POACHING AND FIRM SPONSORED TRAINING: FIRST CLEAN EVIDENCE*

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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 challenge of empirically identifying poaching and its consequences. We use the unique institutional framework of the German apprenticeship training system that provides a transparent definition of visible, measurable and transferable skills that are comparable across firms. Moreover, we introduce a novel method to assess the relative productivity of apprentices within each training firm and the counterfactual wages that leaving apprenticeship graduates would receive in the training firm. We find that only a small number of training establishments in Germany are poaching-victims.

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

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1 Introduction

Employers usually pay for the costs of training even if the accumulated skills are general and can be transferred to other employers (Barron et al., 1999; Loewenstein and Spletzer, 1999; Booth and Bryan, 2004; Bassanini et al., 2007). A number of theoretical contributions that analyse the incentives of companies to sponsor training in general human capital stress the possibility that trained workers can be poached from the training firm after training has taken place. Poaching might imply that the training firm loses its training investments and the poaching firm can meet its skill demand without paying for training investments. As a consequence, poaching and the threat of poaching can lead to an under-investment in training because firms may be hesitant to pay for the training investments for workers who might leave before these investments are paid-off (Stevens 1994, 2001; Acemoglu and Pischke, 1999b; Booth and Zoega, 2004; Leuven, 2005). Under-investment in human capital, however, might undermine the competitiveness and innovation capabilities of companies. For understanding the functioning of training markets and deriving policy measures and company strategies for reaching an efficient training equilibrium, it is necessary to analyse poaching and its consequences. Although many theoretical contributions discuss the effects of poaching on company-sponsored general training behaviour, the existence, the extent, and the consequences of poaching remain an empirical question that has not been analysed so far (Pischke, 2007; Brunello and DePaola, 2009). The main reasons for this remarkable gap in the literature are empirical challenges to identify training investments in visible and transferable skills that are comparable between firms and to construct the counterfactual wage that the training firm would have been willing to pay for the employee leaving the firm.

This paper presents a novel approach to solve these challenges and provides clean evidence for the existence of poaching, estimates a lower bound of its extent, characterises the firms that experience poaching and analyses their response to poaching. We identify poaching on the basis of two sources. We use a unique institutional framework – the German apprenticeship training system – that permits the analysis of firm-sponsored training investments in visible and transferable skills that are unambiguously defined across firms and therefore comparable between them.

Several theoretical papers stress an additional condition for poaching – the employer switch has to be involuntary from the training firm's perspective. Voluntary separations are for example possible if asymmetric information on unobservable employee characteristics between training and poaching firms lead to a negative selection of those who change the employer after training (Malcomson et al., 2002). The trained employees with unobservable

skill deficits receive an inferior or no counter-offer from the training firm because it prefers to keep other trained employees at the wage offered for trained employees by other employers (Soskice, 1994; Acemoglu and Pischke, 1998). We therefore additionally introduce a novel identification of relative productivity (ability) differences between apprentices during the training period. We assume that training firms may voluntarily let go the ones with low productivity (ability) but not the ones with the highest productivity (ability). The relative productivity indicator allows us to identify the best apprentice in a training firm and the potential counter-offer the training firm has been willing to make for the apprentice at the end of the training spell. The counterfactual wage the training firm would pay for the best apprentice is measured by the highest full-time wage as a skilled worker that the next best apprenticeship graduate in the same occupation receives in the same year.

Using transferable and visible training investment that are comparable across firms and the potential counter-offer for costly trained employees leaving the training enterprise, we are able to use a precise poaching definition in this paper: poaching is when the training firm wants to retain an apprenticeship graduate but is not able to keep the best or most productive one. Instead, the best apprenticeship graduate leaves the training firm and works in the poaching firm. The poaching firm in addition pays the graduate a higher wage than he or she would get in the training firm.

The paper shows that among the firms in our sample around 2.9 percent of the training firms are poaching victims. This number represents the lower bound of poaching because our restrictive conditions exclude small firms with less than two apprentices in one occupation and all firms that cannot attract at least one apprenticeship graduate in a given year. These excluded firms are usually considered to have a higher risk to be a poaching victim.

We find that poaching victims have a higher ratio of apprentices to employees, and that they pay on average the same entry wages for skilled employees directly after the apprenticeship as non-poaching victims. Poaching victims however decrease the proportion of new apprenticeships in the year after the poaching incidence but they do not adjust apprenticeship remuneration and entry wages for skilled employees. The response to poaching might be a consequence of the fact that the overwhelming training firms' face poaching when they suffer a labour demand shock but can continue their growth path in the long-run. The shock temporarily lowers firms' opportunity to offer apprenticeship graduates sufficient wages. During such a shock, outsider firms use the opportunity to poach the best apprenticeship graduates. When the firm recovers, it regains the potential to attract the best apprenticeship

graduates. We conclude that actual poaching is a transitory event and firms consider themselves to be in a non-poaching equilibrium. Moreover, not poaching but the potential threat of poaching might influence training behaviour.

The remainder of this paper is organised as follows: The next section reviews the mainly theoretical poaching literature. The third and fourth sections briefly describe the institutional setting of apprenticeship training in Germany and the data. Afterwards, we present our identification strategy for poaching and describe firms that are poaching victims. The sixth section discusses firms' response to poaching. The last section concludes.

2 Background Discussions

A long tradition of theoretical models on training analyses firms' incentives to invest in general skills of their workers. The main argument is that labour market imperfections create a wedge between worker's wage and productivity and lead to the possibility to recoup training investments after training. However, these market imperfections simultaneously induce poaching when the poaching firm can earn a rent on the skills trained elsewhere by outbidding the wage paid by the training firm (Stevens, 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)[1]. Moreover, the future employment is ex-ante non-contractible and training investments usually do not have to be paid back when the trained employee quickly leaves after the training period.

Even if poaching and company sponsored training should simultaneously exist, most contributions conclude that poaching might hamper training investments in visible and transferable skills because a part of the returns to investment accrues to the poaching firm. The training firm only invests until the marginal costs of training equal the marginal benefits. Therefore, poaching leads to a lower number of trainees or even to a non-training equilibrium (Stevens, 1996, 2001; Acemoglu and Pischke, 1999a, 1999b; Booth and Zoega, 2004; Leuven, 2005).

[1] A growing literature analyses the use of counter-offers. In Lazear (1986) model for instance, outside wage offers are only made if the alternative employer is informed and the worker's productivity exceeds the worker's wage. The employing firm then either matches the offer if the worker's productivity is unknown or counters with a wage equal to the known productivity of the worker to the firm, which includes a firm-specific component. The raiding firm is successful in those cases when this firm-specific component is negative. Postel-Vinay and Robin (2004) show a "dual labour market" where some firms commit to an offer-matching policy and other firms commit to a policy of never making counter-offers. Barron et al. (2006) study under which conditions firms use selective counter-offers.

Sadowski (1980) and Moen and Rosen (2004), however, show that poaching is less severe or even non-existent when the training firm gets a reputation for rewarding skill collection and credibly offers long-term contracts. Training investments may be considered as a commitment device which reduces turnover. Therefore, employees might prefer to stay with their training firms although they obtain a higher wage offer from a rivalling firm. Also Cahuc et al. (1990) discuss a model with poaching and training. They split firms with training investments into a group that poaches (they call the group dominating firms) and a group that loses some of their trained workers although they incur a loss by that (the so-called dominated firms). They show that poaching does not necessarily replace own training efforts.

However, even if poaching is only a transitory or random event for training firms, it can force firms to carefully balance their training effort, training intensity and wage offers for apprenticeship graduates. This argument is based on the contestable market theory stating that a permanent threat of new market entrants disciplines market participants (Baumol et al., 1982). Applied to the market for apprenticeship graduates this means that poaching remain a serious threat. As a result, we do not need to observe a high rate of poaching, rather a sporadic occurrence. We can transfer the concept of contestable markets to the German labour market for apprenticeship graduates because poaching firms usually train themselves and they are well informed on the quality of job applicants and the labour market conditions for certain occupations in certain years. It is easy to "hit-and-run" on the labour market for apprenticeship graduates – a wage offer is almost costless and establishments do not need a specific additional infrastructure to hire apprenticeship graduates from the labour market. In addition, poached employees who do not satisfy their expectations can be easily dismissed during the probation period. Finally, there are no taxes on poaching in Germany that might reduce turn-over after apprenticeship training (Moen and Rosén, 2004).

Although a simultaneous equilibrium with poaching and training can be derived in theoretical models, the identification of the existence, extent and consequences of poaching in specific labour markets essentially remain an empirical question. Empirical papers so far have only shown that employers indeed pay for the costs of initial training and skill upgrading even if 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). Only indirect evidence for the existence of poaching can be derived so far. Booth and Bryan (2004) 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, Loewenstein and Spletzer (1999) show that employers reward skills acquired during the

previous employment. Both studies do not directly analyse poaching and therefore we need rather strong assumptions to infer the existence of poaching. The studies 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 – a change of trained employees to other firms therefore might be in the best interest of the training firm (Malcomson et al., 2002).[2] Moreover, both studies analyse continuing training, which is challenging to compare across firms because it incorporates different types and lengths of training, the visibility and transferability of skills and investments in training are hard to assess. Therefore, these studies do not discuss poaching.

3 Institutional Setting

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 transferable and visible skills for employees who can change their employer free of charge. The German apprenticeship training system provides such a unique institutional framework which fulfils all preconditions for empirically analysing poaching and firm sponsored training.[3]

Apprenticeship training in Germany that traditionally provides the highest professional education degree for about two thirds of the German workforce is subject to a curriculum laid down in the Vocational Training Act. The Vocational Training Act describes the length of training, necessary equipment and requirements for training firms. Training firms have to fulfil these requirements to get a permit for apprenticeship training granted by the chambers of industry and commerce or the chambers of craft. The Vocational Training Act also describes the (minimum) skills which have to be acquired in each training occupation for a successful graduation. Moreover, apprentices receive graded skill certificates at the end of the training period. The chambers observe the apprenticeship quality in each enterprise in their region and administer the final exam on the practical part of the skill examination. The theoretical part of the skill examination is administered and graded by publicly funded

[2] Author (2001) has shown that temporary help firms use training as a screening period and therefore voluntarily let trained employees go and Kampkötter and Sliwka (2011) show that firms typically have to pay more when they hire employees from direct competitors.

[3] 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 reason for poaching skilled employees at the beginning of their careers.

vocational schools (Franz and Soskice, 1995). The quality of the theoretical and practical exams therefore is assessed by independent public bodies.

This institutional framework of apprenticeship training in Germany includes all ingredients required for identifying poaching:

First, it offers 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 institutions independent of the training firms.

Second, regulations further imply that training is visible for outsider firms. This is guaranteed by the documented and transparent training curriculum and the graded final exams. An outsider firm therefore knows the skill level of an apprenticeship graduate in a given occupation and can assess the quality of the applicant on the basis of the grades.

Third, the skills are not only observable but also transferable. The institutional requirements severely limit firms' ability to structure apprenticeship training so that it involves mostly firm-specific training.[4]

Fourth, the repayment of training costs for switching apprenticeship graduates is not permitted by law and 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 by firms. The investment costs 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). For expensive blue-collar occupations poaching therefore is a threat for the willingness to training. For white-collar occupations poaching might be a minor problem.

Sixth, apprenticeship graduates who start their first job are a relatively homogeneous group in terms of age, tenure and prior education. Therefore, the initial conditions - an unknown and heterogeneous job history and differences in tenure between stayers and movers (Flinn, 1986)

[4] 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).

- are the same for entrants into apprenticeship because apprentices usually do not have prior 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 as skilled employees).

Seventh, the wage setting for apprentices underlies specific rules. Apprentices' wages are usually set by collective bargaining on the sectoral level according to § 17 of the Vocational Training Act (BBiG). Apprentices in one of the 26 economic sectors defined by collective bargaining in principle should earn the same wage irrespective of their occupation. More than two thirds of apprentices are trained in establishments with collective bargaining and additionally 22% work in establishment whose wages are oriented at collective bargaining (Schönfeld et al., 2010). 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 for apprentices (Lakies and Nehls, 2009). 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: A) enterprises are free to voluntarily pay a wage mark-up. B) 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). C) collective bargaining agreements might include different earnings level options for apprentices and firms might attribute their apprentices differently to these levels. D) wage supplements for especially demanding or dangerous jobs or extra hours are possible.

Taken together, apprentices receive broadly accepted, visible and transparent training certificates at the end of their training period. These skills allow them to flexibly accept a skilled job in either their training firm or an outsider firm. Therefore, firms have to actively offer a contract for the apprenticeship graduates if they want them to stay.

4 Data

Additionally to the institutional framework, an analysis of poaching requires establishment data about the training and the (potential) poaching firm, of individual apprentice characteristics, and the timing and length of training. This information is provided by the longitudinal version 2 of the linked employer-employee data set of the IAB (LIAB). The LIAB combines individual employment statistics from social security records 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 individuals. 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 establishments´ employee composition on the basis of the individual social security records such as qualification, gender, age, employment duration, earnings, and nationality. The IAB Establishment Panel additionally provides establishment-level information such as the age of the establishment, legal structure, industrial relations, and investments.

We use the 2-digit occupation code to identify 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 of every recruitment, lay-off, status change (for example from apprentice to skilled worker), occupation change, and the exact calculation of employment and unemployment durations for every individual. We therefore can calculate the exact number of apprenticeship graduates in each firm/occupation/year cluster and have information about the wage and other individual characteristics of the apprenticeship graduates who stayed and left the training firm.

We restrict the data to spells after 1998 because the exact day of transition from apprenticeship to work was not mandatory reported before 1999 (Jacobebbinghaus 2008). We drop agriculture and non-profit firms. We only use those apprenticeship graduates with full-time employment in the first job after the apprenticeship and regular training duration. A regular training duration begins at the start of a school year and terminates in the occupation specific exam week in the first or second quarter of a year. This definition of regular apprenticeships removes drop-outs and examination repeaters from our final sample.[6] Moreover, we drop individuals who earn less than 50 percent or more than 100 percent of the average in their occupation and do not include 2 year apprenticeships that mostly contain low-level apprenticeships.

We construct the wages of newly hired apprentices, apprentices at the end of the training period and the first skilled wage of apprenticeship graduates on the basis of the deviation of the individual wage from the mean in the respective occupation and year cell and calculate the

[5] The LIAB longitudinal version contains around 4500 establishments.
[6] Around one fourth of all apprentices drop out before the final exams.

mean for each wage variable on the establishment level. This procedure takes into account that training firms have apprentices from different occupations and wages differ strongly between occupations and it also makes the wage setting of training firms comparable irrespective of their occupation shares.

5 Identification of Poaching

We identify poaching by comparing apprenticeship graduates who stay with those who switch their employer. We only compare stayers with switchers in the same occupation who graduated from the same training firm and did not switch their training occupation after graduation[7]. In addition, the employer switcher has to find his or her new job within ten days after graduation.[8] These "immediate" employer switchers make up ten percent of all apprenticeship graduates in our sample. Descriptive characteristics of our sample can be found in Appendix Table A1.

Poaching in our definition requires an employer change against the will of the training firm. To identify such poaching, we assume the best or most productive apprenticeship graduate is the most desirable job candidate and postulate that the training firm wants to keep this candidate. The first poaching condition that "the best apprentice leaves the training firm" states that the switching apprenticeship graduate is more productive than any other staying apprenticeship graduate. This condition requires a relative productivity assessment between staying and leaving apprentices within a firm, occupation, and year cell. 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 (Acemoglu and Pischke, 1998). The second poaching condition, the "wage mark-up" condition, 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 condition implies that the training firm was not able to counter the wage offer of the poaching firm. According to this condition it is also possible that the training firm is willing to bid the wage of the leaving

[7] We do not consider occupational switchers because occupations differ in the average wage-level, reputation and selectivity. We also exclude apprenticeship graduates with an unemployment spell after graduation because that may be a stigma.

[8] Short non-employment spells of switchers are usually interpreted as a sign for quitting instead of firing. Moreover, the most transitions takes place in the first three days.

apprenticeship graduate up to her or his productivity level but assesses the productivity of the leaving apprenticeship graduate at a lower level than the poaching firm.

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 spell. We interpret the wage difference as relative productivity difference 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 wages between two apprentices in the same occupation do not differ because both perform different tasks.[9] Moreover, apprenticeship graduates in the same training occupation in one firm are practically identical in terms of observable variables such as age, education, the point in time they start with their apprenticeship and their prior working experience[10]. Finally, many employers have explicit financial bonus rules for apprentices for good grades at vocational school or good performance at work. Ryan et al. (2010) present in a case study evidence for individual and group-related performance pay for apprentices in 13 out of 18 analysed establishments in the German engineering and retailing industry.

In contrast to the institutional regulations that wages for all apprentices should be equal, wage variation between apprentices in the same apprenticeship year at the same point in time is striking 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 training firms with at least one moving and one staying apprenticeship graduate. 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 2.42 Euros a day – this difference accounts for around 10 percent of the daily gross wages within a firm and occupation cluster (table 1).[11]

We take advantage of the wage dispersion and interpret the wage differences between apprentices at the end of their apprenticeship within the same firm and in the same occupation as relative differences in productivity. There are a couple of justifications for our hypothesis that the wage difference between apprentices at the end of the apprenticeship within an

[9] 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 might account for the wage differences between apprentices at the end of the apprenticeship. However, overtime payment is more likely paid for the more productive apprentices. The imprecision in the wage measure therefore does not invalidate our measure of poaching.

[10] Compare table A2 which displays a regression of individual characteristics on the wage of apprentices.

[11] The average apprentice salary within an establishment/occupation cluster is 28.28 Euros a day.

establishment/occupation/year cell is a good predictor for productivity differences between apprentices. First, a Spearman Rank Correlation Test shows that there is a correlation between the wage difference at the end of the apprenticeship and at the first full-time employment of stayers within an establishment/occupation/year cell (appendix: table A3). Second, a regression shows that the wage deviation at the end of the apprenticeship is a good determinant of the wage deviation of the first full-time employment of stayers (appendix: table A4). When first skilled wages reflect the market value of an employee, we can conclude that our measure also reflects productivity differences of apprentices just at the end of the apprenticeship period when the training firm is informed about relative productivity of its apprentices.[12]

The small wage differences at the end of the apprenticeship training 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 acquired skills. The outsider firm knows nothing about the relative wage rank of apprentices within a firm and occupation but it can assess the general performance through the practical and theoretical exams grades. This means that certification at the end of apprenticeship training allows the (potential) poaching firm at least to a certain extent to assess the quality of apprentices (Acemoglu and Pischke, 2000) and therefore information on graduate quality seem to be symmetric.

We find that 26.4 percent of the immediately moving "best" apprenticeship graduates who work in the training occupation in the first job earn more than the best paid stayer at the end of the apprenticeship, see Table 2. In addition, 21 percent of all immediate movers in expensive blue-collar manufacturing occupations earn more than the stayers in the training firm at the end of the apprenticeship. This share is lower than that for cheaper white-collar occupations (28.2 percent).

The decision of the "best apprentice" to leave the training firm might be a consequence of individual preferences and not of a superior wage offer of the outside firm. Therefore, we additionally 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

[12] Obviously we have to discuss now why firms differentiate between the wages of their apprentices although wages are determined by collective bargaining or other rules that prohibit undercutting of certain wage levels. Our argument is that training firms use their information advantage on relative productivity differences between their apprentices by voluntarily sharing part of the additional rent created by more able apprentices (Farber and Gibbons, 1986). This could give training enterprises a head start on the labour market after the end of the apprenticeship period because the more able apprentices feel more obliged to stay or they are more motivated according to gift exchange considerations (Akerlof 1984).

apprenticeship graduate requires a counterfactual wage which discloses the wage that the leaving apprenticeship graduate would have received if he or she stayed in the training firm. We construct this counterfactual wage based on the highest wage of apprenticeship graduates in the same occupation who stay in the training firm. This wage is the highest revealed willingness to pay for a first-time skilled employee in the training firm. Table 3 shows that 28.7 percent of all immediate movers earn a higher wage than the best paid staying apprenticeship graduate in the first regular job. This proportion is dramatically higher for immediately moving apprenticeship graduates in expensive blue-collar manufacturing occupations (40 percent) than in white-collar occupations (22 percent).

However, the second condition alone is also not sufficient to identify poaching. For example, the "wage mark-up" condition is also 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 only 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 – 9.6 percent of all immediately moving apprenticeship graduates satisfy both poaching conditions. Moreover, poaching is dramatically less frequent in the more cost-intensive blue-collar manufacturing occupations (6.4 percent) than in white-collar occupations (11.9 percent).

6 Characteristics of Poached Firms

Around 2.9 percent of the training firms with at least two apprenticeship graduates in the same training occupation train at least one poached apprenticeship graduate. This number shows that poaching according to our strict definition indeed seems not to be widespread in the apprenticeship system in Germany, but it exists. The poaching conditions exclude firms that only train one apprenticeship graduate in a training occupation and have no staying apprenticeship graduate. Especially these firms may run a relatively high risk to be poaching victims. The restriction to large training firms therefore permits the estimation of a lower bound of poaching.

Table 5 displays differences in establishment characteristics between poaching victims and training firms that can attract the best apprenticeship graduates. Poaching enterprises 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, keep their employees longer and invest more per employee than the comparison group. Finally, the share of part-time and skilled workers is similar in both groups.

Moreover, Table 6 shows changes in the retention rate of poaching victims before and after poaching. Poaching seems to be the consequence of a short-term labour demand shock that reduces the retention rate for one year only.

7 The Response of Training Firms to Poaching

We now turn to the analysis of the response of training firms to poaching. In principle, firms that face poaching can reduce training expenses, try to improve the retention of apprenticeship graduates by increasing the wages of apprentices or apprenticeship graduates, and adjust the number of training places. The reactions to poaching might depend on the nature of poaching - whether poaching is a transitory event and seen as random or seen as permanent and systematic. The timing in our analysis is as follows: the firm suffers poaching in period t – usually in the first or second quarter of the calendar year. The firm hires new apprentice between August and September. We call this the response period (t+1).

Poaching indeed usually is a transitory event. 80 percent of the poaching victims face poaching only once during a five year period. Furthermore, poaching victims face a lower retention rate only during the year when poaching takes place,[13] meaning those firms lose their most productive apprenticeship graduate and not a less productive one. The retention rate is similar in the previous and the consecutive year but drops by ten percentage points in the year when poaching took place (table 6). Furthermore, the wages of apprentices and the share of apprentices on all employees remain constant after poaching.

We estimate the level of new training places and apprentice wages first and check in a next step firms' adjustment of new training places and wages as a response to poaching. Both reactions are easy to implement and change for training firms.[14] Table 7 presents a Tobit estimation of the share of newly hired apprentices on all employees. The main variable of interest – the poaching victim dummy - indicates whether a firm suffered poaching in the previous period. Column one in table 7 shows that poaching victims train a larger proportion of apprentices than non-poaching victims one year after poaching. Column two in table 7 includes an interaction term that indicates whether a firm suffers poaching in more expensive

[13] A temporary reduction in the retention rate also can be caused by other reasons than poaching.
[14] Training firms can also adjust their selection criteria for apprentices and the HRM policy to attract apprenticeship graduates. Both policies are, unfortunately, not observable with our data.

blue-collar manufacturing occupations. Even firms whose best blue-collar apprentice has been poached also train more apprentices than non-poaching victims – obviously poaching does not reduce training investments. The control variables in both estimations of apprentice training intensity have the expected signs (Harhoff and Kane, 1997; Beckmann, 2002).

However, regressions on the level of the training intensity may be an indicator for the efficiency of training and not an indicator for the adjustment of the training strategy after poaching has taken place. Columns three and four in table 7 therefore show regressions with the change in training intensity between the previous year and the year after poaching has taken place as dependent variable. Poaching victims do not change the recruitment of new apprentices. However, if the poaching victim loses an apprenticeship graduate in one of the more expensive blue-collar occupations, the poaching victim adjusts the number of training places and indeed hires a significantly lower number of new apprentices in response to poaching.

The second possible strategy of a poaching victim is the adjustment of wages for new apprentices. Columns one and two of table 8 present regressions on the wage level and columns three and four present regressions on the first wage difference of newly hired apprentices. Poaching victims pay apprentices a similar wage as non-poaching victims in the year after poaching. Moreover, poaching victims do not adjust the wages of apprentices in response to poaching. We find no differences between training occupations.

We run a series of robustness checks on 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 simultaneously determine training intensity and the poaching-victim dummy. 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.[15] This firm is not interested in retaining the best but the cheapest (if any) apprenticeship graduate. Our poaching indicators apply if the poaching firm knows that it gets a good quality apprenticeship graduate and is willing to pay more than the training firm. 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 issue. We use the within-firm changes in the labour demand of young workers as an instrument. More specifically, we instrument the poaching-victim dummy using changes in the retention rate of an

[15] Smits (2006) and Mohrenweiser and Zwick (2009) discuss different training motivations and their consequences.

establishment´s apprenticeship graduates during the observation period (also see von Wachter and Bender, 2006). 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. This shock may make training firms more vulnerable to poaching – we indeed find a strong negative correlation between the establishments` retention rate difference from the long-time average and poaching (compare table 6). Running 2SLS IV regressions, the poaching victim dummy on the share of new training places on all employees remain significant. The point estimate and the variance are higher than expected (see appendix table A5). Poaching victims hire more new apprentices than non-poaching victims even if we take endogeneity of poaching into account.

Second, we relax our rather strong poaching conditions. Instead of the first condition "the leaving best apprentice", we now request 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 many apprenticeship graduates who change the employer meet the weaker poaching condition. This recalculation leads to 4.1 percent of firms classified as poaching-victims. The results of the estimations on the consequences of poaching all remain robust, however.

Third, we test different classifications of training occupations for example the more precise 3-digit occupation code. As a general rule, blue-collar manufacturing or service occupations that have the same 2-digit but different 3-digit codes are usually only another specialisation of the same occupation. Different specialisations might be seen as substitutes for potential poaching 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 existence of poaching and the consequences on training intensity.[16]

8 Conclusions

This paper presents empirical evidence of the existence of poaching, estimates a lower bound of poaching incidence, characterises firms that are poaching victims, and analyses the response of training firms to poaching. The study uses an institutional framework that permits the comparison of general training investments between firms and a novel assessment of the relative productivity of apprentices within those training firms - the German apprenticeship training system. The Vocational Training Act regulates the apprenticeship training and leads

[16] The robustness of wage estimations regarding the 2, 3 or 4 digit occupational code for apprentices is also shown by Wydra-Somaggio and Seibert (2010).

to comparable skills across firms and to acquired skills that are visible by outsiders and transferable between firms. The assessment of the relative productivity of apprentices within a firm stems from relative wage differences between apprentices performing the same job at the end of an externally regulated training duration.

The identification of poaching depends on two conditions. First, the switching apprenticeship graduates have to be more productive at the end of the apprenticeship and, second, earn a higher wage in the first regular full-time job than their counterparts in an establishment, occupation and year cell. The paper shows that at least three percent of the training firms suffer poaching. This represents 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. In addition, poaching is likely to be a transitory event in the training market. In our sample, 80 percent of the poaching victims suffer poaching only once in five years. The overall retention rate dips in the years when poaching takes place. After recovering from the short-term shock, the poaching victim regains its opportunity to attract apprenticeship graduates. Moreover, poaching victims in general do not adjust the training intensity and wages in response to poaching. However, firms which suffer poaching in more expensive training occupations reduce the number of training places in the year after poaching.

The setting allows the identification of a response to a short-term shock because an apprenticeship lasts three years. The firm-specific shock in the final training year is, therefore, exogenous to the recruitment of those apprentices three years before. The endogeneity of the number of apprentices holds even for firms' recovery in the following year. However, poaching remains a serious potential threat for training firms. Training firms have to carefully determine their training strategy in terms of selecting apprentices, efficiency of training and attracting apprenticeship graduates in order not to lose their training investments involuntarily. Contrary to previous considerations, institutional arrangements seem not to fully restrict poaching.

This paper contributes to the empirical training literature by presenting feasible and innovative conditions for identifying poaching – an institutional framework for comparable general training between firms and an empirical assessment of relative productivity differences of employees within those firms. It confirms the theoretical finding of a coexistence of poaching and firm-sponsored training.

The existence of poaching also has implications for our understanding of training markets. Poaching seems to be more relevant in cases of short-term shocks to training firms but

remains a serious threat for all training firms. However, the empirical mechanisms of long-term successful strategies for preventing poaching in training markets remain an important question for future research. Furthermore, this study is only the first step for analysing consequences of poaching for company-sponsored training. The paper lacks a dynamic perspective and cannot infer whether poaching forces firms to withdraw altogether from training. Moreover, the poaching conditions only permit the identification of a lower bound of the extent of poaching and restrict the analysis to large firms. The consequences of attracting expensive skilled workers for the poaching firms such as the winners curse remain an open question for future research.

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

Standard Deviation	2.42
Mean	28.28
Minimum	25.033
Maximum	32.31

Daily wages in Euros, Sample restrictions: at least two (one moving and one staying) apprenticeship graduates in each establishment/occupation/year cell. N= 43134. 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 who leave the training firm

Occupation	Proportion
Blue-collar manufacturing	0.210
White-Collar	0.282
Total	0.264

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=4081. 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 who receive a wage mark-up.

Occupation	Proportion
Blue-collar manufacturing	0.401
White-Collar	0.227
Total	0.287

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=4081. 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	0.064
White-collar	0.119
Total	0.096

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=4081. 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= 142)	Non- poaching-victims (N=4800)	T-Value of Mean Differences
Number of Employees	1608	662	3.55
Share of Apprentices	0.105	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)	14.81	13.94	2.54
Export Share	0.254	0.183	2.77
Tenure in days	3793	3516	2.38
Share of Leaving Skilled Workers	0.115	0.113	0.95
Share of Newly Hired Skilled Worker	0.034	0.027	2.12

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

Table 6: Retention Rates and Poaching

	(t-1)	Year of Poaching	(t+1)
Retention Rate	0.54	0.47	0.53

Table includes only firms that suffer poaching only once during the five year period. Compare text for sample restriction. Source: LIAB Longitudinal version 2.

Table 7: Firms Response to Poaching: the Share of Newly Hired Apprentices.

	Level			First difference	
Firm was Poaching Victim in Previous Year	0.009 (4.05)	0.005 (2.44)		-0.002 (1.33)	-0.0001 (0.01)
Firm with blue-collar Manufacturing Apprentices is Poaching Victim		0.011 (2.17)			-0.006 (1.79)
Collective Bargaining Agreement	0.003 (2.13)	0.003 (2.13)		0.001 (1.08)	0.001 (1.09)
Works Council	-0.041 (6.68)	-0.014 (6.68)		-0.002 (1.21)	-0.002 (1.22)
Ln(capital per employee)	-0.001 (4.01)	-0.001 (4.04)		-0.0002 (1.01)	-0.0002 (0.99)
Number of Employees divided by 1000	0.029 (4.37)	0.029 (4.21)		-0.0008 (0.02)	0.0002 (0.05)
Squared Number of Employees (divided by 1000000)	0.001 (4.38)	0.001 (4.21)		0.0005 (0.26)	0.0008 (0.41)
Share of Skilled Workers	0.017 (6.08)	0.017 (6.03)		0.002 (1.14)	0.002 (1.20)
Share of Part-Time Workers	-0.003 (0.50)	-0.004 (0.52)		0.007 (1.05)	0.008 (1.06)
Share of Employees who are older than 55	-0.041 (3.72)	-0.041 (3.73)		0.004 (0.50)	0.004 (0.49)
Share of Leaving Skilled Workers	-0.020 (5.70)	-0.020 (5.74)		-0.007 (2.89)	-0.007 (2.86)
Share of Newly Hired Skilled Worker	0.014 (1.73)	0.015 (1.76)		0.017 (1.86)	0.016 (1.84)
Share of Foreign Workers	0.023 (2.91)	0.023 (2.90)		0.001 (0.34)	0.002 (0.35)
Share of Female Workers	0.019 (4.61)	0.019 (4.65)		-0.003 (0.87)	-0.003 (0.90)
Sector and Year Dummies	Yes	Yes		Yes	Yes
Number of Observations	4942	4942		4585	4585
Pseudo R square	0.05	0.25		0.01	0.01

Dependent variable: proportion of apprentices on all employees[17]. Estimation method: Tobit Corner Solution Model for levels and OLS for first differences. Standard errors clustered on establishment, t-values in parenthesis. 366 establishments hire no new apprentices in the following year. Source: LIAB longitudinal version 2 1999-2003.

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

Table 8: Firms Response to Poaching: the Wages of New Apprentices.

	Level			First difference	
Firm is Poaching Victim	0.004 (0.00)	-0.347 (0.99)		0.308 (0.73)	0.061 (0.14)
Firm with blue-collar Manufacturing Apprentices is Poaching Victim		1.058 (1.94)			0.728 (1.32)
Collective Bargaining Agreement	1.038 (2.57)	1.036 (2.57)		1.494 (0.97)	1.494 (0.96)
Works Council	0.316 (0.62)	-0.317 (0.62)		2.486 (1.05)	2.487 (1.05)
Ln(capital per employee)	-0.038 (0.67)	-0.039 (0.68)		0.124 (1.01)	0.124 (1.04)
Number of Employees	0.0005 (3.76)	0.0005 (3.77)		-0.0001 (0.54)	-0.0001 (0.54)
Squared Number of Employees (divided by 1000)	0.0002 (2.61)	0.0002 (2.70)		0.0001 (0.18)	0.0001 (0.14)
Share of Skilled Workers	-0.771 (1.36)	-0.786 (1.38)		-0.524 (0.66)	-0.5357 (0.68)
Share of Part-Time Workers	5.226 (4.01)	5.218 (4.01)		0.645 (0.67)	0.641 (0.66)
Share of Employees who are older than 55	1.679 (0.57)	1.671 (0.56)		-5.927 (0.80)	-5.928 (0.80)
Share of Leaving Skilled Workers	-0.208 (0.20)	-0.226 (0.22)		-2.521 (1.05)	-2.534 (1.05)
Share of Newly Hired Skilled Worker	0.909 (0.46)	0.934 (0.47)		-1.652 (0.96)	-1.626 (0.95)
Share of Foreign Workers	10.87 (7.72)	10.870 (7.72)		1.937 (0.65)	1.929 (0.65)
Share of Female Workers	0.912 (0.37)	0.928 (1.11)		-2.021 (0.72)	-2.01 (0.71)
Sector and Year Dummies	Yes	Yes		Yes	Yes
Number of Observations	4576	4576		4071	4071
Pseudo R square	0.13	0.13		0.01	0.01

Dependent variable: establishment average of the deviation of the individual wage from the occupational mean; OLS regressions, standard errors clustered on establishment, t-values in parenthesis. Source: LIAB longitudinal version 2 1999-2003.

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	71.80	28.46	71.80
Mover within 10 day, same occupation	10.49	28.57	69.28
Mover within 10 day, occupational switcher	5.19	26.65	57.78
Mover with unemployment spell of more than 10 days, same occupation	5.49	27.24	72.32
Mover with unemployment spell of more than 10 days, occupational switcher	5.65	25.63	52.71
Out of labour force	1.39	30.29	--

Sample restrictions: at least two (one moving and one staying) apprenticeship graduates in each establishment/occupation/year cell. N=43134, Source: LIAB longitudinal version 2, 1999-2003.

Table A2: Determinants of apprentice wages.

	Coef. (t-Value)
Age	0.156 (0.65)
Age Squared	0.003 (0.21)
University Entrance Diploma	0.250 (0.75)
Female	0.295 (1.68)
Foreigner	0.014 (1.24)
Controls	yes
Observations	30104
Pseudo R square	0.18

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	0.3997
	p-value	0.0000
Kendall's Rank Correlation Coefficients Test	Kendall's tau-a	0.2753
	Kendall's tau-b	0.2754
	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: 34969 all stayers in establishments with at least two apprenticeship graduates. Source: LIAB longitudinal version 2, 1999-2003.

Table A4: 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	0.042 (4.77)
Age	-1.896 (7.92)
Age Squared	0.045 (8.48)
University Entrance Certificate	0.012 (0.14)
Female	0.380 (6.01)
Foreigner	-.001 (0.05)
Constant	19.40 (7.29)
Observations	34969
Pseudo R2	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 A5: IV Regression on the Proportion of Newly Hired Apprentices.

	First Stage	Second Stage
Dummy: Poaching-victim		0.178 (14.22)
Deviation from within-firm retention rate	0.651 (3.33)	
Number of Employees divided by 1000	0.0001 (2.62)	- 0.045 (4.93)
Squared Number of Employees (divided by 1000000)	-0.0003 (1.46)	0.001 (2.75)
Collective Bargaining Agreement	0.315 (2.00)	0.002 (0.98)
Works Council	-0.249008 (1.49)	- 0.014(8.67)
Controls	yes	yes
Number of Observations	4879	4876

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 A6: Descriptive Statistics of the Estimation Sample (N=4585)

	Mean	SD
Proportion of New Apprentices on all Employees	0.027	0.026
Dummy: Poaching-victim	0.029	0.168
Dummy: Collective Bargaining Agreement	0.857	0.349
Dummy: Works Council	0.846	0.360
Number of Employees	692	1427
Proportion of Skilled Employees on all Employees*	0.736	0.222
Proportion of Part-Time Employees on all Employees*	0.104	0.152
Proportion of Employees who are older than 50 on all Employees	0.105	0.058
Proportion of Foreign Employees on all Employees	0.056	0.081
Proportion of Female Employees on all Employees	0.385	0.291
Share of Leaving Skilled Workers	0.112	0.166
Share of Newly Hired Skilled Worker	0.066	0.084

Source: LIAB longitudinal version 2, 1999-2003.