

How to Train an Aging Workforce? Evidence from Company Data

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Abstract

With regard to the demographic development, training an aging workforce becomes a challenge for most companies in the next years. As employees but also suppliers and customers will constantly grow older, skilled and experienced employees are a valuable resource. In this paper we analyze the determinants of participation in various forms of formal employer provided training. Using new data on a large German company from the financial industry, we study in detail the factors determining the number, duration and specificity of training as well as the preferred teaching style chosen by employees of different age groups. Our results indicate that participation in each sort of training is decreasing sharply in the second half of employee's professional life. Especially for the over 50 year olds, training periods become scarce and short. For industry specific courses the decline already starts at age 36. Investing in specially tailored training programs for senior workers might thus be an opportunity to increase training participation.

Keywords: training participation, age, company data

JEL-classification: M53, M12, J14

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1 Introduction

The German population ages. By 2050 the average German will be 48 years of age compared to 41 years today (Voelpel et al. 2007). The decline in birth rates on the one hand and the increased life expectancy on the other hand cause a rise in the average age of the working population coinciding with a lack of qualified workers. Companies are thus going to face serious problems when recruiting qualified young workers giving rise to the need to adequately employ older workers. Apart from the qualification issue, a second reason makes it worth to rethink employing senior workers. As the whole population ages, demographic change does not exclusively affects employees, but also a firm's suppliers, customers and business partners. Companies might thus have a severe interest in continuing already existing business relationships by longer employing the people who established them. As technological and organizational change will constantly outdate acquired skills it is of relevance for both, employer and (older) employees to adapt to changing work environments.

Company training is the most important source of adult education after an initial vocational or academic degree is completed. For a lot of firms, and especially large ones, a varying supply of training programs constitutes an important part of human resource management. The decision to invest in training stems from a need to adapt the existing skill level of the employees to the skill level required in the future. The demanded skill level might be reached by retraining existing employees or by recruiting skilled candidates from the labor market. Training increases the productivity of employees. But productivity decreases within the life span. The aim of motivating senior senior employees to participate in training is thus to decelerate or prevent that decline rather than to further enhance their productivity. However, profitability of training should be higher for younger employees. Hence, young workers receive more training than workers later in their lives (Green 1993). But this rational falls short when there are labor market frictions for young and qualified staff. In the case where stakeholders demand experienced company representatives, replacing training with recruiting becomes even impossible. Older employees are said to be both, less productive and adaptive. But evidence from neuroscience does not support the deficit hypothesis that the capacity to learn decreases with age. It is true that the learning pace of learning slows with age but accuracy rises (Spitzer 2003). A larger background of experience facilitates the integration of new knowledge. As Lindenberger (2000) can show, learning individualizes with increasing age.

As training is an investment in the productivity of the employees workers will be willing to participate in training if it pays-off. The main motivating factors are an increase in wages, better career prospectives and decreasing risk of unemployment (Pannenberg 1995, Büchel & Pannenberg 2004). These three factors are again largest when workers are young.

Career prospectives and wage opportunities are not an option any more (or just to a very limited extent) when workers grow older. Theoretical models on the investing behavior of the individual throughout the life cycle show that the motivation to invest in human capital decreases as the time which is needed to amortize the educational investments trickles off (see e.g. Franz (2006) for details). This might be particularly the case for industry and company specific knowledge as it becomes worthless as soon as the retirement period starts (contrary to general knowledge such as language or computer skills which might still be useful).

This study aims on answering the question if senior workers differ systematically from their younger colleagues in terms of training participation and preferences. As we include age in small five-year intervals we can determine the tipping point where participation behavior changes.¹ We use data from a high-skilled, high-paying company from the financial industry and refer to formal company training as training provided and paid by the employer. Contrary to other studies we can rely on detailed course information and can observe if training was taken in a specific year, how often and in which length. We do further know the content of the course and the teaching style (classroom training vs. self-paced techniques). This allows us to distinguish between industry specific and general training, and enables us to verify if preferences on the teaching style change with employees age.

In using firm-level administrative data our study contributes to the literature in two ways. First, we re-address one of the most interesting questions discussed in the literature. Do older employees participate less in training once we control for further observable characteristics such as occupational status, part-time work or wage? If they do so, is there a crucial age where a change in participation behavior can be observed? Second, as we have access to detailed information on training attendance and employee characteristics, we can assess the factors determining training participation in a more adequate manner than comparative firm-level studies do. Our results indicate that the number, duration and specificity of training as well as the preferred teaching style chosen by employees differ for the various age groups. Training participation is decreasing sharply in the second half of employee's professional life. Especially for the over 50 year olds, training periods become scarce and short. For industry specific courses the decline already starts at age 36.

The paper is organized as follows. Section 2 briefly overviews the literature. Section 3 presents the company data we use and describes the outcome variables of interest. Section 4 outlines the empirical model and presents the results, and section 5 concludes.

¹ As we explicitly want to assess the impact of age on training participation we prefer this modelling to an a priori definition of "old". Nevertheless we are going to use the terms "older" "senior" or "aging worker" in the beginning of the paper and refer to the group of employees above 50 years of age but that is an arbitrary choice.

2 Literature review

The determinants of company training may be approached from two perspectives: from labor economics or from human resource management research. Labor economists focus on microeconomic research on the behavior of labor market participants in general whereas in from the perspective of human resource management, researchers are more interested in the factors that determine organizational behavior(Lazear 1999). Both streams of research thus differ in the level of analysis. This is either the individual or the organization.

Table 1: Classification of the training literature

| | single-firm studies | multi-firm studies |
|----------------------|--------------------------|--|
| individual level | Baker et al. (1994) | Lynch (1992) |
| | Bartel (1995) | Bartel & Sicherman (1998) Arulampalam et al. (2004) |
| organizational level | Ichniowski & Shaw (2003) | Altonji & Spletzer (1991) |
| | Bartel et al. (2004) | Acemoglu & Pischke (1998) Lynch & Black (1998) |
| | | Hughes et al. (2004) |

The overview of studies is not exclusive.

According to these perspectives, the literature on the determinants of training can be sorted by two characteristics.² The research approach can either be driven by human resource management or labor economic thinking and can be applied either study a single firm³ or to carry out a multi-firm analysis. Table 1 gives an overview about the relevant literature applying these two sorting criteria. On the individual level, the studies mentioned in the table study the employee related determinants of participating in formal employer provided training. In case of the organization, the papers study the company related determinants of running training programs. These studies find that large firms with a highly qualified workforce, investments in technology and recently hired employees train more (see e.g. Lynch & Black 1998, Hughes et al. 2004).

From the studies displayed in Table 1 the research on the single-company, individual level is of closest relevance to our study. Although single-company studies are popular in the

² Beyond the literature on training determinants there is a vast literature on the effects of training. Regarding the individual level, mostly effects on wages and mobility are studied (for wages e.g. Leuven (2007) and Frazis & Loewenstein (2007) give comprehensive overviews, for mobility Green et al. (2000) and Sieben (2005) provide relevant literature). On the organizational level productivity is one of the most famous outcome which research looks at (for an overview on that see e.g. Bartel et al. 2004).

³ In case of a very detailed study of a single firm or industry, this field of research is often referred to as insider econometrics (Bartel et al. 2004, Ichniowski & Shaw 2003).

field of personnel economics and “insider econometrics”, evidence on the determinants of investing is surprisingly sparse. Both studies mentioned collected personnel records of one firm. Having 20 years of personnel data from one firm Baker et al. (1994) analyze characteristics of the internal labor market like hierarchical structure, pay levels and career tracks of the employees but does not analyze training participation. In contrast to that Bartel (1995) concentrates on participation in and effects of employer-provided training by using four years of personal records of a manufacturing company. She finds that individuals who stand out relative to their peers and individuals who have a low status in their job compared to peers are more likely to participate in training. Contrary to single-firm studies, analyzes that compare data from various firms are more numerous (e.g. Lynch (1992), Bartel & Sicherman (1998), Arulampalam et al. (2004)).

As most important determinants of training participation these studies mention education, gender and age (Asplund (2004) and Groot (1999) give comprehensive overviews here). The studies provide mainly similar responses for gender and education, but results vary for age. Regarding education all authors conclude that the probability to participate in training is increases the higher the educational degree obtained (see e.g. Arulampalam et al. (2004); for a theoretical explanation see Sicherman & Galor (1990)). This can be explained by a higher affiliation to learn for individuals who stayed in formal school and vocational education for a longer time period. Regarding gender women are observed to show a lower probability to participate in training than men (for a theoretical explanation see Lazear & Rosen (1990), Paglin & Rufolo (1990)). The explanation could be gender gaps in terms of payment which reduce the motivation of women to participate in training as their returns are lower. Although in terms of age, theoretical argumentation for both, employer and employees let expect a negative correlation, previous empirical work does not completely support this prediction. For Germany Lois (2005) shows a negative age effect whereas Aust & Schröder (2006) could not confirm such an effect. Nevertheless, most of the empirical evidence suggests that individuals are more likely to participate in training when they are highly educated, young and male. Further control variables such as occupational and hierarchical status, part-time work and union status are mostly insignificant.

Why is it now important to study training on the company level when most of the aforementioned studies use comparative multi-firm data? As useful multi-firm information is to compare human resource management practices over firms, as much it hinders research on the individual level. With multi-firm data one cannot account for the diversity of human resource management strategies and training programs between organizations. Furthermore it is difficult to measure training incidence even in case of formal training as its definition, reference period and samples differ (Frazis & Loewenstein 2007). However, also single-firm studies are not free of disadvantages. One serious drawback of our data

and research approach is certainly the lack of generalizability of the results to trainings in other firms. According to the criteria of Ichniowski & Shaw (2003) concerning the term “insider econometrics” the study we perform is rather an econometric case study as we are not attempting to measure the effects of different organizational policies. The main advantage however is, that we are confident to provide accurate and reliable results. As one is not to have without the other we aim on providing estimations which are much more hands on human resource management practices in large companies than to deliver just a new set of estimates on multi-firm level (for a discussion on this Ichniowski & Shaw 2003).

So far, when analyzing the determining factors for employees training participation training is measured poorly. Regarding the course characteristics, standard human capital theory does not make any predictions on the impact of intensity, specificity and teaching style on the motivation to participate in continuous training. Some of the aforementioned studies can show that not only incidence of training but also duration is increases with the educational level. When looking at the specificity of training we follow the definition of Lazear (2003) when distinguishing specific and general training. As older employees are expected to participate less in training they might at the same time value the importance of industry specific and general courses differently. Thus, we expect them to decide in favor of rather general then specific courses, as they are not longer necessary for their future career. It may furthermore be the case that older employees prefer different teaching styles compared to their younger counterparts. As Schiermann (2000) points out joint seminars with younger colleagues may discourage senior employees as their style and pace of learning might be considerably different. Senior employees might thus be more attracted by individual teaching methods such as electronic learning or coaching or by small learning groups. In their analysis Aust & Schröder (2006) could not find an age-specific teaching style. The control variables included in these different are expected to behave in a similar manner as already explained for the participation decision in general.

Our data allows to measure formal company training in a very detailed manner. We can complement the individual determinants of training by professional characteristics such as tenure or hierarchical status and training characteristics. Two widely used training characteristics are incidence and intensity. We decompose the intensity measure into number and length of attended trainings. In addition the data allow us to observe the teaching style and content of the training course. The next section gives a more detailed overview of data and variables used.

3 Description of data and variables

The company studied in this paper is a large German firm operating in the financial industry. From the department of human resources we got administrative personnel data on all of the company’s employees for the years 2004, 2005 and 2006.⁴ The company organizes participation in formal employer provided training special software.⁵ This software was introduced in 2003 and it is used to carry out all the steps necessary for participation in the company’s training programmes: information research, signing up, approval of supervisor. The company leaves training decisions to the responsibility of its employees and thereby aims at encouraging an active interest in the own lifelong learning. For the purpose of our analysis, we regard the companies’ supply of training programs as given and do not explore in more detail the factors driving supply decision. The dataset with the training information contains only those employees which actually participated in training in one of the three years (2004, 2005, 2006) since the software was introduced. We merged both data sets and decided to exclude the information of 2004 as important information (e.g. on the teaching style of the course) was missing and the available information differed substantially from the two later years.⁶ The final dataset contains 30,064 employees in the year 2005 and 28,621 employees in the year 2006. For the purpose of our study and reasons of simplicity we report the results based on the year 2006. We also conducted the analyses for 2005 which did not lead to substantially different results.

Table 2: Variables of interest

| individual characteristics | professional characteristics | course characteristics |
|----------------------------|------------------------------|-------------------------|
| gender | corporate title | training incidence |
| age | fulltime/parttime work | number of courses taken |
| formal education | tenure | duration |
| | wage | teaching style |

For our analysis we thus focus on analyzing the individual, professional and course characteristics that drive the decision to participate in the various forms of company training that are offered. Table 2 gives an overview on the variables used for the estimations.

⁴ The reporting date is 31st of December in each year.

⁵ Most job training is informal however Bishop (1996) but as Veum (1995) points out informal training such as learning-by-doing, observing co-workers or by simply asking colleagues is very difficult to measure.

⁶ This is due to the new introduction of the software in 2003 which caused major changes in processes. With the new software training organization became much more demanding and caused a need for extra support and introduction. To avoid biased results caused by start-up difficulties and assure stable acceptance of the training software, we decided to use the available information from 2005 on.

Individual characteristics The individually most prevalent factors are gender, age and education. Regarding gender, men and women are equally represented, overall and within the different age groups. Most of the employees are between 36 and 40 years old. Figure 1 displays the histogram of the age distribution. Conspicuously, employees between 60 years and 67 are virtually non-existent.⁷ This is a consequence of the extensive early retirement programmes during the last years. Regarding the level of formal education, the majority of the employees is educated on a middle level holding a degree from vocational education.

Professional characteristics Concerning job characteristics the corporate title is an important indicator for the hierarchical level of the employees' position. In 2006, 44% of the employees had some type of corporate title. Furthermore, we know if the collective bargained pay scheme applies to the employees' wage. Regarding working time, we can observe the employees full-time equivalent working share on a continuous scale. 80% of the employees are working full-time in 2006. Out of those working part-time only 8% are male. The average duration of employment at the company is 15 years. The average wage is around 49,000 Euro.⁸

Course characteristics Training characteristics covered in the data are training incidence, training intensity (number, length), training specificity (general, industry-specific training) and teaching style (classroom, self-paced learning). 84% of the employees participated in some sort of formal company training in 2006.⁹ The mean number of trainings is 3.2 with a mean length of one day. Thus, employees of this company (which participated in training) spend around four days per year in some sort of company provided training program. Knowing the content of the training courses allows us to distinguish between general and industry-specific training.¹⁰ While 64% of the participants under age 35 have participated a industry-specific training in 2006, the share goes down to 49% for the 35-50 year olds and only 40% of the 50-67 year olds participate in industry-specific training courses. Classroom training (72%) and self-paced learning (71%) are the teaching styles which are most frequently chosen.¹¹

⁷ In 2005 the professional life span was enlarged making 67 years the legal retirement age in Germany.

⁸ The variable describes the basis wage which does not include bonuses or other extra-payments. In the regressions in the following section wage is expressed in dimension 1000 Euro.

⁹ One problem with these numbers is that not all trainings are voluntarily. As the company we look at operates in the financial sector they are obliged by law to guarantee that the employees can always comply with legal requirements.

¹⁰ We grouped courses with business related topics, on information technology and professional qualifications as industry-specific training courses.

¹¹ Note that the figures do not add up to 100% as multiple training participation is possible.

Figure 1: Age distribution of the employees (2006)

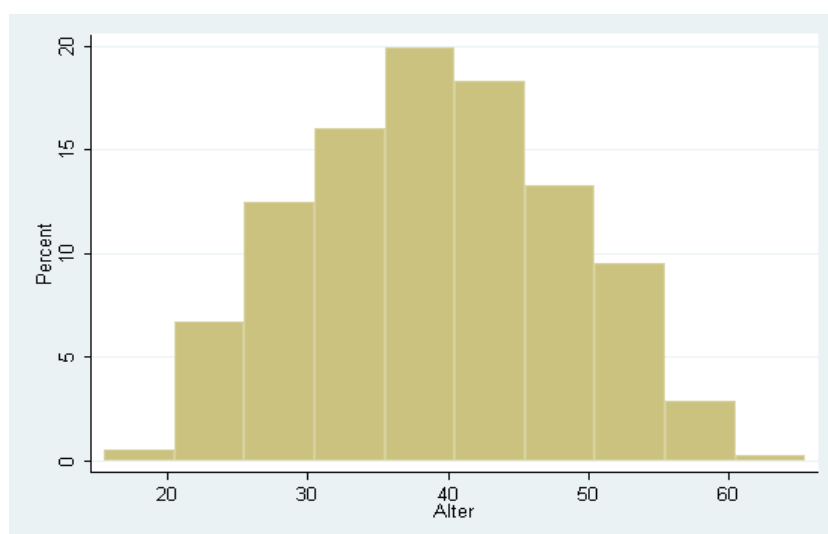


Table 3: Means of variables

| variables | training participants | non-participants |
|-------------------------------------|-----------------------|------------------|
| female | 0.49 | 0.57 |
| age | 38.95 | 40.24 |
| vocational training | 0.6 | 0.53 |
| lowest secondary school track | 0.01 | 0.01 |
| intermediate secondary school track | 0.02 | 0.03 |
| high school | 0.03 | 0.02 |
| applied sciences | 0.1 | 0.07 |
| university | 0.15 | 0.1 |
| wage | 50,442 | 42,776 |
| share of working time | 0.93 | 0.86 |
| union wage | 0.52 | 0.52 |
| corporate title | 0.43 | 0.28 |
| tenure | 14.92 | 14.75 |
| <i>N</i> | <i>24,171</i> | <i>4,450</i> |

Table 3 shows the means of the variables capturing individual and professional characteristics for participants and non-participants. As the comparison shows, participants in company provided training are more often male, younger and do more often have a university degree. They earn higher wages which might partly be due to them working in a full-time position. Concerning tenure, participants do not differ much from their

non-participating counterparts. Complete summary statistics are shown in Table A.1 in the appendix.

4 Estimations and Results

As the analysis provided in this paper is largely descriptive and estimations are pretty much straightforward we present the empirical model used for the estimations rather quickly. As participation in continuous training is a decision with two outcomes, yes and no, we focus our analysis on the estimation of a binary probit model. Our indicator variable Y_i is 1 if the employee i has participated in at least one training and 0 if the employee has not done any form of company provided training in the year 2006. The choice problem is described in the latent variable model

$$\begin{aligned}
 Y_i^* &= age'_i\alpha + gender * age'\beta + education'\gamma + prof.characteristics'_i\delta + \varepsilon_i \quad (1) \\
 Y_i &= \begin{cases} 1 & \text{if } Y_i^* > 0 \\ 0 & \text{if } Y_i^* \leq 0 \end{cases}
 \end{aligned}$$

where Y_i^* is the latent variable. Our main variable of interest is *age* which is included as dummy variables in five year intervals. Furthermore, we interact age and gender to assess differences in participation behavior between men and women. The latent variable depends additionally on a vector of *professional characteristics* (as described above) of individual i and ε_i as the error term which is normally distributed with zero mean and unit variance.

The first step in our empirical strategy is the estimation of a probit model for training participation. Table 4 shows the results from the probit regression of training participation on age dummies and the interaction terms of age and gender. The reference individual is male, less than 20 years old, with a degree from vocational education, works part time and does not possess a corporate title. Results show a decrease in the probability to participate in company provided training which becomes significant from age 46 on. Not only in terms of statistical significance but also regarding economic significance the effects get very large the older the employees are. Compared to the under 20-year-olds, employees aged between 56 and 60 have a 19 percentage points lower probability to participate in training. For over 61-year-olds this probability even rises to more than 30 percentage points. Furthermore, our results suggest that effects are not the same for men and women. Females between 36 and 37 years have a slightly higher probability to participate in training than men in their age group. The higher probability of older women to participate in training might be a mechanism of compensation resulting from former career interruptions. Caused by a family break women might have a severe interest in regaining lost time and renewing

outdated knowledge by participating in training.

Table 4: Regression results reporting marginal effects of age and gender on training participation

| Variable | Coefficient | (Std. Err.) |
|--|-----------------|-------------|
| <i>Age</i> | | |
| age 20-25 | 0.031 | (0.038) |
| age 26-30 | 0.015 | (0.041) |
| age 31-35 | -0.009 | (0.045) |
| age 36-40 | -0.051 | (0.050) |
| age 41-45 | -0.053 | (0.050) |
| age 46-50 | -0.096* | (0.057) |
| age 51-55 | -0.140** | (0.063) |
| age 56-60 | -0.186*** | (0.072) |
| age 61-67 | -0.302*** | (0.097) |
| <i>Gender*Age</i> | | |
| female 17-20 | 0.081* | (0.031) |
| female 21-35 | -0.007 | (0.007) |
| female 36-67 | 0.021*** | (0.005) |
| <i>Highest Educational Degree from ...</i> | | |
| lowest secondary track | 0.010 | (0.021) |
| intermediate secondary track | -0.019 | (0.014) |
| high school | 0.031** | (0.012) |
| university applied sciences | -0.002 | (0.008) |
| university | 0.003 | (0.007) |
| <i>Professional Characteristics</i> | | |
| wage | 0.003*** | (0.000) |
| full-time | 0.084*** | (0.007) |
| union wage | 0.030*** | (0.010) |
| tenure | 0.001 | (0.000) |
| department | 0.002*** | (0.000) |
| corporate title | 0.074*** | (0.010) |
| <i>N</i> | <i>28,621</i> | |
| <i>Pseudo R²</i> | <i>0.0929</i> | |
| χ^2 | <i>2296.866</i> | |

Significance levels: * 10%, ** 5%, *** 1%. Further controls: dummies for missing values.

Regarding education only having a high school degree turns out to be significantly pos-

itively related to training participation. This result is contrary to what literature found before but our variable here is not of very good quality as the information is missing for a considerable amount of individuals. The other controls behave as expected. The probability to participate in training is positively related to full-time work, wage, being paid collectively bargained wages and having a corporate title.

Secondly we estimate the same probit model with participation in industry specific training as dependent variable.¹² As the results in Table 5 show the relationship between age and probability to participate in employer provided training is negative for all age groups and starts to get significant already at age 26. Economic significance is even larger than in the previous regression. So, employees aged between 56 and 60 have a 38 percentage points lower probability to participate in industry-specific training. For over 61-year-olds this probability even rises to nearly 40 percentage points. Compared to men in the same age group, women from age 36 do still have a positive probability to participate in industry-specific training. “Older” women seem thus to still invest in their human capital. Apart from the variable education — whose information is not very reliable — the other controls are pretty much the same as before, although a bit more significant.

¹² Note that the model is estimated for all employees, participants and non-participants. The number of observations decreases by 42 observations because the observations for which the variable wage is missing predict failure perfectly.

Table 5: Regression results reporting marginal effects of age and gender on industry-specific training participation

| Variable | Coefficient | (Std. Err.) |
|--|----------------|-------------|
| <i>Age</i> | | |
| age 20-25 | -0.010 | (0.073) |
| age 26-30 | -0.145** | (0.066) |
| age 31-35 | -0.222*** | (0.060) |
| age 36-40 | -0.270*** | (0.058) |
| age 41-45 | -0.285*** | (0.056) |
| age 46-50 | -0.311*** | (0.049) |
| age 51-55 | -0.353*** | (0.039) |
| age 56-60 | -0.380*** | (0.023) |
| age 61-67 | -0.396*** | (0.016) |
| <i>Gender*Age</i> | | |
| female 17-20 | 0.098 | (0.094) |
| female 21-35 | 0.001 | (0.010) |
| female 36-67 | 0.024*** | (0.009) |
| <i>Highest Educational Degree from ...</i> | | |
| lowest secondary track | -0.152*** | (0.033) |
| intermediate secondary track | -0.064*** | (0.020) |
| high school | -0.027 | (0.019) |
| university applied sciences | -0.028** | (0.011) |
| university | 0.035*** | (0.011) |
| <i>Professional Characteristics</i> | | |
| wage | 0.002*** | (0.000) |
| full-time | 0.139*** | (0.009) |
| union wage | 0.147*** | (0.016) |
| tenure | 0.004*** | (0.001) |
| department | -0.065*** | (0.001) |
| corporate title | 0.145*** | (0.018) |
| <i>N</i> | <i>28,579</i> | |
| <i>Pseudo R²</i> | <i>0.1453</i> | |
| χ^2 | <i>5681.41</i> | |

Significance levels: * 10%, ** 5%, *** 1%. Further controls: dummies for missing values.

For a third and fourth specification we estimate the probit models for the participation in classroom and self-paced trainings for those employees which participated in training

in 2006. The results of the estimations are displayed in Table 6. The dependent variable classroom training (self-paced training) is 1 if the employee has participated at least once in classroom (self-paced) training courses in the year 2006.

Table 6: Regression results reporting marginal effects of age and gender on classroom and self-paced training participation conditioning on participation

| | classroom training | | self-paced training | |
|--|--------------------|-------------|---------------------|-------------|
| | Coefficient | (Std. Err.) | Coefficient | (Std. Err.) |
| <i>Age</i> | | | | |
| age 20-25 | 0.119* | (0.056) | -0.147* | (0.092) |
| age 26-30 | 0.144** | (0.054) | -0.241*** | (0.093) |
| age 31-35 | 0.099 | (0.063) | -0.284*** | (0.092) |
| age 36-40 | 0.083 | (0.066) | -0.306*** | (0.091) |
| age 41-45 | 0.065 | (0.067) | -0.315*** | (0.091) |
| age 46-50 | 0.033 | (0.071) | -0.309*** | (0.093) |
| age 51-55 | 0.010 | (0.073) | -0.346*** | (0.095) |
| age 56-60 | -0.049 | (0.082) | -0.331*** | (0.097) |
| age 61-67 | -0.264 | (0.114) | -0.258** | (0.134) |
| <i>Gender*Age</i> | | | | |
| female 17-20 | 0.015 | (0.086) | -0.010 | (0.100) |
| female 21-35 | -0.003 | (0.010) | 0.002 | (0.010) |
| female 36-67 | -0.016* | (0.008) | 0.031*** | (0.009) |
| <i>Highest Educational Degree from ...</i> | | | | |
| lowest secondary track | -0.065** | (0.034) | -0.031 | (0.032) |
| intermediate secondary track | -0.024 | (0.019) | -0.043** | (0.018) |
| high school | -0.024 | (0.018) | -0.011 | (0.017) |
| university applied sciences | -0.000 | (0.010) | -0.017* | (0.010) |
| university | 0.022** | (0.009) | 0.026** | (0.010) |
| <i>Professional Characteristics</i> | | | | |
| wage | 0.000** | (0.000) | 0.001*** | (0.000) |
| full-time | 0.081*** | (0.009) | -0.009 | (0.009) |
| union wage | 0.043*** | (0.015) | 0.245*** | (0.014) |
| tenure | 0.001** | (0.000) | -0.004*** | (0.000) |
| department | -0.052*** | (0.001) | 0.068*** | (0.001) |
| corporate title | 0.145*** | (0.015) | 0.162*** | (0.015) |
| <i>N</i> | 24,170 | | 24,170 | |
| <i>Pseudo R</i> ² | 0.0931 | | 0.1440 | |
| χ^2 | 2475.30 | | 2870.14 | |

Significance levels: * 10%, ** 5%, *** 1%. Further controls: dummies for missing values. The number of observations decreases by 1 observation because the observation for which the variable wage is missing predicts failure perfectly.

Within the sample of participants, the probability to participate in classroom trainings seems not to be influenced by age. Only the younger employees seem to participate more in this type of training. But that could be simply due to them being new in the firm and thus are required to do introductory courses. Contrary to that, the probability to spend time with self-paced learning modules decreases with age. Although the decrease is not as sharp as for industry-specific courses but is still substantial in size and significance regarding the different age groups. We can thus not confirm the results of Lindenberger (2000) that learning individualizes with increasing age. Rather our results indicate that classroom training is a popular training type over all ages. Regarding female employees the results of the two regressions show that women aged 36 to 67 have a lower probability to participate in classroom trainings than men in this age group but a higher probability to employ self-paced techniques compared to men of the same age.

5 Conclusion

Our results indicate that participation in both — general training and industry specific training — decreases sharply in the second half of employee’s professional life. Especially for the over 50 year olds, training periods become scarce and short. Regarding training specificity, general content courses and industry-specific courses differ strongly. For industry-specific courses, employees aged between 56 and 60 have a 38 percentage points lower probability to participate, compared to 19 percentage points in the regression for training incidence. Furthermore, the decline of participation probability in industry-specific trainings already starts at age 36, which is much earlier compared to the results for training incidence in general.

We can further show that training participation differs between male and female employees. Women between 36 and 67 years have a slightly higher probability to participate in training than men of the same age. We can thus not confirm the findings of other studies whereas women generally participate less in training. Our results rather indicate that female training participation highly depends on age. The higher participation rates might be a mechanism of compensation resulting from former career interruptions.

Regarding teaching style, the negative age effect is stronger for self-paced learning techniques compared to classroom training. To be trained alone in front of a computer is the least popular way of learning for all employees. But the effect of self-paced techniques is particularly large for older workers. Classroom training is thus the preferred teaching style among the whole workforce and one way to provide constant learning environments also for older employees. Investing in specially tailored training programs for senior workers — and/or for women — might be a second opportunity to increase training participation.

References

- Acemoglu, D. & Pischke, J.-S. (1998), ‘Why do firms train? Theory and Evidence’, *Quarterly Journal of Economics* **113**, 79–119.
- Altonji, J. G. & Spletzer, J. R. (1991), ‘Worker Characteristics, Job Characteristics, and the Receipt of On-the-Job Training’, *Industrial and Labor Relations Review* **45**(1), 58–79.
- Arulampalam, W., Booth, A. L. & Bryan, M. L. (2004), ‘Training in Europe’, *Journal of the European Economic Association* **2**(2-3), 346–360.
- Asplund, R. (2004), ‘The Provision and Effects of Company Training: A Brief Review of the Literature’, ETLA Working Paper.
- Aust, F. & Schröder, H. (2006), ‘Beschäftigungssituation älterer Arbeitnehmer. Expertisen zum 5. Altenbericht der Bundesregierung. Band 1’, Lit Verlag.
- Baker, G., Gibbs, M. & Holmstrom, B. (1994), ‘The internal economics of the firm: evidence from personnel data’, *The Quarterly Journal of Economics* **109**(4), 881–919.
- Bartel, A., Ichniowski, C. & Shaw, K. (2004), ‘Using “Insider Econometrics” to Study Productivity’, *The American Economic Review* **94**(2), 217–223.
- Bartel, A. P. (1995), ‘Training, Wage Growth, and Job Performance: Evidence from a Company Database’, *Journal of Labor Economics* **13**(3), 401–425.
- Bartel, A. P. & Sicherman, N. (1998), ‘Technological Change and the Skill Acquisition of Young Workers’, *Journal of Labor Economics* **16**(4), 718–755.
- Büchel, F. & Pannenberg, M. (2004), ‘Berufliche Weiterbildung in West- und Ostdeutschland: Teilnehmer, Struktur und individueller Erfolg’, *Zeitschrift für Arbeitsmarktforschung* **37**(2), 73–126.
- Bishop, J. (1996), ‘What We Know About Employer-Provided Training: A Review of Literature’, CAHRS Working Paper Series.
- Franz, W. (2006), *Arbeitsmarktökonomik*, 6 edn, Springer, Heidelberg.
- Frazis, H. & Loewenstein, M. A. (2007), ‘On-the-Job-Training’, *Foundations and Trends in Microeconomics* **2**(5).
- Green, F. (1993), ‘The Determinants of Training of Male and Female Employees in Britain’, *Oxford Bulletin of Economics & Statistics* **55**(1), 103–122.

- Green, F., Felstead, A., Mayhew, K. & Pack, A. (2000), 'The Impact of Training on Labour Mobility: Individual and Firm-level Evidence from Britain', *British Journal of Industrial Relations* **38**(2), 261–275.
- Groot, W. (1999), Enterprise Related Training: A Survey, in F. van Wieringen & G. Atwell, eds, 'Vocational Education and Training in Europe', Kluwer Academic Publishers, Dordrecht, Boston, London, pp. 357–373.
- Hughes, G., O'Connell, P. & William, J. (2004), 'Company Training and Low-Skill Consumer-Service Jobs in Ireland', *International Journal of Manpower* **25**(1), 17–35.
- Ichniowski, C. & Shaw, K. (2003), 'Beyond Incentive pay: Insiders' Estimates of the Value of Complementary Human Resource Management Practices', *Journal of Economic Perspectives* **17**(1), 155–180.
- Lazear, E. P. (1999), 'Personnel Economics: Past Lessons and Future Directions', *Journal of Labour Economics* **17**(2), 199–236.
- Lazear, E. P. (2003), 'Firm-Specific Human Capital. A Skill-Weights Approach', NBER Working Paper 9679.
- Lazear, E. P. & Rosen, S. (1990), 'Male-Female Wage Differentials in Job Ladders', *Journal of Labor Economics* **8**(1), 106–123.
- Leuven, E. (2007), 'The economics of private sector training: a survey of the literature', *Journal of Economic Survey* **19**(1), 91–111.
- Lindenberger, U. (2000), 'Intellektuelle Entwicklung über die Lebensspanne: Überblick und ausgewählte Forschungsbrennpunkte', *Psychologische Rundschau* **51**(3), 135–145.
- Lois, D. (2005), 'Weiterbildung älterer Erwerbstätiger. Die Messung im Mikrozensus und der Einfluss soziodemographischer Variablen', Working Paper.
- Lynch, L. M. (1992), 'Private Sector Training and the Earnings of Young Workers', *American Economic Review* **82**(1), 299–312.
- Lynch, L. M. & Black, S. E. (1998), 'Beyond the Incidence of Employer-Provided Training', *Industrial and Labor Relations Review* **52**(1), 64–81.
- Paglin, M. & Rufolo, A. M. (1990), 'Heterogenous Human Capital, Occupational Choice and Male-Female Earnings Differences', *Journal of Labor Economics* **8**(1), 123–144.

- Pannenberg, M. (1995), *Weiterbildungsaktivitäten und Erwerbsbiographie: Eine empirische Analyse für Deutschland*, Campus, Frankfurt, New York.
- Schiermann, C. (2000), 'Weiterbildung älterer Arbeitskräfte angesichts einer veränderten Weiterbildungsorganisation', *Zeitung für Gerontologie und Geriatrie* **33**, 284–288.
- Sicherman, N. & Galor, O. (1990), 'A Theory of Career Mobility', *Journal of Political Economy* **8**, 169–192.
- Sieben, I. (2005), 'Does Training Trigger Turnover ... Or Not? The Impact of Formal Training on Young Men's and Women's Job Search Behaviour', Working Paper ROA-RM-2005/6E.
- Spitzer, M. (2003), 'Langsam, aber sicher — Gehirnforschung und das Lernen Erwachsener', *DIE Zeitschrift für Erwachsenenbildung* **10**(3), 38–40.
- Veum, J. R. (1995), 'Sources of Training and Their Impact on Wages', *Industrial and Labor Relations Review* **48**(4), 812–826.
- Voelpel, S. C., Leibold, M. & Früchtenicht, J.-D. (2007), *Herausforderung 50 plus. Konzepte zum Management der Aging Workforce: Die Antwort auf das demographische Dilemma*, Publicis–Wiley, Erlangen – New York.

A Appendix

Table A.1: Descriptive statistics for the sample and the subgroups of participants and non-participants

| | sample | | participants | | non-participants | |
|--|--------|-------------|--------------|-------------|------------------|-------------|
| | Coeff. | (Std. Err.) | Coeff. | (Std. Err.) | Coeff. | (Std. Err.) |
| <i>Age</i> | | | | | | |
| age <20 | 0.01 | (0.07) | 0.01 | (0.07) | 0.01 | (0.07) |
| age 20-25 | 0.07 | (0.25) | 0.07 | (0.25) | 0.07 | (0.25) |
| age 26-30 | 0.12 | (0.33) | 0.13 | (0.33) | 0.11 | (0.31) |
| age 31-35 | 0.16 | (0.37) | 0.16 | (0.37) | 0.14 | (0.34) |
| age 36-40 | 0.2 | (0.4) | 0.2 | (0.4) | 0.2 | (0.4) |
| age 41-45 | 0.18 | (0.39) | 0.19 | (0.39) | 0.17 | (0.37) |
| age 46-50 | 0.13 | (0.34) | 0.13 | (0.34) | 0.15 | (0.35) |
| age 51-55 | 0.1 | (0.29) | 0.09 | (0.29) | 0.12 | (0.33) |
| age 56-60 | 0.03 | (0.17) | 0.03 | (0.16) | 0.04 | (0.2) |
| age 61-67 | 0 | (0.05) | 0 | (0.05) | 0.01 | (0.08) |
| <i>Gender*Age</i> | | | | | | |
| female 17-20 | 0 | (0.06) | 0 | (0.06) | 0 | (0.05) |
| female 21-35 | 0.19 | (0.39) | 0.19 | (0.39) | 0.18 | (0.38) |
| female 36-67 | 0.31 | (0.46) | 0.3 | (0.46) | 0.39 | (0.49) |
| <i>Highest Educational Degree from ...</i> | | | | | | |
| vocational education | 0.59 | (0.49) | 0.6 | (0.49) | 0.53 | (0.5) |
| lowest secondary track | 0.01 | (0.09) | 0.01 | (0.09) | 0.01 | (0.09) |
| intermediate secondary track | 0.02 | (0.16) | 0.02 | (0.15) | 0.03 | (0.16) |
| high school | 0.03 | (0.16) | 0.03 | (0.17) | 0.02 | (0.13) |
| university applied sciences | 0.1 | (0.29) | 0.1 | (0.3) | 0.07 | (0.26) |
| university | 0.14 | (0.35) | 0.15 | (0.35) | 0.1 | (0.3) |
| <i>Professional Characteristics</i> | | | | | | |
| wage | 49,250 | (26,559) | 50,442 | (24,979) | 42,776 | (33,142) |
| full-time | 0.8 | (0.4) | 0.82 | (0.38) | 0.67 | (0.47) |
| union wage | 0.52 | (0.5) | 0.52 | (0.5) | 0.52 | (0.5) |
| tenure | 14.9 | (9.84) | 14.92 | (9.6) | 14.75 | (11.07) |
| department | 2.12 | (2.53) | 2.16 | (2.5) | 1.88 | (2.66) |
| corporate title | 0.41 | (0.49) | 0.43 | (0.49) | 0.28 | (0.45) |
| <i>Training Characteristics</i> | | | | | | |
| industry-specific | 0.43 | (0.5) | 0.51 | (0.5) | 0 | (0) |
| classroom | 0.6 | (0.49) | 0.72 | (0.45) | 0 | (0) |
| self-paced | 0.6 | (0.49) | 0.71 | (0.45) | 0 | (0) |
| <i>N</i> | 28,621 | | 24,171 | | 4,450 | |