POACHING AND FIRM SPONSORED TRAINING: FIRST CLEAN EVIDENCE*

Jens Mohrenweiser (ZEW Mannheim)
Uschi Backes-Gellner (University of Zurich)
Thomas Zwick (LMU Munich and ZEW Mannheim)

Version January 2011

ABSTRACT:
A series of seminal theoretical papers argues that poaching may hamper company sponsored training. Extent, determinants and consequences of poaching remain an open empirical question, however. We address the empirical challenge of identifying poaching and its consequences using the unique institutional framework of the German apprenticeship training system. The Vocational Training Act provides an unambiguous and transparent definition of visible, measurable and transferable training across firms. We identify those establishments that cannot keep their best apprenticeship graduates. For these graduates the poaching enterprise pays a wage above the wage of those who stay in the training establishment. We show that a small number of training firms in Germany are poaching victims. These establishments train more apprentices than firms which can attract their apprenticeship graduates.

JEL Codes: J24, M51, M53
Key words: poaching, company sponsored training, recruiting, apprenticeship

* Corresponding author Jens Mohrenweiser: mohrenweiser@zew.de, 0049 621 1235160
The research was supported by the Swiss Federal Office for Professional Education and Technology through its Leading House on Economics of Education, Firm Behaviour and Training Policies. We thank 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 via guest research spells at FDZ and afterwards via controlled data remote access at the FDZ.

1 Introduction

A number of theoretical contributions of company sponsored general training stress the possibility that freshly trained workers are poached from the training firm after training has taken place. The training firm might lose (part of) its training investments and the poaching or outsider firm can satisfy its skill demand without own training investments. Poaching therefore can lead to an under-investment in training because firms may be hesitant to pay for the acquisition of skills for workers who leave before the training investments are paid-off (Stevens 1994, 2001; Acemoglu and Pischke, 1999b; Booth and Zoega, 2004; Leuven, 2005). Under-investment in training undermines the competitiveness and innovation of companies. Existence, extent and determinants of poaching, however, remain an empirical question which is not analysed so far (Pischke 2007, Brunello and DePaola 2009).

Measuring poaching is an empirical challenge. It requires an institutional framework for firm sponsored training in general - visible and transferable – skills and a unique definition of training across firms (Pischke, 2007). Such an institutional framework represents the German apprenticeship system (Soskice, 1994; Acemoglu and Pischke, 1998; Dustmann and Schönberg, 2009).

This paper shows the existence of poaching, estimates a lower bound of the extent of poaching and analyse the consequences of poaching on firms' training intensity. The paper identifies poaching when the training firm wants to retain an apprenticeship graduate but cannot attract the best or most productive one. The best apprenticeship graduate leaves the training firm and works in the poaching firm which pays a higher wage than he or she would get in the training firm. The paper estimates that at least 3.8 percent of the training firms are poaching victims.

Furthermore, the paper discusses the consequences of poaching on the training intensity. While the most theoretical contributions conclude that poaching leads to underinvestment of training, the paper shows that poaching increases the training intensity by three percentage points. However, the necessary conditions for identifying poaching restrict the sample and inferences to large training firms which can attract a minimum proportion of their own apprenticeship graduates.

The remainder of this paper is organised as follows: The next section reviews the poaching and training literature. Then, we describe the empirical design and the data. Afterwards, we present our assumptions to identify poaching and describe firms that are poaching victims.

Then, we discuss the consequences of poaching on firms training intensity. The last section concludes.

2 Background Discussions

A long tradition of theoretical models of on-the-job training analyses firms' incentives to invest in general skills of their workers induced through several market imperfections. Labour market imperfections create a wedge between worker's wage and productivity and lead to a larger marginal effect of training on productivity than on outside wages. Thus, the training firm benefits from training. However, the firm only has an incentive to pay for general skills if these profits increase in skills and the trained workers stay with a positive probability in the training firm. However, the market imperfection simultaneously induces poaching when the poaching firm can earn a rent on the skills trained elsewhere and the trained workers have a positive probability of leaving the training firm (Steven, 1994, Acemoglu and Pischke, 1999a, 1999b; Booth and Zoega, 2004; Leuven, 2005). The transferability of the acquired skills between firms and the visibility or transparency of the acquired skills for outsider firms determines the probability of an outside offer and, hence, poaching (Lazear, 1986; Stevens, 1996, 2001). Moreover, poaching can take place when the future employment is ex-ante non-contractible so that a hold-up problem arises.

Even if poaching and company sponsored training should simultaneously exists, the theoretical consequences of poaching on firms training intensity are not clear. The most contributions conclude that poaching might hamper training investments in general skills because the training firm loses a part of its returns to investment. In detail, a part of the returns to investment accrues to the future employer because the training firm only trains until the marginal costs of training equals the marginal benefits. Therefore, poaching lead to a lower number of trainees. Stevens (1996) points additionally out that poaching might cause a lower training quality. Even if the Vocational Training Act defines the type of skills, the training firm may choose the quality of training. The training firm choose a too low quality of training, if the marginal benefit of increasing the skill level is less than the marginal social benefits.

Poaching can also increase the training intensity, if training firms screen apprentices during the training period or have to make sure that their demand for skilled employees can be satisfied by their own former apprentices. An additional condition is that the least productive

skilled employee who stays with the training firm has a productivity level that covers the investment costs at least in the long run.

Even if a huge body of theoretical literature analyses company-sponsored training and poaching, empirical papers have only shown that employers mostly pay for the costs of initial training and skill upgrading independently of whether the accumulated skills can be transferred to other employers (Barron et al., 1999; Loewenstein and Spletzer, 1999; Booth and Bryan, 2004; Bassanini et al., 2007). There is some indirect evidence of poaching, however. Both and Bryan (2004), using data from the British Household Panel, show that the wage increase at the future employer exceeds the wage increase at the training firm for workers who report company-sponsored training in general skills during the last year. In a similar way, Lowenstein and Spletzer (1999), using US datasets NLSY and EOPP, show that employers mostly reward skills trained during a previous employment. Indeed, both studies do not analyse poaching and we need rather strong assumptions to infer poaching. They analyse individual data which lack information about the number of trained employees in each training firm. The training firms may screen employees during training and may retain only the best trainees. [1] Moreover, both studies analyse further training which incorporates different types and lengths of training and which is challenging to compare across firms.

3 Empirical Design

An appropriate study of poaching and its impact on company sponsored training requires an institutional framework which allows researchers to investigate whether firms pay for training in general – transferable and visible – skills and prevent ex-ante contracts of employment after training has taken place. The German apprenticeship training system provides such a unique institutional framework which fulfils all preconditions for empirically analysing poaching and firm sponsored training.[2]

The apprenticeship training in Germany follows a curriculum laid down in the Vocational Training Act. The Vocational Training Act describes necessary equipment and requirements for training firms that have to be fulfilled to rain apprentices adequately. Training firms need a permit for apprenticeship training granted by the chambers of industry and commerce or the

[1] Author (2001) has shown that temporary help firms use training as a screening period.
[2] For the sake of clean identification of poaching, we concentrate on job entrants after apprenticeship training. We therefore exclude a vast area of poaching activities concentrating on experts whose transfer can serve as a mechanism for the acquisition of externally developed knowledge (Song et al., 2003). We assume that learning by hiring (means to enter new product markets, acquisition of internally non-existing knowledge or social capital) is only a minor point in poaching skilled employees at the beginning of their careers.

chambers of craft. The Vocational Training act also describes the (minimum) skills which have to be trained in each training occupation. Moreover, apprentices receive a graded skill certificate at the end of the training period. The observance of the apprenticeship and the final exam is centrally monitored by the chambers of industry and commerce and the chambers of craft (Franz and Soskice, 1995).

This institutional framework offers, first, a consistent and unambiguous definition of training across firms. Apprenticeship graduates who receive training in different firms but in the same occupation have comparable and guaranteed minimum skills that are monitored and examined by the chambers. Second, training regulations further imply that training is observable by outsider firms documented by a transparent training curricula and the graded final exams from the chambers for the practical part and the vocational schools for the theoretical part. An outsider firm therefore knows the skill level of an apprenticeship graduate in a given occupation. Third, the skills are not only observable but also transferable. Institutional arrangements severely limit firms' ability to structure apprenticeship training so that it involves mostly firm-specific training.[3] Fourth, future employment of apprenticeship graduates is non-contractible. Apprenticeship training contracts legally terminate at the day after the final exam and employment has to be negotiated at the end of the apprenticeship. Fifth, apprenticeships are a training investment at least for some occupations. Occupations significantly differ in the amount of firms training investment. Apprentices in blue-collar manufacturing occupations are unambiguously considered as demanding substantial training investments of firms. The investment cost for blue-collar apprentices are on average three times higher than that for white-collar apprentices (Schönfeld *et al.*, 2010). White-collar apprentices, by contrast, are more productive during the apprenticeship and recoup (most of) their training costs already during the apprenticeship training period (Mohrenweiser and Zwick, 2009). Differences in training investments between occupations allow us to test whether poaching is more important in occupations that demand investments during the apprenticeship period.

Sixth, apprenticeship graduates starting their first job are a relatively homogeneous group in terms of age and prior education. Therefore, the initial conditions problem does not appear. The initial conditions problem arises when we by compare job changers and stayers with an unknown job history and differences in tenure (Flinn, 1986). Initial conditions are the same for all apprentices and apprenticeship graduates, however. All apprentices do not have prior

[3] This fact can also be derived from low or non-existent wage disadvantages establishment changers face with respect to stayers directly after their apprenticeship training (Goeggel and Zwick, 2011).

experience on the labour market but directly come from school. They all started their training at the same point in time (and therefore there are no differences in occupation selectivity during the business cycle) and their contract ends at the same point in time (therefore there are no differences in specific labour demand at the moment they start their career). [4]

Taken together, apprentices receive a broadly accepted, visible and transparent training certificate at the end of their training period that makes them flexible in accepting a skilled job in either their training firm or an outsider firm. Therefore, firms have to actively offer a contract for the apprenticeship graduates either to stay in the training firm or to switch to an outsider firms.

4 Data

Additionally to such institutional framework, an analysis of poaching requires information about the training and the potential poaching firm of the trainee and the timing and duration of training. Such data structure provides the longitudinal version 2 of the linked employer-employee data set of the IAB (LIAB). The LIAB combines social security records individual-based employment statistics with plant-level data from the IAB Establishment Panel. The distinctive feature of the LIAB is the combination of administrative information on individuals and details concerning establishments that employ those. The longitudinal version of the LIAB comprises all establishments with three consecutive observations in the IAB Establishment Panel between 1999 and 2002 and all employees who worked at least one day in those establishments between 1997 and 2003. For these employees, the data report the complete employment history between 1993 and 2006 (Jacobebbinghaus 2008)[5]. We construct variables of establishment's worker composition on the basis of the individual social security records such as qualification, gender and nationality shares. The IAB Establishment Panel provides establishment-level information such as the age of the establishment, legal structure, industrial relations and investments.

The individual-based social security records contain the exact wage, employment duration and information about the occupation, education, qualification, gender, nationality and an employer identifier. We use the 2-digit occupation code for identifying the training occupation. The LIAB longitudinal data are particularly well suited for our analysis because the employment history is available as spell-data. The spell-data allow a day-based calculation

[4] Festerer et al. (2008) find no significant selection in different apprenticeships.
[5] The LIAB longitudinal version contains around 4500 establishments.

of every recruitment, lay-off, status change (apprentices to skilled worker), occupation change, and the exact calculation of employment and unemployment duration of every individual. We therefore can calculate the exact number of apprenticeship graduates in each firm/ occupation cluster and have information about the wage of the apprenticeship graduates who stayed and left the training firm.

We restrict the data to spells after 1998 because we cannot distinguish apprentices from participants in internships before 1999 (Jacobebbinghaus *et al.* 2009) and drop agriculture and non-profit firms. We use only those apprenticeship graduates with full-time employment in the first job after the apprenticeship and drop individuals who earn less than 50 percent or more than 100 percent of the average in the occupation. We do not include 2 year apprenticeships that mostly contain low-level apprenticeships. Moreover, we only use establishments with at least two graduated apprentices in the same occupation in a certain year between 1999 and 2003. We need this restriction to identify poached apprenticeship graduates, as described in the next section.

5 Identification of Poaching

Poaching requires an employer change against the will of the training firm. Therefore, we define poaching when the training firm wants to retain an apprenticeship graduate but cannot attract the best or most productive apprenticeship graduate. This poaching definition contains two conditions: The best apprenticeship graduate leaves the training firm and receives a higher wage in the poaching firm than he or she would get in the training firm. The first condition, “the best apprentice leave” states that the switching apprenticeship graduate is more productive than the staying apprenticeship graduate, within a firm, occupation and year cell. This condition require a relative productivity assessment between staying and leaving apprentices in a within a firm, occupation and year cell. It, however, postulates that employers want to keep the best apprenticeship graduates. The identification of this condition restricts the sample to training firms that have staying and leaving apprenticeship graduates in the same training occupation in one year. The first condition entails the possibility that employers plan from the start to keep only a certain fraction of apprenticeship graduates because they screen apprentices during the apprenticeship. The second poaching condition, the “wage mark up”, states that the switching apprenticeship graduate receives a higher wage in the poaching firm than he or she would get in the training firm. This implies that the training firm was not able to pay the leaving apprenticeship graduate a higher wage than the poaching firm. This

condition also postulates the possibility that the training firm is willing to bid the wage of the leaving apprenticeship graduate up to her or his productivity but assess the productivity of the leaving apprenticeship graduate lower than the poaching firm.

For identifying poaching, we compare staying with switching apprenticeship graduates. Switchers are, however, no homogenous group. We only compare immediately switchers with switchers who learnt and graduated in the same firm and both work in the same training occupation as skilled employees. The immediately switcher finds his or her new job within 10 days after graduation, so that we can assume that the employer change marks poaching[6]. These immediate employer movers make up 10 percent of all apprenticeship graduates in our sample. Stayers account for around two thirds of all apprenticeship graduates. We do not consider occupational switchers because occupations differ in the average wage-level and do not examine apprenticeship graduates with an unemployment spell after graduation that may be a stigma. Both groups account for around 19 percent of all apprenticeship graduates (Appendix A1).

We operationalise the first condition, "the best apprentice leaves" by comparing the wages of the staying and switching apprentices within an establishment/occupation/year cluster at the end of the apprenticeship. We can interpret this wage differences as relative productivity differences because these apprentices learn the same job and the Vocational Training Act determines the tasks that apprentices should perform and learn during each stage of the apprenticeship. Therefore, the wage between two apprentices in the same occupation does not differ because both perform different tasks. Moreover, apprenticeship graduates in the same training occupation are identical in terms of observable variables such as age, education, the point in time they start with their apprenticeship and their prior working experience[7]. We analyse the relative wage difference between apprentices within an occupation, year and establishment cell. On the one hand, firms may differ in the opportunity to pay a wage mark-up to the collective agreement. On the one hand, training occupations differ in the training curricula and skills. Therefore firms might be willing to voluntary pay wage mark-ups for certain occupations. Furthermore, yearly wages might differ too.

Before we discuss the wage structure of apprentices, we briefly summarise the institutional wage setting for apprentices. Apprentices' wages are usually set by collective bargaining on the sectoral level according to § 17 of the Vocational Training Act (BBiG) – this means that apprentices in one of the 26 economic sectors defined by collective bargaining should earn the

[6] Short non-employment spells of switchers are usually interpreted as a sign for quitting instead of firing.
[7] Compare table A2 which displays a regression of individual characteristics on the wage of apprentices.

same wage irrespective of their occupation. According to § 17 BBiG a firm has to pay an appropriate wage also when it is not covered by collective bargaining. A wage is appropriate, if it is at most 20 percent below the collective bargaining rate. The chambers control whether the wages in the training contracts are within that range. There is some leeway for individual wage setting even for employers with collective bargaining, however: First, enterprises are free to voluntarily pay a wage mark-up. Second, there are usually regional differences in the more than 500 wage contracts concerning apprentices (mainly between East and West Germany, but also for smaller regions). Third, collective bargaining agreements might include different earnings level options for apprentices and firms might attribute their apprentices differently to these levels. Fourth wage supplements for especially demanding or dangerous jobs or extra hours are possible.

In contrast to the institutional regulations, the wage variation is striking between apprentices in the same apprenticeship year at the same point in time even in the same occupation and in one establishment. The standard deviation of apprentices' wage at the end of the apprenticeship is zero for only 4.4 percent of firms with at least one moving and one staying apprenticeship graduate. The most training establishments pay their apprentices slightly different wages even if we only compare apprentices of the same age and education background within the same establishment and occupation cell. The average dispersion of the wages is 2.93 Euros a day that account for around 10 percent of the daily gross wages within a firm and occupation cluster (table 1). The average apprentice salary within an establishment/occupation cluster is 28.31 Euros a day and the range between the smallest and highest salary is 9.62 Euros a day.

We take advantage of the wage dispersion and interpret the wage differences between apprentices at the end of the apprenticeship within the same firm and in the same occupation as relative differences in productivity. The wage difference between apprentices at the end of the apprenticeship within an establishment/ occupation/year cell is a major predictor for the wage variation in the first full-time employment for stayers. First, a Spearman Rank Correlation Test shows the dependence between the wage difference at the end of the apprenticeship and the first full-time employment of stayers within an establishment/ occupation/year cell (appendix: table A3). Second, we observe only a few switchers between the first and the last quartile between the stayers wage distribution at the end of the apprenticeship and the first full-time employment (appendix: table A4). Third, we run a regression and show that the wage deviation from establishment/ occupation/year cell at the end of the apprenticeship is a major determinant of the wage deviation from establishment/

occupation/year cell of the first full-time employment of stayers (appendix: table A5). Therefore, we can conclude that the wage difference between apprentices within an establishment/ occupation/year cell permits the identification whether the training firm values the productivity of switching apprenticeship graduate higher than his or her staying counterpart.

However, these small wage differences are not observable by outsider firms but only by the external researcher. For outsider firms, apprenticeship graduates in one firm and occupation cluster are homogenous in terms of schooling, age and general, occupational-specific and firm-specific skills. The outsider firm knows nothing about the relative wage rank of apprentices within a firm and occupation but can assess the relative performance through the exam grades.

Applying the within establishment/occupation/year cell wage variation to our first poaching condition, the "leaving best apprentice", we find that 24.6 percent of the immediate moving apprenticeship graduates working in the training occupation in the first job earn more than the best paid stayer at the end of the apprenticeship. Table 2 further displays differences between blue-collar manufacturing and white collar apprentices. 26.8 percent of all immediate movers in blue-collar manufacturing occupations, which indicate the highest training investments, earn more than the stayers in the training firm at the end of the apprenticeship. This share is higher than that for white-collar occupations which are more beneficial for the training firms during training.

The first condition, however, is not sufficient to identify poaching. The decision of the "best apprentice" to leave the training firm might be based on regional preferences and not a superior wage offer of the outside firm. Therefore, we impose the second condition that the poaching firm offers a wage mark-up for the switching apprenticeship graduates. Assessing the wage mark-up for the switching apprenticeship graduate requires a counterfactual wage which discloses the wage that the leaving apprenticeship graduate would receive if he or she stays in the training firm. We construct this counterfactual wage basing on the wage of apprenticeship graduates that stay in the training firm. We use the highest wage of all staying apprenticeship graduates in the respective occupation and year as the counterfactual wage. This wage is the highest revealed willingness to pay for a skilled job entrant in a certain qualification in the training firm. Table 3 displays that 23.9 percent of all immediate movers in the training occupation earn a higher wage than the best paid apprenticeship graduate in the training firm. Again, this proportion is higher for immediately moving apprenticeship

graduates in expensive blue-collar manufacturing occupations than in white-collar occupations.

Note that the second condition alone is also not sufficient to identify poaching. For example, the "wage mark-up" condition is met if the second best paid apprentice leaves the training firm and receives a wage mark-up in the new firm. However, the training firm may have planned to hire the best apprentice ("leaving best apprentice" condition). Therefore, we combine both conditions to identify poaching. We define an employer change of an apprenticeship graduate as poaching when he or she receives a higher wage at the end of the apprenticeship and earns more in the first job after the apprenticeship than the best staying apprenticeship graduates. Table 4 displays the existence of poaching according to our strict criteria. 7.1 percent of all immediately moving apprenticeship graduates satisfy both poaching conditions. Moreover, poaching is more frequent in the more cost-intensive blue-collar manufacturing occupations (11 percent) than in white-collar occupations (5.7 percent).

6 Characteristics of Poached Firms

Turning to the establishment level, around 3.1 percent of the training firms with at least two apprenticeship graduates in the same training occupation train at least one poached apprenticeship graduate. The majority of these firms only lose one apprenticeship graduate this way. This number shows that poaching indeed seems not to be widespread in the apprenticeship system in Germany but it exists.

Table 5 displays differences between poaching victims and firms that can attract all apprenticeship graduates they liked, given our sample restrictions. The latter tend to train a smaller fraction of apprentices and employ fewer employees than the poaching victims. Poaching victims export a higher share of their products and invest more per employee than non-poaching victims. Otherwise, the share of part-time and skilled workers is similar between both groups.

However, the poaching conditions restrict the analysis to firms with at least one staying and one leaving apprenticeship graduates within a firm, occupation and year cluster. This restriction excludes two types of firms which might be likely poaching victims. First, the poaching conditions exclude firms that only train one apprenticeship graduate in a training occupation. This group contains many small firms which generally retain a smaller proportion of apprenticeship graduates and are less attractive for apprenticeship graduates than large firms. Second, the poaching condition excludes firms that cannot attract a single

apprenticeship graduates[8]. Such firms may particularly be poaching victims. Both identification conditions exclude more likely rafts firms that train apprentices more efficient than manufacturing firms and lead to a sample of large firms. Large firms incur higher training investment costs and are more attractive for employees than small firms (Soskice, 1994). The restriction to large training firms permits the estimation of a lower bound of poaching.

Moreover, the poaching conditions restrict the analysis on the consequences of poaching on firms' training intensity. We cannot draw inferences about the training incidence and whether poaching forces training firms to retrieve from training

7 The Consequences of Poaching on Firms Training Intensity

We turn to the analysis of the consequences of poaching on firms' training intensity. Table 6 displays the results of the OLS regression of a dummy variable whether a firm is poaching victim on the proportion of apprentices on all employees for establishments which train at least two apprenticeship graduates. The explanatory variable "Firm is Poaching Victim" equals one if our strict two-part poaching definition applies. The table shows estimations with two different control groups. Column one includes all firms with at least two apprenticeship graduates within an establishment/year/occupation cluster. Column two includes only firms that can attract at least 50 percent of all apprenticeship graduates.

Both estimates show that training firms which are poaching victims tend to train a higher proportion of apprentices than training firms which can prevent poaching. The training intensity increases by 2.3 percentage points if the firm is a poaching victim. This accounts for around one quarter of the proportion of apprentices relative to the average training intensity of 8.6 percent for non-poaching victims.

The control variables have the expected signs and are usually well-known from previous studies investigating the determinants of apprentices training intensity (Harhoff and Kane, 1997; Beckmann, 2002). The training intensity concavely increases in the number of employees. Works councils are associated with a lower share of apprentices and the proportion of skilled of employees has a positive influence on the share of apprentices.

[8] Mohrenweiser and Backes-Gellner (2010) compare firm characteristics of training firms which retain less than 20 percent and more than 80 percent in three consecutive years. The former are smaller, invest and export less and are less likely covered by a works council or a collective bargaining contract.

We run a series of robustness checks about the estimates of the training intensity and the identification conditions of poaching. First, the consequences of poaching on the training intensity of firms may be endogenous when unobservable firm characteristics determine the training intensity and whether a firm is poaching victim. For example, a firm may train more apprentices because the firm pursues a low cost strategy and uses apprentices as cheap substitutes for unskilled workers.[9] Hence, this firm is simultaneously not interested in retaining the best but the cheapest, if any, apprenticeship graduate. Moreover, a simultaneity problem may arise when firms adjust the training intensity when they anticipate that poaching is likely. We test the robustness of our results using an instrumental variables approach to tackle the endogeneity issues. We use the within-firm changes in the labour demand of young workers as an instrument. More specifically, we instrument the poaching victim using changes in the retention rate of an establishment´s apprenticeship graduates during the observation period. The retention rate is defined as the share of staying apprenticeship graduates on all apprenticeship graduates in a firm.[10] A shock in the firm's labour demand leads to a lower retention rate of apprenticeship graduates than in another year because this is an efficient and cheap way to reduce the number of employees. The poaching victim dummy turns to an insignificant but still positive influence on the proportion of apprentices on all employees (see appendix table A6).

Second, we relax our rather strong poaching conditions. We relax the first condition "the leaving best apprentice" and redefine that the leaving apprenticeship graduate has to earn more than the mean of the staying apprenticeship graduates within a firm/ occupation/ year cluster at the end of the apprenticeship. Around twice as much apprenticeship graduates meet the weaker poaching condition. This recalculation leads to 4.1 percent of firms classified as poaching victims. The results of the estimations about the consequences of poaching remain robust. However, the definition of poaching remains an open question.[11] Form the firms' point of view, the first poaching condition (the leaving best apprenticeship graduate) alone may be seen as poaching. However, we aim to estimate a lower bound so that we impose both rather strict poaching conditions.

Third, we test different classifications of training occupations for example the more precise 3-digit occupation code. As a general rule, two blue-collar manufacturing or service occupations

[9] Smits (2006) and Mohrenweiser and Zwick (2009) discuss different training motivations and their consequences.
[10] Mohrenweiser and Backes-Gellner (2010) show the stability of firms' retention rate over time.
[11] Theoretical models analysing the social optimum of company-sponsored training in a economy define poaching when training is lower than the social optimum (Stevens 1994, 1996, Moen and Rosen 2004).

that have the same in the 2-digit but different in the 3-digit code are mostly only different specialisation of metal mechanics or clerks for example. Different specialisation might be seen as substitutes for potential outsider firms so that a 3-digit code is in our view less appropriate for our kind of analysis. However, using a 3-digit code does not change our main results about the existences of poaching and the consequences on training intensity.

Fourth, the wage definition in the LIAB data entails full-time wages for apprentices. A fraction of apprentices might receive additional extra hours and bonuses in one establishment/ occupation/ year cell and this overtime payment accounts for the wage differences between apprentices at the end of the apprenticeship. However, if extra hours or bonuses are more likely paid for the more productive apprentices and firms are interested in keeping the best apprenticeship graduates; this imprecise wage measure does not invalidate our measure of poaching.

8 Conclusions

This paper presents an empirical analysis on the existence of poaching, estimates a lower bound of poaching and analyse the consequences of poaching on firm's training intensity. The study is based on a unique identification of poaching and exploits the institutional framework of apprenticeship training in Germany. The Vocational Training Act regulates the apprenticeship training and leads to comparable skills across firms and to acquired skills that are visible by outsiders and transferable between firms. We identify poaching using two conditions. First, we show that a small number of training firms cannot retain their best apprenticeship graduates. Therefore, we take advantage of the relative wage differences between switching and staying apprenticeship graduates at the end of the apprenticeship training within the same establishment, year, and occupation. Second, poaching firms pay the switching apprenticeship graduate a wage above the highest wage of the staying apprenticeship graduates in the training firm. The paper shows that around 11 percent of all immediately switching apprenticeship graduates that work in the training occupation at the first full-time job meet both poaching conditions. Apprentices in blue-collar occupations in manufacturing are more likely to be poached than apprentices in white-collar occupations. Combining both poaching conditions leads to a lower bound of 3.8 percent of training firms which are poaching victims. However, we can only estimate a lower bound because our poaching conditions restrict our sample to larger firms that are generally seen to be less prone to poaching than small firms.

This paper confirms two theoretical findings. First, it presents the first clean empirical evidence of the coexistence of poaching and firm sponsored training. Second, it shows that poaching does not necessarily hamper firms training investments for large firms.

The paper presents feasible and innovative conditions for identifying poaching. However, it is only the first step for analysing consequences of poaching for company-sponsored training. The paper lacks a dynamic perspective and cannot answer if poaching forces firms to withdraw from training. The poaching conditions only permit the identification of a lower bound, restrict the analysis to large firms and prevent estimations of consequence for the training incidence. Moreover, it remains for future research to investigate the consequences of poaching for the poaching firms such as the winners curse. Moreover, the direction of the employee switchers is not clear. Good apprenticeship graduates may simply switch to a more attractive employer who can pay a wage mark-up because of a superior production technology.

References

Acemoglu, D., & Pischke, J.-S. (1998). Why Do Firms Train? Theory and Evidence. *Quarterly Journal of Economics 113(1)*: 79-119.

Acemoglu, D., & Pischke, J.-S. (1999). The Structure of Wages and Investment in General Training. *Journal of Political Economy 107(3)*: 539-572.

Acemoglu, D., & Pischke, J.-S. (1999). Beyond Becker: training in imperfect labour markets. *Economic Journal 109(453)*: 112-142.

Acemoglu, D., & Pischke, J.-S. (2003). Minimum Wages and On-the-Job Training. *Research in Labor Economics 22*: 159-202.

Author, D. (2001): Why do Temporary Help Firms Provide Free General Skills Training? *Quarterly Journal of Economics, 116(4)*: 1409-1448.

Barron, J. M., Berger, M. C. & Black, D. A. (1999). Do Workers Pay for On-the-Job Training? *Journal of Human Resources 34(2)*: 235-252.

Bassanini, A., Booth, A. L., Brunello, G., De Paola, M., & Leuven, E. (2007). Workplace Training in Europe. In G. Brunello, P. Garibaldi & E. Wasmer (Eds.), *Education and Training in Europe*. Oxford: Oxford University Press.

Beckmann, M. (2002). Firm-sponsored Apprenticeship Training in Germany: Empirical Evidence from Establishment Data. *LABOUR: Review of Labour Economics and Industrial Relations 16(2)*: 287-310

Booth, A. L. &Zoega, G. (2004). Is Wage Compression a Necessary Condition for Firm-Financed General Training? *Oxford Economic Papers 56(1)*: 88-97.

Booth, A. L. & Bryan M. L. (2005). Testing Some Predictions of Human Capital Theory: New Training Evidence from Britain. *Review of Economics and Statistics 87(2)*: 391-394.

Brunello, G., & De Paola, M. (2009). Is There under-Provision of Training. *Empirical Research in Vocational Education and Training 1(1)*: 1-18.

Dustmann, C., & Schönberg, U. (2009). Training and Union Wages. *Review of Economics and Statistics 91(2):* 363-376.

Elbaum, B. & Singh, N. (1995). The Economic Rationale of Apprenticeship Training: some Lessons from British and U.S. Experience. *Industrial Relations 34(4)*: 593-622.

Festerer, J., Pischke, J.-S. & Winter-Ebmer, R. (2008). Returns to Apprenticeship Training in Austria: Evidence from Failed Firms. *Scandinavian Journal of Economics 110(4)*: 733-753.

Flinn, C. (1986). Wages and Job Mobility of Young Workers, *Journal of Political Economy 94 (3):* S88-S110.

Franz, W., & Soskice, D. (1995). The German Apprenticeship System. In F. Buttler, W. Franz, R. Schettkat & D. Soskice (Eds.), *Institutional Frameworks and Labor Market Performance: Comparative Views on the U.S. and German Economies* (pp. 208-234). London: Routledge.

Göggel, K. & Zwick, T. (2011). The Quality of Apprenticeship Training. *Scandinavian Journal of Economics forthcoming.*

Harhoff, D., & Kane, T. J. (1997). Is the German Apprenticeship System a Panacea for the U.S. Labor Market? *Journal of Population Economics 10(2):* 171-196.

Jacobebbinghaus, P. (2008). LIAB-Datenhandbuch, Version 3.0. *FDZ Datenreport 03/2008*.

Jacobebbinghaus, P., Mohrenweiser, J., & Zwick, T. (2009). Wie kann die Ausbildungsquote in Deutschland korrekt gemessen werden? *Wirtschafts- und Sozialstatistisches Archiv, 3(4)*: 225-240.

Lazear, E. P. (1986). Raids and Offer-Matching. *Research in Labor Economics, 8(A)*: 141-165.

Lazear, E. P. (2009). Firm-Specific Human Capital: A Skill-Weights Approach. *Journal of Political Economy 117(5)*: 914-940.

Leuven, E. (2005). The Economics of Private Sector Training: A Survey of the Literature. *Journal of Economic Surveys 19(1)*: 91-111.

Loewenstein, M. A. & Spletzer, J. R. (1999). General and Specific Training: Evidence and Implications. *Journal of Human Resources 34(4)*: 710-733.

Mohrenweiser, J., & Zwick, T. (2009). Why Do Firms Train Apprentices? The Net Cost Puzzle Reconsidered. *Labour Economics 16(6)*: 631-637.

Mohrenweiser, J. & Backes-Gellner, U. (2010). Apprenticeship Training: for Investment or Substitution? *International Journal of Manpower 31(5)*, 545-562.

Pischke, J.-S. (2007). Comments on "Workplace Training in Europe". in: G. Brunello, P. Garibaldi, E. Wasmer (Eds.) *Education and Training in Europe* (pp. 330-342): Oxford University Press.

Schönfeld, G., Wenzelmann, F., Dionisus, R. Pfeifer, H. & Walden, G. (2010*). Kosten und Nutzen der dualen Ausbildung aus Sicht der Betriebe*. Bielefeld: Bertelsmann Verlag.

Smits, W. (2006). The Quality of Apprenticeship Training. *Education Economics, 14(3):* 329-344.

Song, J., Almeida, P. & Wu, G. (2003). Learning-by-Hiring: When is Mobility More Likely to Facilitate Interfirm Knowledge Transfer? *Management Science 49(4)*: 351-365.

Soskice, D. (1994). Reconciling Markets and Institutions: The German Apprenticeship System. In L. M. Lynch (Ed.), *Training and the Private Sector: International Comparisons* (pp. 26-60). Chicago: University of Chicago Press.

Stevens, M. (1994) A theoretical model of on-the-job training with imperfect competition. *Oxford Economic Papers 46(4)*: 537-562.

Stevens, M. (1996). Transferable Training and Poaching Externalities. In A. L. Booth & D. J. Snower (Eds.), *Acquiring Skills - Market Failures, Their Symptoms and Policy Responses* (pp. 19-37): Cambridge University Press.

Stevens, M. (2001). Should Firms Be Required to Pay for Vocational Training? *Economic Journal 111(473)*: 485-505.

Table 1: Wage dispersion of apprenticeship graduates at the end of the apprenticeship within establishment/occupation/year cells.

Standard Deviation	2.93
Mean	28.31
Minimum	24.29
Maximum	33.91

Daily wages in Euros, Sample restrictions: at least two (one moving and one staying) apprenticeship graduates in each establishment/occupation/year cell. N= 52896. The mover finds his or her new job in the training occupation within 10 days after apprenticeship termination. Source: own calculations of the LIAB longitudinal version 2.

Table 2: Proportion of best apprenticeship graduates that leave the training firm

Occupation	Proportion
Blue-collar manufacturing	0.268
White-Collar	0.198
Total	0.246

Apprenticeship graduates who earn more than all staying apprenticeship graduates within an occupation/ establishment cell at the end of the apprenticeship as a proportion of all immediate movers. Sample restrictions: at least two (one moving and one staying) apprenticeship graduates in each occupation/ establishment cell. N=4612. The mover finds his or her new job in the training occupation within 10 days after apprenticeship termination. Source: own calculations of the LIAB longitudinal version 2 1999-2003.

Table 3: Proportion of immediately switching apprenticeship graduates receiving a wage mark-up.

Occupation	Proportion
Blue-collar manufacturing	0.397
White-Collar	0.167
Total	0.239

Apprenticeship graduates who earn more than all staying apprenticeship graduates within an occupation/establishment cell at the first full-time employment as a proportion of all immediate movers. Sample restrictions: at least two (one moving and one staying) apprenticeship graduates in each occupation/ establishment cell. N=4612. The mover finds his or her new job in the training occupation within 10 days after apprenticeship termination. Source: own calculations of the LIAB longitudinal version 2

Table 4: Occupations of poached apprenticeship graduates.

Occupation	Proportion
Blue-collar manufacturing	0.110
White-collar	0.057
Total	0.071

Proportion of poached apprenticeship graduates who receive a higher wage at the end of the apprenticeship and a higher wage at their first employment as a skilled worker than the staying apprenticeship graduates in the training firm. Sample restrictions: at least two (one moving and one staying) apprenticeship graduates in each occupation/ establishment cell. N=4612. The mover finds his or her new job in the training occupation within 10 days after apprenticeship termination. Source: own calculations of the LIAB longitudinal version 2

Table 5 Descriptive Characteristics of Poached Firms.

	Poaching victims (N= 186)	Non- poaching victims (N=5954)	T-Value of Mean Differences
Number of Employees	1608	662	3.55
Share of Apprentices	0.102	0.085	2.99
Share of Skilled Workers	0.652	0.662	0.74
Share of Part-Time Workers	0.113	0.098	1.43
Share of Employees who are older than 55	0.089	0.097	2.27
Collective Bargaining Agreement	0.941	0.848	4.21
Works Council	0.892	0.831	2.63
Log(Investments per Capita)	14.53	13.56	4.54
Export Share	0.241	0.178	2.77
Tenure in days	3793	3516	2.38
Difference Experience and Tenure (days)	2169	2028	1.40

Source: own calculations on basis of the longitudinal version 2 of the LIAB.

Table 6: OLS Regressions of the Proportion of Apprentices on all Employees[12].

	(1)		(2)
Firm is Poaching Victim	0.0223 (3.49)		0.027 (4.19)
Collective Bargaining Agreement	0.003 (0.89)		-0.001 (0.07)
Works Council	-0.052 (12.05)		-0.045 (10.84)
Number of Employees divided by 1000	-0.014 (9.08)		-0.0114 (8.35)
Squared Number of Employees (divided by 1000000)	0.007 (7.09)		0.005 (6.52)
Share of Skilled Workers	0.063 (9.21)		0.059 (9.67)
Share of Part-Time Workers	-0.032 (2.36)		0.004 (0.28)
Share of Employees who are older than 55	-0.128 (4.77)		-0.137 (5.86)
Share of Leaving Skilled Workers	0.018 (2.61)		0.028 (2.56)
Share of Newly Hired Skilled Worker	-0.022 (1.31)		-0.044 (2.96)
Share of Foreign Workers	0.042 (2.31)		0.024 (1.50)
Share of Female Workers	0.085 (8.16)		0.062 (6.80)
Controls	yes		yes
Number of Observations	6140		4670
Pseudo R sq	0.34		0.35

Dependent variable: Proportion of Apprentices on all Employees. Standard errors clustered on establishment, t-values in parenthesis, column (1) control group contains all establishments with at least two apprenticeship graduates and column (2) control group contains establishments that attract at least 50% of the apprenticeship graduates; further control variables: 12 industry and 4 yeas dummies. Source: LIAB longitudinal version 2 1999-2003.

[12] All employee shares do not include apprentices in the denominator.

Appendix

Table A1: Descriptive Comparison between Stayer and Mover

	In Proportion to all apprenticeship graduates	Daily wage at the end of the apprenticeship in Euro	Daily wage at the first full-time employment in Euro
Stayer	72.53	28.37	70.81
Mover within 10 day, same occupation	10.97	28.72	67.74
Mover within 10 day, occupational switcher	4.88	25.69	56.00
Mover with unemployment spell of more than 10 days, same occupation	4.80	26.85	70.63
Mover with unemployment spell of more than 10 days, occupational switcher	5.54	25.13	51.25
Out of labour force	1.28	26.93	--

Sample restrictions: at least two (one moving and one staying) apprenticeship graduates in each establishment/occupation/year cell. N= 52986, Source: LIAB longitudinal version 2, 1999-2003.

Table A2: Determinants of apprentice wages.

	Coef. (t-Value)
Age	0.666 (0.99)
Age Squared	-0.009 (0.64)
University Entrance Diplomma	-0.831 (1.19)
Female	-0.029 (0.24)
Foreigner	0.018 (1.59)
Controls	yes
Observations	52896
Pseudo Rsq	0.21

OLS regression; dependent variable: wage of apprentices. Standard errors clustered on establishment, t-values in parenthesis, further control variables contain dummy variables for all mover categories (compare table A1), occupation and year dummies. Source: LIAB longitudinal version 2 1999-2003.

Table A3: The stability of the stayer wages before and after the end of the apprenticeship period

Spearman Rank Correlation Coefficients Test	Spearman's Rho	0.3375
	p-value	0.0000
Kendall's Rank Correlation Coefficients Test	Kendall's tau_a	0.2301
	Kendall'S tau-b	0.2302
	z-value	0.0000

Comparison between the wage rank at the end of the apprenticeship and the first full-time employment after the apprenticeship of stayers in the same occupation. Number of observations: 37100 all stayers in establishments with at least two apprenticeship graduates. Source: LIAB longitudinal version 2, 1999-2003.

Table A4: The stability of the wage quartiles of stayers before and after the end of the apprenticeship period

	Wage quartile of the first employment wage				
Wage Quartiles of the last apprenticeship wage		P25	P25-P50	P50-P75	>P75
	P25	0.168	0.086	0.125	0.063
	P25 – P50	0.056	0.053	0.079	0.034
	P50-P75	0.075	0.047	0.034	0.034
	>P75	0.034	0.029	0.034	0.035

Number of observations: 37100, all stayers in establishments with at least two apprenticeship graduates. Source: LIAB longitudinal version 2, 1999-2003.

Table A5: OLS Regression of the Deviation from Establishment/ Occupation/ Year Mean in the First Full-Time Employment

	Coef. (t-Value)
Deviation from Establishment/ Occupation/ Year Mean at the End of the Apprenticeship	0.036 (4.54)
Age	-1.757 (7.63)
Age Squared	0.041 (8.14)
University Entrance Diplomma	0.085 (1.05)
Female	0.792 (11.93)
Foreigner	-.004 (0.50)
Constant	17.77 (6.88)
Observations	37100
Pseudo Rsq	0.01

OLS regression; dependent variable: deviation from establishment/ occupation/ year mean in the first full-time employment. Standard errors clustered on establishment, t-values in parenthesis. Source: LIAB longitudinal version 2 1999-2003.

Table A6: IV Regression on the Proportion of Apprentices.

	First Stage	Second Stage
Dummy: Poaching Victim		0.061 (0.91)
Deviation from within-firm retention rate	0.693 (4.25)	
Number of Employees divided by 1000	0.0001 (2.62)	- 0.146 (8.54)
Squared Number of Employees (divided by 1000000)	-0.0003 (1.00)	0.007 (-7.19)
Collective Bargaining Agreement	0.337 (2.62)	0.003 (0.71)
Works Council	-0.008 (0.007)	- 0.052 (12.05)
Controls	yes	yes
Number of Observations	6140	

Sample contains all apprenticeship graduates in the first skilled job after graduates. Sample Restriction: at least two employees in each firm. Source: LIAB longitudinal version 2, 1999-2003.

Table A7: Descriptive Statistics of the Estimation Sample (N=6140)

	Mean	SD
Proportion of Apprentices on all Employees	0.085	0.069
Dummy: Poaching Victim	0.030	0.171
Dummy: Collective Bargaining Agreement	0.851	0.356
Dummy: Works Council	0.833	0.373
Number of Employees	652	1420
Proportion of Skilled Employees on all Employees*	0.727	0.223
Proportion of Part-Time Employees on all Employees*	0.108	0.154
Proportion of Employees who are older then 50 on all Employees	0.106	0.062
Proportion of Foreign Employees on all Employees	0.056	0.082
Proportion of Female Employees on all Employees	0.393	0.296
Share of Leaving Skilled Workers	0.117	0.191
Share of Newly Hired Skilled Worker	0.069	0.087

Source: LIAB longitudinal version 2, 1999-2003.