

# Recruitment and Apprenticeship Training

By Jens Mohrenweiser<sup>\*</sup>  
(Bournemouth University)

*This Version: May 2015*

## **Abstract:**

The paper assesses non-training firm's potential for free-riding on the training efforts of firms that train apprentices. In order to assess potential free-riding, the paper analyses whether training or non-training firms are more likely to recruit apprenticeship graduates that have been trained elsewhere. Firms without apprenticeships are less likely to hire apprenticeship graduates trained elsewhere than training firms. If these firms do hire apprenticeship graduates, they hire a smaller proportion compared to all new-hired skilled workers that have an apprenticeship degree than training firms. The paper discusses three potential explanations for this finding: lower demand for apprenticeship graduates, information disadvantage and apprentices' preferences.

**JEL Codes:** J24, M51, M53

**Key words:** company-sponsored training, training participation, recruiting, apprenticeship, employer coordination

---

<sup>\*</sup> mohrenweiserj@bournemouth.co.uk; Bournemouth University, 89 Holdenhurst Road, BH8 8EB, Bournemouth, UK.

I thank Felix Noth, Robert Wagner, Felix Wenzelmann, Thomas Zwick, the participants at the GEABA 2011 in Zurich, the editor and referees for helpful comments and the Research Data Centre (FDZ) of the Federal Employment Agency at the Institute for Employment Research for the data access and the support with analysis of the LIAB data. Data access was granted via guest research spells at FDZ and afterwards via controlled data remote access at the FDZ.

## Introduction

The willingness of firms to provide apprenticeship training is of major interest to understand incentives of those firms that invest in employees transferable skills. Firms' investments in transferable skills increase the risk of firms free-riding since competitors can poach the newly trained skilled workers (Harhoff and Kane, 1997; Acemoglu and Pischke, 1998; Stevens, 2001; Leuven, 2005; Wolter and Ryan, 2011). For countries considering adopting an apprenticeship training system, the risks of poaching and free-riding are a feared obstacle and detrimental to firms' willingness to invest in apprentices transferable skills.

Despite its relevance, empirical evidence on potential free-riding is scarce. Empirical studies usually focus on the provision of apprenticeship programs. On the contrary, this paper argues that understanding potential free-riding of non-training firms requires an analysis of the recruitment strategy comparing non-training and training firms. Such analysis can show whether non-training firms are able to hire graduates immediately after apprenticeship and provides additional explanations for the functioning of apprenticeship training markets.

The paper finds that non-training firms are seven percent less likely to hire apprenticeship graduates trained elsewhere opposed to training firms. If non-training firm hired recent apprenticeship graduates, they hire a smaller proportion compared to all newly hired skilled employees over the course of a year.

Previous theoretical arguments have focused on a low free-riding probability. The economic literature argues that market mechanisms, such as monopsony power which is based on information asymmetry, transaction costs or complementarities to specific skills, can prevent poaching (Acemoglu and Pischke, 1998; Leuven, 2005; Wolter and Ryan, 2011). Political science literature discusses how employer coordination solves the commitment problem to training and reduce free-riding through information circulation, deliberation, monitoring and sanctioning (Soskice, 1994; Culpepper, 2001; Trampusch and Eichenberger, 2012).

Nevertheless, these theoretical models do not explain whether certain firms are more likely to hire apprenticeship graduates trained elsewhere despite a sizeable proportion of apprenticeship graduates leave immediately after training in occupations that require a high investment (Euwals and Winkelmann, 2004; Autorengruppe Bildungsberichterstattung, 2010; Göggel and Zwick, 2012). This paper discusses three mechanisms that influence the lower probability of non-training firms hiring apprenticeship graduates immediately after training. First, non-training firms might not have demand apprenticeship graduates as a condition of employment. Hence, there is no incentive to free-ride. Second, the *group of training firms*

might have an information advantage. These firms may gain an information advantage because training supervisors are also members of apprentices' examination committees. Thus, they are in a better position to assess the quality of each apprenticeship graduate in comparison to all apprenticeship graduates in a respective training occupation. Additionally, these training firms have more insight into the quality of training among training firms. This superior knowledge gives training firms a competitive advantage in hiring switching apprenticeship graduates. Third, switching graduates may simply prefer to work for firms that actively support apprenticeship training. Empirically, this paper cannot reject the relevance of these three explanations.

### **The apprenticeship training system**

The German apprenticeship training system follows a curriculum established by the Vocational Training Act and occupation-related training curricula. The Vocational Training Act describes necessary equipment and requirements training firms must fulfill in order to train apprentices to standard. Training firms need a permit for apprenticeship training which is granted by the chambers of industry and commerce or the chambers of craft. The training curricula describes the level of acceptable skills that at minimal needs to be trained to as well as the length of training for each specific occupation. Consequently, at the end of the training period apprentices will receive a graded skill certificate. Finally, the chambers centrally monitor apprenticeships and administer the final exams.

These institutional settings impose a consistent and unambiguous definition of training across firms as well as transparent and visible skills. Apprenticeship graduates who receive training in different firms, but in the same occupation have a comparable and guaranteed minimum level of skills. In particular, institutional requirements severely limit a firms' ability to structure apprenticeship training in a manner that is specific to the firm. Furthermore, apprenticeship training contracts are legally terminated on the day following the final exam. Thus, employment has to be negotiated at the end of the apprenticeship. Apprentices are free to switch employers after training. Therefore, training firms have to actively entice graduates to stay on as skilled workers; whereas in principle, non-training firms could easily hire them and free-ride on the efforts of training firms (Franz and Soskice 1995; Mohrenweiser et al. 2013).

Nevertheless, collective bargaining contracts increasingly protect apprenticeship graduates and entail retention clauses for training firms that may limit mobility after training. Since the

mid-90s, collective bargaining contracts with retention clauses in specific sectors went beyond pure appeals. An overview on the effects of these clauses on the retention rates by Bispinck et al. (2002) shows firms rarely changed their retention policy in the wake of these clauses. Instead, firms used the numerous remaining loopholes– for example by offering skilled jobs in faraway establishments or unattractive jobs as they trust that a lower than legal retention rate does not result in graduates or unions in taking legal action.

The apprenticeship training system is the main route into the labor market and trains around two-thirds of a birth cohort. Immediately after graduation, around 66 percent of apprenticeship graduates stay in the training firm, and 75 percent are employed one month after graduation (Autorengruppe Bildungsberichterstattung, 2010). The retention rate in the training firm decreases to 30 percent five years after apprenticeship completion (Winkelmann, 1996). Moreover, during the first year post-graduation, around one-third of all graduates switch occupations. The retention rate, employment rate and rate of occupational switchers varies greatly between occupations and sectors (Autorengruppe Bildungsberichterstattung, 2010).

### **Theoretical background and hypotheses**

Analyzing the decision of non-training firms to hire apprenticeship graduates incorporates two dimensions. First, do non-training firms demand apprenticeship graduates instead of experienced employees and second, if they demand apprenticeship graduates, do non-training firms have an (dis)advantage in hiring apprenticeship graduates compared to training firms.

A firms' demand for apprenticeship graduates depends on whether the firm sees graduates as perfect or imperfect substitutes to more experienced skilled workers with an apprenticeship degree. If both are perfect substitutes, firms may hire both depending on marginal cost/benefit considerations. If both are imperfect substitutes, for example because employees learn additional and important skills during employment but not during apprenticeship, firms may prefer either type of workers. Imperfect substitution may cause firms to not (or occasionally) hire apprenticeship graduates and to not train apprentices at all. This leads to the first hypothesis that non-training firms are less likely to hire apprenticeship graduates trained elsewhere because they do not have a demand for them.

If firms demand apprenticeship graduates, they have two options in principle. Firms can decide to train apprentices and employ their graduates afterwards. This decision refers to the investment training motive (Merrilees, 1983; Mohrenweiser and Zwick, 2009; Ryan and

Wolter, 2011).<sup>12</sup> Contrarily, firms that demand apprenticeship graduates can decide to hire them from outside firms instead of providing apprenticeship training. This free-riding on the training efforts of other firms can imply poaching which is generally considered as a major obstacle for firms' investment in transferable skills (Acemoglu and Pischke, 1999; Stevens, 2001; Leuven, 2005). Indeed, a firm can rely on both strategies train apprentices and additionally hire graduates trained elsewhere.

Before addressing whether training or non-training firms that demand apprenticeship graduates are more likely to hire apprenticeship graduates trained elsewhere, I summarize the main established theoretical arguments as to why free-riding should be considered a minor issue. Economic theory argues that firms invest in apprentices' transferable skills because of labor market imperfections such as information asymmetries, a regional monopsony power, transaction costs, complementarities to specific skills, collective agreements and minimum wages, all of which generate monopsony power for training firms. Monopsony power enables training firms to keep graduates and pay wages lower than productivity after apprenticeship training (Acemoglu and Pischke, 1999; Leuven, 2005; Wolter and Ryan, 2011).

Political science literature argues that employer coordination plays a major role in ensuring a firms' commitment to apprenticeship training and restricts systematic free-riding. Employer associations manage the communication between firms and the government as well as amongst member firms by information circulation, deliberation, monitoring and sanctioning (Soskice, 1994; Culpepper, 2001, Trampusch and Eichenberger, 2012). Both economic and political science arguments state that poaching and free-riding should be of minor relevance which is empirically supported by Mohrenweiser et al. (2013). However, both arguments do not answer the question whether non-training firms are less likely to hire switching apprenticeship graduates despite 40 percent of apprenticeship graduates switching employers after training is completed (Autorengruppe Bildungsberichterstattung, 2010).

I propose a further argument why training firms might be more likely to hire apprenticeship graduates trained elsewhere than non-training firms using arguments of economic theories of company-sponsored training investments. Training firms might have not only an information advantage against the market about the type of apprentices (Chang and Wang, 1995; Acemoglu and Pischke, 1998) or training content (Katz and Ziderman, 1990), but also the *group of training firms* has an information advantage against the group of non-training firms. Training firms are better situated to assess the quality of each graduate in comparison to all apprenticeship graduates in a respective training occupation as well as the quality of a training

firm in relation to other firms<sup>3</sup>. The information advantage is based on institutions such as that the training supervisors are also members of examination committees for exams in the chambers of industry and commerce or craft. Training firms thereby acquire information about the quality of outsider training firms and apprentices. This superior knowledge gives training firms an advantage in recruiting apprenticeship graduates trained elsewhere. They can distinguish between high and low productive switching apprentices and contingent the wage offer on apprentices' type. On the contrary, non-training firms cannot distinguish between both types and therefore offer an average wage. Hence, high productive switching apprenticeship graduates are more likely to work for outsider training firms than for outsider non-training firms. Whereas, outsider non-training firms are more likely to end-up with less productive graduates. This mechanism may prevent non-training firms from hiring apprenticeship graduates or hire them occasionally<sup>4</sup>. This leads to the second hypotheses that training firms are more likely to hire apprenticeship graduates trained elsewhere than non-training firms because of an information advantage.

The argument about the information advantage of the group of training firms rests on the assumption that firms can decide whom to keep. However, signing an employment contract is a decision between the employer and employee. Apprenticeship graduates may prefer to work at a training firm rather than a non-training firm. Apprenticeship graduates may see a firms' non-participation in apprenticeship training as an adverse signal about work-conditions or career possibilities (Backes-Gellner and Tuor, 2010). In this case, I also expect fewer apprenticeship graduates in non-training firms.

I test the hypothesis whether training firms are more likely to hire switching graduates trained elsewhere than non-training firms. This finding is expected due to three potential mechanisms. First, non-training firms may not demand apprenticeship graduates, but prefer experienced employees with an apprenticeship degree. Second, the group of training firms collectively has an information advantage over the group of non-training firms in terms of the productivity of apprenticeship graduates and as such can offer superior contracts. Third, apprenticeship graduates prefer to work in training firms.

However, I am not aware of any empirical paper analyzing a firms' demand for apprenticeship graduates or firms' recruiting strategy in regards to apprenticeship graduates. Somewhat related is a paper by Bellmann and Janik (2007) analyzing the impact of uncertainty in the recruitment of skilled workers and apprentices simultaneously. However, they do not focus on graduate recruitment and instead estimate a positive impact of the share

of skilled workers, employment growth and high investments on the recruitment of skilled workers. Moreover, a large strand of literature investigates firms' motivation to train apprentices, whereby the investment training motive assumes that firms train because they demand the skills of apprenticeship graduates (Mohrenweiser and Zwick, 2009; Mohrenweiser and Backes-Gellner, 2010; Wolter and Ryan, 2011; Wenzelmann, 2012). Finally, empirical papers analyzing information asymmetries in labor markets usually focus on the relation between the current employer and outsider firms (the market). They typically compare the mover/ stayer wage differential between a group of employees that carries a stigma (the laid-off workers) and a group that does not carry this stigma - mostly displaced workers because of a plant closure (Grund, 1999; Göggel and Zwick, 2012) or military quitters (Acemoglu and Pischke, 1998). These studies do not include a variable training firm<sup>5</sup>.

## **Data**

The paper uses the longitudinal version 2 of the IAB linked employer-employee data set (LIAB). The longitudinal version of the LIAB is composed of all establishments with three consecutive observations in the IAB Establishment Panel between 1999 and 2002 and all employees who worked at least one day within those establishments between 1997 and 2003. For these employees, the data reports the complete employment history between 1993 and 2006 (Jacobebbinghaus, 2008).

The LIAB is the only available dataset that combines individual employment histories with establishment-level information. This allows for the identification of apprenticeship graduates and the analysis of establishment characteristics of recruiting firms. However, since the dataset does not contain any grossing-up factors, the descriptive results should carefully be interpreted.

I use the individual Social Security Records to identify staying and switching apprenticeship graduates.<sup>6</sup> The data does not entail information about successful apprenticeship graduation, but instead includes the apprenticeship status. Therefore, I use a regular training duration definition to prevent drop-outs in my sample.<sup>7</sup> A regular training duration lasts between 800 and 1,500 days. It starts at the beginning of a school year and ends in the occupation-specific exam week between January and July. Additionally, I restrict the data to post-1998 because the exact day of a transition from apprenticeship to work was not mandatorily reported prior to 1999 (Jacobebbinghaus, 2008). I use the first employment spell after apprenticeship and

collapse individual Social Security Records on the establishment level. This procedure provides an establishment-level data-set of the first employer after graduation.

At the establishment-level, I merge two data sources. First, the Social Security Records provides additional variables of establishment's worker composition such as qualification, age shares and shares of newly hired and laid-off workers with an apprenticeship degree. Second, I merge the IAB Establishment Panel, an annual establishment survey. The IAB Establishment Panel provides establishment-level information such as the location, sector, legal structure, industrial relations and investments. At the establishment level, I exclude agriculture, public and non-profit firms, and firms with more than 50 percent apprentices (pure training firms). Furthermore, I use only firms that train or do not train apprentices during the entire observation period, which consists of 85 percent of all establishments.

## **Variable definitions and descriptive statistics**

### *Dependent variable*

Table 1 summarizes the definition of variables and provides the descriptive statistics. The first part describes the dependent and the second the independent variables. The analysis focuses on the firms' recruitment decisions. I define two key dependent variables. First I construct a dummy if a firm hires an apprenticeship graduate during a calendar year (incidence). The second variable is the share of newly hired apprenticeship graduates trained elsewhere among all newly hired employees holding an apprenticeship degree during a calendar year (intensity). The intensity variable reveals the extent to which a firm hires apprenticeship graduates subject to their demand for skilled workers during a given period because the denominator entails all new workers holding an apprenticeship degree with and without work experience. Note that apprenticeship graduates have no work experience after graduation and experienced skilled workers have at least one employment spell after graduation. Apprenticeship graduates trained elsewhere comprise 2.3 percent of all intakes holding an apprenticeship degree in one calendar year (intensity) and 16 percent of all firms hire apprenticeship graduates trained in outside firms (incidence).

For a robustness check, I use three sub-categories of switching apprenticeship graduates. I divide the nominator of apprenticeship graduates trained elsewhere into: immediate switchers, who found their first job within 10 days of completing their apprenticeship<sup>8</sup>, occupational switchers, who work in an occupation other than what they were trained in<sup>9</sup>, and switchers with an unemployment spell, who need more than 10 days to find a job after their



apprenticeship ends. The three groups are not mutually exclusive because occupational switchers can find a new job after an unemployment spell.

#### *Explanatory variables*

The independent variable of main interest is the apprentice-training firm. Around 60 percent of all firms train in the final sample (Table 1). Furthermore, I control for a number of covariates influencing the recruitment of newly hired workers with an apprenticeship degree.

First, firms offering specialized career opportunities, internal labor markets and deferred pay should be more likely to hire young workers. Specialized career opportunities and internal labor markets are usually associated with investments in human capital which is less likely to be in demand in the external labor market. Workers and firms are more likely to share investments in such firm-specific human capital. This creates a monopsony and leads to long employment relations (Becker, 1964; Osterman, 1984; Lazear, 2009; Pfeifer et al., 2013). Those firms are also more likely to offer deferred payment schemes (Lazear, 1979; Zwick, 2012). Specialized careers, internal labor markets and deferred payment are more likely to be observed in large firms, firms with a longer than average tenure of skilled workers and firms with a low labor turnover.

Second, firms dominating the local labor market may be more likely to attract apprenticeship graduates trained elsewhere (Mühlemann and Wolter, 2011). Dominating firms are firms that pay higher wages and offer a more interesting work environment opposed to competitors in local labor markets. This enables dominating firms to attract employees from outside firms. Dominating firms use a more capital intensive production technology due to their superior production processes.<sup>10</sup> A further hint for dominating firms is the skill composition of the workforce.

Third, the membership in an employer association plays a major role in firms' commitment to apprenticeship training (Soskice, 1994; Culpepper, 2001). The membership in voluntary employer associations depicts a dummy whether the firm is covered by a collective bargaining agreement. Additionally, I control for the existence of a works council (Kriechel et al., 2014). Finally, I control for legal structure, ownership status and sectors with dummy variables.

#### *Descriptive statistics*

Table 2 summarizes the descriptive pattern of newly recruited skilled workers holding an apprenticeship certificate for training and non-training firms during a calendar year. The third row ("all newly hired skilled workers" which includes graduates and those with work

experience after apprenticeship) shows that 86.9 percent of training firms and 47.8 percent of non-training firms hire skilled workers holding an apprenticeship degree during a single calendar year. These skilled employees with apprenticeship degrees can either be experienced workers with an apprenticeship degree (row 5: experienced skilled workers), own apprenticeship graduates (row 6: stayer) or apprenticeship graduates trained elsewhere (row 7: switcher). Graduates, stayer and switcher, are those in their first job after apprenticeship and experienced worker are those with at least one employment spell after graduation.

Training firms that hire skilled employees with an apprenticeship degree can satisfy their skill demand with their own apprentices. 51 percent of training firms retain own apprentices (row 6).<sup>11</sup> Own apprenticeship graduates account for 16 percent of the total new skilled workers during one calendar year. This number shows that one's own apprenticeship graduates are an important source of skilled labor for training firms. Moreover, 27 percent of training firms hire apprenticeship graduates trained elsewhere, which account for 3.3 percent of all new hires (row 7). This proportion entails 0.6 percent immediate switchers (row 8), 1.2 percent occupational switchers (row 9), and 1.7 percent<sup>12</sup> of apprenticeship graduates with an unemployment spell between apprenticeship completion and the first job (row 10).

Contrary to training firms, only 48 percent of non-training firms hire skilled workers holding an apprenticeship certificate during a calendar year (row 3). This represents approximately half of the number of training firms. Non-training firms that hire skilled workers primarily hire experienced skilled workers (98.5 percent), accounting for 97 percent of all new recruits holding an apprenticeship degree during one year (row 5). Additionally, 11.6 percent hire apprenticeship graduates trained elsewhere in their first job after graduation- this accounts for 3.2 percent of total new skilled employees (row 7). The newly hired apprenticeship graduates in non-training firms entail 0.7 percent immediate switchers, 1.8 percent occupational switchers and percent switchers with an unemployment spell between training completion and the first job among all newly hired skilled workers.

These differences between training and non-training firms at establishment-level translate into even larger differences in total numbers on the apprentice-level: only 13 out of 100 apprenticeship graduates who leave the training firm after graduation find their first job in a non-training firm. Also, only four out of 100 apprenticeship graduates find their first job in a non-training firm (both numbers not shown in Tables).

These numbers show that training firms are more likely to hire switching apprenticeship graduates trained elsewhere than non-training firms. And, if they hire them, they hire a larger

number measured as apprenticeship graduates trained elsewhere on all new employees holding an apprenticeship degree.

## **Findings**

I test the hypothesis whether training firms are more likely to hire apprenticeship graduates trained elsewhere than non-training firms by using a pooled cross-section establishment-level dataset. Hence, the results should be carefully interpreted because they show an association but no causal relationship between apprenticeship training and recruitment of switching apprenticeship graduates trained elsewhere.

First, this section presents estimations of the incidence that firms recruit apprenticeship graduates trained elsewhere in their first job. These estimations use a Probit ML procedure with standard errors clustered on the establishment-level. Second, I estimate the intensity or the proportion of apprenticeship graduates trained elsewhere amongst all newly hired skilled workers using a corner solution model, the Tobit ML approach. This estimation method is appropriate because around 84 percent of all firms do not hire apprenticeship graduates trained elsewhere. Third, I investigate the relevance of the three explanations for a lower recruitment of apprenticeship graduates trained elsewhere by non-training firms: lower demand, information disadvantage and apprentices' preferences.

Models 1 and 2 in Table 3 show coefficients and marginal effects for the incidence regression. Training firms are more likely to hire apprenticeship graduates trained elsewhere in the first job. A training firm is 6.5 percent more likely to hire an apprenticeship graduate trained elsewhere than a non-training firm. The control variables show expected signs. Larger firms are more likely to hire apprenticeship graduates trained elsewhere. Firms with a higher portion of workers over 54-years old and a higher share of skilled white-collar employees, hire fewer apprenticeship graduates trained elsewhere. Firms with a higher average tenure of skilled workers and single-site firms tend to hire fewer apprenticeship graduates trained elsewhere.

Model 3 in Table 3 presents the estimations for the recruiting intensity. In training firms, apprenticeship graduates trained elsewhere account for a larger proportion among all newly recruited skilled workers during a calendar year than in non-training firms. The marginal effect on the probability to hire those apprenticeship graduates is 6.1 percentage points – similar to the previous model – and the marginal effect on the intensity is two percentage points<sup>13</sup>. The control variables show similar influences as in Model 2.

Non-training firms have a lower probability in hiring apprenticeship graduates trained elsewhere; and, if they hire them, they hire a lower proportion. For this finding, the theoretical background section discusses three potential explanations: lower demand of non-training firms, information disadvantage of non-training firms and preferences of apprentices. The following regressions indicate if the first two explanations are relevant but cannot exactly test and reject their impact and should therefore be cautiously interpreted.

Table 4 investigates the relevance of the demand explanation. Table 4 splits the sample by firms demand for skilled workers. If the demand argument is relevant, the recruiting strategy of non-training firms should not react to increasing demand, but reacting to the training firms' demands. Hence, I expect a stronger coefficient of training firms in the high-demand rather than in the low demand regression.

Table 4 shows the coefficients of the apprenticeship training firms only but controls for the same variables in Table 3 model 2. Training firms are more likely to hire apprenticeship graduates trained elsewhere than non-training firms in the high and low demand regime. Notably, the coefficient nearly doubles in the high demand regime. This supports the idea of the demand explanation. The result for the intensity measure is similar.

Table 5 investigates the relevance of the information disadvantage argument. Table 5 splits the numerator of the apprenticeship graduates trained elsewhere into three sub-categories: immediate switchers, occupational switchers and switchers with an unemployment spell between the completion of their apprenticeship and their first job. If the information disadvantage argument is valid, training firms should be more likely to hire immediate switching apprenticeship graduates because these are most likely to be the better ones.

Table 5 shows the coefficients of the apprenticeship training firm for six separate regressions which are conditioned on the same control variables as in Table 3 model 2, but use different dependent variables. For each dependent variable, the table shows estimates for the incidence in the first column and for the intensity of recruiting each of the respective apprenticeship graduates amongst all newly recruited skilled employees in the second column. Training firms are more likely to hire immediate switching apprenticeship graduates trained elsewhere than non-training firms (row immediate switchers, column incidence) and they also hire a larger proportion of newly recruited skilled employees holding an apprenticeship degree (row immediate mover, column intensity). Furthermore, training firms are more likely to hire apprenticeship graduates trained elsewhere who change the occupation, but the firms do not hire a larger share of apprentice graduates amongst all new skilled recruits. Finally,

apprenticeship training firms are more likely to hire graduates with an unemployment spell after graduation. If training firms hire them, they also hire a larger percentage. The finding for immediate switchers' supports the information disadvantage explanation. However, both checks should be carefully interpreted. Both cannot reject one of the explanations. In addition, the individual preferences argument cannot be analyzed with an establishment-level data set.

Several estimations check the robustness of the results. Table A1 shows the results for small firms with less than 50 employees. This sample equally includes training and non-training firms whereas, training firms predominate in larger firm size categories. Table A1 confirms the main results. Furthermore, the findings are robust for single-site firms, for which joint apprenticeship training for several establishments can be ruled out. Using LPM instead of Probit and OLS instead of Tobit as well as estimating each year separately does not change the findings. The results are robust for several sample restrictions, such as for manufacturing firms, service firms, firms with and without collective bargaining contract and firms with and without a works council.

## **Conclusion**

This paper analyses if and to what extent non-training firms hire switching apprenticeship graduates. The paper shows that unlike training firms, non-training firms are less likely to hire apprenticeship graduates trained elsewhere. Non-training firms that hire apprenticeship graduates hire also a smaller share of them as measured as a proportion on all newly hired skilled workers with an apprenticeship degree during a calendar year. Furthermore, the descriptive results show that only 13 out of 100 apprenticeship graduates who leave the training firm after graduation find their first job in a non-training firm. Moreover, staying graduates account for 16 percent of all newly recruited employees with an apprenticeship degree during a calendar year in training firms.

The paper discusses three explanations for the key result that non-training firms are less likely to hire apprenticeship graduates. First, non-training firms do not demand apprenticeship graduates. Second, the *group of training firms* has an information advantage in evaluating apprenticeship graduates trained elsewhere. They may be better equipped to assess the quality of training firms and of apprenticeship graduates trained elsewhere. Third, apprenticeship graduates prefer to work at training firms. Even if the empirical approach cannot distinguish between the three explanations, it cannot reject the first two explanations.

These findings have further implication on the understanding of training markets. First, the finding supports the idea of employer commitment for a non-poaching agreement. Since training firms are more likely to hire apprenticeship graduates trained elsewhere, it is easier to achieve a non-poaching agreement among training firms because employer coordination improves if firms become more homogenous. Employer coordination is generally considered to be one of the key ingredients for the functioning of apprenticeship training. Moreover, assuming that a firms' knowledge about the quality of apprentices and outside training firms' increases a firms' involvement in training, the potential loss from opportunistic (poaching) behavior of training firms' increases equally.

Second, the findings call for further empirical studies analyzing wage differences for switching apprenticeship graduates between training and non-training firms. Analyzing this wage difference could contribute to the question of whether asymmetric information exists between training and non-training firms in regards to the quality of training firms and of apprentices. Such information asymmetries would induce a comparative advantage of training firms in hiring skilled workers holding an apprenticeship degree.

Third, if non-training firms simply do not demand apprenticeship graduates, public intervention to increase the supply of apprenticeships should focus on cost-benefit relations during apprenticeship to motivate training firms to increase the train intensity.

This study focused solely on the firm's perspective. Since employment decisions require agreement between the employer and employee, future studies could improve the knowledge of recruitment after apprenticeship training taking both perspectives into account. The second limitation of the paper is to test the relevance of the three potential mechanisms why training firms are more likely to hire apprenticeship graduates elsewhere. More rigorous tests are encouraged.

## References:

- Acemoglu D and Pischke J (1999). Beyond Becker: training in imperfect labour markets, *Economic Journal* 109(453): 112-142.
- Autorengruppe Bildungsberichterstattung (2010). Bildung in Deutschland 2010, [http://www.bildungsbericht.de/daten2010/bb\\_2010.pdf](http://www.bildungsbericht.de/daten2010/bb_2010.pdf).
- Backes-Gellner U (1996). Betriebliche Bildungs- und Wettbewerbsstrategien im deutsch-britischen Vergleich: ein Beitrag der Personalökonomie zur internationalen Betriebswirtschaftslehre: Hampp Verlag.
- Bellmann U and Janik F (2007). To Recruit or to Train One's Own? Vocational Training in the Face of Uncertainty as to the Rate of Retention of Trainees on Completion of Training, *in Journal of Labour Market Research* 40 (2/3): 205-219.
- Bellmann U and Hübler O (2014). Skill Shortages in German Establishments, IZA dp 8290.
- Bispinck R, Dorsch-Schweizer M and Kirsch J (2002). Tarifliche Ausbildungsförderung begrenzt erfolgreich - eine empirische Wirkungsanalyse, *WSI Mitteilungen* 04/2002: 213-219.
- Culpepper PD (2001). Employers, Public Policy, and the Politics of Decentralized Cooperation in Germany and France, in Hall PA and Soskice D (eds.) *Varieties of Capitalism: The Institutional Foundations of Comparative Advantage*, Oxford University Press, Oxford.
- Franz W and Soskice D (1995). The German Apprenticeship System, in Buttler F, Franz W, Schettkat R and Soskice D (eds), *Institutional Frameworks and Labor Market Performance: Comparative Views on the U.S. and German Economies*, Routledge, London: 208-234.
- Geel R and Backes-Gellner U (2011). Occupational mobility within and between skill clusters: an empirical analysis based on the skill weights approach, *in Empirical Research in Vocational Education and Training* 3(1): 21-38.
- Goeggel K and Zwick T (2012). The Quality of Apprenticeship Training, *in Scandinavian Journal of Economics* 114 (3), 756-779.
- Harhoff D and Kane TJ (1997). Is the German Apprenticeship System a Panacea for the U.S. Labor Market? *In Journal of Population Economics* 10(2): 171-196.
- Jacobebbinghaus P (2008). LIAB-Datenhandbuch, Version 3.0. *FDZ Datenreport 03/2008*.
- Kriechel B, Muehlemann S, Pfeifer H and Schuette M (2014). Works councils, collective bargaining and apprenticeship training, *in Industrial Relations* 53(2): 199-222.

- Lazear EP (1979). Why Is There Mandatory Retirement?; in *Journal of Political Economy* 87(6): 1261-1284.
- Mohrenweiser J and Zwick T (2009). Why Do Firms Train Apprentices: The Net Costs Puzzle Reconsidered, in *Labour Economics* 16(6): 631-637.
- Mohrenweiser J and Backes-Gellner U (2010). Apprenticeship Training: for Investment or Substitution? in *International Journal of Manpower* 31(5), 545-562.
- Mohrenweiser J, Zwick T and Backes-Gellner U (2013). Poaching and Firm Sponsored Training: First Clean Evidence, in *ZEW discussion paper 13-037*.
- Mohrenweiser J, Zwick T and Wydra-Somaggio G (2015). Work-Related Ability as Source of Information Advantages of Training Employers, *SOLE 2015*.
- Muehlemann S and Wolter SC (2011). Firm-sponsored training and poaching externalities in regional labor markets, in *Regional Science and Urban Economics* 41(6): 560-570.
- Muehlemann S, Braendli R and Wolter SC (2013). Invest in the best or compensate the weak? An empirical analysis of the heterogeneity of a firm's provision of human capital. in *Evidence-based HRM* 1(1): 80-95.
- Mueller S (2008). Capital Stock Approximation using Firm Level Panel Data, in *Jahrbücher für Nationalökonomie und Statistik* 228(4) 357-371.
- Osterman P (1984). Choice of Employment Systems in Internal Labor Markets, in *Industrial Relations* 26(1): 46-67.
- Pfeifer C, Janssen S, Yang P and Backes-Gellner U (2013). Effects of Training on Employee Suggestions and Promotions in an Internal Labor Market, *Schmalenbachs Business Review* 65(3): 270-287.
- Ryan P, Wagner K, Teuber S and Backes-Gellner U (2013). Trainee Pay in Britain, Germany and Switzerland: Institutions, Market Forces, Market Power, in *European Journal of Industrial Relations* 19(3): 201-220.
- Schoenberg U (2007). Testing for asymmetric employer learning. in *Journal of Labor Economics* 25 (4): 651-692.
- Schoenfeld G, Wenzelman F, Dionisus R, Pfeifer H and Walden G (2010). *Kosten und Nutzen der dualen Ausbildung aus Sicht der Betriebe*, Bertelsmann: Bielefeld.



- Smits W (2006). The Quality of Apprenticeship Training, in *Education Economics* 14(3): 329-344.
- Soskice D (1994). Reconciling Markets and Institutions: The German Apprenticeship System, in Lynch LM (ed), *Training and the Private Sector: International Comparisons*, University of Chicago Press, Chicago: pp. 26-60.
- Stevens M (2001). Should Firms Be Required to Pay for Vocational Training? *Economic Journal* 111(473): 485-505.
- Trampusch C and Eichenberger P (2012). Skills and Industrial Relations in Coordinated Market Economies - Continuing Vocational Training in Denmark, the Netherlands, Austria and Switzerland, in *British Journal of Industrial Relations* 50(4): 644-666.
- Backes-Gellner U and Tuor SN (2010). Avoiding Labor Shortages by Employer Signaling - On the Importance of Good Work Climate and Labor Relations, in *Industrial and Labor Relations Review* 63(2): 271-286.
- Wagner R and Zwick T (2012). How Acid are Lemons? Adverse Selection and Signalling for Skilled Labour Market Entrants, in *Economics of Education Working Paper* No. 71.
- Wenzelmann, F (2012). Ausbildungsmotive und die Zeitaufteilung der Auszubildenden im Betrieb, in *Journal of Labour Market Research* 45(2): 125-145.
- Winkelmann R (1996). Employment Prospects and Skill Acquisition of Apprenticeship-Trained Workers in Germany, in *Industrial and Labor Relations Review* 49(4): 658-672.
- Wolter SC, Muehleemann S and Schweri J (2006). Why Some Firms Train Apprentices and Many Others Do Not, in *German Economic Review* 7(3):249-264.
- Wolter SC and Ryan P (2011). Apprenticeship, in Hanushek R, Machin S and Woessmann L (eds), *Handbook of Economics of Education (Vol 3-4)*, Elsevier, London: 208-234.
- Wydra-Somaggio G and Seibert H. (2010). Signalwirkung von Lehrabschlüssen: Einkommensunterschiede von Ausbildungsabsolventen beim Berufseinstieg. in *Sozialer Fortschritt* 59(12): 296-305.
- Zwick, T (2012). Consequences of Seniority Wages on the Employment Structure, in: *Industrial and Labor Relations Review* 65 (1): 108-125.

**Table 1:** Variable definition and descriptive statistics.

<b>Dependent variables</b>		<b>incidence</b>	<b>intensity</b>
Switcher	Share of newly hired apprenticeship graduates trained elsewhere (first job after apprenticeship) amongst all newly hired skilled workers.	m: 0.161, sd: 0.367	m: 0.023; sd: 0.099
Immediate Switchers	Share of newly hired apprenticeship graduates (first job after apprenticeship) who found the new job within 10 days after completion of the apprenticeship amongst all newly hired skilled workers.	m: 0.034, sd: 0.181	m: 0.004, sd: 0.044
Occupational Switchers	Share of newly hired apprenticeship graduates (first job after apprenticeship) who changed the occupation after the apprenticeship amongst all newly hired skilled workers.	m: 0.100, sd: 0.300	m: 0.009, sd: 0.060
Switcher with Unemployment Spell	Share of newly hired apprenticeship graduates (first job after apprenticeship) who suffer an unemployment spell after completion of the apprenticeship amongst all newly hired skilled workers.	m: 0.112, sd: 0.315	m: 0.012, sd: 0.070

*Continued on next page*

*Continued from previous page*

<b>Explanatory variables</b>	
Variable	Definition (Mean; Std. Dev.)
Training Firm	Dummy variable; 1 if the firm trains apprentices (0.595, 0.491).
51-100 employees	Dummy variable; 1 if the firm employs between 51 and 100 employees (0.106, 0.308).
101-250 employees	Dummy variable; 1 if the firm employs between 101 and 250 employees (0.125, 0.330).
251-500 employees	Dummy variable; 1 if the firm employs between 251 and 500 employees (0.065, 0.247).
More than 500 employees	Dummy variable; 1 if the firm employs more than 500 employees (0.077, 0.265).
Employment growth	Percentage change in number of employees to previous year (0.024, 0.90).
High-Skilled Employees*	Share of employees with a university degree amongst all employees (0.019; 0.053).
Skilled Blue-Collar Employees*	Share of blue-collar employees with an apprenticeship certificate among all employees (0.323; 0.329).
Skilled White-Collar Employees*	Share of white-collar employees with an apprenticeship certificate amongst all employees (0.379; 0.332).
Part-time Employees*	Share of part-time employees amongst all employees (0.111; 0.212).
Foreign Employees*	Share of non-German employees amongst all employees (0.047; 0.113).
Old Employees*	Share of employees older than 54 years amongst all employees (0.106; 0.139).
Leaving Skilled Employees	Share of skilled workers who left the firm during the last twelve months amongst all employees (0.159; 0.256).
ln(capital investments per Employee)	Logarithm of capital investments per employee; capital investments are calculated using the perpetual inventory method (10.90; 3.75).
Works Council	Dummy variable; 1 if the firm is covered by a works council (0.369; 0.482).
Collective Bargaining Contract	Dummy variable; 1 if the firm is covered by collective bargaining agreement (0.561; 0.496).
Average Tenure	Average tenure of all employees in the firm in days (2835; 1663).
Single-Site Firm	Dummy variable; 1 if the firm is a single-site firm (0.742; 0.437).

N = 19,941, \* apprentices are not counted as regular employees in the denominator of stock variables. Source: LIAB longitudinal version 2 1999-2003.

**Table 2:** Incidence and intensity of newly hired apprenticeship graduates by training firm.

	Training Firms		Non-Training Firms	
	Incidence	Intensity	Incidence	Intensity
All firms:				
All newly hired skilled workers	0.869	--	0.478	--
Firms that hire skilled workers:				
Experienced skilled workers	0.947	0.808	0.985	0.968
Stayer*	0.514	0.158	--	--
Switcher*	0.268	0.033	0.116	0.032
of it: Immediate switcher	0.059	0.006	0.020	0.007
of it: Occupational switcher <sup>+</sup>	0.164	0.012	0.081	0.018
of it: Unemployment spell <sup>+</sup>	0.184	0.017	0.087	0.020

N= 11,858 training firms and 8,083 non-training firms (upper panel) and N = 10,305 training firms and 3863 non-training firms in lower panel; <sup>+</sup> occupational switcher with an unemployment spell are counted in both rows, \*graduates: first job after apprenticeship. Non –weighted numbers. The denominator in the intensity measure comprises all newly hired skilled workers during one calendar year. Source: LIAB longitudinal version 2, 1999-2003.

**Table 3:** Incidence and intensity of hiring apprenticeship graduates trained elsewhere in their first job.

	Incidence		Intensity
	Coef.	dydx	Coef.
Training Firm	0.381 (9.18)***	0.065 (9.18)***	0.118 (8.05)***
51-100 employees	0.620 (12.38)***	0.146 (12.38)***	0.138 (9.10)***
101-250 employees	0.947 (17.80)***	0.247 (17.80)***	0.208 (12.89)***
251-500 employees	1.278 (19.79)***	0.382 (19.79)***	0.267 (14.61)***
More than 500 employees	1.952 (26.77)***	0.625 (26.77)***	0.387 (19.09)***
Employment Growth	-0.002 (0.54)	-0.001 (0.54)	-0.001 (0.61)
High-Skilled Employees	0.102 (0.32)	0.018 (0.32)	0.121 (0.87)
Skilled Blue-Collar Employees	-0.059 (0.82)	-0.011 (0.82)	-0.002 (0.08)
Skilled White-Collar Employees	-0.321 (4.25)***	-0.057 (4.25)***	-0.073 (3.21)***
Part-time Employees	-0.071 (0.78)	-0.013 (0.78)	-0.026 (0.93)
Foreign Employees	-0.015 (0.11)	-0.003 (0.11)	-0.003 (0.07)
Old Employees	-0.792 (5.00)***	-0.141 (5.00)***	-0.237 (4.68)***
Leaving Skilled Employees	0.507 (9.89)***	0.090 (9.89)***	0.112 (7.72)***
ln(capital investments per Employee)	0.005 (0.91)	0.001 (0.91)	0.001 (0.44)
Works Council	-0.062 (1.46)	-0.011 (1.46)	-0.003 (0.25)
Collective Bargaining Contract	0.017 (0.49)	0.003 (0.49)	0.006 (0.56)
Average Tenure	-0.001 (10.37)***	-0.0001 (10.37)***	-0.0001 (8.70)***
Single-Site Firm	-0.344 (7.28)***	-0.056 (7.28)***	-0.089 (5.24)***
Number of Observations	19,441	19,441	19,441
Pseudo Rsq (McFadden)	0.24	0.24	0.19

Dependent Variables: dummy if the firm hires an apprenticeship graduate trained elsewhere (Incidence), Share of newly hired apprenticeship graduates trained elsewhere at first job on all new recruits holding an apprenticeship degree(Intensity); Methods: incidence with a Probit and intensity with a Tobit procedure; marginal effects calculated at the mean; standard errors clustered on establishment level; further control variables: 14 industry, 16 Federal States and 4 year dummies; z-values in parentheses; \*\*\* significant at the 1% level, \*\* significant at the 5% level and \* significant at the 10% level, Source: LIAB longitudinal version2 1999-2003.

**Table 4:** Separate regressions by employment growth.

	Incidence	Intensity
	Coef. [dydx]	Coef.
Negative employment growth		
Training firm	0.236 [0.042] (3.77)***	0.071 (3.11)***
Observations	8205	8205
Pseudo Rsq (McFadden)	0.21	0.16
Positive or zero employment growth		
Training firm	0.440 [0.071] (8.83)***	0.135 (7.67)***
Observations	11,736	11,736
Pseudo Rsq (McFadden)	0.29	0.22

Dependent Variables: dummy if the firm hires an apprenticeship graduate trained elsewhere (Incidence), Share of newly hired apprenticeship graduates trained elsewhere in their first job on all new recruits holding an apprenticeship degree (Intensity); Method: Probit ML (Incidence) and Tobit (Intensity), standard errors clustered on establishment-level, z-values in parenthesis, marginal effects calculated at the mean in brackets, Control variables as in Table 3: four firm size categories, employment growth, share of high skilled employees, share of blue-collar employees, share of skilled white collar employees, share of part-time employees, share of foreign employees, share of employees above 55 years, Share of skilled employees who leave the firm during one calendar year, log of capital investments per employee, works council, collective agreement, average tenure of employees, single site firm, sector, Federal State and year dummies; ; \*\*\* significant at the 1% level, \*\* significant at the 5% level and \* significant at the 10% level; Source: LIAB longitudinal version 2 1999-2003.

**Table 5:** The incidence and intensity of hiring apprenticeship graduates trained elsewhere in their first job, coefficient of training firm in six separate regressions.

	Incidence	Intensity
	Coef.	Coef.
<b>Immediate Switchers</b>		
Training Firm	0.214 [0.007] (2.48) **	0.062 (1.91) *
Controls	Yes	Yes
Observations	19,941	19,941
Pseudo Rsq (McFadden)	0.20	0.19
<b>Occupational Switchers</b>		
Training Firm	0.100 [0.009] (1.94) *	0.013 (0.92)
Controls	Yes	Yes
Observations	19,941	19,941
Pseudo Rsq (McFadden)	0.28	0.27
<b>Switcher with Unemployment Spell</b>		
Training Firm	0.276 [0.032] (5.97) ***	0.073 (5.27) ***
Controls	Yes	Yes
Observations	19,941	19,941
Pseudo Rsq (McFadden)	0.24	0.21

Table displays the coefficient of training firm from six separate regression; Dependent Variables: dummy if the firm hires an apprenticeship graduate trained elsewhere (Incidence), Share of newly hired apprenticeship graduates trained elsewhere (first job) on all new recruits holding an apprenticeship degree (Intensity); Definition of independent variables: immediate switchers are only immediate switching apprenticeship graduates in the nominator, occupational switchers are only apprenticeship graduates who switch the training occupation and firm, switcher with an unemployment spell includes only apprenticeship graduates who have an unemployment spell between graduation and the first job; Non-displayed control variables: four firm size categories, employment growth, share of high skilled employees, share of blue-collar employees, share of skilled white collar employees, share of part-time employees, share of foreign employees, share of employees above 55 years, Share of skilled employees who leave the firm during one calendar year, log of capital investments per employee, works council, collective agreement, average tenure of employees, single site firm, sector and year dummies; estimation methods: incidence with a Probit procedure (marginal effects calculated at the mean in brackets) and the intensity with a Tobit procedure; standard errors clustered on establishment level; z-values in parentheses; Source: LIAB longitudinal version 2 1999-2003.

## Appendix

**Table A1:** Incidence and Intensity for small establishments with less than 50 employees

	Incidence		Intensity
	Coef.	dydx	Coef.
Training Firm	0.538 (11.50)***	0.050 (11.50)***	0.421 (10.95)***
Employment Growth	0.139 (2.46)**	0.012 (2.46)**	0.109 (2.45)**
High-Skilled Employees	0.253 (0.73)	0.021 (0.73)	0.303 (0.93)
Skilled Blue-Collar Employees	0.004 (0.005)	0.0003 (0.05)	0.009 (0.11)
Skilled White-Collar Employees	-0.228 (2.24)**	-0.019 (2.24)**	-0.167 (1.99)**
Part-time Employees	-0.282 (2.21)**	-0.024 (2.21)**	-0.216 (2.05)**
Foreign Employees	0.004 (0.02)	0.0004 (0.02)	0.022 (0.14)
Old Employees	-0.360 (2.51)**	-0.030 (2.51)**	-0.306 (2.50)**
Leaving Skilled Employees	0.425 (6.98)***	0.035 (6.98)***	0.291 (6.76)***
ln(capital investments per Employee)	0.007 (1.01)	0.0006 (1.01)	0.005 (0.90)
Works Council	0.149 (2.40)**	0.014 (2.40)**	0.118 (2.28)**
Collective Bargaining Contract	0.017 (0.36)	0.001 (0.36)	0.022 (0.56)
Average Tenure in 1,000 days	-0.121 (7.12)***	-0.010 (7.12)***	-0.092 (6.56)***
Single-Site Firm	-0.292 (5.82)***	-0.024 (5.82)***	-0.205 (5.02)***
Number of Observations	12,497	12,497	12,497
Pseudo Rsq (McFadden)	0.09	0.09	0.07

Dependent Variables: dummy if the firm hires an apprenticeship graduate trained elsewhere (Incidence), Share of newly hired apprenticeship graduates trained elsewhere at first job on all new recruits holding an apprenticeship degree(Intensity); Methods: incidence with a Probit and intensity with a Tobit procedure; marginal effects calculated at the mean; standard errors clustered on establishment level; further control variables: 14 industry, 16 Federal States and 4 year dummies; z-values in parentheses; \*\*\* significant at the 1% level, \*\* significant at the 5% level and \* significant at the 10% level, Source: LIAB longitudinal version2 1999-2003.



---

<sup>1</sup> The literature distinguishes several motivations of firms to participate in apprenticeship training beyond the investment training motive (see Wolter and Ryan 2011 for a recent survey). First, some firms train apprentices as substitutes for unskilled or semi-skilled workers because of their lower unit-labor costs (substitution training motive). Second, some firms train apprentices because training enforces the reputation of those firms as a superior employer in the regional labour market (reputation training motive). (Mohrenweiser and Zwick, 2009; Mohrenweiser and Backes-Gellner, 2010; Schoenfeld et al. 2010; Wolter and Ryan, 2011; Wenzelmann, 2012).

<sup>2</sup> Backes-Gellner (1996) and Bellmann and Hübler (2014) push a further accentuation of the investment training motive. They argue that firms train more apprentices than needed in order to increase to pool of skilled applicants in time of unexpected employment growth or labour shortage.

<sup>3</sup> Smits (2006) shows quality differences of training between training firms.

<sup>4</sup> The arguments so far rely on the assumption that apprentices differ in their ability. However, the firm-level analyses in the empirical part cannot differentiate the quality of apprentices. For the relevance of the ability of apprentices for training costs compare Muehleemann et al. (2013) and for the fact that training firms are able to retain more able apprentices compare Wydra-Somaggio and Seibert (2010) and Mohrenweiser et al. (2015).

<sup>5</sup> An interesting study by Wagner and Zwick (2012) shows that high occupation-level and firm-level retention rates are negative stigmas for switching apprenticeship graduates but high apprenticeship wages, works councils and establishment size signal high training quality. Geel and Backes-Gellner (2011) show that occupational mobility within a cluster of similar apprenticeship occupations is accompanied by wage gains and mobility between skills clusters results in wage losses.

<sup>6</sup> Since the data contain individuals subjected to Social Security Contribution, apprentices comprise only apprentices in the dual system and no school-based apprenticeships.

<sup>7</sup> Around 25 percent of all apprentices leave the training firm before the final examination (Autorengruppe Bildungsberichtserstattung, 2010). This is a major problem in the German Social Security Records because the data does not provide a variable indicating the successful completion of the apprenticeship. However, the final exams in an occupation take place during two consecutive weeks in the first half of the year, and each apprenticeship legally ends the day after the final exam. The definition of the regular apprenticeship takes advantage of institutional regulation and prevents drop-outs.

<sup>8</sup> The result does not change if I allow for longer time-spans, since most employer switches occur in the first three days.

<sup>9</sup> Occupational switchers are defined on two-digit occupational code.

<sup>10</sup> I calculate the capital intensity using the capital-value approach suggested by Mueller (2008).

<sup>11</sup> Indeed, several training firms do not have an apprenticeship graduate every year but 84 per cent of training firms with at least one apprenticeship graduate, retain at least one (not shown in Tables).

<sup>12</sup> Occupational switchers can also suffer unemployment before the first job.

<sup>13</sup> Marginal effects after Tobit at the extensive and intensive margin - results not reported in the tables.