	(6.75)**
No professional degree				Reference				
Vocational school	0.11	(5.31)***	0.10	(5.07)***	0.11	(5.31)**	0.10	(4.98)**
Apprenticeship	0.12	(10.92)***	0.11	(10.55)***	0.12	(11.30)***	0.12	(10.83)***
Master craftsman	0.21	(15.79)***	0.20	(15.43)***	0.23	(16.97)***	0.22	(16.27)***
University of applied sciences	0.23	(13.01)***	0.22	(12.62)***	0.25	(13.99)***	0.24	(13.62)***
University	0.31	(17.58)***	0.29	(16.83)***	0.33	(18.69)***	0.32	(18.60)***
Hessen				Reference				
Schleswig-Holstein	-0.04	(-2.09)**	-0.04	(-2.09)**	-0.04	(-2.12)**	-0.04	(-2.08)**
Hamburg	-0.03	(-1.44)	-0.03	(-1.36)	-0.03	(-1.48)	-0.03	(-1.35)
Niedersachsen	-0.01	(-0.76)	-0.01	(-0.71)	-0.01	(-0.71)	-0.01	(-0.84)
Bremen	-0.01	(-0.51)	-0.01	(-0.52)	-0.01	(-0.46)	-0.01	(-0.53)
Nordrhein-Westfalen	0.02	(1.74)*	0.02	(1.71)*	0.02	(2.01)**	0.02	(1.81)*
Rheinland-Pfalz	-0.03	(-1.90)*	-0.03	(-2.03)**	-0.03	(-1.73)*	-0.03	(-1.89)*
Baden-Württemberg	0.02	(1.45)	0.02	(1.20)	0.02	(1.66)	0.02	(1.21)
Bayern	-0.01	(-1.13)	-0.02	(-1.22)	-0.01	(-0.95)	-0.01	(1.02)
Berlin	-0.14	(-8.60)***	-0.14	(-8.32)***	-0.15	(-8.74)***	-0.15	(-9.08)***
Mecklenburg-Vorpommern	-0.37	(-17.95)***	-0.37	(-17.84)***	-0.38	(-18.26)***	-0.38	(-18.31)***
Brandenburg	-0.33	(-17.06)***	-0.33	(-17.17)***	-0.34	(-17.35)***	-0.34	(-17.35)***
Sachsen-Anhalt	-0.40	(-21.20)***	-0.40	(-21.50)***	-0.40	(-21.56)***	-0.40	(-21.47)***
Thüringen	-0.34	(-17.75)***	-0.34	(-17.86)***	-0.35	(-17.94)***	-0.34	(-18.05)***
Sachsen	-0.39	(-25.10)***	-0.39	(-25.36)***	-0.39	(-25.26)**	-0.39	(-25.61)**
F()	(28, 15268)	261.38	(28, 15268)	269.32	(28, 15268)	251.15	(28, 15268)	266.87
R-Squared		0.34		0.35		0.33		0.34

A constant is included in the estimations; Number of observations is 15,297.

For all regressions, Prob > F is 0.00; Significance levels : * : 10% ** : 5% *** : 1%

Table 16: Correlation of training with wages (BiBB/IAB)

	Internship		Special assignment		Technical literature		Other training	
	coef.	t-values	coef.	t-values	coef.	t-values	coef.	t-values
Training	-0.01	(-0.78)	0.08	(10.71)***	0.10	(15.32)***	0.04	(5.41)***
Age	0.03	(9.97)***	0.02	(9.77)***	0.02	(9.89)***	0.02	(9.81)***
Age squared	0.00	(7.02)***	0.00	(6.78)***	0.00	(6.98)***	0.00	(6.88)***
Female	-0.21	(-32.18)***	-0.21	(-31.75)***	-0.21	(-31.24)***	-0.21	(-32.05)***
White-collar worker	0.12	(16.80)***	0.11	(16.00)***	0.10	(13.92)***	0.12	(16.38)***
No schooling degree				Reference				
Lower secondary school	0.00	(0.17)	0.00	(0.03)	0.00	(0.12)	0.00	(0.08)
Intermediate secondary school	0.08	(3.41)***	0.08	(3.48)***	0.07	(3.31)***	0.08	(3.45)***
Entrance examination for university of applied sciences	0.16	(6.32)***	0.16	(6.29)***	0.14	(5.85)**	0.16	(6.28)**
High school diploma	0.16	(6.96)***	0.16	(6.93)***	0.15	(6.41)**	0.16	(6.96)**
No professional degree				Reference				
Vocational school	0.11	(5.35)***	0.11	(5.25)***	0.11	(5.18)**	0.11	(5.29)**
Apprenticeship	0.12	(11.36)***	0.12	(11.01)***	0.11	(10.68)***	0.12	(11.23)***
Master craftsman	0.23	(17.01)***	0.22	(16.48)***	0.20	(15.21)***	0.23	(16.84)***
University of applied sciences	0.25	(14.06)***	0.24	(13.76)***	0.22	(12.84)***	0.24	(13.88)***
University	0.33	(18.79)***	0.32	(18.51)***	0.30	(17.05)***	0.32	(18.59)***
Hessen				Reference				
Schleswig-Holstein	-0.04	(-2.11)**	-0.04	(-2.22)**	-0.04	(-2.03)**	-0.04	(-2.10)**
Hamburg	-0.03	(-1.52)	-0.03	(-1.40)	-0.03	(-1.17)	-0.03	(-1.41)
Niedersachsen	-0.01	(-0.70)	-0.01	(-0.69)	-0.01	(-0.54)	-0.01	(-0.62)
Bremen	-0.01	(-0.40)	-0.01	(-0.30)	0.00	(0.14)	-0.01	(-0.34)
Nordrhein-Westfalen	0.03	(2.07)**	0.02	(1.89)*	0.02	(2.00)**	0.03	(2.18)**
Rheinland-Pfalz	-0.03	(-1.75)*	-0.03	(-1.70)*	-0.02	(-1.67)*	-0.03	(-1.75)*
Baden-Württemberg	0.02	(1.73)*	0.02	(1.61)	0.02	(1.64)	0.02	(1.75)*
Bayern	-0.01	(-0.97)	-0.01	(-0.98)	-0.01	(-1.06)	-0.01	(-0.98)
Berlin	-0.15	(-8.71)***	-0.15	(-8.80)***	-0.14	(-8.33)***	-0.15	(-8.76)***
Mecklenburg-Vorpommern	-0.38	(-18.10)***	-0.37	(-18.10)***	-0.37	(-18.10)***	-0.37	(-18.09)***
Brandenburg	-0.34	(-17.33)***	-0.34	(-17.17)***	-0.34	(-17.35)***	-0.34	(-17.53)***
Sachsen-Anhalt	-0.40	(-21.45)***	-0.40	(-21.57)***	-0.40	(-21.33)***	-0.40	(-21.53)***
Thüringen	-0.34	(-17.77)***	-0.34	(-17.94)***	-0.34	(-17.92)***	-0.35	(-17.91)***
Sachsen	-0.39	(-25.11)***	-0.39	(-25.20)**	-0.39	(-25.53)**	-0.39	(-25.34)**
F()	(28, 15268)	250.88	(28, 15268)	258.57	(28, 15268)	267.78	(28, 15268)	252.86
R-Squared	0.33		0.34		0.34		0.33	

A constant is included in the estimations; Number of observations is 15,297.

For all regressions, Prob > F is 0.00; Significance levels : * : 10% ** : 5% *** : 1%

3.4 Comparison of Results

Large differences in training indicators are already apparent in the descriptive statistics. The reported incidence of training over a period of one year is as low as 1.9 percent in the GSOEP calendarium, where it includes company training, further training, and retraining and where individuals are employed in the same month they participate in training. The reason for the extreme low training incidence in the GSOEP might be that individuals are asked to report only relevant training courses and seminars (see also Jürges and Schneider, 2005). It is likely that only long and formal training courses are reported. In addition, the recall problem might be more severe in this survey than in the others because no further help is provided as to which type of training to consider. Alternatively, results with the GSOEP are less robust due to the low number of training participants and, hence, also less reliable.

In the MZ, participation four weeks prior to the survey is 5.8 percent. In the BiBB/IAB data, the reported incidence of training in one year is as high as 21 percent for training courses and seminars. When help is provided to remember training activities by giving many examples of formal and informal training types, more than 60 percent of the employees in the BiBB/IAB sample report having participated in some kind of training over the last two years. This reasoning suggests that the recall problem is much higher in the GSOEP than in the other data sets.

As well as the way in which the training question is phrased and whether the recall problem is minimised by providing examples, an important role may also be played by the position of the question in the questionnaire and whether the question is read and explained by an interviewer. The question is placed more prominently in the BiBB/IAB survey and in the MZ than in the GSOEP, which might explain the very low incidence in the GSOEP.

Even more important in explaining the extremely low incidence of training in the GSOEP calendarium is the fact that only “important” training spells are considered (employees might consider very few training types as important and do not report most training spells).

The type of training is defined differently in the various data sets and makes an important difference not only in the econometric analysis but also in descriptive statistics. For example, around 6 percent of the employees in the MZ report taking part in training today or over the last four weeks and just under 1 percent report general training over the last four weeks. In the section discussing the participation rates in various training forms in the BiBB/IAB, huge differences are apparent as well. The time span considered also differs widely and should be carefully taken into account when comparing numbers on training incidence. 21 percent of the employees took part in training courses and seminars last year, 30 percent took part over the last two years, and 43 percent participated within the last three years in the BiBB/IAB sample.

The difference in participation for men and women and eastern and western Germany is similar in all samples: women participate more often than men and employees in western Germany participate more often than those in eastern Germany, *ceteris paribus*. Differences in age groups are most evident in the GSOEP, where young employees participate more often in training and where training for young employees is also most intensive. In the MZ the same pattern holds for firm-related continuing training but not for general training. In the BiBB/IAB data no difference in participation by age groups is evident, neither for training courses and seminars, nor for the indicator comprising formal and informal training courses. Similarly in all samples participation rates vary strongly by qualification (especially for training intensity) for firm-related training and for formal training.

In the probit estimations the most important determinants of training are qualificational indicators. Participation increases with both higher schooling and professional degrees. In the GSOEP all other variables have no significant influence on training participation. This might be due to the small sample size since only 42 people in the sample participated in continuing training. In the MZ, the dummy for white collar workers is also positive and significant and some regional indicators are significant, indicating that participation in poorer East German regions is lower. In the BiBB/IAB data, where average incidence of training is highest, females and young workers participate less in continuing training, *ceteris paribus*. This contrasts with the first look at the descriptive statistics where females appeared to participate more often than men. Participation rates in training courses and seminars do not differ by region, but fewer employees take part in informal training in poorer regions (in eastern Germany).

Some interesting differences in determinants appear when comparing the various training types in the BiBB/IAB data. For example, older employees visit lectures more often, participate more in company measures such as quality circles, or take on special learning-related tasks. In contrast, older employees take part less often in internships and age plays no significant role in determining visits to trade fairs, on-the-job training, or in reading technical literature. Females participate less in trade fairs, lectures, company measures and read technical literature less often. White collar workers have a higher probability of participating in all training types other than on-the-job training. On-the-job training is also the only type of training where employees in eastern Germany participate more often, West German employees participate more in all other types of training.

The schooling degree significantly determines visits to trade fairs, attendance at lectures, and the reading of technical literature. None of the other training types are determined by schooling degrees but only by professional degrees. Internship is the only type of training that is not determined by qualification.

The correlation of training to wages varies between the data sets and training variables used. In the GSOEP, no significant correlations between training participation and net or gross wages are apparent. The insignificance of the coefficients is mainly due to the very small sample size (only 42 training participants). In the other data sets used I find positive and significant correlations between training and wages. In the MZ correlations between continuing vocational training and net wages and general training and net wages are both positive. The estimated coefficient and t-value in the wage regression is much higher for general training than for continuing vocational training. This is in line with the finding in Kuckulenz and Zwick (2003) that (firm) specific training leads to higher wage increases than training of a more general nature. The wage regressions with the BiBB/IAB data reveal a strong positive correlation between wages and continuing training (including formal and informal training), (formal) training courses and seminars, trade fairs, lectures, company measures, special assignments, and technical literature. For on-the-job training, internship, and other training, correlations with wages are less strong or insignificant.

The estimated coefficients in the wage regressions are probably biased and inconsistent estimates of the causal effect from training on wages because endogeneity of training is not accounted for. For example, if motivated and able employees take part in training more often than less motivated and able employees, the coefficients overestimate the impact of training on wages. The reason for the likely overestimation is that these individuals, who have a high probability of participating in training, are also likely to earn more even without their participation in training. This is not important in the context discussed here where the interest is in differences between different training variables in various data sets, and not in the exact size of the effect from training participation on wages.

4 Conclusion

The analysis of training incidence, determinants of training, and the correlation of training and wages with three German data sets including training information from the year 1998 revealed huge differences in the definition of training variables. The training question is set up in various ways and placed in more or less prominent positions in the survey. Sometimes the question is posed in a broader way and examples are given, so that many employees remember having taken part in some training. In the GSOEP, where individuals were asked to report the exact month in which training took place, very few individuals reported participating in training. The most important reason for this seems to be the framing of the survey question which asked individuals to report only relevant training courses. The GSOEP is less suitable for econometric analysis of the training variable than the MZ and the BiBB/IAB data because of the very small sample size. The advantage of the GSOEP – that individuals can be followed over several years and that wages before and after training participation can be observed – is diminished by the small sample size. An alternative might be to use only certain years in which additional questions on continuing training are included in the GSOEP (like Pischke, 2001, using the data from 1989).

Results are very similar in the MZ and the BiBB/IAB data. Both are reliable data sets and have their advantages: the sample size is larger in the MZ, but the BiBB/IAB data offers more information on the type of training and the timing. The type of training is important for the determinants of training as well as for the correlation with wages. Hence, making comparisons of studies analysing determinants of training or the impact of training on wages is anything but a trivial task. Account not only needs to be taken of the econometric method when comparing estimates, great importance also attaches to the way the training variable is defined, how the survey question is posed and the type of training – formal or informal, general or firm specific, all or just “relevant” training – which is included. One should be careful when interpreting econometric results because training variables may capture very diverse kinds of training.

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5 Appendix

Table 17: Data for further training

Name of the survey	Sponsor/enforcing institution	Kind of survey	Criteria of the survey
Official Statistics (Amtliche Statistiken)			
Micro-Census	enforcement: Federal Statistical Office (Statistisches Bundesamt)/ Statistical Offices of the Länder (Statistische Landesämter)	household sample about the population and the labour market, questions about further education with a sampling fraction of 0,5% of the population; periodicity: annual	<ul style="list-style-type: none"> * participants of advanced vocational training * location of the measure * purpose * duration * socio-demographic information * participants of general further education * location of the measure * purpose * duration * socio-demographic information
Continuing Vocational Training Survey (CVTS)	European Commission/ Eurostat enforcement for Germany: Federal Statistical Office (Statistisches Bundesamt)/ Statistical Offices of the Länder (Statistische Landesämter)/ Federal Institute for Vocational Training and Education (Bundesinstitut für Berufsbildung (BIBB))	establishment survey on European level (stratified random sample at businesses with more than 10 employees); periodicity: irregular 1994, 1999	<ul style="list-style-type: none"> * establishment provided offers of further education * participation quota * participation hours * socio-demographic information * cost
Statistics of the general-education schools (evening schools)	enforcement: Federal Statistical Office (Statistisches Bundesamt)/ Statistical Offices of the Länder (Statistische Landesämter) (coordinated statistics of the Länder)	total survey of the evening schools; periodicity: annual	<ul style="list-style-type: none"> * participants (students) * lessons * classes * socio-demographic information

to be continued...

...table 17 continued

Name of the survey	Sponsor/enforcing institution	Kind of survey	Criteria of the survey
Statistics of the technical schools (vocational schools)	enforcement: Federal Statistical Office (Statistisches Bundesamt)/ Statistical Offices of the Länder (Statistische Landesämter) (coordinated statistics of the Länder)	total survey of the vocational schools; periodicity: annual	* participants (students) * final examinations * socio-demographic information
Statistic of the vocational education	enforcement: Federal Statistical Office (Statistisches Bundesamt)/ Statistical Offices of the Länder (Statistische Landesämter)	total survey of the responsible departments for approval of further education examination and the examination for master craftsman's certificate; periodicity: annual	* participants of examinations * passed examinations * kind of degree/certificate * socio-demographic information
Social Security Code III (SGBIII) Statistic	Federal Employment Office (Bundesanstalt für Arbeit)	annual statistic of the Federal Employment Office; periodicity: annual	* admissions, stocks, retirements of participants * socio-demographic information * expenses
Statistics of guest auditors	enforcement: Federal Statistical Office (Statistisches Bundesamt)/ Statistical Offices of the Länder (Statistische Landesämter)	total survey of the universities; periodicity: annual	* guest auditors * socio-demographic information

to be continued...

...table 17 continued

Name of the survey	Sponsor/enforcing institution	Kind of survey	Criteria of the survey
Surveys of (economic) institutes individual surveys			
Further education report system (Berichtssystem Weiterbildung)	Federal Ministry of Education and Research (Bundesministerium für Bildung und Forschung) enforcement: Infratest social research (Infratest Sozialforschung) in cooperation with the Institute for development planning and structure research (Institut für Entwicklungsplanung und Strukturforschung) and Helmut Kuwan, Social-scientific research and consulting, Munich (Sozial-wissenschaftliche Forschung und Beratung)	sample survey of the population at the age of 19 to 64 years (stratified random sample); periodicity: every 3 years (since 1979) since 1988 including other further education statistical data as integrated report	<ul style="list-style-type: none"> * participation quota * participation cases * further education volume * socio-demographic information * information concerning employment * structure of the activity * structure of the responsible bodies * motivationale (motivational?) factors * structures of informal and self-directed learning * cost and financing * regional characteristics
BiBB/IAB surveys	Federal Institute for Vocational Training and Education (Bundesinstitut für Berufsbildung (BiBB))/Institute for Employment Research (Institut für Arbeitsmarkt und Berufsforschung (IAB))	sample survey of employees older than 15 years with a regularly, paid employment of at least 10 hours per week; survey for gainful employment and educational biography; periodicity: irregular 1979, 1985/86, 1991/92, 1998/99	<ul style="list-style-type: none"> * participation quota * learning location * courses and other kinds of learning * socio-demographic information * demand for further education

to be continued...

...table 17 continued

Name of the survey	Sponsor/enforcing institution	Kind of survey	Criteria of the survey
German Economic Panel (GSOEP)	Federal Ministry of Education and Research (Bundesministerium für Bildung und Forschung)/ German Research Foundation (Deutsche Forschungsgemeinschaft) enforcement: German Institute for Economic Research (Deutsches Institut für Wirtschaftsforschung), Infratest social research (infratest Sozialforschung)	household sample of the resident population at the age of 20 to 65 years with thematically emphasized phases; periodicity: annual, on-the-job training irregular 1989, 1993, 2000	* participation quota * socio-demographic information * duration of the measure * lessons * kind of event * motivating factors
establishment surveys			
IAB- Betriebspanel	Institute for Employment Research (Institut für Arbeitsmarkt und Berufsforschung (IAB))	establishment survey (stratified random sample at companies with at least one employee who is subject to social insurance contribution); periodicity: annual, on-the-job training since 1997 every 2 years	* offers of on-the-job training * participation quota * subject areas * socio-demographic information * informal further education * financing
IW (Institute of the German Economy) survey on-the-job training	Institute of the German Economy (Institut der Deutschen Wirtschaft (IW)) in cooperation with the board of trustees of the German Economy for vocational training (Kuratorium der Deutschen Wirtschaft für Berufsbildung) (association of the central organizations of the economy)	establishment survey; periodicity: every 3 years (since 1992)	* offers of on-the-job training * participation cases * subject areas * courses and other kinds of learning * socio-demographic information * time organization * cost

to be continued...

...table 17 continued

Name of the survey	Sponsor/enforcing institution	Kind of survey	Criteria of the survey
German life course study (Deutsche Lebensverlaufsstudie (DELVA))	Max-Planck-Institut (MPI) for education research (für Bildungsforschung)	persons in age-group cohorts; periodicity: irregular (last time 1998/1999)	persons in age-group cohorts; periodicity: irregular (last time 1998/1999)
further education monitor (Weiterbildungsmoitor (wbmonitor))	Federal Institute for Vocational Training and Education (Bundesinstitut für Berufsbildung (BIBB))	provider of further education, persons; periodicity: up to two times per year	provider of further education, persons; periodicity: up to two times per year
Statistics of the responsible departments			
Statistics of the adult education program	German Institute for Adult Education (Deutsches Institut für Erwachsenenbildung)	Achievement statistics (Leistungstatistik) of all German adult education programs; periodicity: annual	Achievement statistics (Leistungstatistik) of all German adult education programs; periodicity: annual
Statistics of the protestant adult education	German Protestant joint venture for adult education (Deutsche Evangelische Arbeitsgemeinschaft für Erwachsenenbildung)	Achievement statistics (Leistungstatistik); periodicity: annual	Achievement statistics (Leistungstatistik); periodicity: annual
Statistics of the catholic adult education	Catholic Federal joint venture for adult education (Katholische Bundesarbeitsgemeinschaft für Erwachsenenbildung)	Achievement statistics (Leistungstatistik); periodicity: annual	Achievement statistics (Leistungstatistik); periodicity: annual
Statistics of the Chambers of Industry and Commerce	German Association of Industry and Commerce (Deutscher Industrie- und Handelstag)	Secondary statistics (Sekundärstatistik); periodicity: annual	Secondary statistics (Sekundärstatistik); periodicity: annual
Statistics of the Chambers of Handicrafts	German Confederation of Skilled Crafts (Zentralverband des Deutschen Handwerks)	Secondary statistics (Sekundärstatistik); periodicity: annual	Secondary statistics (Sekundärstatistik); periodicity: annual
Statistics of the Chambers of Agriculture culture	Chambers of Agriculture (Landwirtschaftskammern)	Secondary statistics (Sekundärstatistik); periodicity: annual	Secondary statistics (Sekundärstatistik); periodicity: annual

to be continued...

...table 17 continued

Name of the survey	Sponsor/enforcing institution	Kind of survey	Criteria of the survey
Statistics of the "Berufsbildungswerk (bfw)" of the German Confederation of Trade Unions (DGB)	Berufsbildungswerk (bfw)	Secondary statistics (Sekundärstatistik); periodicity: annual	
Statistic of the correspondence courses	Federal Ministry of Education and Research (Bundesministerium für Bildung und Forschung) enforcement: Federal Statistical Office (Statistisches Bundesamt), Forum Distance-Learning (ehemals Deutscher Fernschulverband)	Survey of the correspondence colleges periodicity: annual	

Table 18: Means and standard deviations of variables used in the 3 data sets

Variables	Micro-Census 99		SOEP 99		BIBB-IAB 99	
	Means	Std. Dev.	Means	Std. Dev.	Means	Std. Dev.
Female	0.33	0.47	0.36	0.48	0.30	0.46
East Germany	0.25	0.43	0.24	0.43	0.25	0.43
Age	41.09	9.81	41.40	9.85	41.41	10.14
Age 17 to 19	0.00	0.00	0.00	0.00	0.00	0.00
Age 20 to 24	0.00	0.00	0.00	0.00	0.00	0.00
Age 25 to 29	0.13	0.34	0.12	0.33	0.13	0.34
Age 30 to 34	0.18	0.38	0.18	0.38	0.18	0.38
Age 35 to 39	0.17	0.38	0.17	0.37	0.16	0.37
Age 40 to 44	0.15	0.36	0.15	0.36	0.15	0.36
Age 45 to 49	0.14	0.35	0.14	0.35	0.13	0.34
Age 50 to 54	0.10	0.30	0.10	0.31	0.10	0.30
Age 55 and above	0.12	0.33	0.13	0.34	0.14	0.35
Lower secondary school	0.40	0.49	0.38	0.49	0.42	0.49
Intermediate secondary school	0.36	0.48	0.34	0.47	0.36	0.48
Entrance examination for university of applied sciences	0.05	0.22	0.05	0.22	0.05	0.22
High school diploma	0.17	0.38	0.17	0.38	0.16	0.37
Without school leaving certificate	0.01	0.09	0.02	0.14	0.02	0.15
Without professional degree	0.08	0.27	0.11	0.32	0.10	0.30
Vocational school	0.07	0.25	0.11	0.31	0.03	0.17
Apprenticeship on the job	0.58	0.49	0.56	0.50	0.62	0.48
Apprenticeship at school	0.65	0.48	0.65	0.48	0.65	0.48
Master craftsman	0.09	0.29	0.08	0.27	0.12	0.33
University of applied sciences	0.06	0.24	0.05	0.23	0.05	0.22
University	0.09	0.28	0.10	0.30	0.08	0.26
Gross monthly wage			4741.37	2110.17	4286.16	1957.06
Net monthly wage	3026.64	1556.66	2996.44	1395.08		
Blue-collar worker	0.40	0.49	0.39	0.49	0.42	0.49
White-collar worker	0.60	0.49	0.61	0.49	0.58	0.49
Hamburg	0.02	0.14	0.02	0.14	0.02	0.13
Niedersachsen	0.09	0.29	0.10	0.30	0.10	0.00
Bremen	0.01	0.08	0.01	0.08	0.01	0.09
Nordrhein-Westfalen	0.20	0.40	0.24	0.42	0.20	0.40
Hessen	0.07	0.25	0.06	0.24	0.07	0.26
Rheinland-Pfalz	0.06	0.24	0.06	0.23	0.06	0.24
Baden-Württemberg	0.12	0.33	0.10	0.30	0.12	0.33
Bayern	0.15	0.35	0.13	0.34	0.14	0.35
Berlin	0.04	0.20	0.05	0.21	0.04	0.20
Brandenburg	0.04	0.20	0.03	0.18	0.04	0.20
Mecklenburg-Vorpommern	0.03	0.16	0.02	0.15	0.03	0.16
Sachsen	0.07	0.25	0.07	0.25	0.06	0.25
Sachsen-Anhalt	0.04	0.19	0.04	0.19	0.04	0.19
Thüringen	0.04	0.19	0.04	0.19	0.04	0.19
Schleswig-Holstein	0.03	0.18	0.05	0.22	0.03	0.18
Number of observations	10,6262		6,212		17,915	

Table 19: Training related questions in the SOEP 1999 data set

German	English
<p>SOEP1-99) (Alle) Sind Sie derzeit in Ausbildung? Das heißt: besuchen Sie eine Schule, Hochschule, machen Sie eine Berufsausbildung oder nehmen Sie an einem Weiterbildungslehrgang teil? – Antworten : ja, nein bei ja nächste Frage</p>	<p>SOEP1-99e) (All) Are you currently in some sort of education? In other words, do you attend a school or institution of higher education, are you engaged in an apprenticeship or are you participating in further education or training? – Answers: yes, no yes, next question</p>
<p>SOEP2-99) (Alle) Was für eine Ausbildung oder Weiterbildung ist das? – Antworten: - Lehrgang/Kursus zur Weiterbildung - Berufliche Umschulung - Berufliche Fortbildung - Berufliche Rehabilitation - Allgemeine oder politische Weiterbildung - Sonstiges</p>	<p>SOEP2-99e) (All) What type of education or further training is that? – answers: - Training, classes for further education and training - Professional or vocational retraining (Umschulung) - Further education in your profession - Professional rehabilitation - Further education in politics or general - Other</p>
<p>SOEP3-99) (Nur Erwerbstätige) Wie wahrscheinlich ist es, dass innerhalb der nächsten zwei Jahre die folgenden beruflichen Veränderungen für Sie eintreten? – Antworten: - Dass Sie sich durch Lehrgänge/Kurse weiterqualifizieren oder fortbilden? Skala von 0 bis 100 von “mit Sicherheit nicht eintreten” bis “mit Sicherheit eintreten”</p>	<p>SOEP3-99e) (Only employees) Is it likely that within the next 2 years you will experience the following occupational changes? – answers: - That you will gain further qualifications or education through courses?</p>
<p>SOEP4-99) (Alle) Haben Sie im Zeitraum seit Anfang 1998 eine Schule, eine Berufsausbildung oder ein Hochschulstudium abgeschlossen? Wenn ja, wann war das? – Antworten: - 1998 Monat ? - 1999 Monat ?</p>	<p>SOEP4-99e) (All) Did you finish schooling, vocational training, or university education since the beginning of 1998? If yes, when? – Answers: - 1998 month ? - 1999 month ?</p>

to be continued...

...table 19 continued

German	English
<p>SOEP5-99) (Alle) Um was für einen Bildungsabschluss handelt es sich?</p> <ul style="list-style-type: none"> - Antworten: - Beruflicher Ausbildungsabschluss ... - Betriebliche Umschulung - Sonstiges, z.B. Fortbildungslehrgang 	<p>SOEP5-99e) (All) What sort of a degree did you receive?</p> <ul style="list-style-type: none"> - answers: - Vocational Degree - Company retraining - Other, for example further training
<p>SOEP6-99) (Alle) Und nun denken Sie bitte an das ganze letzte Jahr, also 1998.</p> <ul style="list-style-type: none"> - Antworten: Kalender mit allen 12 Monaten, diese ankreuzen in welchen man "in betrieblicher Ausbildung/Fortbildung/Umschulung" war 	<p>SOEP6-99e) (All) And think back now on all of 1998.</p> <ul style="list-style-type: none"> - answers: calendar with all 12 months, cross the ones in which you were "in company training/ apprenticeship/ further training/retraining"

Table 20: Training related questions in the Micro-Census 1999 data set

German	Englisch
MZ1-99) Nehmen Sie gegenwärtig an einer Bildungsmaßnahme teil, oder haben Sie an einer solchen seit Ende April 1998 teilgenommen? - Antworten: Ja... ...an einer beruflichen Aus- oder Fortbildung bzw. Umschulung ...an einer Maßnahme der allgemeinen Weiterbildung ...sowohl an einer beruflichen Aus- oder Fortbildung bzw. Umschulung als auch einer Maßnahme der allgemeinen Weiterbildung - - Nein	MZ1-99e) Do you currently take part in an education measure or did you since end of April 1998? - answers: Yes... ...a vocational, training or retraining or further education ... a measure of general further education ... as well as - No
MZ2-99) Haben Sie an der beruflichen Ausbildung, Fortbildung oder Umschulung in den letzten 4 Wochen teilgenommen? - Antworten: ja, nein	MZ2-99e) Did you take part in the vocational training, retraining or further education in the last 4 weeks? - answers: yes, no
MZ3-99) Ist (oder war) diese Maßnahme ein berufliches Praktikum oder eine Lehrausbildung? - Antworten: Ja... ...ein berufliches Praktikum ...eine Lehrausbildung - Nein, eine sonstige Ausbildung, Fortbildung, Umschulung	MZ3-99e) Is (or was) this measure a professional practical course or a Lehrausbildung? - answers: Yes... ...a professional practical course ...a Lehrausbildung - No, a different training, retraining, further education to be continued...

...table 20 continued

German	Englisch
<p>MZ4-99) Was ist (oder war) der Zweck dieser Maßnahme?</p> <ul style="list-style-type: none"> - Antworten: - Erste berufliche Ausbildung - Durch das Arbeitsamt geförderte Maßnahme der Aus- und Fortbildung, Umschulung - Berufliche Weiterbildung und zwar... ...zur beruflichen Weiterentwicklung, Vertiefung von Fachkenntnissen, Anpassung an technologische Veränderungen ...zur Vorbereitung auf die Rückkehr ins Arbeitsleben nach längerer Unterbrechung ...zu sonstigen Zwecken 	<p>MZ4-99e) What is (or was) the purpose of this measure?</p> <ul style="list-style-type: none"> - answers: - first job training - measure of training, retraining, further education funded by the Federal Employment Office – vocational further education... ...for vocational advancement, deepening specialized knowledge, accommodation on technical changes ...as preparation for return to working life after a long break ...other purposes
<p>MZ5-99) Wo beziehungsweise wie wird (oder wurde) diese Maßnahme überwiegend durchgeführt?</p> <ul style="list-style-type: none"> - Antworten: - Am Arbeitsplatz und in einer beruflichen Schule/Bildungseinrichtung - Unterricht an einer beruflichen Schule/Hochschule oder einer sonstigen Bildungseinrichtung - Am Arbeitsplatz - Durch Fernunterricht - Selbststudium - Tagungen, Seminare, Arbeitsgruppen 	<p>MZ5-99e) Where respectively how is (or was) this measure predominantly accomplished?</p> <ul style="list-style-type: none"> - answers: - at working place and in vocational school/education institution - lessons at a vocational school/academy or different education institution - at working place - through distance learning - private study - diet, seminars, working groups

to be continued...

...table 20 continued

German	Englisch
MZ6-99) Wie lange dauert (oder dauerte) diese Maßnahme insgesamt?	MZ6-99e) How long takes (or took) this measure all in all?
- Antworten:	- answers:
- unter 1 Woche	- less than 1 week
- 1 Woche bis unter 1 Monat	- between 1 week and 1 month
- 1 bis unter 3 Monate	- between 1 month and 3 months
- 3 bis unter 6 Monate	- between 3 months and 6 months
- 6 bis unter 12 Monate	- between 6 months and 12 months
- 1 bis unter 2 Jahre	- between 1 year and 2 years
- 2 Jahre und mehr	- 2 years and longer
- unbestimmte Dauer	- length is unknown
MZ7-99) Wie viele Ausbildungsstunden umfaßt (oder umfaßte) die Maßnahme üblicherweise pro Woche?	MZ7-99e) How many lessons contains (or contained) this measure usually per week?
- Antwort: Angabe der Stundenanzahl	- answers:
MZ8-99) Haben Sie an der Maßnahme der allgemeinen Weiterbildung in den letzten 4 Wochen teilgenommen?	MZ6-99e) Did you participate in the measure of general further education in the last 4 weeks?
- Antworten: ja, nein, keine Angabe	- answers: yes, no, no comment
MZ9-99) Wie oben: Frage nach dem wo bei allgemeiner Weiterbildung	Like above: question on where general training took place

Table 21: Training related questions in the BiBB/IAB 1998/99 data set

German	Englisch
<p>BiBB2) Denken Sie nun einmal an die letzten 5 Jahre, also die Zeit von Anfang 1994 bis heute. Haben Sie in dieser Zeit Lehrgänge, Kurse oder Seminare besucht, die der Weiterbildung im Beruf oder der beruflichen Umschulung dienen? – Antworten: ja, nein, weiß nicht</p>	<p>BiBB2e) Please think of the last 5 years, the time since the beginning of 1994 till now. Did you take any courses, trainings or seminars, which served further education in the job or vocational retraining?</p>
<p>BiBB3) In welchem Jahr haben Sie zuletzt an einem solchen Lehrgang oder Kurs teilgenommen?</p>	<p>BiBB3e) In which year did you lastly attend such a course or training?</p>
<p>BiBB4) Welche der folgenden Fortbildungsmöglichkeiten haben Sie in den vergangenen zwei Jahren - also seit Beginn 1997 - genutzt, um zusätzliche Kenntnisse zu erwerben? (Mehrfachnennungen) – Antworten: - Fachmessen, Kongresse, Ausstellungen besucht - An Fachvorträgen, Vorführungen, Präsentationen teilgenommen - Einarbeitung, Einweisung am Arbeitsplatz - An betrieblichen Maßnahmen wie Qualitätszirkeln, Lernstatt o.ä. teilgenommen - Praktikum, Hospitation, Abordnung - Besondere Aufgaben übernommen, um berufliche Kenntnisse, Erfahrungen zu erweitern - Regelmäßige Lektüre von Fachzeitschriften, Fachliteratur - Anderweitig beruflich fortgebildet (aber nicht Lehrgänge, Kurse oder Seminare) - nichts davon - weiß nicht/verweigert</p>	<p>BiBB4) Which of the following possibilities for further education did you use in the last two years to gain additional skills? - visited trade fairs, conventions, exhibitions - participated in lectures, performances, presentations - briefings, adjustment to the place of employment - participated in internal measures - internship, attendance, delegation - took special duties and responsibilities to extend my professional skills, experiences - regular reading of trade journals, technical literature - ulterior vocational upgrading</p>

Table 22: Impact of training in Germany

Authors	Data	Investigation period	Kind of searched qualification	Outcome variable	Methods	Results
Pannenberg (1995)	GSOEP west	1984-1991	1. off-the-job training 2. on-the-job training	1. probability of (re)employment income 2. probability of reemployment income	1. discrete hazard-rate model 2. fixed effects model 1. discrete hazard-rate model 2. linear panel model with fixed effects	1. probability of employment: + 2. income: + 1. probability of reemployment: main effect: 0 2. income: main effect: -
Weiterbildungsaktivitäten und Erwerbsbiographie. Eine empirische Analyse für Deutschland, Frankfurt, New York.						
Pannenberg (1997)	GSOEP west	1984-1991	on-the-job training and find of financing; * self-financed * shared-financed * employer-financed * employer supported	1. starting wages 2. wages 3. job mobility 4. inter-nal career ladder	1. OLS with corrected covariance matrix (White) 2. fixed effects model with corrected covariance matrix 3. Poisson model 4. Bivariate probit with mixed structure	1. on-the-job training: ++ self-financed: ++ employer-supported: ++ 2. on-the-job training: ++ shared-financed: ++ employer-financed: + 3. on-the-job training: n.s. 4. on-the-job training: n.s. employer-supported finance: -
Financing on-the-job training: Shared investment or promotion based system? Evidence from Germany in: Zeitschrift für Wirtschafts- und Sozialwissenschaften Nr. 117, S. 525-543.						
Pannenberg (1998)	GSOEP	1989-1993	on-the-job training effect differentiated in tenure	income	linear panel model with fixed effects with robust covariance matrix	men: 3rd year tenure ++ remainder tenure: + (variance of coefficients 0-13) women: 3rd year tenure ++ remainder tenure: + (variance of coefficients 0-24, especially in the first years more)
Weiterbildung, Betriebszugehörigkeit und Löhne: Ökonomische Effekte des "timings" von Investitionen in die berufliche Weiterbildung in: to be continued...						

...table 22 continued

Authors	Data	Investigation period	Kind of searched qualification	Outcome variable	Methods	Results
Pfeiffer, F./Pohlmeier W. (Hrsg.) Qualifikation, Weiterbildung und Arbeitsmarkterfolg. ZEW Wirtschaftsanalysen, Band 31. Baden-Baden: Nomos.						
Lechner (1999)	GSOEP east	1990-1994	on-the-job training	1. unemployment 2. full-time employment 3. income	framework: "potential outcome approach to causality" nonparametric regression matching approach	1. unemployment: 0 2. full-time employment: 0 3. income: +
The Effects of Enterprise-Related Continuous Vocational Training in East Germany on Individual Employment and Earnings in: Annales d'Economie et de Statistique, No. 55-56, pp. 97-128, 1999.						
Pfeiffer, Reize (2001)	BiBB/IAB survey	1991/92	formal and informal on-the-job training	1. determinants of training 2. income 3. income differentials	switching regression model with endogenous switching	2. partial correlation between income and training: employees (formal): 0,10 employees (informal): 0,078 self-employed: 0
Formelle und informelle berufliche Weiterbildung und Verdienst bei Arbeitnehmern und Selbständigen. in: Robert K. von Weizsäcker, Bildung und Beschäftigung, Schriften des Vereins für Socialpolitik Bd. 284, Berlin, 215 - 273.						
Bellmann, Büchel (2001)	IAB establishment panel	1997-1998	on-the-job training	1. firm productivity	1. semi-logarithmic regression 2. Heckmann selection correction	1. firm productivity: + (highly significant) 2. firm productivity: + (under 10% level of significance)
Betrieblich finanzierte Weiterbildung und Unternehmenserfolg. In: Backes-Gellner, Uschi/Moog, Petra (Hrsg.): Bildungssystem und betriebliche Beschäftigungsstrategien. Berlin: Duncker-Humblot, S. 75-92.						
Pischke (2001)	GSOEP west	1986-1989	on-the-job training	income	(fixed-effects regression) fixed growth rates estimation	during work hours: + (ns) during leisure time: ++ (ns) (especially women)
Continuous training in Germany in: Journal of Population Economics, 2001, v. 14, iss. 3, pp. 523-548.						

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...table 22 continued

Authors	Data	Investigation period	Kind of searched qualification	Outcome variable	Methods	Results
Schömann, Becker (2002)	GLHS west GSOEP east	1950-1993 1989-1993	1. on-the-job training 2. on-the-job training 3. off-the-job training (public financed)	1. income (west) job change/same job 2. job security (east) 3. probability of employment	1. job change: instrumental variable estimation (?) same job: stochastic differential equation with hazard rate 2. dynamic estimation with hazard rate 3. exponential model with hazard rate	1. job change: men: + women: + (only when job and employer change) same job: men: + women: + 2. job security: + 3. probability of employment: men: 0 women: +
A long-term perspective on the effects of training in Germany in: Schömann, K./Becker, R. Education, training and employment dynamics: Transitional labour markets in the European Union, 200, pp. 153-185.						
Hempel (2003)	Mannheim Innovation Panel in Services (MIP-S)	1994-1998	1. ICT-investments 2. firm-sponsored training	firm productivity	two-step GMM estimator system	1. firm productivity: 0 2. firm productivity: + (n.s.) 3. firm productivity (both): ++
Do Computers Call for Training? Firm-level Evidence on Complementarities Between ICT and Human Capital Investments. ZEW Discussion Paper No. 03-20.						
Zwick (2004)	IAB establishment panel	1997-2000	intensity of training (fraction of trained employees)	1. firm productivity (work councils) 2. firm productivity (no work councils)	1.1. system GMM estimator 1.2. instrumental variable estimation (IV) 2. fixed effects	1.1. firm productivity: + (only marginal significant) 1.2. firm productivity: + 2. firm productivity: 0
Weiterbildungsintensität und betriebliche Produktivität in: Zeitschrift für Betriebswirtschaft, July 2004, v. 74, iss. 7, pp. 651-668.						
Büchel, Pannenberg (2004)	GSOEP BiBB/IAB survey	1984-2001 1998/1999	on-the-job training	1. income 2. course of career 3. risk of unemployment	longitudinal analysis 1. linear panel model with fixed effects 2. probit model 3. probit model	1. income: + 2. course of career: young west: + over 45 west: 0 male young east: + remainder east: 0 3. risk of unemployment: +
Berufliche Weiterbildung in West- und Ostdeutschland - Teilnehmer, Struktur und individueller Ertrag in: Zeitschrift für Arbeitsmarktforschung, Jg. 37, H.2. S. 73-126.						

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Authors	Data	Investigation period	Kind of searched qualification	Outcome variable	Methods	Results
Jürges, Schneider (2005)	GSOEP west	1984-2000	on-the-job training	income	1. regressions (Hausmann-Taylor resp. fixed growth) 2. matching approaches	1. income: + (ns) 2. income: + (ns)
Dynamische Lohneffekte beruflicher Weiterbildung - Eine Längsschnittanalyse mit den Daten des SOEP. MEA Discussion Paper No. 92-2005.						
Zwick (2005)	IAB establishment panel	1997-2001	kind of training	firm productivity	cross-section analysis, switching regression model, two-step panel estimation (1st step: system GMM, 2nd step: fixed effects estimation)	formal courses: ++ internal courses: + (short-run) informal: 0 on-the-job-training: -
Continuing Vocational Training Forms and Establishment Productivity in Germany in: German Economic Review, May 2005, v. 6, iss. 2, pp. 155-184.						
Zwick (2006)	IAB establishment panel	1997-2000	intensity of training (fraction of trained employees)	firm productivity	1. fixed effects 2. instrumental variable estimation (IV)	1. firm productivity: + (only marginal significant) 2. firm productivity: +
The Impact of Training Intensity on Establishment Productivity in: Industrial Relations 45 (1), 26-46.						