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Abstract: This paper analyses the effect of the economic crisis in the years 2008 and 2009 on individual training activities of different employee groups within establishments. We use a unique German linked employer–employee panel data set with detailed information on individual training history (WeLL-ADIAB). The so-called Great Recession can be seen as an exogenous, unexpected, and time-limited shock. Although our results cannot be interpreted in a strictly causal manner, our Diff-in-Diff analyses suggest a direct negative effect of the crisis on individual training activities in 2009 and 2010. The negative effect therefore sets in with a time lag and lasts until after the recession. Furthermore, the recession has a stronger effect for employees in unskilled jobs than for employees in skilled jobs.

Keywords: training, financial crisis, linked employer employee data set

JEL Classification: M53, O16

1 Introduction

Further training in Germany is market driven and investment decisions are mainly taken and funded by the establishments (Bender et al. 2008a). Training firms expect productivity gains at the individual and establishment levels (Zwick 2005) and aim to recoup their training investments by obtaining a difference between productivity and wages after training (Dearden et al. 2000). Training therefore might increase the competitiveness of employers. However, in economically difficult and uncertain times, credit constraints and a reduced cash flow might induce employers to reduce training. Training investments might be reduced because of uncertain future employment needs and the lower expected tenure of trained employees. Training might also decrease when employers shift

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investments to more pressing areas because training investments are often expensive, their true benefits are rather hard to assess, and they may come with a lag. Firms however also might use slack periods during recessions in order to increase the share of training in total investments because their opportunity costs are temporarily low. In addition, the outside options for trained employees decrease in uncertain times and therefore the costs necessary to retain trained employees might be lower. Both arguments lead to different predictions of the consequences of recessions for training investments and competitiveness. Hence, it is important to empirically investigate how establishments' training activities are affected by a recession. As establishments' training provision often depends on the skill level of the employees (Barron et al. 1999; Blundell et al. 1999), the question also arises whether establishments' reactions in training activities are specific to certain employee groups. If less skilled employee groups are hit harder by recessions, this might be a reason for the increase in inequality after recessions (Forster et al. 2011; Grabka 2015; OECD 2015).

This paper focuses on the consequences of the so-called Great Recession in the years 2008 and 2009 on training efforts of firms in Germany. This crisis was triggered primarily by the collapse of the US real estate market. In particular, the bankruptcy of the bank Lehman Brothers in late 2008 and the subsequent collapse of the interbank lending market led to a decline in demand, resulting from banks' restricted resources for lending and credit constraints (Bond et al. 2005; Ivashina/Scharfstein 2010). In contrast to other countries, the labour market in Germany was only partially affected with mainly the export-oriented manufacturing industry being hit by demand reductions and credit constraints (Möller 2010; Hochfellner et al. 2015). Other economic sectors were hardly affected. The crisis was short, pervasive, and it came as a surprise for most politicians, managers, and employees (Bloom 2014). We therefore do not have to take anticipation effects into account and we can use the Great Recession as quasi-natural experiment. In this experiment the training reactions of a treatment group of firms that was affected by an exogenous demand and credit shock can be compared to training activities of firms that were not affected. We use a Diff-in-Diff analysis and therefore can to a certain extent avoid the usual problem that unobservable third factors such as management quality or the importance of human capital for competitiveness drive both, the impact of the business cycle and firm training decisions (Hochfellner et al. 2015; Popov 2014).

This paper builds on contributions that analysed the consequences of the Great recession in Germany on training incidence and replicates their results using a different sample of the same basic data source, the IAB establishment data (Bellmann et al. 2014; Hochfellner et al. 2015). The paper's three main contributions to the literature are the following:

- 1) We differentiate between the effects of the recession on training incidence of employees working in skilled and unskilled jobs. We therefore can take into account that the establishments' training provision often depends on the skill level required for the job. Higher ability that is usually required for skilled jobs in comparison to unskilled jobs lowers the costs of training. Lower training costs might result in increasing rates of returns to training with the skill level required for the job. Furthermore, higher education and skill levels help employees to adapt more rapidly to new tasks (Blundell et al. 1999). Nevertheless, firms might also offer up-skilling to employees in low-skill jobs during a recession in order to be able to retain these employees and enable them for new tasks during the next boom phase (Brunello 2009).¹
- 2) We extend the observation period to the years 2006 until 2010. We therefore can include two pre-crisis years and one year in which many firm have already recovered from the crisis. We therefore can show whether the effect of the crisis on training deepens if it takes longer for certain employers.
- 3) We use information about training incidence derived from an individual employee survey instead of an employer survey. The WeLL-ADIAB allows us to relate detailed individual training information to the establishments in which the training measures took place (Bender et al. 2008a; Spengler 2007). From these establishments we have detailed yearly information on the degree to which they were hit by the economic crisis (Fischer et al. 2008). As the two main variables of our analysis, training incidence and crisis information therefore come from two distinct sources, we avoid common method bias that potentially affects analyses that derive their information from one source only.²

The paper is organised as follows. Chapter 2 provides the theoretical framework and derives the hypotheses. Chapter 3 presents the data set and the identification strategy. The results of descriptive and multivariate analyses as well as the robustness checks are shown and discussed in Chapter 4. The paper ends with a conclusion in Chapter 5.

¹ Hochfellner et al. (2015) also look at differences in the consequences of the Great recession by qualification. They concentrate on earnings however because the LIAB does not provide information on further training incidence.

² Hochfellner et al. (2015) also avoid common method bias and use the location of firms as an indirect crisis indicator.

2 Theoretical framework

2.1 Background discussion

From a theoretical perspective, there is ambiguity as to whether an economic crisis leads to higher or lower training activities. In economically tough times, declines in demand often leave capacities underutilized. As the loss of working time is cheaper with idle capacities, opportunity costs of further training are lower (Aghion/Saint-Paul 1998; Brunello 2009). During the crisis, the outside options for trained employees are also relatively bad and therefore the risk of poaching for these employees declines. The lower exit risk of trained workers additionally reduces the opportunity costs of training (Felstead/Green 1996; Mason/Bishop 2015). As a consequence, establishments might have higher incentives to exempt employees from everyday work to participate in training measures. Furthermore, the possibility of participating in training even in rough times may contribute to employees' motivation and commitment (Bellmann et al. 2014). Another argument for higher training activities in a recession is that qualified employees will be more productive in the following upswing (Brunello 2009). Keeping people in the establishment instead of dismissing them also saves adjustment costs such as dismissal costs and costs of new hiring and initial training (Horning 1994; Knudsen/Lien 2015; Mason/Bishop 2015). The strategy of labour hoarding in combination with training activities is particularly important in view of the expected shortage of skilled workers and the necessity of retaining qualified employees in a boom phase (Möller 2010). Finally, recessions frequently lead to a faster implementation of new vintages of technology (Caballero/Hammour 1994). The increased technological change might increase the training demand in order to keep employees productive (Hershbein/Kahn 2018).

However, economic theory also suggests that establishments may reduce training activities in times of crisis. Owing to declining sales and possible credit constraints, establishments must limit their investments in all areas (Mason/Bishop 2015). Training costs are often very high, and their effects and benefits are generally rather hard to assess and may come with a lag (Becker 1962). Therefore, establishments might tend to invest their limited resources in areas where short-term returns can be generated (Bellmann et al. 2014; Popov 2014). Especially when the duration of the crisis and establishments' future prospects are difficult to predict, it is uncertain whether a return on training can be achieved at all. Training measures only become efficient for establishments when the marginal productivity of the trained employees is higher than their

wages (Barron et al. 1997). However, when capacity utilization is not expected to return to pre-recession levels, there may also be lower expectations regarding the impact of training on productivity (Mason/Bishop 2015; Shury 2010). In case of reduced commercial activities, the capabilities of trained employees cannot be fully utilized. In addition, there is lower demand for initial training because fewer employees are hired (Brunello 2009). In consequence, establishments may consider training as unprofitable and reduce their investments (Stevens 1994).

Cost–benefit considerations of training often suggest skill levels as key drivers for the provision of training. Higher abilities of the qualified employees reduce their training costs (Blundell et al. 1999; Cohen/Levinthal 1989). Better learning results are mainly caused by the well-established cumulative effect of knowledge acquisition. Accordingly, employees with higher levels of skills required in their jobs learn more easily (Dierickx/Cool 1989; Hatch/Dyer 2004). Also, Card (1999) and Heckman (1999) emphasize that higher skilled employees have higher learning abilities in further training. Higher learning abilities in turn lead to higher rates of return for trained employees with higher skills³ (Arulampalam/Booth 2001; Barron et al. 1989). In consequence, it usually is more profitable for an establishment to train well-qualified employees (Bassanini/Ok 2007; Kuckulenz/Zwick 2005). Furthermore, skilled employees are able to adapt more rapidly and efficiently to new tasks and they are often the main source of innovation (Blundell et al. 1999). Thus, especially employees in skilled jobs help to overcome an economic crisis that is associated with uncertainty and a higher need to adapt quickly (Caballero/Hammour 1996). Employees in skilled jobs are therefore more likely to be retained and trained during a recession (Hochfellner et al. 2015; Knudsen/Lien 2015). If employees in unskilled jobs get less retention and training offers during a recession, this might be one reason for the observation that earnings inequality frequently increases after recessions (Forster et al. 2011; Grabka 2015; OECD 2015; Foster et al. 2016).

The effect of a recession on training provision also might depend on the length and severity it (Brunello 2009). Some firms might sustain their previous training level in the hope that the recession is short and only those firms that find themselves hit by the recession for a long time strongly reduce training investments.

³ Positive selection into training must be considered. It is difficult to know whether the higher earnings of better qualified employees are caused by their higher education, or whether these employees choose to acquire more training. According to this, the return on training is sometimes overestimated (Blundell et al. 1999; Card 1999; Heckman 1999).

2.2 Previous empirical evidence

There are some studies on the impact of a recession on further training and they show contradicting results. Based on data from the US National Longitudinal Survey of Youth (NLSY), Majumdar (2007) reveals pro-cyclical training activities for the period from 1979 to 1988. He shows that the probability of receiving training decreases with the local unemployment rate. This relationship is explained by better recruitment possibilities in the labour market and therefore reduced incentives for establishments to provide training. Sepulveda (2004) also uses the NLSY data from 1979 to 1998 but finds counter-cyclical training participation. The training incidence and intensity of on-the-job training and off-the-job training decrease with GDP. Using data from 15 European countries, Bassanini/Brunello (2008) also suggest a negative relationship between the proportion of employees participating in training and the economic situation. Bassanini et al. (2007) find a positive correlation between training activities of establishments and unemployment rates in different European countries.

There are some studies analysing the effects of the Great Recession in the years 2008 and 2009 on the establishments' training activities. Based on different data sets and qualitative interviews from the UK, Felstead et al. (2012) find that the crisis had not a dramatic impact on training provision. Only a minority of establishments reduced spending per head. In many cases, establishments searched for more cost-effective ways of training and adapted these measures to their business needs. In contrast, Popov (2014) stresses that limited access to financial resources and bank credit is associated with significantly lower training investments. Analysing survey data on small and medium-sized establishments from 25 transition economies, he also reveals stronger negative effects of the recession on training in education-intensive sectors and in sectors with a good global growth potential (Popov 2014). Based on the IAB Establishment Panel, Bellmann et al. (2014) find that German establishments reduced their training activities in 2009 – at the peak of the crisis – compared with 2008, independently of whether or not they have been directly affected by the economic crisis. In addition, establishments that have been directly affected by the crisis reduced their training efforts to a much larger extent than other establishments. Mason/Bishop (2015) differentiate the impact of the recession on training for employee groups. Based on longitudinal data from the Employer Skills Updating Surveys in the UK, they find that the downturn has contributed to reductions in training especially for off-the-job training and for skilled and highly skilled employees. On-the-job training was reduced slightly and stronger targeted at employees with identified skill improvement needs. The employers were however just asked about training needs and not about the actual training

participation of their employees. Therefore, employers may have had an interest in reporting training statistics to their advantage. Hochfellner et al. (2015) provide the only analysis that examines the impact of the recent crisis on individual-level outcomes such as earnings, unemployment probability, and mobility. Based on a linked employer–employee data set for Germany (LIAB), they show that unskilled, less educated and less experienced employees are most negatively affected by financial shocks in the downturn. In contrast, employees in the higher skill categories are able to mitigate these shocks.

2.3 Hypotheses

From the theoretical perspective, it is not clear whether difficult economic times lead to higher or lower establishment training activities. There is empirical evidence for training being counter-cyclical (Sepulveda 2004) or pro-cyclical (Bassanini et al. 2007; Bassanini/Brunello 2008; Majumdar 2007). However, all studies that have analysed the effects of the Great Recession find negative effects on establishments' training activities (Bellmann et al. 2014; Felstead et al. 2012; Mason/Bishop 2015; Popov 2014). Our assumptions therefore are:

H₁: When establishments are negatively affected by the Great Recession, the training participation of their employees decreases.

H₂: When establishments are negatively affected by the Great Recession, the number of training measures offered decreases.

In the context of training decisions, for establishments, cost–benefit considerations are decisive. Training only becomes effective when employees' post-training benefits are greater than their costs and establishments achieve positive rates of return (Barron et al. 1997; Becker 1962). Owing to the limited financial resources, returns of training are essential in times of crisis. Training theory suggests higher returns of training and higher expected values for skilled training participants (Arulampalam/Booth 2001; Barron et al. 1989, 1999; Card 1999). Davis and Haltiwanger (1990) and Caballero and Hammour (1994) point to accelerated technological progress during recessions that forces employers to train their existing workforce or hire new employees with newer vintages of knowledge (“pitstop function of recessions”). Consequently, during recessions, large numbers of workers find their skills depreciated and a need to retrain in order to keep their jobs. Employees in skilled jobs might better be able to adapt to changes in skills demanded and to new technologies or business models than employees in unskilled jobs (Blundell et al. 1999).

The necessity of training during recessions therefore might be more than proportionally offered to employees in skilled jobs. We therefore assume:

H₃: When establishments are negatively affected by the Great Recession, the training participation of employees in unskilled jobs decreases stronger than training participation of employees in skilled jobs.

H₄: When establishments are negatively affected by the Great Recession, the number of training measures decreases stronger for employees in unskilled jobs than for employees in skilled jobs.

3 Data and identification strategy

We use the German linked employer–employee panel data set WeLL-ADIAB. The data set is based on a survey of 149 establishments that were selected from the 2005 wave of the IAB Establishment Panel.⁴ From these establishments, 7,352 randomly selected employees were asked in four annual waves⁵ about their individual training behaviour between 2006 and 2010.⁶ Training information includes the start and end dates, the duration as well as the thematic focus of the measures. An advantage of the data set is the linkage of the individual training information with administrative data at the individual level plus some information on the employer (Bender et al. 2008a; Spengler 2007; Dietz/Zwick 2016). Thus, in addition to socio-demographic information (age, sex, occupational status⁷), the complete

⁴ In the selection process, only establishments from manufacturing or the service industry located in the German federal states of Bavaria, Schleswig-Holstein and North Rhine-Westphalia, Mecklenburg-Western Pomerania and Saxony and establishments with between 50 and 1,999 employees were considered (Bender et al. 2008b; Knerr et al. 2012). As the selection of establishments did not occur randomly, the data set cannot claim to be representative of the population of German establishments. Please note that also the establishments covered in the LIAB are a sub-sample of the IAB Establishment Panel. It is however improbable that all establishments covered in WeLL-ADIAB are also included in the LIAB.

⁵ The first wave contains the complete training information for the years 2006 and 2007, the second wave the training information for the year 2008, the third wave for 2009 and the fourth wave for 2010.

⁶ The questionnaire presented a list of formal and informal training measures the questions on training participation are related to: internal and external courses, participation in presentations and congresses, on-the-job training, participation in quality circles or other workshops, coaching/mentoring, job rotation and self-directed learning, compare Bender et al. (2008b).

⁷ We include information about the topical occupational status (*Stellung im Beruf*, stib) variable in the data set (unskilled vs. skilled) because we think that the job an employee performs is more important for training than the schooling back-ground.

individual employment history⁸ for training participants and non-participants is available (Schmucker et al. 2014). Furthermore, based on the linkage between individual information and establishment-level data from the IAB Establishment Panel, it is possible to assign the training information to the establishment the training took place. In addition to information about the establishment that might be related to training provision (size, sector, location), we also have detailed information on the degree to which the establishment was hit by the economic crisis (Fischer et al. 2008).

The training information and all individual data therefore come from the employees and the crisis information originates from the employers. This combination has the advantage that employees can provide much more detailed and reliable information on their educational and employment biographies as well as on certain training measures than their employers. Although the training measures are offered by establishments, it is often unclear for the management to what extent employees participate in them. In addition, separating the source of training data from the source of crisis information also helps us to avoid common method bias. Another problem the literature on the impact of recessions on training provision faces is that it is often hard to observe when and how establishments are affected by a recession and how the causality runs between business cycle and training. More specifically, it is usually hard to exclude unobservable third factors such as higher manager quality or better growth opportunities that influence both, the risk of the firm to be hit by a recession and its training behaviour (Popov 2014). Endogeneity therefore might bias the estimated relationship between a recession and training efforts. In order to avoid this problem, a crisis must be exogenous in the sense that it affects firms independently of their training strategy and other factors related to training behaviour. In addition, we must control for all time-varying factors related to the assessment to be hit by the crisis and training efforts.

A recession often is the result of unanticipated changes in the environment, such as bursting bubbles in the property or stock market or dramatic changes in commodity prices. Thus, such a crisis can be seen as an exogenous shock for establishments and the entire economy (Knudsen/Lien 2015). In addition, a recession is temporary,⁹ and establishments know that it will be over sooner

⁸ The employment history includes start and end dates of employment periods, the exact daily wage in the respective periods, further characteristics of employment (e. g. occupation, job status, working time) and unemployment spells. This information has been collected for social insurance reasons by administrative institutions and is therefore highly reliable (Bender et al. 2009; Schmucker et al. 2014).

⁹ This distinguishes a recession from a technological shock that leads to permanent changes in the economy (Knudsen/Lien 2015).

or later (Koberg 1987). The economic crisis in 2008 and 2009 in addition was unpredictable. Therefore, the Great Recession can be seen as an exogenous shock and anticipation effects of firms can be mainly excluded.

Previous empirical studies investigating the impact of the Great Recession use different identification strategies. Felstead et al. (2012) as well as Mason and Bishop (2015) identify the crisis by means of time. They assume that the year 2008 is a pre-crisis period, 2009 during the crisis and 2010 after the crisis. Both studies do not differentiate between affected and unaffected establishments. Furthermore, they are not able to rule out that training efforts as well as the involvement in the crisis may be influenced by unobservable third factors (Popov 2014). In order to avoid this endogeneity problem, Popov (2014) and Hochfellner et al. (2015) apply Diff-in-Diff approaches including a treatment group of firms affected by the recessions and control group of firms not affected. Hochfellner et al. (2015) exploit an institutional feature of the German banking system to identify a control group. They mark all establishments in regions of *Landesbanks* that lost billions of Euros in the Great recession after having speculated in U.S. mortgage-backed securities as affected by the crisis. Their argument is that *Landesbanks* are the owners of the German savings banks. The savings banks and the *Landesbanks* themselves had to reduce lending as a consequence of their speculations crisis in comparison to their savings banks and *Landesbanks* counterparts in other regions that did not speculate. Despite their convenient empirical setting, it is however unclear whether all establishments in the states with a *Landesbank* suffering from credit constraints are affected by the crisis, given that German savings banks provide less than 40 % of bank loans.

We apply Bellmann et al.'s (2014) identification strategy.¹⁰ We therefore also use information from the 2010 wave of the IAB Establishment Panel. Based on self-assessments, managers and personnel managers were asked whether and to what extent their establishments were affected by the Great Recession. This has the advantage that crisis indicator and training information come from two different sources. In addition, our data do not allow a Regression Discontinuity Design because we just have two waves of information before the crisis. Therefore we have to use a Difference-in-Differences specification (Diff-in-Diff) approach as proposed by Bellmann et al. (2014) that exploits the quasi-experimental situation of the unforeseen recession.

¹⁰ Our data set is limited to six federal states, five of which are categorized as states with *Landesbanks* with exposure to the U.S. subprime crisis (only the smallest state in our sample, Mecklenburg – Western Pomerania is in the control group). We therefore cannot replicate the alternative identification strategy proposed by Hochfellner et al. (2015).

Based on the questions ‘have you been affected by the economic crisis in the last two years?’ and ‘were the effects on your establishment predominantly negative?’, we calculate a dummy variable that is equal to one if the establishments agree to both questions; otherwise, the crisis dummy is 0. In the 2010 wave of our data set, there are 78 establishments with information about the crisis. Of these, 40 establishments claimed that they had been negatively affected by the crisis and these are henceforth referred to as crisis establishments. Another 30 companies stated that they were not affected by the crisis and they are referred to as non-crisis establishments.¹¹ In 2010, 11 of the crisis establishments indicated that they were not affected by the recession any longer and they therefore switched to the group of the non-affected establishments. Although there are no differences in expected business volumes in 2006, 2007 and 2010, the business expectations of crisis establishments were more negative in 2008 and 2009 than those of non-crisis establishments. Crisis establishments have fewer employees and they are found especially in the manufacturing industry, compare Bellmann et al. (2014) and Hochfellner et al. (2015).¹²

From the 40 crisis and 30 non-crisis establishments, we have detailed information of 2,398 employees. Only employees with jobs covered by social security contributions¹³ are included in the sample. Furthermore, in order to obtain a homogeneous sample, we eliminated 442 employees who worked short-time.¹⁴ Thus, the sample consists of 5,983 observations from 1,956 individuals.

The main goal of this paper is the identification of the causal effect of the crisis on establishments’ individual training activities. The training activities of individuals must be compared not only between crisis establishments and non-crisis establishments, but also before, during and after the crisis. A quasi-experimental design such as the Diff-in-Diff achieves such a comparison. The changes in training effort in the control group are subtracted from the changes in the treatment group. In this way, distortions between control and treatment group resulting from fundamental differences in both groups as well as

11 The remaining eight establishments were eliminated from the sample because they indicated that they had been affected both positively and negatively by the crisis.

12 Due to the data protection agreement with the IAB no descriptive results can be presented at the operational level for crisis and non-crisis establishments.

13 Apprentices, people in internships, part-time employees and employees in partial retirement have been excluded from the sample.

14 Many contributions pointed to a strong increase of short-time work during the recessions and the strong incentives of employers to provide training for employees working short-time (Brenke et al. 2013). In order to avoid biased results from this additional adaptation channel between recession and training, we exclude short-time work in the main analysis and run a robustness check later.

distortions resulting from temporal trends can be removed (Angrist/Pischke 2009; Wooldridge 2009). Using i to index an individual, j an establishment and t the time, we specify the following estimation model:

$$y_{ijt} = \beta_0 + C_{ij} * T'_t \beta_1 + C_{ij} \beta_2 + T'_t \beta_3 + X'_{ijt} \beta_4 + Z'_{ijt} \beta_5 + \varepsilon_{ijt}$$

Focusing on the individual perspective, the dependent binary variable y_{ijt} takes the value of 1 if an employee i participates in training offered by the training establishment j in the respective year t . Otherwise, the variable takes the value 0. In addition, we take the number of individual training measures¹⁵ per year into account. For the research question, it is important to know when and in which establishment the training measure took place. Therefore, we eliminate all training measures that have no detailed information concerning their start and end dates and that could not be clearly assigned to an establishment (126 eliminations).

The binary variable C_{ij} indicates whether an establishment was hit by the economic crisis ($C_{ij} = 1$) or not. The binary variable T'_t reflects the cyclical differences in training activities over time with a vector of time dummies for the years 2006 to 2010. The interactions between the two variables $C_{ij} * T'_t$ can be interpreted as the differences in the development of individual training activities over time between employees in crisis and non-crisis establishments. We have four Diff-in-Diff dummies: the interactions of the years 2007 to 2010 with C_{ij} . Given the unexpected exogenous shock of the crisis, prior to the occurrence of this shock, the development of training effort should be the same for crisis and non-crisis establishments. In order to verify this identification assumption, a placebo test should indicate no significant interaction effect for the pre-crisis period (Bellmann et al. 2014).

In addition to the crisis information, further individual- and establishment-level characteristics are considered that may influence training participation and the likelihood of being affected by the crisis simultaneously. International empirical evidence suggests lower training participation especially for women and older employees with higher tenure and work experience (Blundell et al. 1996; Picchio/van Ours 2013). In Germany, training participation of women is sometimes found to be similar or even higher than training participation of men (Wotschack 2018). One reason for this result may be that women more often participate in self-initiated training and men more often participate in

¹⁵ In order to ensure consistency, we limit the maximum number of training measures per year to 12 and delete four observations with additional information.

employer-initiated training (Burgard 2012; Eurostat 2016). Depending on what kind of training is included in the data set, results on gender training participation may differ. Higher qualified employees have a higher probability of participating in training (Arulampalam/Booth 2001; Card 1999; Gritz 1993). In addition, it is known that employees with longer work experience are less affected by the crisis (Hochfellner et al. 2015). Therefore, the individual characteristics vector X'_{ijt} includes the variables gender, age, occupational status, tenure, and work experience.¹⁶ Studies focusing on establishment-level determinants of training find that especially employees in larger establishments have a higher probability of receiving training. Furthermore, the sector and the location of the establishment have an impact on the likelihood of training (Bellmann/Gerner 2011; Gerlach/Jirjahn 2001; Holtmann/Idson 1991; Lynch 1991). At the same time, these establishment characteristics may also influence the likelihood of being affected by the crisis. Bellmann et al. (2014) and Möller (2010) for example find that the crisis mainly affected larger establishments from the manufacturing sector. The establishment characteristics vector Z'_{ijt} therefore includes the variables establishment size, sector, and location.¹⁷ The symbol ε_{ijt} reflects an idiosyncratic error term.

We estimate a linear probability model explaining individual training participation and a linear regression model explaining the number of training measures. In order to gain insights into whether employees with specific characteristics are affected differently by the economic crisis, the sample is also subdivided into employees in skilled and unskilled jobs. For the separate samples, we estimate identical regression models for each training indicator. In addition, we test the significance of the differences between the coefficients of interest in the two samples using a Chi² test. The standard errors were adjusted using a robust, cluster-adjusted sandwich estimator. As clustering is carried out at the individual and the establishment level, it is possible to control for correlated observations within the individuals and the establishments (Moulton 1990).

16 Age is measured as a cohort effect for the following birth year groups: birth year before 1951, between 1952 and 1961, between 1962 and 1971 and after 1972. For the two variables tenure and work experience, in each case, we use the classification less than 10 years, between 10 and 20 years and more than 20 years of tenure or experience.

17 As a result of the selection process, only establishments from manufacturing and the service industry with a maximum of 1,999 employees were available in the data set. The establishment size is classified as less than 199, between 200 and 499 and between 500 and 1,999 employees. The location is captured with a dummy, indicating Western or Eastern Germany.

4 Findings

4.1 Descriptive statistics

Table 1 shows descriptive sample characteristics of individuals employed in crisis and non-crisis establishments. The individuals are mainly male (64.62%), born between 1952 and 1971 (61.62%), and work in a skilled job (84.74%). Although 78.63% have more than 10 years of professional experience, only 53.48% have been working in the same establishment for more than

Table 1: Description of differences of employees in crisis and non-crisis establishments.

Socio-demographic indicators	Total %	Crisis establishments %	Non-crisis establishments %	t-values
Female	35.38	23.31	41.72	14.49***
<i>Birth year</i>				
≤ 1951	14.67	13.67	15.20	1.63
1952–61	34.41	35.56	33.80	-1.37
1962–71	27.21	28.52	26.51	-1.67*
≥ 1972	23.71	22.25	24.49	1.93*
<i>Experience</i>				
< 10 years	21.37	19.44	22.39	2.67***
10–20 years	48.64	51.89	46.92	-3.68***
> 20 years	29.99	28.67	30.69	1.63
<i>Tenure</i>				
< 10 years	46.52	46.86	46.34	-0.39
10–20 years	39.06	41.46	37.80	-2.78***
> 20 years	14.42	11.68	15.86	4.41***
<i>Occupational status</i>				
Unskilled job	15.26	25.04	10.13	-15.65***
Skilled job	84.74	74.96	89.87	15.64***
Log daily wage	4.63	4.58	4.64	5.21***
Training participation	67.05	60.89	70.29	7.44***
Number of training measures per year	1.28	1.11	1.37	6.48***
Observations	5,983	2,089	3,894	
Individuals	1,956	734	1,222	
Establishments	70	40	30	

(Log) daily wage is measured as the logarithmic weighted daily wage; *Statistically significant at the 0.10 level; **at the 0.05 level; ***at the 0.01 level.

Source: WeLL-ADIAB 2006–2010.

10 years. Looking at the characteristics of employees in crisis and non-crisis establishments, there are only few differences between the two groups. Significantly fewer women and employees in skilled jobs are employed in crisis establishments. However, these differences might be a consequence of the fact that the crisis establishments are more likely to be in the manufacturing sector. In addition, employees in non-crisis establishments have a slightly higher income and highest educational attainment.

Employees in non-crisis establishments have a higher probability of participating in further training (70.29%) and a higher average number of training measures (1.37) per year than employees in crisis establishments (60.89%/1.11 measures). Figure 1 shows the development of training participation and the number of training measures over the observation period. A decline can be observed for both training indicators in all establishments. For employees in non-crisis establishments, the probability of participating in training declines slightly in 2008 and otherwise remains constant between 2006 and 2009. However, there is a decline in the year 2010. In contrast, there is a sharp and continuous decline in the training probability for employees in crisis establishments from 2008 onwards. A similar picture emerges for the development of the number of training measures. It only declines slightly in the years 2008 and 2009 and then more sharply in 2010 in non-crisis establishments. Employees in crisis establishments experience a strong and continuous decline in the number of trainings between 2008 and 2010. Thus, the training activities of employees in crisis-affected establishments are more negatively affected than those of employees in unaffected establishments.

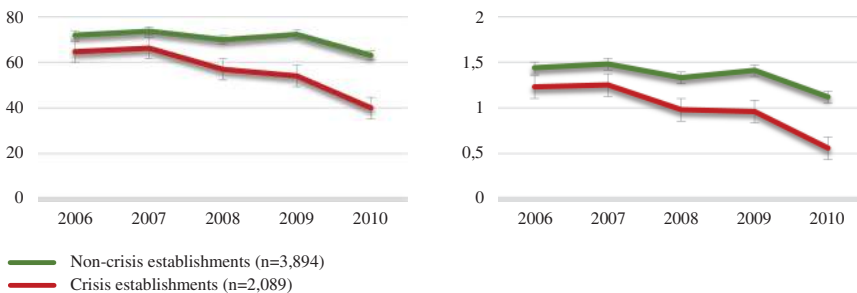


Figure 1: Development of the training participation in % (left) and the number of training measures (right) in crisis and non-crisis establishments. Standard errors are included.

Taking the occupational status of the employees into account in Figure 2, differences in training activities are also evident here. Employees in skilled jobs have a

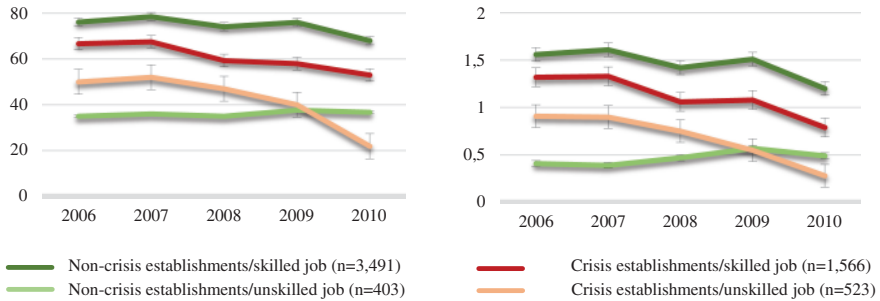


Figure 2: Development of training participation in % (left) and the number of training measures (right) separated by occupational status in crisis and non-crisis establishments. Standard errors are included.

significantly higher probability of participating in training as well as a higher average number of training measures in both crisis and non-crisis establishments. Differences between employees in skilled and unskilled jobs are larger in non-crisis than in crisis establishments but these differences converge over time. Considering the training participation of employees in skilled jobs, a stronger negative effect can be observed in crisis establishments, especially in 2008 and 2009. Otherwise, the development of training incidence is comparable in both establishment groups. A completely different picture can be seen for the development of training participation among employees in unskilled jobs. Whereas these employees experience a slight increase in training participation from 2008 to 2009 and a constant participation in 2010 in the non-crisis establishments, the picture in crisis companies is exactly the opposite. Although they have a higher probability of participating in training before the crisis, training participation declines since 2008 and collapses sharply in 2009 and 2010.

The number of training measures for employees in skilled jobs also declines in both crisis and non-crisis establishments, but slightly stronger in crisis establishments from 2008 onwards. For employees in unskilled jobs, the number of training measures in crisis establishments is higher than in non-crisis establishments before the crisis but declines sharply from 2008 onwards. In contrast, the number of training measures for employees in unskilled jobs in non-crisis establishments remains relatively constant over time.

4.2 Multivariate analyses

The regression output in Table 2 shows the determinants of participating in training (model 1) and of the number of training measures (model 2). The main

Table 2: Determinants of training participation and number of trainings.

Dependent variable	Training dummy	Number of trainings
	(1) Diff-in-Diff	(2) Diff-in-Diff
Crisis * Year 2007	-0.001 (0.013)	-0.004 (0.029)
Crisis * Year 2008	-0.044 (0.032)	-0.084 (0.092)
Crisis * Year 2009	-0.100*** (0.038)	-0.215* (0.114)
Crisis * Year 2010	-0.124* (0.064)	-0.301** (0.133)
Year 2007	0.017** (0.008)	0.025 (0.020)
Year 2008	-0.031* (0.018)	-0.164*** (0.060)
Year 2009	-0.006 (0.021)	-0.068 (0.068)
Year 2010	-0.136*** (0.026)	-0.453*** (0.069)
Crisis (treatment)	0.035 (0.027)	0.149* (0.080)
Skilled job	0.236*** (0.026)	0.615*** (0.061)
Tenure < 10 years	0.068** (0.032)	0.214** (0.087)
Tenure 10–20 years	0.038 (0.033)	0.156* (0.086)
Experience < 10 years	-0.093** (0.043)	-0.166 (0.128)
Experience 10–20 years	-0.014 (0.028)	-0.055 (0.086)
Birth year 1952–1961	0.076*** (0.028)	0.201** (0.081)
Birth year 1962–1971	0.088*** (0.030)	0.296*** (0.092)
Birth year > 1972	0.162*** (0.042)	0.428*** (0.126)
Female	-0.022 (0.019)	0.133** (0.065)
Employees_199	-0.158*** (0.026)	-0.535*** (0.071)
Employees_499	-0.052** (0.023)	-0.066 (0.072)

(continued)

Table 2: (continued)

Dependent variable	Training dummy	Number of trainings
	(1) Diff-in-Diff	(2) Diff-in-Diff
Western Germany	0.026 (0.025)	0.094 (0.076)
Service sector	0.144*** (0.022)	0.487*** (0.063)
R ²	0.093	0.096
Observations	5,983	5,983

Dependent variables: training participation (model 1), number of training (model 2); reference category for year: 2006; reference category for age: birth year ≤ 1951 ; reference category for tenure: tenure ≥ 20 years; reference category for experience: experience ≥ 20 years; reference category for occupation status: unskilled job; reference category for establishment size: ≥ 500 employees. *Statistically significant at the 0.10 level; **at the 0.05 level; ***at the 0.01 level.

Source: WeLL-ADIAB 2006–2010.

focus of our Diff-in-Diff estimations is on the interaction terms of crisis dummy and years, which indicate the effect of the crisis on both training indicators over time. The causal interpretation of our results hinges on several assumptions all of which we unfortunately cannot test, see the discussion in our conclusions.

The results for model 1 show no significant Diff-in-Diff effect for the pre-crisis period in 2007. Thus, the identification assumption is fulfilled that, without a crisis, the training behaviour for employees in crisis and non-crisis establishments was the same. As a consequence, the Diff-in-Diff approach identifies the causal recession effect¹⁸ if we assume that there are no unobserved third factors that jointly influence the identification of an employer as being affected by the crisis and training incidence of the employers' training. However, there is a reduction in training participation by 10.0 PP in 2009 and 12.4 PP in 2010 for individuals employed in crisis establishments. Therefore, we find support for the first hypothesis that the crisis of the years 2008 and 2009 reduced training efforts. The reduction in training expenditures increased with the duration of the recession. Significant year dummies in 2008 and 2010 indicate a decline in training participation for employees in all establishments irrespectively of

¹⁸ An insignificant Diff-in-Diff coefficient before the treatment also can be called a placebo test. This method serves as an alternative for more data-intensive approaches such as matching (Bellmann et al. 2014).

whether they were hit by the crisis or not. The insignificant crisis dummy indicates that there are no differences in training participation of employees in the treatment group and the control group beyond the year effects measured by the interaction terms. Furthermore, especially young employees, employees in skilled jobs and employees with higher professional experience have a higher training participation. In addition, employees working for larger companies and in the service sector tend to participate more in training.

Results for model 2 suggest similar effects of the crisis on the number of training measures. Again, there is a negative effect for employees in all establishments for the years 2008 and 2010. Beyond this effect, significantly negative Diff-in-Diff effects for the years 2009 (-0.215) and 2010 (-0.301) indicate that the decline in the number of training measures is greater for employees in crisis establishments than in non-crisis establishments. This finding supports the assumption of the second hypothesis. Effects of further individual and establishment characteristics are similar to the training dummy.

Our results confirm the negative crisis effect on training reported in Popov (2014) and Bellmann et al. (2014). In addition to the previous results, we find a negative significant crisis effect for the year 2010. Our data allow us to directly identify whether a firm was hit by the crisis instead of identifying the crisis by the calendar time. Our measure shows that although the crisis was over in 2010 for several firms that had been hit by the recession and it never affected several firms in our sample, some firms still felt the negative consequences of the crisis in 2010. It seems that firms that were still in crisis mode in 2010 amid a general recovery of the economy, strongly further reduced their training efforts.¹⁹

In the next step, we analyse whether the impact of the crisis on training activities differs by occupational status. For this purpose, we look at the effects on training participation (Table 3) and on the number of training measures (Table 4) separately for employees in unskilled and skilled jobs.

Table 3 shows that the recession reduced the probability to participate in training for employees in unskilled jobs additionally by 21.5 PP in 2009 and by 42.7 PP in 2010 in comparison to employees in skilled jobs. There is only a slightly negative effect on training participation for employees in skilled jobs of 8.1 PP in the year 2009 and hardly any negative Diff-in-Diff effect in 2010 (-2.4 PP, not significant). Furthermore, the Chi^2 test indicates that the coefficients of both groups are significantly different in the year 2010. Thus, the findings suggest a stronger effect of the crisis on training participation for employees in unskilled

¹⁹ In a robustness check (not shown here) we find that the negative crisis effect in 2010 is stronger driven by the service sector. The crisis effect for firms in manufacturing is large but insignificant in the year 2010.

Table 3: Determinants of the training participation by occupational status.

Dependent variable	Training dummy		Differences (Chi ² test)
	Employees in unskilled jobs (1) Diff-in-Diff	Employees in skilled jobs (2) Diff-in-Diff	
Crisis * Year 2007	0.051 (0.038)	-0.014 (0.013)	2.68 (0.102)
Crisis * Year 2008	-0.054 (0.082)	-0.048 (0.036)	0.00 (0.946)
Crisis * Year 2009	-0.215** (0.100)	-0.081* (0.042)	1.56 (0.212)
Crisis * Year 2010	-0.427*** (0.123)	-0.024 (0.086)	7.40*** (0.007)
Year 2007	0.002 (0.025)	0.020** (0.008)	0.77 (0.380)
Year 2008	-0.017 (0.059)	-0.030 (0.019)	0.05 (0.828)
Year 2009	0.062 (0.072)	-0.012 (0.022)	0.96 (0.327)
Year 2010	0.060 (0.081)	-0.156*** (0.027)	6.63*** (0.009)
Crisis (treatment)	0.213*** (0.070)	-0.019 (0.030)	9.54*** (0.002)
Tenure < 10 years	-0.051 (0.090)	0.086** (0.034)	
Tenure 10–20 years	-0.167** (0.081)	0.075** (0.036)	
Experience < 10 years	-0.045 (0.103)	-0.104** (0.046)	
Experience 10–20 years	-0.089 (0.065)	-0.017 (0.031)	
Birth year 1952–1961	0.006 (0.093)	0.084*** (0.030)	
Birth year 1962–1971	0.025 (0.096)	0.098*** (0.032)	
Birth year > 1972	0.025 (0.112)	0.164*** (0.044)	
Female	-0.189*** (0.057)	-0.012 (0.021)	
Employees_199	-0.165** (0.064)	-0.137*** (0.029)	
Employees_499	-0.038 (0.059)	-0.044* (0.026)	

(continued)

Table 3: (continued)

Dependent variable	Training dummy		Differences (Chi ² test)
	Employees in unskilled jobs (1) Diff-in-Diff	Employees in skilled jobs (2) Diff-in-Diff	
Western Germany	0.049 (0.058)	0.033 (0.027)	
Service sector	0.117** (0.054)	0.118*** (0.025)	
R ²	0.122	0.057	
Observations	926	5,057	

Dependent variable: training participation; separate analysis for skill groups; reference category for year: 2006; reference category for age: birth year \leq 1951; reference category for tenure: tenure \geq 20 years; reference category for experience: experience \geq 20 years; reference category for establishment size: \geq 500 employees. Standard errors based on a robust cluster-adjusted sandwich estimator in parentheses; *Statistically significant at the 0.10 level; **at the 0.05 level; ***at the 0.01 level.

Source: WeLL-ADIAB 2006–2010.

jobs than for employees in skilled jobs especially for those firms still in crisis mode in 2010. Therefore, the third hypothesis can be confirmed.

Table 4 shows the impact of the crisis on the number of training measures for employees in unskilled and skilled jobs. Analogously to training participation, the crisis had a significant additional negative effect on the number of trainings for employees in unskilled jobs in 2008 (−0.279), 2009 (−0.452), and especially in 2010 (−0.936). In contrast to the results on training incidence, there is a significantly negative Diff-in-Diff effect for employees in unskilled jobs only in 2009 (−0.216). Thus, the Chi² test suggests significantly different Diff-in-Diff coefficients for the year 2010 for employees in skilled and unskilled jobs. Consequently, the fourth hypothesis can be confirmed. The other individual- and establishment-level determinants for both training indicators are robust to the change in the dependent variable.

4.3 Robustness checks

In order to control whether we find the negative effect of the crisis on employees in unskilled jobs also when we use the full sample with additional interaction terms for employees in skilled and unskilled jobs, a regression equation

Table 4: Determinants of the number of trainings by occupational status.

Dependent variable	Number of trainings	Number of trainings	Differences (Chi ² test)
	Employees in unskilled jobs (1) Diff-in-Diff	Employees in skilled jobs (2) Diff-in-Diff	
Crisis * Year 2007	0.071 (0.063)	-0.028 (0.032)	2.03 (0.155)
Crisis * Year 2008	-0.279* (0.158)	-0.091 (0.104)	1.00 (0.316)
Crisis * Year 2009	-0.452** (0.203)	-0.216* (0.128)	0.99 (0.320)
Crisis * Year 2010	-0.936*** (0.228)	-0.249 (0.178)	5.76** (0.016)
Year 2007	0.005 (0.037)	0.036 (0.022)	0.89 (0.346)
Year 2008	-0.099 (0.102)	-0.186* (0.106)	5.64** (0.018)
Year 2009	0.194 (0.118)	-0.091 (0.074)	4.24** (0.039)
Year 2010	0.129 (0.128)	-0.509* (0.276)	18.80*** (0.000)
Crisis (treatment)	0.511*** (0.132)	-0.065 (0.095)	8.57*** (0.003)
Tenure < 10 years	-0.063 (0.166)	0.245** (0.098)	
Tenure 10–20 years	-0.144** (0.155)	0.210** (0.098)	
Experience < 10 years	-0.107 (0.219)	-0.131** (0.148)	
Experience 10–20 years	0.084 (0.129)	-0.035 (0.103)	
Birth year 1952–1961	0.183 (0.142)	0.202** (0.089)	
Birth year 1962–1971	0.158 (0.138)	0.300*** (0.103)	
Birth year > 1972	0.383** (0.193)	0.388*** (0.143)	
Female	-0.255** (0.100)	-0.203*** (0.074)	
Employees_199	-0.408*** (0.147)	-0.531*** (0.082)	
Employees_499	-0.018 (0.142)	-0.063 (0.085)	

(continued)

Table 4: (continued)

Dependent variable	Number of trainings	Number of trainings	Differences (Chi ² test)
	Employees in unskilled jobs (1) Diff-in-Diff	Employees in skilled jobs (2) Diff-in-Diff	
Western Germany	0.021 (0.128)	0.132 (0.091)	
Service sector	0.363*** (0.134)	0.450*** (0.076)	
R ²	0.114	0.068	
Observations	926	5,057	

Dependent variable: number of training measures; separate analysis for skill groups; reference category for age: birth year ≤ 1951 ; reference category for tenure: tenure ≥ 20 years; reference category for experience: experience ≥ 20 years; reference category for establishment size: ≥ 500 employees. Standard errors based on a robust cluster-adjusted sandwich estimator in parentheses; *Statistically significant at the 0.10 level; **at the 0.05 level; ***at the 0.01 level. Source: WeLL-ADIAB 2006–2010.

with triple interaction terms is calculated as a robustness check. More specifically, all four Diff-in-Diff interaction terms ($C_{ij} * T'_t$) are additionally interacted with a binary variable that takes the value of 1 if individuals are in an unskilled job. Thus, the triple interaction terms (Difference-in-Difference-in-Differences) in Table 5 in the Appendix imply the additional effects of the crisis for employees in unskilled jobs in comparison to employees in skilled jobs between 2007 and 2010. According to our previous results, we find stronger negative effects of the crisis for employees in unskilled jobs. The crisis reduces the participation of training for employees in unskilled jobs additionally by 14.2 PP in 2009 (not significant) and by 42.9 PP in 2010. Additional negative effects of the crisis for employees in unskilled jobs are also evident in the number of training measures. However, again the triple Diff-in-Diff effect is only significant in 2010 (-0.673).

In the analyses carried out so far, employees in short-time work have been excluded. As training in the crisis was often offered in conjunction with short-time work (Brenke et al. 2013), establishments' training decisions were probably based on other than the usual cost–benefit considerations. In order to ensure that training investments in the crisis were not driven by short-time working arrangements, our last robustness check also includes employees who attended short-time work. The results in Table 6 in the Appendix confirm the previous findings.

5 Conclusions

The objective of this paper is to determine the effect of an economic crisis on the training activities of different employee groups. From a theoretical point of view, the effect is unclear because there are arguments for both directions. The existing empirical studies on the Great Recession indicate a counter-cyclical development of training (Bellmann et al. 2014; Felstead et al. 2012; Mason/Bishop 2015; Popov 2014). However, there is no empirical evidence regarding the individual training behaviour of employee groups. Based on a unique German linked employer–employee panel data set, this paper seeks to fill this gap. Using Diff-in-Diff analyses, we avoid endogeneity problems caused by unobservable third factors that otherwise influence both the training activities of the establishment and its probability of being hit by the recession (Hochfellner et al. 2015; Popov 2014). Furthermore, by separating the source of training data (employee) from the source of crisis information (employer), we avoid common method bias and do not have to rely on calendar time as identification for employers being hit by the crisis. Moreover, the so-called Great Recession in 2008 and 2009 can be interpreted as an unforeseen, exogenous and time-limited shock. Our causal interpretation of the impact of the crisis on training participation and the number of training measures hinges on several assumptions that we unfortunately cannot test. First, there are no (important) time-variant unobserved factors that change between the period before and during the crisis related to training efforts. Second, the parallel trends assumption is fulfilled, i. e. changes in training incidence would have been the same in the firms affected by the crisis and the firms not affected by the crisis without the recession after 2008. Third, there is no measurement error of the indicator that the firm is affected by the crisis that is related to other unobserved factors for training incidence. If for example managers would have a tendency to blame the exogenous recession on decisions that reduce training incidence instead of their own management errors, the correlation between recession and training incidence is overestimated.

Our results suggest a negative effect of the crisis on individual training activities in 2009 and 2010. The strong negative effect of firms hit by the recession that are still in crisis mode in the year 2010 shows that the identification of the business cycle by calendar time misses part of the effect in the aftermath of the recession. The reduction in training efforts seems to be especially strong for employees in unskilled jobs. Although there is only a slight negative effect of the crisis on employees in skilled jobs in 2009, we observe a much greater negative impact of the crisis for employees in unskilled jobs

especially in 2009 and 2010. The stronger reduction in training opportunities for employees in unskilled or semi-skilled jobs might be one of the reasons for the frequently observed increase in income inequality and polarisation of the labour market after recessions (Forster et al. 2011; Grabka 2015; Hochfellner et al. 2015; OECD 2015). The recession might have increased the speed of technologic adjustment (Hershbein/Kahn 2018). Employees in (higher) skilled jobs might be better able to cope with the flexibility required to keep their job and therefore the recession might have a stronger long lasting positive effect on training for employees in (higher) skilled jobs.

Some implications of our findings are that the cleansing effect of recessions is probably mirrored by the reduction in training efforts by those firms hit hardest by the recession (measured in this paper by those firms that are still in recession in 2010). In addition, also the widening gap in employment opportunities between unskilled and skilled employees after a recession might be partly caused by the increased difference in training opportunities during a recession. If politicians want to cushion the painful adaptation processes on the labour market during and after a recession, they should target unskilled employees in firms hit hardest by the recessions for example with subsidised training offers. Martin and Grubb (2001) for example find in their literature review that targeted subsidies for training programs for specific groups are more effective than training programs open for all employee groups. They however also note that employment effects of training measures targeted at disadvantaged youths seem to be small. Subsidised short-time work offered during the Great Recession certainly cushioned employees from the immediate negative labour demand effects and therefore avoided unemployment. It however seems that not particularly the firms hit hardest by the recession made use of the subsidies and only a small part of the budget for training subsidies associated with short-time work was used by the firms (Brenke et al. 2013; Crimmann et al. 2010). Subsidies on short-time work therefore indirectly might have increased the economic differences between firms and employee groups during the recession.

There are some limitations of this paper. First, we only can use a subsample of firms in our data set with information on the crisis status, compare Dietz and Zwick (2016). Second, important training information in the data set is not available from all surveys. Therefore, we cannot include further training characteristics such as training costs, training topics or certificates. Third, the data set is limited to certain economic sectors and federal states. Therefore, the representativeness of the results has to be examined critically in future research.

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WeLL) data set provided by the Research Data Centre (FDZ) of the Federal Employment Agency at the Institute for Employment Research (IAB). Data access was via guest research spells at FDZ and afterwards via controlled remote data access at FDZ (project number 603). We thank Alexandra Schmucker and Stefan Bender for advice with data preparation and interpretation. We also thank Boris Hirsch, Susanne Steffes, Arne Warnke, and three anonymous referees for useful comments on earlier versions of this paper.

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Appendix

Table 5: Determinants of the training participation and the number of trainings, triple-diff-in-diff-estimation.

Dependent variable	Training dummy	Number of trainings
	(1) Diff-in-Diff	(2) Diff-in-Diff
Crisis * Year 2007 * Unskilled job	0.059 (0.041)	0.114 (0.071)
Crisis * Year 2008 * Unskilled job	-0.005 (0.089)	-0.158 (0.198)
Crisis * Year 2009 * Unskilled job	-0.142 (0.108)	-0.225 (0.246)
Crisis * Year 2010 * Unskilled job	-0.429*** (0.146)	-0.673*** (0.264)
Crisis * Year 2007	-0.014 (0.013)	-0.028 (0.032)
Crisis * Year 2008	-0.048 (0.036)	-0.091 (0.105)

(continued)

Table 5: (continued)

Dependent variable	Training dummy	Number of trainings
	(1) Diff-in-Diff	(2) Diff-in-Diff
Crisis * Year 2009	-0.081* (0.042)	-0.215* (0.128)
Crisis * Year 2010	-0.027 (0.085)	-0.262 (0.175)
Crisis * Unskilled job	0.281*** (0.072)	0.588*** (0.152)
Year 2007 * Unskilled job	-0.022 (0.026)	-0.056 (0.043)
Year 2008 * Unskilled job	0.007 (0.062)	0.250** (0.118)
Year 2009 * Unskilled job	0.068 (0.075)	0.271* (0.139)
Year 2010 * Unskilled job	0.199** (0.087)	0.609*** (0.151)
Year 2007	0.020** (0.008)	0.033 (0.022)
Year 2008	-0.032 (0.019)	-0.191*** (0.066)
Year 2009	-0.013 (0.022)	-0.096 (0.074)
Year 2010	-0.156*** (0.027)	-0.516*** (0.075)
Employee in unskilled job	-0.391*** (0.053)	-1.015*** (0.097)
Crisis (treatment)	-0.020 (0.028)	0.037 (0.090)
Individual characteristics	Yes	Yes
Establishment characteristics	Yes	Yes
R ²	0.103	0.100
Observations	5,983	5,983

Dependent variables: training participation, number of training measures; separate analysis for skill groups; reference category for age: birth year ≤ 1951 ; reference category for tenure: tenure ≥ 20 years; reference category for experience: experience ≥ 20 years; reference category for establishment size: ≥ 500 employees. Standard errors based on a robust cluster-adjusted sandwich estimator in parentheses; *Statistically significant at the 0.10 level; **at the 0.05 level; ***at the 0.01 level.

Source: WeLL-ADIAB 2006–2010.

Table 6: Determinants of the training participation and number of trainings (sample with short-time workers).

Dependent variable	Training participation Diff-in-Diff	Number of trainings Diff-in-Diff
Crisis * Year 2007	0.005 (0.015)	0.004 (0.043)
Crisis * Year 2008	-0.024 (0.032)	-0.077 (0.089)
Crisis * Year 2009	-0.075** (0.036)	-0.241*** (0.089)
Crisis * Year 2010	-0.171*** (0.041)	-0.343*** (0.097)
Crisis (treatment)	Yes	Yes
Individual characteristics	Yes	Yes
Establishment characteristics	Yes	Yes
R ²	0.101	0.113
Observations	7,763	7,763

Dependent variables: training participation and number of training measures; separate analysis for experience groups; Further individual characteristics: occupation status, tenure, age, gender; establishment characteristics: size, location, sector. Standard errors based on a robust cluster-adjusted sandwich estimator in parentheses; *Statistically significant at the 0.10 level; **at the 0.05 level; ***at the 0.01 level.

Source: WeLL-ADIAB 2006–2010.