Zusammenfassung:

Die Auswirkung des Leistungslohns auf die Bindung von Lehrlingsabsolventen: Eine Panel-Datenanalyse

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Dezember 2014

Die Bereitschaft eines Unternehmens, eine allgemeine Ausbildung in Form einer Lehrlingsausbildung anzubieten und zu bezahlen, hängt entscheidend davon ab, ob es in der Lage ist, die Ausbildungskosten zu refinanzieren. Eine erfolgreiche Strategie besteht darin, die produktivsten Auszubildenden nach dem Abschluss zu halten. Dadurch kann viel Geld für die Rekrutierung neuer Mitarbeitenden gespart werden.

In diesem Artikel wird untersucht, ob Lehrbetriebe dank Leistungslöhnen Lernende erfolgreicher motivieren können, im Betrieb zu verbleiben.

Die Wirtschaftstheorie sagt voraus, dass sich von Natur aus produktivere Arbeitnehmer aufgrund höherer erwarteter Renditen selbst für leistungsbezahlte Jobs entscheiden. Anhand repräsentativer Daten aus einer großen Arbeitgeber-Arbeitnehmer-Umfrage testen wir, ob im Kontext der Lehrlingsausbildung eine ähnliche Beziehung besteht.

Bei Verwendung einer Panel-IV-Methode stellen wir fest, dass sich sowohl die Höhe als auch die Wahrscheinlichkeit einer Leistungsvergütung signifikant positiv darauf auswirkt, dass Lernende nach der Ausbildung im Betrieb verbleiben.

Lehrbetriebe mit Leistungslohn sind aufgrund ihres höheren Retentionserfolgs wiederum besser positioniert, um allgemeine Schulungen zu finanzieren.
Schlüsselwörter: Lehrlingsausbildung, Berufsausbildung, Bindung, Einstellung, Leistungsbezahlung, Humankapitaltheorie

Working Paper No. 104

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The Swiss Leading House on Economics of Education, Firm Behavior and Training Policies is a Research Program of the Swiss State Secretariat for Education, Research, and Innovation (SERI).

www.economics-of-education.ch

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Preliminary version; do not cite without permission of the authors

December 2014

Abstract

A firm's willingness to provide and pay for general training in the form of apprenticeship training crucially depends on whether it is able to recoup the training costs. A successful strategy is to retain the most productive apprentices after graduation. This article explores whether training firms can use performance pay plans as a successful retention mechanism. Economic theory predicts that inherently more productive workers self-select into performance pay jobs because of higher expected returns. Using representative data from a large employer-employee survey, we test whether a similar relationship exists in the apprenticeship-training context. Using a panel IV method, we find that both the magnitude and the likelihood of performance pay have a significantly positive effect on a firm's share of internal apprenticeship graduates. Because of their higher retention success, performance pay firms are in turn better positioned to finance general training.

Keywords: apprenticeship training, vocational education, retention, hiring, performance pay, human capital theory

JEL Classification: J24, J33, C23

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† This study is partly funded by the Swiss Federal Office for Professional Education and Technology through its Leading House on the Economics of Education, Firm Behavior and Training Policies. We would like to thank John T. Addison, Edward Lazear, Jens Mohrenweiser, Aderonke Osikominu, Paul Ryan, seminar participants at the University of Zurich, the participants of the 16th Colloquium on Personnel Economics, the participants of the SASE conference in Milan, and the participants of the annual meeting of the German Economic Association (Verein fuer Socialpolitik) in Duesseldorf for helpful comments. We would also like to thank the Swiss Federal Statistical Office for data provision.

1. Introduction

Declining labor market prospects for young people have renewed interest in firms' investments in training of labor market entrants. Recent evidence suggests that a dual training system, combining formal education at a vocational school with on-the-job training, smoothens youths' entry into the labor market (Bell and Blanchflower, 2010; Scarpetta et al., 2010). However, the greatest challenge to the introduction of a dual training system is firms' refusal to bear the training costs (Harhoff and Kane, 1997). The market problem for firms in this context is uncertainty about graduates' post-training behavior, which affects their ability of recouping the investment costs. Therefore, a firm's willingness to offer and finance training crucially depends on its ability to retain graduates.

Acemoglu and Pischke (1998) have introduced a theoretical model and provided empirical evidence that in imperfect labor markets firms have a certain market power, which enables them to retain the more productive graduates. In recent years, an increasing amount of studies have identified different sources of labor market frictions and tested their impact on a firm's willingness to offer and finance apprenticeship training (see e.g. Acemoglu and Pischke, 1999a; 1999b; Booth and Bryan, 2007; Dustmann and Schönberg, 2007; Katz and Ziderman, 1999; Mohrenweiser and Backes-Gellner, 2010). So far, only little discussion exists on whether factors other than imperfect markets might exist that enable firms to retain their graduates. In this article, we want to fill this gap by exploring a potential solution that firms can create internally and that does not rely on external market imperfections.

The retention of workers is a widely studied topic in personnel economics. Here, however, the focus lies on the firm and less so on the market environment. In particular, personnel economics has focused on a firm's compensation structure as a means to hire and retain workers. Starting with Lazear (1986), a growing body of evidence has shown that performance pay, defined as pay tied to worker output, has two effects. First, the incentive effect causes performance pay workers to increase their effort. Second, the sorting effect causes more able workers to select and stay in performance pay jobs, while less able workers stay away from or leave performance pay jobs (see e.g. Dohmen and Falk, 2011; Gielen et al., 2009; Lazear, 2004; 2000). In equilibrium, workers have reallocated according to their ability so that productivity and wages in performance pay firms are higher.

We apply these findings from personnel economics to the theory of training and investigate the effects of performance pay on the retention of apprenticeship graduates. In this context, however, the set-up is quite different. While in the classic performance pay models the employees' abilities are assumed to be private information, training theory assumes that

apprentices reveal information about their ability during the training period. Firms can thus selectively choose whom to offer an employment contract upon graduation, offering contracts only to the more able graduates. They use performance pay less so for workers to self-select but rather as an attractive incentive for the more productive workers to stay. In this framework, thus, retention is always efficient. . We develop a simple contracting framework that provides a rationale for this firm policy.

Our empirical analysis focuses on Switzerland, which provides the most suitable context for our investigation. First, Switzerland has a large institutionalized apprenticeship training system; each year about 65 percent of a youth cohort enrolls in this type of training. Second, training is mostly in general skills and financed largely by training firms. For our analysis, we use the Swiss Earnings Structure Survey (SESS), a large employer-employee survey. Even though the survey is designed as a cross-section, we are able to identify most firms in subsequent points of time and are therefore able to construct a firm panel. We control for unobserved fixed effects and the potential endogeneity of performance pay in the estimation of the retention of apprenticeship graduates.

Our results show that training firms with performance pay plans have a significantly higher retention of apprenticeship graduates than training firms with fixed pay salary. We develop two different measures for the use of performance pay in a firm, one reflecting the intensity, i.e., the amount of performance pay in relation to the total pay in a firm, and the other reflecting the coverage rate, i.e., the share of employees receiving performance pay. We find that both factors matter: The performance pay intensity and the coverage rate have a highly significant positive effect on the retention of graduates.

Our research adds to the training literature by providing an additional answer to the question of why firm-sponsored investment in general training exists. We argue and provide evidence that imperfect labor markets might not be the sole condition for the existence of an efficient apprenticeship training system. This finding should be of high interest to policy makers who are considering the introduction of an apprenticeship training system as a means to tackle youth unemployment. We argue that the focus should shift away from the market or institutional environment only and instead focus more on the firm and potentially successful firm strategies.

The paper is organized as follows: Section 2 reviews the literature and introduces our model. Section 3 gives an overview of institutional setting. Section 4 introduces the data and the sample design and Section 5 presents our empirical strategy. Section 6 discusses the results, and Section 7 concludes.

2. Conceptual Framework

The question of why firms should offer and pay for general training has received a lot of attention in the training literature. A general finding is that market imperfections explain the existence of a successful apprenticeship training system. Imperfect labor markets allow training firms[1] to pay their graduates less than the market wage for skilled workers. While being able to retain a sufficiently high number of graduates, training firms recoup the investment costs with the rent accrued from the productivity-wage gap.

In recent years, an increasing amount of studies has identified different sources of market frictions. Some contributions point out that regulations such as employment protection and institutions such as unions or works councils increase a firm's ability to retain a sufficiently high number of graduates and thus its training incentive (Acemoglu and Pischke, 1999a; Dustmann and Schönberg, 2009; 2007; Jansen et al., 2012). Other studies focus on mobility costs and low labor turnover rates caused by residential inertia (Harhoff and Kane, 1997; Stevens, 1994), on information asymmetries (Acemoglu and Pischke, 1998; Katz and Ziderman, 1999), on reputation aspects and social expectations (Harhoff and Kane, 1997; Sadowski, 1980), and on complementarities between general and firm-specific training (Franz and Soskice, 1994). A more recent strand of literature compares training firms with non-training firms to see what the systematic differences between these two types of firms are. Recent studies have found that training firms are on average more productive than non-training firms, mainly due to their ability of attracting and retaining a more productive workforce (Autor, 2001; Cappelli, 2004; Tuor and Backes-Gellner, 2010).

Along parallel lines, personnel economists argue that performance pay firms are on average more productive than salary firms because of their more productive workforce (Lazear, 1986). In particular, they argue and present evidence that performance pay has two effects. First, the incentive effect causes performance pay workers to work harder. Second, the sorting effect causes more able workers to select performance pay jobs, while less able workers leave performance pay jobs. In a case study of a firm's switch from salaries to piece-rate, Lazear (2000) reports a substantial increase in productivity (44 percent), that is partly the result of selection effects and partly the result of incentive effects. He also finds that turnover rates fell for the most productive workers and rose for the least productive ones. He argues that the firm was able to retain its high-quality workers and recruit other high-quality workers

[1] Training firms follow either a substitution strategy or an investment strategy. Substitution firms use apprentices as cheap substitutes for unskilled or semiskilled workers and have no incentive in retaining them at the end of the training period (Harhoff and Kane, 1997; Mohrenweiser and Backes-Gellner, 2010). Investment firms invest in their apprentices, incur higher training costs and want to retain at least some of their graduates. Our analysis focuses on the latter firms.

because it was able to pay these workers more. A number of studies have confirmed Lazear's findings (see e.g. Dohmen and Falk, 2011 running a controlled laboratory experiment or (Gielen et al., 2009 using a Dutch firm panel). Thus, one stylized fact that emerges from these studies is that performance pay induces workers' selection into the right jobs.

In this article, we apply these findings from the performance pay literature to the literature on the theory of training and argue that similar dynamics apply in the context of apprenticeship training. In particular, we extend the model of Acemoglu and Pischke (1998) by Lazear's (1986) theoretical considerations on performance pay and fixed salaries. We argue that performance pay should induce more productive graduates to stay with their training firm because of higher expected compensation.[2]

Consider a simple two-period model similar where firms and workers are risk-neutral and form a principal-agent relationship. The firm maximizes expected profit, whereas the workers maximize their expected utility. There is no discounting between periods.

In period one the firm hires apprentices and starts training them. The apprentices' ability is distributed according to a distribution function $F(\eta)$. Apprentices are thus randomly assigned to training firms such that each firm has a group of apprentices that are similar in their ability distribution. This is a reasonable assumption given that we know from previous research that apprentices' initial choice of training firm does not depend on whether a firm offers performance pay (Oswald and Backes-Gellner, 2014). Assume also that firms train more apprentices than they have vacancies to fill. Indeed, the average retention rate is 36 percent in Switzerland (Schweri et al., 2003). At the end of the first period, i.e., at the end of the training, the firm learns the ability of each of its apprentices.

In period two, the firm chooses which graduates to lay off and which ones to retain and it offers an employment contract with a fixed salary plus bonus payments to the latter. If the graduates accept the offer, they are hired. Again, unlike in the classic case of worker self-selection and reallocation, the training firm knows the productivity of its individual workers and can choose not to further employ its less productive workers at no additional separation costs. Here, the focus of the analysis lies on firm's selection and less on worker's self-selection. Following Acemoglu and Pischke (1998), the firm will lay off all graduates on whom it would lose money. Importantly, because offering different contracts to different ability-type graduates would reveal the firm's private information about graduate ability, it has to offer a uniform contract to all those graduates it want to retain. Thus, the firm will simply choose a cutoff ability whereby all workers above a certain skill level will be kept.

[2] Importantly, we do not argue that the graduates' wages in performance pay firms equal their marginal productivity. We simply argue that their wages are higher than in salary firms.

In this setting, the firm is maximizing its profit by hiring more productive graduates and thus building up a highly productive workforce. How are graduates maximizing their utility? Graduates accept the employment offer if the expected compensation at their training firm is larger than their outside options. To sketch these options, we have to take into account two firm characteristics, training firms and non-training firms as well as salary firms and performance pay firms. As we have pointed out previously, training firms are on average more productive than non-training firms (Autor, 2001; Backes-Gellner and Tuor, 2010; Cappelli, 2004). Since more productive firms pay higher wages (Abowd et al., 1999), accepting the offer will always lead to a higher utility level than renouncing it and starting to work at a non-training firm.[3]

Similarly, accepting the offer will always yield a higher utility than leaving and starting to work at a training firm with a fixed salary. Again, more productive graduates expect to receive a higher wage with a performance pay firms because their higher productivity will be observed and rewarded in this type of firms.

In our model, the only option yielding the same utility is an offer from a training firm with performance pay. However, because each firm trains more apprentices than it wishes to recruit, these firms already have a sufficiently high number of graduates they want to retain and do not have any incentives to hiring graduates from external firms, engaging in potentially costly poaching activities. [4]

In equilibrium, these training firms with performance pay should be able to retain the more productive graduates. Given that the interest of all training firms is to hire the more productive graduates only, we should observe that training firms with performance pay have a higher rate of internal graduates because they offer the most attractive compensation plan for these graduates.

[3] Indeed, (Mohrenweiser, 2013) shows empirically for Germany that almost all inter-firm movement of apprenticeship graduates takes place between training firms. Non-training firms hardly participate in the post-graduation recruitment market.

[4] As Acemoglu and Pischke (1998) show, an additional explanation for why outside firms might not engage in poaching activities is the winner's curse.

3. Institutional Setting

Apprenticeship training constitutes the main pathway for young people into the Swiss labor market. It is the most common form of post-compulsory education and training in Switzerland; each year about 65 percent of a youth cohort enrolls in apprenticeship training programs (Wolter et al., 2014). The most common form of apprenticeship training is the dual program, which combines formal education at a vocational school with training in and working for a training firm. This on-the-job training provides apprentices with the practical know-how, knowledge, and skills they need for their chosen occupation. Moreover, they actively take part in the training firm's production processes.

This type of education is more than merely tuition-free. From the first year, apprentices receive a monthly salary. Even though Swiss labor regulations leave employers complete discretion over the form of compensation they wish to use, employer organizations often issue salary recommendations for apprentices and most firms adhere to these recommendations. The salary recommendations are made publicly available, providing apprentices with a benchmark for the salary paid in the occupation they want to be trained in. Most relevant to our study, only 14 percent of all training firms offer performance pay already to their apprentices.[5] Instead, most firms start paying performance pay only after graduation (Wolter and Strupler Leiser, 2012). In line with Oswald and Backes-Gellner (2014), we assume that the apprentice's initial firm choice is random.

Unlike other sectors of the Swiss educational system, apprenticeship training is market-driven, i.e., young people have no guarantee of receiving a training place, nor are firms obligated to provide training. The two main types of training last three or four years, with the apprentices graduating after passing both a practical and a theoretical examination. The graduates receive a federal certificate that is recognized throughout Switzerland. The employment relationship ends automatically upon the completion of training, so that any extension must be negotiated in a new contract.

[5] Among those 14 percent, it is mostly firms with net training costs that offer performance pay. These net cost firms have a stronger incentive to retain graduates in order to recoup training costs. In line with our hypothesis, (Wolter and Strupler Leiser, 2012) argue that these net cost firms use performance pay as a selection mechanism so that apprentices reveal information about their individual ability during their training.

4. Data

The Swiss Earnings Structure Survey

For our empirical analysis, we use the Swiss Earnings Structure Survey (SESS), an employer-employee survey that is conducted every two years by the Swiss Federal Statistical Office (SFSO). The SFSO ensures representativeness of the sample by randomly drawing firms from the Swiss central register of firms within groups based on size, geographical location, and industry.[6] Participation in the survey is compulsory ensuring a very high response rate. Firms with fewer than 20 employees must report on their entire workforce, firms with fewer than 50 employees on at least half of their workforce, and firms with more than 50 employees, on at least one third of their workforce. Firms not reporting their entire workforce randomly select the employees for whom they provide data. [7]

The SESS is particularly suitable for our analysis for three reasons. First, the SESS is the only Swiss dataset that contains separate information about the base and bonus pay of each individual employee, enabling us to investigate the effect of both the incidence and the magnitude of performance pay.[8] Second, the SESS is an establishment survey, i.e., personnel officers fill out the questionnaire (most firms file electronically). Since the data come from establishment records they are not subject to recall error and clustering at round figures typically observed in earnings data (Zweimüller, 1992). Third, the sampling has two levels, firms and individual workers. We have firm-level information such as firm size, industry[9], and location, as well as detailed information about individual worker characteristics.

Due to the sampling technique, we cannot follow individual workers over several observation periods. However, we can observe the same firms over different periods. We thus decide to aggregate the individual employee data to the firm level and generate a firm panel that allows us to control for time-specific and firm-specific effects. To conduct the panel study on the firm level, we use the waves from 1998 through 2004. Even though later waves of the SESS are available, we can only use the data until 2004. Unfortunately, from 2006 onwards the firm identifier has changed so that we cannot match firms over time anymore.

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[6] The survey is conducted on establishment level.

[7] The survey guidelines instruct firms that choose to report data on part of their employees to sort them by family name or social security number and to report data on every second or every third employee in the sorted list.

[8] The SFSO combines information on earnings and working time to compute a standardized monthly wage corresponding to the earnings of an employee working 4.3 workweeks per month at 40 hours per week (Graf, 2006). Since the SESS reports the four components included in the standardized monthly wage separately, simple computations allow decomposing it into a standardized base pay and a standardized bonus (performance pay) component.

[9] The sectors are defined according to NOGA 2002, the official general classification of economic activities used in Switzerland.

Variable Construction

1. Apprenticeship Graduates

Firms in the SESS provide information on their worker's education, age and tenure. We use these variables to identify workers who have recently graduates at the firm that they are currently working for. The SESS records tenure in a firm starting from the very first day of the training program and we know from official statistics that apprentices typically start their training at age 17.[10] We also know that training curricula last for three to four years so that graduates are on average 20 or 21 years old.

Combining these pieces of information, we can identify internal apprenticeship graduates. For example, 20-year old employees with an apprenticeship degree and with three years of tenure are highly likely to have received their training with the current employer. We can confidently infer that these employees have not switched firms since their graduation. We construct the dummy *internal graduate*, which denotes whether employees have received training from their current employers. We apply the following equation for each person *i* with an apprenticeship degree:

$$age_i - tenure_i \leq 17 \; s.t. \; age \leq 21$$

We thus develop a very conservative measure and capture the lower bound of internal graduates.[11] For the sake of inference we decide to use this lower bound.[12]

Next we aggregate the dummy *internal graduate* to the firm level. Obviously, the larger the firm is, the higher is the number of apprentices and graduates. To account for firm size effects, we divide the number of graduates within a firm by the number of workers with an apprenticeship degree ("VET workers") in that firm. We cannot relate the number of graduates who stay to the overall number of former apprentices within a firm, because the SESS contains only information on core workers but not on apprentices. Therefore, we use the number of VET workers, which should be a good indicator for the number of apprentices i.e., graduates within a firm.

[10] The SFSO has provided us with data on the starting age of apprentices. In 2012, around nine percent of first-year apprentices were 15 years old, 38 percent were 16 years old, 23 percent were 17 years old, and 30 percent were above 18 years old.

[11] We cannot enlarge our inequality to 18 or more because otherwise we might erroneously categorize those individuals as internal graduates who finished their apprenticeship at 18 years of age and then switched firms.

[12] In the empirical analysis, we run a series of robustness checks where we modify the above equation and use different bounds. These modifications do not change our results.

2. Performance Pay

The SESS has the unique feature that it provides separate information on the base and bonus (performance pay) components of earnings of each employee.[13] This characteristic enables us to investigate the effect of both the incidence and the magnitude of performance pay. Since we are interested in firm level outcomes, we aggregate the individual information to the firm level. To measure the magnitude, we sum the individual performance pay amounts that VET workers receive in a firm. To generate a performance pay rate, we relate this aggregated amount of performance pay to the aggregated monthly wage of VET workers. We call this measure "performance pay intensity" because it shows the percentage of the overall payment that is performance pay based.

Next, we construct a dummy variable indicating whether a worker has received bonus payments. Again, as we are interested in firm level outcomes, we add up the dummy variable to see how many VET workers receive performance pay within a firm. We divide this per-firm number by the total number of VET workers in a firm to construct a rate measuring the share of employees receiving performance pay. We call this measure "performance pay coverage" because it reflects the percentage of employees covered by a performance pay contract. Figure 1 gives a short overview of the variable construction.

{Figure 1 here}

3. Controls

In addition to the above earnings data, the survey contains a rich set of worker-level control variables: age, tenure, occupational tasks, occupational status, workload (hours worked as a percentage of full-time), gender, citizenship and immigration status, and highest educational degree. For each firm and year we aggregate the following control variables: monthly gross wage, age and age squared (in years), tenure and tenure squared (in years), occupational tasks (categorical), job requirements (categorical), gender (dummy), and nationality (dummy). Importantly, we do not exclude workers by educational degree when aggregating our control variables. We also control for firm size, industry, geographical location, and year (all dummies).

[13] The SESS breaks earnings down into the following parts: gross earnings, social security contributions, extra payments (including payments made for shift work, night work, weekend work, and overtime), and bonus payments, the amount of performance pay.

C. Sample and Descriptive Statistics

We restrict our sample as follows: We exclude firms in the public sector, because they usually do not behave in a profit-maximizing way, which can have consequences for their training and retention decision (Mühlemann et al., 2007) In addition, we exclude some firms that appear to be switching industries due to inconsistencies in the data. We also drop firms in the agricultural sector because the observations in our sample are not representative. In line with previous literature, we exclude firms with fewer than five employees, because their expansion potential through hiring new graduates is very limited (Mühlemann et al., 2007). We also exclude the relatively small fraction of part-time workers. Finally, since we want to explore the effect of performance pay on the retention of graduates, we compare training firms offering performance pay with training firms offering a fixed salary. In line with Mohrenweiser and Backes-Gellner (2010), we define a training firm following an investment strategy as a firm that has retained at least one graduate during the observation period.

Table 1 provides summary statistics for the aggregated variables, i.e., all variables are firm-level averages. The dependent variable, the rate of internal apprenticeship graduates is 0.4 percent, a clear indication that our measure is a lower bound of the real rate. The rate varies between 0 and 0.5 and has a standard deviation of 0.021. Regarding our main explanatory variables, about 10 percent of monthly average wages (about 580 CHF) are performance pay earnings. Performance pay varies greatly within and between firms with a minimum of 0 and a maximum of 89 percent. On average, 12 percent of VET workers receive performance pay. The average worker is 41 years old, has 10 years of tenure and earns a monthly gross wage of 6100 CHF. Sixty percent of the workforce is Swiss and 75 percent is male. The very high percentage of male workers is due to the exclusion of all part-time workers.

Occupational tasks describe 24 different kinds of tasks that the worker has to do on the job. Examples are administrative tasks, accounting, or logistics. The output of some of these tasks is more easily measured than others. Job requirements has four categories and describes how demanding the job is, decreasing in numbers. Category 4 comprises repetitive tasks, category 3 comprises tasks where some expert knowledge is needed, category 2 comprises autonomous tasks, and category 1 describes tasks with the highest level of expert knowledge. Finally, occupational position has five categories with 1 describing the highest management position and 5 describing a position without any management function.

{Table 1 here}

5. Empirical Strategy

Our model predicts that performance pay has a positive impact on a firm's ability to retain its more productive graduates. The function that has to be estimated can be specified as follows:

$$y_{jt} = \alpha_{jt} + \beta_{jt} * PP_{jt} + x'_{jt} * \gamma_{jt} + \varepsilon_{jt}$$

where *t* is a time indicator and *j* is a firm indicator, y_{jt} is the share of internal apprenticeship graduates, PP_{jt} is the main explanatory variable, performance pay intensity in model I and performance pay coverage in model II. x'_{jt} is a vector of control variables and ε_{it} is the error term, which is assumed to be mean zero and normally distributed. We call this function the graduates equation. All models include wages, age and tenure and their squared terms, occupational task measures, gender dummies, nationality dummies, firm size, and industry, location and year dummies.

To begin an investigation of the effect of performance pay on the retention success, we run pooled OLS regressions. Because we consider observations of the same firm in different years as independent and we do not take unobserved firm heterogeneity into account, this regression is potentially biased. Most firms have unobserved characteristics that influence both a firm's payment strategy and the rate of internal apprenticeship graduates. One example is a firm's productivity level, because a higher productivity leads to higher performance pay rates, and at the same time to higher training endeavors. To overcome time invariant unobserved heterogeneity we can take advantage of the panel structure of our data and estimate firm fixed effects regressions.

However, a convincing analysis of the causal link between performance pay and retention requires an exogenous source of variation in performance payments. It is conceivable that exogenous demand shocks might influence both a firm's payment and retention strategy. Positive demand shocks induce an upward bias if they cause firms to increase their recruitment and retention of apprentices to cope with increased skilled labor needs. The fixed effects results might thus still be biased either positively or negatively due to the potential endogeneity of our performance pay variables. A consistent estimate of the true effect can be obtained if there is a component of the vector X_i that affects performance pay but not directly the retention. We need to identify a causal determinant of performance pay that can be legitimately excluded from our graduates equations.

The occupational position might be such a variable. In our dataset, occupational position is a categorical variable with five categories. Workers belong to either one of the

following categories: (1) upper management, (2) middle management, (3) lower management, (4) lowest management, and (5) no management function. Simple correlational analysis reveal that the higher the occupational position, the more likely persons receive performance pay. The occupational position should thus affect the amount and incidence of performance pay. However, the occupational position should be uncorrelated with the retention of internal graduates, especially given that these young graduates are mostly in category (5) as they are at the beginning of their career. We thus assume that the occupational position can be omitted from equation (1), since the direct role of occupations is adequately captured by the regressors "occupational tasks" and "job requirements." To implement the IV approach, we estimate the following 2SLS:

$$PP_{jt} = \alpha_{jt} + \beta_{jt} * OP_{jt} + x'_{jt} * \gamma_{jt} + \varepsilon_{jt} \text{ (first stage)}$$
$$y_{jt} = \alpha_{jt} + \beta_{jt} * predicted\ PP_{jt} + x'_{jt} * \gamma_{jt} + \varepsilon_{jt} \text{ (second stage)}$$

6. Results

Table 2A and Table 2B report the results of the pooled OLS with clustered standard errors. The results show that performance pay intensity (PP-intensity) and performance pay coverage (PP-coverage) show a positive and statistically significant value. To interpret the effect size, we need to keep in mind that both our dependent variable and our main explanatory variables are rates. A one percentage point increase in PP-intensity increases the *rate* of internal apprenticeship graduates by 1.4 percent. A one percentage point increase in PP-coverage increases the rate of internal apprenticeship graduates by 1.1 percent. The control variables comprise individual and firm characteristics aggregated at the firm. Size and direction of the coefficients are similar in both models. Average wages have a small, but significantly positive effect on the rate of internal apprenticeship graduates. We include the wage as a control variable to ensure that our PP-variables are not simply capturing wage effects, i.e., it is not only the higher wage that induces graduates to stay.

{Tables 2A and 2B here}

As discussed earlier, pooled OLS regressions are potentially biased. Exploiting the panel structure of our data by estimating fixed effects helps us overcome this bias and improve our estimation results. Tables 3A and 3B report the results of the firm fixed-effects

regressions with cluster-robust standard errors. Overall, we can confirm the results obtained with the pooled OLS regressions. Again, we find that both performance pay measures are significantly positively correlated with the share of internal apprenticeship graduates. The effect size is marginally reduced and the standard errors are marginally increased. A one percentage point increase in PP-intensity increases the rate of internal apprenticeship graduates by 1 percent while a one percentage point increase in PP-coverage increases the rate internal apprenticeship graduates by almost one percent (0.87 percent). Again, average wages have a rather small, but statistically significant positive effect on the internal apprenticeship graduates.

{Tables 3A and 3B here}

Despite their stability across specifications, the estimated performance pay coefficients in Tables 2 and 3 may give a biased estimate of the true economic effect. We thus recur to using instrumental variable technique to come closer to estimating a true causal effect. Tables 4A and 4B present the results from our IV regressions, using the occupational position as an instrument. To check for the validity of the instrument, we first run the reduced form regression. The reduced form coefficients confirm that the occupational position (OP) is highly significant and positively correlated with the dependent variable. The coefficient is rather small, however, it is similar in size to the coefficients of the control variables. Recall that our dependent variable measures the low bound of internal graduates, therefore, the effect sizes we capture are downward biased by construction.

In our 2SLS regression, the first stage regression has high explanatory power and the coefficient OP is positive, as expected, and highly statistically significant. Because we have one instrument for one endogenous variable, we cannot test for instrument validity. However, the first stage tests for instrument relevance. The value of the F-statistic of the first stage is well above 10 in both models so that we can confidently assume that the problem of weak instruments does not occur (Staiger and Stock, 1997). Stock and Yogo (2005) proposed an additional test of weak instruments for the just-identified case. If we are willing to tolerate distortion for a 5% Wald test based on the 2SLS estimator so that the true size can be at most 10%, then we reject the null hypothesis if the test statistic exceeds 16.38. The F statistic greatly exceeds this value so that we feel comfortable in rejecting the null of weak instruments.

Finally, the second stage results with robust standard errors show a statistically significant positive effect of performance pay on the retention of apprenticeship graduates. The use of occupational position as an exogenous determinant of performance pay yields IV estimates of the performance pay effect of 13 percent for the PP-intensity and 5 percent for the PP-coverage. The 2SLS estimates differ substantially from the corresponding OLS estimates. This is strong evidence that the performance pay variables are endogenous. The effect of intensity is more than two times larger that the effect of coverage. This does make sense intuitively given that the decision-making should be driven more by the amount of extra money an individual receives than the likelihood that a person receives an extra amount of money. The standard errors of the IV estimates are obviously larger than the OLS estimates, but are not inflated to a worrisome size.

{Tables 4A and 4B here}

As we are able to take into account both unobserved heterogeneity and endogeneity, the panel IV regression is our preferred estimation specification. Overall, the results support our hypothesis. We are able to consistently show a causal relationship between performance pay and the internal rate of apprenticeship graduates, thus that a performance pay effect exists that influences a firm's ability to retain graduates. Both performance pay measures have a significant impact on the retention rate.

7. Conclusion

This paper examines the effect of performance pay on the retention of apprenticeship graduates. Being able to retain apprenticeship graduates is crucial for a firm's willingness to participate in an apprenticeship training system where firms are expected to incur substantial training costs. Previous studies have explained a firm's training incentive with the existence of imperfect labor markets, identifying different market frictions and institutions that induce a training investment. Yet, we explore a potential non-market solution in this retention game. Applying findings from personnel economics to the theory of training, we argue that training firms use performance pay plans to incentivize their most productive graduates to stay. Drawing on a theoretical model introduced by Acemoglu and Pischke (1998) and enriching it with the setup in Lazear (1986), we develop a simple contracting framework to provide a rationale for this firm behavior.

In our empirical analysis, we use data from a representative employer-employee survey that contains register data on the base pay and performance pay of individual workers. We develop two different performance pay measures, one reflecting the performance pay intensity and the other the coverage, reflecting the share of workers receiving performance pay. To establish a credible causal link between our PP-measures and a firm's ability to retain graduates we use IV regression. We instrument the PP-measures with a variable measuring the occupational position of single employees, arguing that the position should be correlated with performance pay but should not have any effect on the retention of graduates. Our analysis shows that training firms with PP-plans have a higher retention of apprenticeship graduates than training firms with salary pay.

Our study should be of highest interest for policy makers who are considering the introduction of apprenticeship training as a possible solution to the high youth unemployment. As retaining the more productive graduates helps covering a firm's training costs, an increased retention rate should in turn lead to a higher likelihood of participating in apprenticeship training. In this respect, we contribute to the theory of training investments by providing an additional answer to the question of why firms provide and pay for training even if that training is general and easily marketable. From a policy point of view, apprenticeship training is thus likely to prove most efficient if firms pay performance.

References

Abowd, J.M., Kramarz, F., Margolis, D.N., 1999. High Wage Workers and High Wage Firms. Econometrica 67, 251–333.

Acemoglu, D., Pischke, J.-S., 1998. Why Do Firms Train? Theory and Evidence. The Quarterly Journal of Economics 113, 79–119.

Acemoglu, D., Pischke, J.-S., 1999a. Beyond Becker: Training in Imperfect Labour Markets. The Economic Journal 109, F112–F142.

Acemoglu, D., Pischke, J.-S., 1999b. The Structure of Wages and Investment in General Training. Journal of Political Economy 107, 539.

Autor, D.H., 2001. Why Do Temporary Help Firms Provide Free General Skills Training? The Quarterly Journal of Economics 116, 1409–1448.

Backes-Gellner, U., Tuor, S.N., 2010. AVOIDING LABOR SHORTAGES BY EMPLOYER SIGNALING: ON THE IMPORTANCE OF GOOD WORK CLIMATE AND LABOR RELATIONS. Industrial and Labor Relations Review 63, 271–286.

Bell, D.N.F., Blanchflower, D.G., 2010. Youth unemployment in Europe and the United States. Nordic Economic Policy Review 1, 11–37.

Booth, A.L., Bryan, M.L., 2007. WHO PAYS FOR GENERAL TRAINING IN PRIVATE SECTOR BRITAIN?, in: Aspects of Worker Well-Being, Research in Labor Economics. Emerald (MCB UP), Bingley, pp. 85–123.

Cappelli, P., 2004. Why do employers pay for college? Journal of Econometrics 121, 213–241.

Dohmen, T., Falk, A., 2011. Performance Pay and Multidimensional Sorting: Productivity, Preferences, and Gender. American Economic Review 101, 556–590.

Dustmann, C., Schönberg, U., 2007. Apprenticeship Training and Commitment to Training Provision.

Leading House Working Paper No. 32.
Dustmann, C., Schönberg, U., 2009. TRAINING AND UNION WAGES. The Review of Economics and statistics 91, 363–376.
Franz, W., Soskice, D.W., 1994. The German apprenticeship system. Disucssion Paper, Center for International Labor Economics (CILE), University of Konstanz No.11.
Gielen, A.C., Kerkhofs, M.J.M., van Ours, J.C., 2009. How performance related pay affects productivity and employment. Journal of Population Economics 23, 291–301.
Graf, M., 2006. Swiss Earnings Structure Survey 2002–2004. Swiss Federal Statistical Office, Neuchatel.
Harhoff, D., Kane, T.J., 1997. Is the German apprenticeship system a panacea for the U.S. labor market? Journal of Population Economics 171–196.
Jansen, A., Strupler Leiser, M., Wenzelmann, F., Wolter, S.C., 2012. The effect of labor market regulations on training behavior and quality: the German labor market reform as a natural experiment. Leading House Working Paper No. 83 1–24.
Katz, E., Ziderman, A., 1999. Investment in General Trainig: The Role of Information and Labour Mobility. The Economic Journal 403, 1147–1158.
Lazear, E.P., 1986. Salaries and Piece Rates. The Journal of Business 59, 405–431. doi:10.1086/296345
Lazear, E.P., 2000. Performance Pay and Productivity. American Economic Review 90, 1346–1361.
Lazear, E.P., 2004. Output-based pay: incentives, retention or sorting?, in: Research in Labor Economics, Research in Labor Economics. Emerald (MCB UP), Bingley, pp. 1–25. doi:10.1016/S0147-9121(04)23001-1
Mohrenweiser, J., 2013. Recruitment and Apprenticeship Training. Leading House Working Paper No. 73 1–22.
Mohrenweiser, J., Backes-Gellner, U., 2010. Apprenticeship Training: for investment or substitution? International Journal of Manpower 31, 545–562.
Mühlemann, S., Schweri, J., Winkelmann, R., Wolter, S.C., 2007. An Empirical Analysis of the Decision to Train Apprentices. LABOUR 21, 419–441.
Oswald, Y., Backes-Gellner, U., 2014. Learning for a bonus: How financial incentives interact with preferences. Journal of Public Economics 118, 52–61.
Sadowski, D., 1980. Berufliche Bildung und betriebliches Bildungsbudget: Zur ökonomischen Theorie der Personalbeschaffungs- und Bildungsplanung im Unternehmen. Poeschel.
Scarpetta, S., Sonnet, A., Manfredi, T., 2010. Rising Youth Unemployment During The Crisis.
Schweri, J., Mühlemann, S., Pescio, Y., Walther, B., Wolter, S.C., Zürcher, L., 2003. Kosten und Nutzen der Lehrlingsausbildung aus der Sicht der ausbildenden schweizerischen Betriebe. Rüegger, Chur.
Staiger, D., Stock, J.H., 1997. Instrumental Variables Regression with Weak Instruments. Econometrica 65, 557–586.
Stevens, M., 1994. A Theoretical Model of On-the-Job Training with Imperfect Competition. Oxford Economic Papers 46, 537–562.
Stock, J., Yogo, M., 2005. Testing for Weak Instruments in Linear IV Regression, in: Andrews, D.W.K. (Ed.), Identification and Inference for Econometric Models. Cambridge University Press, New York, pp. 80–108.
Tuor, S.N., Backes-Gellner, U., 2010. Risk-return trade-offs to different educational paths: vocational, academic and mixed. International Journal of Manpower 31, 495–519.
Wolter, S.C., Cattaneo, M.A., Denzler, S., Diem, A., Grossenbacher, S., Hof, S., 2014. Swiss Education Report 2014. SKBF|CSRE Swiss Coordination Centre for Research in Education, Aarau.
Wolter, S.C., Strupler Leiser, M., 2012. Die duale Lehre: eine Erfolgsgeschichte - auch für die Betriebe: Ergebnisse aus der dritten Kosten-Nutzen-Erhebung der Lehrlingsausbildung aus Sicht der Betriebe. Rüegger, Chur.
Zweimüller, J., 1992. Survey non-response and biases in wage regressions. Economics Letters 105–109.

TABLES

Figure 1: Performance Pay Measures

Performance Pay Intensity in Firm j
$\frac{\sum_{i=1}^{N} Monthly\ performance\ pay\ of\ VET\ worker\ i}{\sum_{i=1}^{N} Monthly\ gross\ wage\ \ of\ VET\ worker\ i}$
Performance Pay Coverage in Firm j
$\frac{\sum_{i=1}^{N} VET\ worker\ i\ receiving\ performance\ pay}{\sum_{i=1}^{N} VET\ worker\ i}$

Table 1: Descriptive statistics

	Obs.	Mean	St. Dev.	Min	Max
Internal apprenticeship graduates	16,641	0.004	0.021	0	1
PP-intensity	16,641	0.095	0.159	0	0.89
PP-coverage	16,641	0.123	0.223	0	1
Wage	16,641	6,132	2,536	2,689	16,346
Occupational tasks	16,641	20.835	9.296	10	40
Occupational position	16,641	3.862	1.520	0	5
Job requirements	16,641	2.765	1.039	0	4
Tenure	16,641	10.212	9.487	0	48
Age	16,641	41.091	11.026	16	65
Male	16,641	0.754	0.430	0	1
Swiss	16,641	0.605	0.489	0	1
Firmsize	16,641	181.227	692.604	5	32,000
Industry	16,641	7.079	3.282	3	15.00
Region	16,641	3.625	1.856	1	7
Year	16,641	2002	2	1998	2004

Table 2A: Pooled OLS with clustered standard errors (clustered on firms)

VARIABLES	Internal apprenticeship graduates
PP-intensity	0.0135***
	(0.00199)
Wage	2.31e-06***
	(1.61e-07)
Age	-0.00140***
	(0.000175)
Age squared	1.50e-05***
	(1.94e-06)
Tenure	0.000234***
	(4.74e-05)
Tenure squared	-7.14e-06***
	(1.27e-06)
Male	-0.000896**
	(0.000401)
Swiss	-3.93e-05
	(0.000306)
Occupational tasks	2.04e-05
	(1.56e-05)
Job requirements	-4.75e-05
	(0.000124)
Constant	0.0308***
	(0.00394)
Firm size	Yes
Industry	Yes
Region	Yes
Year	Yes
Observations	16,641
R-squared	0.154

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2B: Pooled OLS with clustered standard errors (clustered on firms)

VARIABLES	Internal apprenticeship graduates
PP-coverage	0.0110***
	(0.00138)
Wage	2.30e-06***
	(1.50e-07)
Age	-0.00138***
	(0.000173)
Age squared	1.47e-05***
	(1.93e-06)
Tenure	0.000235***
	(4.73e-05)
Tenure squared	-7.11e-06***
	(1.26e-06)
Male	-0.000890**
	(0.000399)
Swiss	-0.000129
	(0.000305)
Occupational tasks	2.15e-05
	(1.56e-05)
Job requirements	-9.25e-05
	(0.000123)
Constant	0.0304***
	(0.00392)
Firm size	Yes
Industry	Yes
Region	Yes
Year	Yes
Observations	16,641
R-squared	0.157

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3A: Firm-fixed effects with robust standard errors

VARIABLES	Internal apprenticeship graduates
PP-intensity	0.0101***
	(0.00294)
Wage	2.36e-06***
	(1.77e-07)
Age	-0.00106***
	(0.000183)
Age squared	1.16e-05***
	(2.07e-06)
Tenure	0.000152***
	(5.79e-05)
Tenure squared	-5.50e-06***
	(1.58e-06)
Male	-2.22e-05
	(0.000525)
Swiss	6.35e-05
	(0.000385)
Occupational tasks	-8.42e-06
	(2.84e-05)
Job requirements	0.000415**
	(0.000206)
Constant	0.0226***
	(0.00476)
Firm size	Yes
Industry	Yes
Region	Yes
Year	Yes
Observations	16,641
Number of firms	6,868
R-squared	0.098

Table 3B: Firm-fixed effects with robust standard errors

VARIABLES	Internal apprenticeship graduates
PP-coverage	0.00873***
	(0.00209)
Wage	2.35e-06***
	(1.66e-07)
Age	-0.00104***
	(0.000182)
Age squared	1.14e-05***
	(2.06e-06)
Tenure	0.000156***
	(5.79e-05)
Tenure squared	-5.48e-06***
	(1.58e-06)
Male	-1.58e-05
	(0.000525)
Swiss	3.20e-05
	(0.000385)
Occupational tasks	-7.67e-06
	(2.84e-05)
Job requirements	0.000387*
	(0.000206)
Constant	0.00873***
	(0.00209)
Firm size	Yes
Industry	Yes
Region	Yes
Year	Yes
Observations	16,641
Number of firms	6,868
R-squared	0.100

Table 4A: IV-regression with robust standard errors, Instrument: occupational position

VARIABLES	Reduced form, Dep. Var. *intern*	First stage Dep. Var. *ppcov*	Second stage Dep. Var. *intern*
PP-intensity			0.130***
			(0.0500)
Wage	2.61e-06***	.000027***	-8.53e-07
	(1.58e-07)	(7.64e-07)	(1.35e-06)
Age	-0.00104***	-.0016456*	-0.000826***
	(0.000180)	(.0006718)	(0.000189)
Age squared	1.14e-05***	.0000156*	9.39e-06***
	(2.03e-06)	(7.98e-06)	(2.12e-06)
Tenure	0.000162***	.0000302	0.000158**
	(5.82e-05)	(.0003384)	(7.05e-05)
Tenure squared	-5.72e-06***	-5.26e-06	-5.03e-06***
	(1.59e-06)	(9.59e-06)	(1.95e-06)
Male	3.12e-05	-.0040041	0.000553
	(0.000526)	(.0026044)	(0.000623)
Swiss	0.000207	.0021341	-7.10e-05
	(0.000388)	(.0023825)	(0.000482)
Occupational tasks	-6.92e-06	.0002233	-3.60e-05
	(2.84e-05)	(.00016)	(3.62e-05)
Job requirements	-0.000161	-.000253	-0.000128
	(0.000280)	(.0015794)	(0.000325)
Occupational position	0.000626***	.004804***	
	(0.000204)	(.0011213)	
Firm size category	Yes	Yes	Yes
Industry	Yes	Yes	Yes
Region	Yes	Yes	Yes
Year	Yes	Yes	Yes
Observations	16,641	16,641	16,641
Number of firms	6,868	6,868	6,868
F-Statistic first stage	18.35	18.35	18.35
Stock-Yogo critical value	16.38	16.38	16.38

Table 4B: IV-regression with robust standard errors, Instrument: occupational position

VARIABLES	Reduced form, Dep. Var. *intern*	First stage Dep. Var. *ppcov*	Second stage Dep. Var. *intern*
PP-coverage			0.0492***
			(0.0163)
Wage	2.61e-06***	.0000317***	1.04e-06*
	(1.58e-07)	(1.11e-06)	(5.47e-07)
Age	-0.00104***	-.0032466***	-0.000880***
	(0.000180)	(.0009705)	(0.000169)
Age squared	1.14e-05***	.0000352**	9.69e-06***
	(2.03e-06)	(.0000116)	(1.91e-06)
Tenure	0.000162***	-.0001994	0.000172***
	(5.82e-05)	(.0004968)	(6.12e-05)
Tenure squared	-5.72e-06***	-.0000101	-5.22e-06***
	(1.59e-06)	(.000014)	(1.66e-06)
Male	3.12e-05	-.0041918	0.000238
	(0.000526)	(.0038774)	(0.000531)
Swiss	0.000207	.0075829*	-0.000166
	(0.000388)	(.0034888)	(0.000414)
Occupational tasks	-6.92e-06	.0001619	-1.49e-05
	(2.84e-05)	(.0002306)	(2.92e-05)
Job requirements	-0.000161	-.0042085*	4.63e-05
	(0.000280)	(.0022564)	(0.000245)
Occupational position	0.000626***	.0127093***	
	(0.000204)	(.0015798)	
Firm size category	Yes	Yes	Yes
Industry	Yes	Yes	Yes
Region	Yes	Yes	Yes
Year	Yes	Yes	Yes
Observations	16,641	16,641	16,641
Number of firms	6,868	6,868	6,868
F-Statistic first stage	64.72	64.72	64.72
Stock-Yogo critical value	16.38	16.38	16.38

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1