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Firms' method of pay and the retention of apprentices

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Firms' method of pay and the retention of apprentices

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Abstract

The new training literature views regulated labour markets as critical for firms' willingness to participate in apprenticeship training. These regulations allow training firms to retain their apprenticeship graduates at the end of the training period and recoup training costs. Yet, in spite of an only loosely regulated labour market, many Swiss firms offer and pay for training. Using representative data from a large employer-employee survey, we investigate whether these firms use performance-related pay to retain their graduates. We find that both the magnitude and the likelihood of performance-related pay are significantly related to a firm's retention success.

JEL codes: J24; J33; M52; M53

1. Introduction

In the standard human capital model (Becker, 1962) firms do not invest in general training, because the associated returns accrue fully to the worker. However, a particular feature of the dual apprenticeship system is that training firms offer and pay for the general training of their apprentices. The latest cost-benefit analyses show that about 70% of German training firms and more than 40% of Swiss training firms incur net costs of training (Wolter and Strupler Leiser, 2012; Jansen *et al.*, 2015a).

The new training literature explains a firm's incentive to offer general training through the existence of labour market imperfections (Stevens, 1994; Acemoglu and Pischke, 1998). The main assumption is that labour market frictions and institutions provide firms with a certain market power that prevents the successful apprenticeship graduates from switching employers without losing income. Studies have identified different sources of labour market frictions, such as residential inertia, and different types of labour market institutions, such as works councils, and tested their impact on firms' willingness to offer and finance training (e.g. Katz and Ziderman, 1990; Stevens, 1994; Harhoff and Kane, 1997; Acemoglu and Pischke, 1998, 1999a, b; Booth and Bryan, 2007; Dustmann and Schönberg, 2007, 2009).

Little discussion exists about whether factors other than frictions and institutions may enable training firms to retain the successful completers of apprenticeship (hence, 'graduates'). We fill this gap by exploring a potential solution that firms can create internally. Drawing on findings from personnel economics, we hypothesize that firms use performance-related pay (PRP) to induce their graduates to stay. Specifically, we draw on the sorting effect of PRP (i.e. PRP helps to attract and retain more productive workers) and are less concerned with the incentive effect (i.e. PRP motivates workers to exert more effort).[1]

We argue that the more productive graduates have two main reasons to stay with their training firm if that firm offers PRP. First, they expect a higher compensation because, with parts of their pay having a performance pay component, their individual productivity is more likely to be directly rewarded. Second, they expect to gain from further positive effects from

[1] Most of the PRP literature focuses on the importance of PRP as an incentive generator. Therefore, some studies caution that PRP can be drastically dysfunctional, if output cannot be easily monitored and measured. But the literature often overlooks that PRP also performs a sorting role, whereby more productive workers self-select into PRP firms. In our study, we focus on this latter role of PRP.

training which do not exist in non-training firms. Specifically, a number of studies show that training firms are on average more productive than non-training firms (Autor, 2001; Cappelli, 2004; Backes-Gellner and Tuor, 2010). More productive firms not only have higher revenue and profit, but also pay higher wages (Van Reenen, 1996; Abowd *et al.*, 1999; Frías *et al.*, 2009). Graduates should thus always prefer working at a training firm to working at a non-training firm. The more productive graduates should reach their highest productivity level with PRP training firms, implying that expected earnings are also highest with those firms. In turn, training firms with PRP should be more successful in retaining graduates than training firms without it.

Switzerland provides the most suitable setting to test our hypothesis. It has a large institutionalized dual apprenticeship system, where training is mostly in general skills (Schweri *et al.,* 2003). Furthermore, compared to other countries with a strong apprenticeship tradition like Germany, the Swiss labour market is loosely regulated (Mühlemann *et al.*, 2010; Ryan *et al.*, 2013). Therefore, Swiss firms may be less able to rely on market frictions and instead need to find other ways of retaining their graduates.

Empirically, we focus on firms that are most likely to be offering training as a source of future skill supplies rather than current cheap labour.[2] Further, we assume that the PRP firms we investigate have largely solved the challenges of adequately measuring and monitoring performance (Holmström, 1979; Grossman and Hart, 1983; Hart and Holmström, 1987). Therefore, they should be able to avoid or at least minimize the well-known dysfunctions of PRP schemes such as the multi-tasking incentive problem (Holmström and Milgrom, 1990; Baker, 1992), and the crowding out of intrinsic motivation (Whyte, 1956; Slater, 1980; Frey, 1994; Frey and Jegen, 2001). These dysfunctions of PRP should be less of a concern in our study, also because the workers we are investigating are not on piece-rate schemes. Not all of their pay, but merely about 1% of it, is variable.

For the analysis, we use data from the Swiss Earnings Structure Survey (ESS), a representative employer-employee survey. The main advantage of this data set is that it contains

[2] Training firms follow either a substitution or an investment strategy. Substitution firms use apprentices as cheap substitutes for unskilled or semi-skilled workers and have no incentive in retaining them. Investment firms invest in their apprentices and want to retain at least some of them (Mohrenweiser and Backes-Gellner, 2010). We are interested in comparing training firms with an investment motive that differ in their method of pay.

separate information about workers' base and bonus payments. We develop two PRP measures, one reflecting the intensity, i.e. the amount of PRP in relation to total pay, and the other reflecting the coverage, i.e. the share of workers receiving PRP. Although the ESS is designed as a cross-section, we are able to identify most firms in subsequent points in time and construct a firm panel for the years 1998 through 2004. We run firm fixed effects regressions with a wide range of control variables to investigate the relationship between PRP and the retention of internal graduates. We further test the sensitivity of our results in a series of robustness checks. We find a statistically significant and positive association between PRP schemes and the retention of internal graduates.

This paper contributes to the new training literature by providing an additional answer to the question of why firms provide and pay for investment in general training. We argue and provide evidence that labour market frictions and institutions might not be the sole condition for the existence of firm-provided general training. In well-regulated labour markets, it might be that works councils guarantee that higher firm productivity is translated into higher worker wages, which could explain the positive association between the existence of works councils and firms' training incentives (Dustmann and Schönberg, 2009; Kriechel *et al.*, 2014). In weakly regulated labour markets, we show that training firms might resort to PRP to incentivize their graduates to stay.

2. Theoretical background

2.1 Related literature

The standard theory of training draws a crucial distinction between general and specific training (Becker, 1962). While general training increases workers' productivity in many firms, specific training increases their productivity only in the firm providing the training. In perfectly competitive labour markets, general training is solely beneficial to the worker, because it directly translates into higher wages. Therefore, Becker (1962) predicts that firms will never pay for general training.

The empirical evidence is difficult to reconcile with this model. In many countries with a dual apprenticeship system, firms provide and pay for training that is largely general (von Bardeleben *et al.*, 1995; Schweri *et al.* 2003; Beicht *et al.*, 2004). The new training literature provides an explanation for this apparent puzzle. The assumption of perfect markets is relaxed

and it is argued that market imperfections provide training firms with a certain market power that prevents their graduates from switching employers without losing income (Stevens, 1994; Acemoglu and Pischke, 1998).

Studies have identified different types of market imperfections: some point out that labour market regulations and institutions increase a firm's ability to retain its graduates (Acemoglu and Pischke, 1999b; Dustmann and Schönberg, 2007, 2009; Jansen *et al.*, 2015b). Others focus on mobility costs and low labour turnover rates caused by residential inertia (Stevens, 1994; Harhoff and Kane, 1997), on information asymmetries (Katz and Ziderman, 1990; Acemoglu and Pischke, 1998), on reputation aspects and social expectations (Harhoff and Kane, 1997), and on complementarities between general and firm-specific training (Franz and Soskice, 2005; Kessler and Lülfesmann, 2006). The crucial assumption common to these studies is that labour market frictions and institutions reduce the mobility of workers and that employers earn rents on their trained workers.

Although they may well affect investments in human capital, the new training literature does generally not discuss the role of payment schemes. Contrarily, personnel economics has traditionally focused on a firm's payment strategy as a means to hire and retain workers. Therefore, drawing on findings from personnel economics to investigate the retention process of graduates should be inherently fruitful.

Personnel economic theory argues that performance-related pay (PRP) has an incentive and a sorting role (Lazear, 1986; Baker *et al.*, 1988; Brown, 1990). First, PRP should provide workers with additional incentives to put forth effort. Second, PRP should induce different types of workers to select into different types of firms. Most of the literature focuses on the importance of PRP as generating incentives. Theory predicts that, ceteris paribus, workers will supply more output if they are paid based on their output. This prediction has been empirically proven in Lazear (2000) and a number of controlled laboratory experiments (e. g. Cadsby *et al.*, 2007; Eriksson and Villeval, 2008; Dohmen and Falk, 2011). However, given that measuring and monitoring individuals' effort and output is straightforward in these studies, the external validity of their results is not guaranteed.

Different strands of social science research caution that PRP does not always work as intended. For example, Holmström and Milgrom (1991) and Baker (1992) introduce the multi-

tasking incentive problem, whereby compensation on any subset of tasks will result in a reallocation of activities towards those that are directly compensated. Furthermore, executive compensation research finds very low sensitivity of CEO pay to firm value (Baker *et al.*, 1988; Jensen and Murphy, 1990; Murphy, 1999). Finally, some economists (Frey, 1994; Frey and Jegen, 2001), sociologists (Whyte, 1955; Slater, 1980), and organizational psychologists (Deci, 1971; Deci *et al.*, 1999) predict a crowding out of intrinsic motivation, which might reduce individual performance. PRP does thus not always provide the right incentives and is not always the right choice for firms, especially so for jobs where output is not easily measured and monitored.

Rather than focusing on the incentive role, we stress the importance of the sorting role of PRP. The sorting role causes more able workers to select and stay with PRP firms, while less able workers leave those firms. In equilibrium, workers have reallocated according to their ability so that productivity and wages in PRP firms are on average higher than in fixed-salary firms (Lazear, 1986, 2000). In this study, we hypothesize that firms can use PRP to induce their internal graduates to stay. We expect to find that PRP firms are more successful in retaining their graduates than firms with fixed salaries.

2.2 The retention mechanism of performance-related pay

To lay out the retention mechanism of performance-related pay (PRP), we reproduce the simple two-period model of Lazear (1986), and modify it to include the set-up in Acemoglu and Pischke (1998). Firms and workers are risk-neutral and form a principal-agent relationship. Firms maximize expected profit and workers maximize expected utility. A firm's profit function is given by total revenues from selling output q_t produced in period t at price p_t minus total costs incurred from paying salaries, w_t, i.e. $\pi(q_t, p_t, w_t) = p_t * q_t - w_t$. A worker's utility function depends on the wage received and the effort invested. It is given by $u_t = w_t - C(e)$, where e is the exerted effort and $C' > 0$ and $C'' > 0$. A worker's maximization problem simply is: $\max_e w_t - C(e)$. Further, let a denote aptitude to perform the job, such that worker output depends on effort and aptitude, $q_t = f(a, e)$.

Firms can choose between two payment schemes. They either pay a salary $w_t = S$, where w_t equals the wage the worker receives in period t and is a fixed amount, or they pay $w_t =$

$f(q_t)$, where q_t is the output the worker produces in period t and the wage is some function of this output.[3] There is no discounting between periods.

Furthermore, we do not make any assumptions about whether the salary w_t is above or below workers' marginal productivity. This is a crucial difference to Acemoglu and Pischke (1998), where firms' monopsony power enables them to pay their graduates a wage below the graduates' marginal productivity. We argue that because the selection effect of PRP also applies to training graduates, more productive graduates will self-select into PRP firms, because they expect a higher compensation. We are agnostic about whether or not this compensation equals the graduates' marginal productivity; the only important point is that their pay will be higher with PRP firms than with fixed-salary firms. We thus focus less on the firm's decision and more on the graduate's decision.

The hiring and retaining of graduates happens in two stages. In the first stage, in period one, firms hire apprentices and start training them. We assume that in this first stage the matching of apprentices to training firms is independent of the firm's payment scheme. This assumption is sensible for a number of reasons. First, these apprentices are teenagers who have just finished compulsory schooling. Prospective apprentices apply for apprenticeship positions about one year in advance, during their last school year. Because they are only around 16 years old when they apply for a position, it is unlikely that these prospective apprentices select their training firm based on the compensation type.

Second, most apprentices live with their parents so that their mobility and thus their search radius are very low. Indeed, previous research shows that the proximity to home is a critical factor for apprentices' firm choice (Ebner *et al.*, 2006; Neuenschwander *et al.*, 2007). Similarly, recent data on commuting behaviour show that persons aged between 15 and 24 commute on average about 13 kilometres between their home and their workplace (Bundesamt für Statistik, 2016).

Thus, we argue that whether firms offer PRP or not does not influence apprentices' firm choice. This result is empirically proven by Oswald and Backes-Gellner (2014), who investigate the effect of financial incentives on student performance using data on Swiss apprentices. They

[3] In practice, most jobs fit somewhere in between these two extremes; many employees receive a large proportion of their compensation as a fixed amount and some bonus payment depending on their output. This does not harm the validity of the model.

show that apprentices' training firm choice is not determined by whether the firm pays a bonus to their apprentices for good school grades.

Although training firms certainly apply a selection process to identify the best matching applicants, it is not clear how accurate applicants' signals are, i.e. how well school grades predict a person's ability to perform a certain type of job. Indeed, many studies have shown that school achievements are a noisy and biased measure of effective abilities of pupils (Baron-Boldt, 1989; Kronig, 2007; Bauer and Sheldon, 2008; De Paola and Scoppa, 2010). Moreover, in Switzerland, sometimes even across municipalities, educational tracking and school curricula differ considerably. Therefore, comparing school grades of applicants is rather difficult.[4] Indeed, Oswald and Backes-Gellner (2014) show that apprentices in firms with PRP do not significantly differ along observables–such as personal characteristics and a number of ability measures–from apprentices in firms without PRP.[5]

We thus assume that firms' pool of apprentices is similar in their aptitude for the job, conditional on firm size and occupation. Indeed, Acemoglu and Pischke (1998) argue that the early years of a worker's career, once they are on the job, reveal the most valuable information about whether someone is suited for the occupation they have chosen.

In period two, apprentices have finished their training and decide whether they wish to stay with their training firm or to look for employment elsewhere. Crucially, we argue that a firm's payment method matters for this decision in period two only. We assume that training firms make an employment offer to all of their graduates who meet an aptitude threshold a^*. Because of the initially similar aptitude distribution, relative to firm size, all training firms will want to hire an approximately equal number of graduates. Graduates accept the employment offer if the expected compensation at their training firm is equal to or larger than their outside options. To

[4] Many firms require their applicants to take the 'Multicheck', a standardized aptitude test, because they cannot infer candidates' aptitude for the job from school grades. However, the only scientific study on the Multicheck shows that the test results have low predictive power in explaining apprenticeship success (Siegenthaler, 2011). Therefore, selecting candidates based on the Multicheck results would likely not improve the matching between applicant and firm.

[5] If the initial allocation of apprenticeship candidates to firms were selective, then our finding that PRP firms have greater retention success would not be solely driven by the sorting role of PRP upon completion of the apprenticeship. Instead, the sorting role of PRP may already have been in effect at the first stage, for the selection of prospective apprentices into their training firms. While this is an empirical possibility, we assess it to be unlikely. Unfortunately, the ESS does not allow explicitly testing this assumption. We have to leave it to future research to test for differences in the productivity of apprentices at the recruitment stage.

investigate these options, we have to take into account two firm characteristics, training firms and non-training firms as well as fixed-salary firms and performance pay firms.

First, we discuss the differences in expected compensation between training firms and non-training firms. As pointed out previously, a number of studies show that training firms are on average more productive than non-training firms (Autor, 2001; Cappelli, 2004; Backes-Gellner and Tuor, 2010). More productive firms not only have higher revenue and profit, they also pay higher wages (Van Reenen, 1996; Abowd *et al.*, 1999; Frías *et al.*, 2009). Therefore, accepting the employment offer will always lead to a higher utility level than renouncing it and starting to work at a non-training firm. Graduates should always prefer working at a training firm to working at a non-training firm.

Second, we discuss the differences in expected compensation between training firms with PRP and with fixed salaries. Lazear (1986; 2000) shows that PRP firms have on average a more productive workforce than fixed-salary firms. For the more productive graduates, accepting the offer from a training firm with PRP will thus always yield a higher utility than leaving and starting to work at a training firm with fixed salaries. Again, the more productive graduates expect to receive a higher wage with a PRP firm, because it is more likely that graduates' higher productivity will be observed and rewarded in this type of firm.

The only option yielding the same utility is an offer from another training firm with PRP. In that case, graduates should be indifferent between staying at their training firm and accepting the offer from another training firm with PRP. Therefore, they should not have any incentives to switch.

Finally, in Lazear's model, a reallocation of more productive workers to PRP firms, and less productive workers to fixed-salary firms does not necessarily change the overall firm size. In our framework, however, we expect to find an increase in the retention of graduates, because of the initially similar distribution of apprentices in terms of their aptitude to perform the job. Specifically, given that all training firms' interests are to hire the more productive graduates only, i.e. those who are above a certain productivity threshold a^*, we should observe that training firms with PRP retain more graduates than training firms with fixed salaries, because they offer the most attractive compensation for these graduates.

3. Institutional background and data

3.1 The Swiss Earnings Structure Survey

The Swiss Earnings Structure Survey (ESS) is conducted bi-annually by the Swiss Federal Statistical Office (SFSO), with compulsory participation. It is based on two-level sampling, surveying both establishments and workers. This data set is representative of all economic sectors except agriculture. The ESS selects establishments by randomly drawing from the Swiss central register of firms within groups based on size, region, and industry. Firms with fewer than 20 employees must report on their entire workforce, firms with fewer than 50 employees on at least half, 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.[6]

The ESS is the only Swiss data set that contains separate information about the base and the bonus pay of employees, enabling us to investigate both the incidence and the magnitude of performance-related pay. Moreover, it is an establishment survey, i.e. personnel officers fill out the questionnaire. Since the data come from establishment records, they are not subject to recall error and clustering at round figures typically observed in earnings data.

To conduct the panel study on the firm level, we aggregate the individual-level data to the firm level and generate a panel that allows controlling for time-specific and firm-specific effects. In the analysis, we use the waves from 1998 through 2004. Although later waves of the ESS are available, from 2006 onwards the firm identifier changes so that we cannot match firms over time anymore.

3.2 Measurements

3.2.1 Internal graduates

Our dependent variable is the rate of internal graduates, relating the number of graduates who received their training with their current firm to the total number of workers with a vocational education and training (VET) degree in the firm. Apprentices typically start their training after

[6] Different establishments of the same firm can only be identified if they are located in different regions. Multiple establishments located in the same region appear as a single establishment in the data. This restriction, however, is not decisive for the focus of our analysis.

compulsory schooling, when they are on average 17 years old.[7] They spend between one to two days per week in a vocational school and three to four days at the training firm where they receive on-the-job training and take active part in the firm's production process.

The two main types of training last either three or four years. Apprentices graduate after passing both a practical and a theoretical examination. They receive a federal certificate that is recognized throughout Switzerland. Because their skills are externally assessed, graduates have a qualification that is portable and can move to different employers. The employment relationship ends automatically upon the completion of training and any extension must be negotiated in a new contract.

To identify those workers who graduated at the firm where they are currently employed, we use three pieces of information, namely education, age, and tenure. The ESS records tenure in a firm starting from the first day of the apprenticeship programme. Therefore, any worker with a VET degree, who has been working at the same firm since age 17, has probably received his training with his current firm. Formally, we apply the following equation for each person i with a VET degree to identify internal graduates: $age_i - tenure_i \leq 17$.

We construct a dummy assuming the value one if a worker fulfils these criteria and call it the 'internal graduates dummy'.[8] To construct a firm rate, we sum up the internal graduates within a firm and divide this sum by the number of workers with a VET degree in that firm.

Because the ESS contains only information on skilled workers but not on apprentices, we cannot relate the number of graduates who stay to the overall number of former apprentices within a firm, which would give us the more commonly used retention rate. We use the number of VET workers instead, which should be a good indicator for the number of apprentices and graduates within a firm. While this ratio is not a 'true' retention rate, it approximates it in the best possible way. Therefore, we define the rate of internal graduates of firm j as:

[7] The department of education of the canton of Zurich provided us with data on apprentices' age. In 2012, around 9% of first-year apprentices were 15 years old or younger, 38% were 16 years old, 23% were 17 years old, and 30% were 18 years old or older.

[8] In a robustness check, we modify this definition to include only young graduates who are not older than 21 years. The results are robust to this stricter definition.

$$intern_{ij} = \frac{\sum_{i=1}^{N} internal\ VET\ worker\ i\ in\ firm\ j}{\sum_{i=1}^{N} VET\ worker\ i\ in\ firm\ j} \quad (1)$$

3.2.2 Performance-related pay

The ESS has the unique feature of containing separate information on the base and bonus components of earnings.[9] This characteristic enables us to construct our main explanatory variables, performance pay intensity and coverage, to investigate both the magnitude and the incidence of performance-related pay (PRP). Since we are interested in firm-level outcomes, we aggregate the individual information to the firm level.

To measure the magnitude, we add up the amount of PRP that individual VET workers receive within a firm. To generate a rate, we relate this aggregated PRP amount to the aggregated monthly wage of all workers in a firm, independent of their education degree. We call this measure 'performance pay intensity', because it shows the percentage of total pay that is based on performance. Formally, we define the performance pay intensity of firm j as:

$$PRP - intensity_{ij} = \frac{\sum_{i=1}^{N} PRP\ of\ VET\ worker\ i\ in\ firm\ j}{\sum_{i=1}^{N} gross\ wage\ \ of worker\ i\ in\ firm\ j} \quad (2)$$

To measure the incidence, we construct a dummy indicating whether a worker receives PRP. Again, because we are interested in firm-level outcomes, we add up the dummy variables within a firm. We divide this number by the total number of workers in a firm (i.e. firm size) to construct a measure for the share of workers receiving PRP within a firm. We call this measure 'performance pay coverage', because it reflects the percentage of workers receiving PRP. Formally, we define the performance pay coverage of firm j as:

$$PRP - coverage_{ij} = \frac{\sum_{i=1}^{N} VET\ worker\ i\ receiving\ PRP\ in\ firm\ j}{\sum_{i=1}^{N} worker\ i\ in\ firm\ j} \quad (3)$$

[9] The ESS 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-related pay.

We include only VET workers in the nominators of the PRP measures, because we are only interested in the PRP-effects for these workers. Including workers with a different degree might lead to biased results if e.g. a firm pays large amounts of PRP primarily to low-skilled or high-skilled workers.

3.2.3 Controls

For each firm and year, we use the following control variables: log wage, age and tenure, occupational tasks, job requirements, gender, and nationality. We aggregate these individual-level variables to the firm level and compute firm-level means. Importantly, given that we want to ensure that firm characteristics do not drive our results, when aggregating these variables, we include all workers within a firm. We also control for firm size and include dummies for industry, region, and year. Finally, we control for employment growth[10] and GDP-share per industry. These latter variables are standardized to have a mean of zero and a standard deviation of one.

3.3 Sample and summary statistics

We restrict our sample as follows. First, we exclude about 13% of public sector firms, because they do not tend to behave in a profit-maximizing way, which can have consequences for their training and retention decision (Mühlemann *et al.*, 2007). Second, we exclude all agricultural firms (0.05%), because the observations in our data are not representative. Third, we exclude about those 3% of firms with fewer than five employees, because their expansion potential is very limited (Mühlemann *et al.*, 2007). Moreover, we focus on firms that retain at least one internal graduate over the observation period as a proxy to differentiate between investment-oriented and production-oriented training firms. With this restriction, we drop around half of the observations. Finally, at the worker level, we exclude part-time workers (27% of our sample) and workers who are not under a salaried contract (0.03%).

[10] We measure employment growth on the firm level. While Neal (1995) measures employment growth on the industry level to control for switching behavior, we cannot do so because we would run into multi-collinearity problems. However, the same rationale applies on the firm level too. In growing firms, graduates should be both more likely to receiving an offer by their training firm and more likely to stay.

After removing missing variables and creating the panel, our sample comprises 12,517 observations. Table 1 provides summary statistics for the aggregated variables, i.e. all variables are firm-level averages. The dependent variable, the rate of internal graduates, is 1.78%, a clear indication that our measure is a lower bound of the real rate. Because not all training firms retain graduates in every observation year, the dependent variable assumes zero values. The rate of internal graduates differs somewhat by firm size, but no clear pattern emerges. It is highest for small firms with 5-19 employees (2.9%) and lowest for firms with 250-499 employees (1.21%), which indicates that retention success is not increasing in firm size.

Concerning our main explanatory variables, workers with a VET degree receive about 1% of the firm-level average wage as PRP. The number is this low, because we relate the PRP of VET workers to the overall sum of wages within the firm. Performance pay intensity differs marginally by firm size. It is highest for firms with 5-19 employees (1.04%) and lowest for firms with 20-49 employees (0.94%). Within a firm's workforce, about 8% of workers hold a VET degree and receive PRP. Performance pay coverage is highest for small firms with 5-19 employees (10.3%) and lowest for firms with 50-249 employees (6.5%).

To simplify the interpretation of the results, in the empirical analysis, we standardize the PRP measures to have a mean of zero and a standard deviation of one. Table 1 also reports the standardized values. Table 1 also shows that the average worker earns a monthly gross wage of 6,241 CHF, is 40 years old, and has 10 years of tenure. About 70% of the workforce is male and Swiss. Manufacturing and service tasks are dummy variables, included to control for occupational tasks. The variable 'job requirements' has four categories and describes how demanding a job is, ranging from repetitive tasks to tasks with the highest level of expert knowledge. Employment growth and GDP-share per industry control for macroeconomic conditions. Finally, firm size is continuous, ranging from 5 to 32,000 employees. The industry controls represent broad industry classes in Switzerland. The regional controls represent major regions in Switzerland, which consist of one or more cantons.

{Table 1 here}

4. Empirical approach

4.1 Identification strategy

To investigate the relation between performance-related pay (PRP) and a firm's retention success, we exploit the panel structure of the data and estimate firm fixed effects. By including fixed effects, we control for average differences across firms in observable or unobservable predictors. Most firms have unobserved characteristics that influence both a firm's payment strategy and its retention success. One example is a firm's productivity level, because a higher productivity leads to higher PRP rates and at the same time to higher training endeavours. By estimating fixed effects, we can thus greatly reduce the threat of omitted variable bias.

Because our dependent variable is confined to the [0,1] interval, and in addition, a significant amount of observations take on values at the boundary of 0, OLS estimation could produce out-of-sample predictions, which cannot be interpreted. However, probability models would only produce predictions for the extreme values.

A promising model that overcomes these limitations is the fractional response model by Papke and Wooldridge (1996). Their idea is to specify not the full conditional distribution of the fractional response variable, but only its conditional mean. Let y denote the fractional response variable and x the set of explanatory variables. The conditional mean is then defined as $E[y|x] = G(x'\beta)$, where $G(\cdot)$ denotes a function bounded between zero and one. This link function ensures that the model's predictions lay between zero and one, making them consistent with the nature of the fractional response variable.

Papke and Wooldridge (2008) further develop their original model to the case of panel data. They propose using a panel fractional logit with a Mundlak correction (Mundlak, 1978) to approximate a fixed effects estimation. The Mundlak correction consists of including time-averaged means of the exogenous variables in the regression. As a sensitivity check, we therefore apply this approach.

4.2 Estimation equation

The function that has to be estimated can be specified as follows:

$$y_{jt} = \beta_0 + \beta_1 PRP_{jt} + X_{jt}\gamma + Z_{jt}\delta + \alpha_j + \lambda_t + \varepsilon_{jt} \qquad (4)$$

where t is a time indicator and j is a firm indicator. The dependent variable y_{jt} is the share of internal graduates, bounded between 0 and 1. The main explanatory variable, PRP_{jt}, is a standardized measure for performance pay intensity in specification I and performance pay coverage in specification II. The firm fixed effect α_j captures the impact of time-invariant differences among firms in observed and unobserved characteristics.

The control vector X_{jt} includes average worker characteristics, i.e. log wage, age and tenure, gender and nationality dummies, occupational task dummies, a job requirements measure, as well as firm characteristics, i.e. continuous measures for firm size and firm employment growth. The control vector Z_{jt} includes a measure for the GDP-share per industry and region, industry, and year dummies to control for macroeconomic conditions. To avoid the dummy variable trap (Wooldridge, 2009), we drop one of each of the set of dummies. The error term, ε_{jt}, is assumed to be mean zero and normally distributed.

5. Results

Tables 2.1 and 2.2 report the results for firm fixed effects regressions with robust standard errors for specifications I and II respectively. We first regress our dependent variable on the performance pay measures alone and then include control variables step-wise.

Confirming our hypothesis, we find that both PRP measures are significantly positively correlated with the rate of internal graduates. It thus appears that the sorting role of PRP also applies to apprenticeship graduates, indicating that PRP is an effective tool for retaining internal graduates. To interpret the effect size, we need to keep in mind that our main explanatory variables are standardized. The coefficients indicate the difference from the mean of the original variable in number of standard deviations. In the full model, an increase in PRP-intensity by one standard deviation is associated with an increase in the rate of internal graduates by 1.55 percentage points. Similarly, an increase in PRP-coverage by one standard deviation is associated with an increase in the rate of internal graduates by 2.4 percentage points. These effects are economically substantial, which may be explained by the fact that the average rate of internal graduates is 1.78% only.

Average wages have a small, but significantly positive effect on the rate of internal graduates, although the coefficient is not significant upon inclusion of all control variables. Our PRP variables are thus not simple wage effects, i.e. not only higher wages induce internal graduates to stay. The remaining controls comprise aggregated worker and firm characteristics as well as macroeconomic controls. Size and direction of the coefficients are similar in both models. Age is U-shaped and tenure is inverted U-shaped and both are statistically significant. Both effects are in line with expectations and result from our definition of internal graduates. Moreover, employment growth is not significantly correlated, while the GDP-share of an industry is significantly positive in one specification. These controls may be better captured by our industry, region, and time dummies.

{Tables 2.1 and 2.2 here}

Because our dependent variable is a fraction, Tables 2.1 and 2.2 may show biased estimates of the true economic effect. Therefore, in the next step, we run the approach proposed by Papke and Wooldridge (2008). Table 3 presents the marginal effects from a panel fractional logit regression with Mundlak correction. The results indicate that for a firm j with mean characteristics $\bar{x}_j$, an increase in PRP-intensity by one standard deviation increases the rate of internal graduates by 0.5 percentage points. In the same vein, the rate of internal graduates increases by 1 percentage point if PRP-coverage increases by one standard deviation.

Comparing these results to the fixed effects estimates in Tables 2.1 and 2.2 points to non-linearities in the relation between PRP and the rate of internal graduates. Although the effect size is halved, we can confirm our previous findings from the fixed effects regressions. We can thus infer that both the magnitude and the likelihood of receiving PRP matter for graduates' decisions.

{Table 3 here}

6. Robustness checks

To investigate the robustness of our results, we run a number of additional regressions. We start by using the same specification as in equation (4), but modify the dependent variable. First, we restrict the dependent variable to only include the most recent graduates, i.e. we apply the following formula to redefine internal graduates: $age_i - tenure_i \leq 17\ s.t. age \leq 21$. Table 4 reports results from the fixed effects regressions. The statistical relation between PRP and the rate of internal graduates is robust even to this very restrictive definition.

Second, we run a placebo test using as dependent variable the share of workers who were hired over the last year. Table 5 shows that no statistically significant relationship exists between our PRP measures and recently hired workers. We thus mitigate concerns that PRP firms simply have higher turnover rates, which could be explaining the higher retention rates of graduates.

Third, to check for the extent of monitoring costs, we again apply equation (4) but run separate fixed effects regressions for manufacturing and service-sector firms. Tables 6 and 7 report the results. While we find a larger effect of PRP-intensity for manufacturing firms, overall, the results are similar for both types of firms. The statistically significant and positive relation between PRP and the rate of internal graduates is confirmed. These results indicate that while monitoring costs may play a role for whether or not firms offer PRP, this role does not seem to be very pronounced.

Finally, in an additional regression reported in the online appendix, we test the robustness of our definition of focusing on firms that are empirically most likely to be offering training as a source of future skill supplies. To investigate whether our definition excludes the bulk of production-oriented training firms, we run a regression where we take into account all firms. While we still find a positive association between PRP and the rate of internal graduates, the effect size is halved. These findings indicate that our definition does indeed exclude a large part of training firms with a production motive.

{Tables 4 through 7 here}

7. Conclusion

This study examines the relation between performance-related pay (PRP) and the retention of internal apprenticeship graduates. The new training literature explains a firm's incentive to offer general training through the existence of labour market frictions, which hamper graduates' post-training mobility. Our explanation relies less on external labour market frictions and instead explores what firms themselves could do.

Drawing on Lazear (1986, 2000), we argue that the sorting effect of PRP should help firms to retain their more productive graduates. We argue that more productive graduates have two main reasons to stay with their current training firm if that firm offers PRP. First, they expect a higher compensation because, with parts of their pay being performance-related, their individual productivity is more likely to be directly rewarded. Second, given that training firms are on average more productive than non-training firms, graduates expect to gain from additional positive effects from training.

In the empirical analysis, we use data from a representative employer-employee survey that contain register data on the base pay and PRP of individual workers. We construct two PRP-measures, one reflecting the share of PRP relative to the base pay, and the other the share of workers receiving PRP. We run firm fixed effects regressions to investigate the dynamic relationship between a firm's use of PRP and its retention success.

We find a statistically significant positive relation between PRP and the rate of internal graduates. In a series of robustness checks, we confirm our main findings. These results not only support our hypothesis, but also provide important insights into the role of PRP as a retention tool.

Our study contributes to the theory of training by providing an additional answer to the question of why firms provide and pay for training if that training is general and easily marketable. In a next step, it could be valuable to investigate whether higher retention success also leads to higher training participation. This would be the case if training firms with PRP, while paying their graduates higher wages, would be able to also make a higher return on their training investment than training firms with fixed salaries. To investigate this relationship, data on individual worker productivity and earnings are needed.

Finally, with researchers identifying firms' refusal to bear the training costs as the greatest challenge to the introduction of an institutionalized apprenticeship system (Harhoff and

Kane, 1997), our study should be of high interest to policy makers who are considering such an introduction. With PRP as an effective retention tool for apprenticeship graduates, firms' hesitation could at least partly be mitigated.

Supplementary material

Supplementary material is available online on the OUP website. The Swiss Earnings Structure Survey (ESS) used for this study is confidential (the data can be accessed upon request from the Swiss Federal Statistical Office), but the replication files are available along with an online appendix.

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Tables

Table 1. Summary statistics

Variables	Mean	St. Dev.	Min	Max
Internal graduates	0.0178	0.0617	0	1
PRP-intensity	0.0098	0.0206	0	0.2743
PRP-intensity (standardized)	0	1	-0.4763	12.8575
PRP-coverage	0.0807	0.1595	0	0.9286
PRP-coverage (standardized)	0	1	-0.5058	5.3160
Wage	6,241	1,364	3,013	15,763
Age	40.08	4.321	22.18	62
Tenure	9.847	4.079	0	33.75
Male	0.680	0.252	0	1
Swiss	0.713	0.237	0	1
Manufacturing tasks	0.403	0.365	0	1
Service tasks	0.543	0.355	0	1
Job requirements	2.754	0.458	1	4
Employment growth	0.054	0.776	-0.965	54.22
GDP-share per industry	0.169	0.121	0.007	0.857
Firm size	197.71	751.48	5	32,000
Industry	6.931	3.066	3	15
Region	3.658	1.810	1	7

Notes. N=12,517.
Source. Authors' calculations, based on ESS, 1998-2004.

Table 2.1. FE estimates of performance pay intensity on the rate of internal graduates

	(1)	(2)	(3)	(4)	(5)
PRP-intensity (standardized)	0.0157***	0.0154***	0.0154***	0.0154***	0.0155***
	(0.0014)	(0.0014)	(0.0014)	(0.0014)	(0.0014)
Log wage		0.0126	0.0158*	0.0153*	0.0107
		(0.0078)	(0.0088)	(0.0088)	(0.0090)
Age		-0.0060**	-0.0061**	-0.0061**	-0.0054**
		(0.0025)	(0.0025)	(0.0025)	(0.0026)
Age squared		0.00005	0.00005*	0.00005*	0.00004
		(0.00003)	(0.00003)	(0.00003)	(0.00003)
Tenure		0.0025**	0.0025**	0.0027***	0.0035***
		(0.0010)	(0.0010)	(0.0010)	(0.0011)
Tenure squared		-0.00001	-0.00001	-0.00002	-0.00004
		(0.00003)	(0.00003)	(0.00003)	(0.00003)
Male			-0.0029	-0.0030	-0.0017
			(0.0084)	(0.0084)	(0.0084)
Swiss			-0.0110*	-0.0108	-0.0097
			(0.0065)	(0.0066)	(0.0067)
Manufacturing tasks			0.0029	0.0028	0.0042
			(0.0110)	(0.0109)	(0.0110)
Service tasks			-0.0013	-0.0013	-0.0005
			(0.0105)	(0.0105)	(0.0105)
Job requirements			0.0004	0.0005	0.0009
			(0.0021)	(0.0021)	(0.0021)
Employment growth (standardized)				-0.00005	0.00001
				(0.00023)	(0.00027)
GDP-share per industry (standardized)				0.0010**	-0.0003
				(0.0004)	(0.0005)
Firm size	No	No	No	No	Yes
Industry	No	No	No	No	Yes
Region	No	No	No	No	Yes
Year	No	No	No	No	Yes
Observations	12,517	12,517	12,517	12,517	12,517
R-squared	0.0467	0.0530	0.0534	0.0537	0.0654

Notes. *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.
Source. Authors' calculations, based on ESS, 1998-2004.

Table 2.2. FE estimates of performance pay coverage on the rate of internal graduates

	(1)	(2)	(3)	(4)	(5)
PRP-coverage (standardized)	0.0244***	0.0242***	0.0242***	0.0242***	0.0241***
	(0.0017)	(0.0017)	(0.0017)	(0.0017)	(0.0017)
Log wage		0.0119	0.0149*	0.0146*	0.0119
		(0.0077)	(0.0087)	(0.0087)	(0.0089)
Age		-0.0056**	-0.0059**	-0.0058**	-0.0051**
		(0.0023)	(0.0024)	(0.0024)	(0.0025)
Age squared		0.00005	0.00005*	0.00005	0.00003
		(0.00003)	(0.00003)	(0.00003)	(0.00003)
Tenure		0.0028**	0.0028**	0.0029***	0.0035***
		(0.0010)	(0.0010)	(0.0010)	(0.0010)
Tenure squared		-0.00001	-0.00001	-0.00002	-0.00003
		(0.00003)	(0.00003)	(0.00003)	(0.00003)
Male			-0.0043	-0.0044	-0.0035
			(0.0082)	(0.0082)	(0.0083)
Swiss			-0.0090	-0.0088	-0.0083
			(0.0064)	(0.0064)	(0.0066)
Manufacturing tasks			-0.0031	-0.0032	-0.0015
			(0.0107)	(0.0107)	(0.0108)
Service tasks			-0.00006	-0.00011	0.00113
			(0.01032)	(0.01032)	(0.01037)
Job requirements			0.0020	0.0020	0.0021
			(0.0020)	(0.0020)	(0.0020)
Employment growth (standardized)				-0.00002	0.00004
				(0.00025)	(0.00029)
GDP-share per industry (standardized)				0.0007*	-0.0002
				(0.0004)	(0.0005)
Firm size	No	No	No	No	Yes
Industry	No	No	No	No	Yes
Region	No	No	No	No	Yes
Year	No	No	No	No	Yes
Observations	12,517	12,517	12,517	12,517	12,517
R-squared	0.0990	0.1059	0.1062	0.1064	0.1168

Notes. *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.
Source. Authors' calculations, based on ESS, 1998-2004.

Table 3 Panel fractional logit estimates of performance pay on the rate of internal graduates, marginal effects

	(1)	(2)
PRP-intensity (standardized)	0.0052*** (0.0006)	
PRP-coverage (standardized)		0.0103*** (0.0006)
Log wage	0.0218** (0.0094)	0.0231** (0.0095)
Age	-0.0070*** (0.0023)	-0.0061*** (0.0023)
Age squared	0.00006** (0.00003)	0.00004 (0.00003)
Tenure	0.0039*** (0.0011)	0.0039*** (0.0011)
Tenure squared	-0.00005 (0.00003)	-0.00004 (0.00003)
Male	-0.0039 (0.0086)	-0.0086 (0.0087)
Swiss	-0.0111 (0.0084)	-0.0059 (0.0081)
Manufacturing tasks	0.0053 (0.0099)	-0.0050 (0.0100)
Service tasks	0.0015 (0.0092)	0.0004 (0.0094)
Job requirements	0.0017 (0.0022)	0.0021 (0.0020)
Employment growth (standardized)	0.0004 (0.0004)	0.0007 (0.0005)
GDP-share per industry (standardized)	0.00008 (0.0008)	0.0004 (0.0008)
Firm size	Yes	Yes
Industry	Yes	Yes
Region	Yes	Yes
Year	Yes	Yes
Observations	12,517	12,517

Notes. *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.
Source. Authors' calculations, based on ESS, 1998-2004.

Table 4. FE estimates of performance pay on the rate of young internal graduates

	(1)	(2)	(3)	(4)
PRP-intensity (standardized)	0.0041*** (0.0006)	0.0041*** (0.0006)		
PRP-coverage (standardized)			0.0065*** (0.0006)	0.0064*** (0.0006)
Log wage		0.0033 (0.0042)		0.0035 (0.0041)
Age		-0.0067*** (0.0011)		-0.0066*** (0.0011)
Age squared		0.00007*** (0.0000)		0.00007*** (0.0000)
Tenure		0.0010** (0.0004)		0.0010** (0.0004)
Tenure squared		-0.00003*** (0.0000)		-0.00003** (0.0000)
Male		-0.0039 (0.0042)		-0.0043 (0.0042)
Swiss		0.0007 (0.0026)		0.0011 (0.0025)
Manufacturing tasks		0.0011 (0.0042)		-0.0004 (0.0041)
Service tasks		0.0013 (0.0045)		0.0017 (0.0044)
Job requirements		0.0012 (0.0009)		0.0015* (0.0008)
Employment growth (standardized)		-0.00007 (0.00009)		-0.00006 (0.0001)
GDP-share per industry (standardized)		-0.00003 (0.0002)		-0.00001 (0.0002)
Firm size	No	Yes	No	Yes
Industry	No	Yes	No	Yes
Region	No	Yes	No	Yes
Year	No	Yes	No	Yes
Observations	12,517	12,517	12,517	12,517
R-squared	0.0202	0.0332	0.0436	0.0563

Notes. *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.
Source. Authors' calculations, based on ESS, 1998-2004.

Table 5. FE estimates of performance pay on the rate of recently hired workers

	(1)	(2)	(3)	(4)
PRP-intensity (standardized)	-0.0013	-0.0014		
	(0.0013)	(0.0012)		
PRP-coverage (standardized)			0.0026	0.0019
			(0.0019)	(0.0017)
Log wage		0.0165		0.0130
		(0.0156)		(0.0154)
Age		0.0074*		0.0075*
		(0.0041)		(0.0041)
Age squared		-0.0001		-0.0001
		(0.0000)		(0.0000)
Tenure		-0.0299***		-0.0298***
		(0.0028)		(0.0028)
Tenure squared		0.0007***		0.0007***
		(0.0001)		(0.0001)
Male		0.0192		0.0193
		(0.0155)		(0.0155)
Swiss		-0.0258*		-0.0260*
		(0.0137)		(0.0137)
Manufacturing tasks		0.0015		0.0002
		(0.0137)		(0.0137)
Service tasks		0.0040		0.0032
		(0.0126)		(0.0125)
Job requirements		0.0053		0.0051
		(0.0036)		(0.0036)
Employment growth (standardized)		-0.0028***		-0.0028***
		(0.0006)		(0.0006)
GDP-share per industry (standardized)		0.0008		0.0008
		(0.0013)		(0.0013)
Firm size	No	Yes	No	Yes
Industry	No	Yes	No	Yes
Region	No	Yes	No	Yes
Year	No	Yes	No	Yes
Observations	12,517	12,517	12,517	12,517
R-squared	0.0002	0.0958	0.0006	0.0959

Notes. *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.
Source. Authors' calculations, based on ESS, 1998-2004.

Table 6. FE estimates of performance pay on the rate of internal graduates. Manufacturing firms

	(1)	(2)	(3)	(4)
PRP-intensity (standardized)	0.0277***	0.0282***		
	(0.0063)	(0.0061)		
PRP-coverage (standardized)			0.0229***	0.0224***
			(0.0049)	(0.0048)
Log wage		0.0513**		0.0460**
		(0.0234)		(0.0228)
Age		-0.0043		-0.0049
		(0.0058)		(0.0059)
Age squared		0.00002		0.00003
		(0.00007)		(0.00007)
Tenure		0.0047**		0.0043*
		(0.0023)		(0.0024)
Tenure squared		-0.00004		-0.00003
		(0.00007)		(0.00007)
Male		-0.0011		-0.0072
		(0.0270)		(0.0261)
Swiss		-0.0287*		-0.0277
		(0.0168)		(0.0171)
Manufacturing tasks		0.0389		0.0279
		(0.0340)		(0.0315)
Service tasks		0.0377		0.0280
		(0.0348)		(0.0322)
Job requirements		-0.0010		-0.0007
		(0.0044)		(0.0043)
Employment growth (standardized)		-0.0016		-0.0017
		(0.0014)		(0.0013)
GDP-share per industry (standardized)		0.0012		0.00003
		(0.0025)		(0.0027)
Firm size	No	Yes	No	Yes
Industry	No	Yes	No	Yes
Region	No	Yes	No	Yes
Year	No	Yes	No	Yes
Observations	3,389	3,389	3,389	3,389
R-squared	0.0907	0.1421	0.0964	0.1407

Notes. *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.
Source. Authors' calculations, based on ESS, 1998-2004.

Table 7. FE estimates of performance pay on the rate of internal graduates. Service-sector firms

	(1)	(2)	(3)	(4)
PRP-intensity (standardized)	0.0172***	0.0193***		
	(0.0044)	(0.0047)		
PRP-coverage (standardized)			0.0212***	0.0216***
			(0.0053)	(0.0054)
Log wage		-0.0258		-0.0177
		(0.0336)		(0.0316)
Age		-0.0047		-0.0051
		(0.0078)		(0.0075)
Age squared		0.00004		0.00006
		(0.00010)		(0.00010)
Tenure		0.0030		0.0035
		(0.0036)		(0.0035)
Tenure squared		-0.00004		-0.00008
		(0.00012)		(0.00012)
Male		0.0275		0.0127
		(0.0241)		(0.0236)
Swiss		-0.0306		-0.0264
		(0.0261)		(0.0258)
Manufacturing tasks		-0.0289		-0.0212
		(0.0373)		(0.0382)
Service tasks		-0.0351		-0.0241
		(0.0306)		(0.0296)
Job requirements		-0.0146		-0.0133
		(0.0125)		(0.0120)
Employment growth (standardized)		-0.0010		-0.0015**
		(0.0008)		(0.0006)
GDP-share per industry (standardized)		-0.0012		-0.0010
		(0.0038)		(0.0036)
Firm size	No	Yes	No	Yes
Industry	No	Yes	No	Yes
Region	No	Yes	No	Yes
Year	No	Yes	No	Yes
Observations	1,877	1,877	1,877	1,877
R-squared	0.0400	0.0897	0.1104	0.1505

Notes. *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.
Source. Authors' calculations, based on ESS, 1998-2004.