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Invest in the best or compensate the weak? An empirical analysis of the heterogeneity of a firm's provision of human capital

Samuel Muehlemann, Romy Braendli and Stefan C. Wolter

Universität Zürich
IBW – Institut für Betriebswirtschaftslehre

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Title: Invest in the best or compensate the weak? An empirical analysis of the heterogeneity of a firm's provision of human capital

Author(s): Samuel Muehlemann, Romy Braendli, Stefan C. Wolter*

Abstract:

The paper aims to test whether a firm's provision of training depends on the intake quality of trainees. While a firm may just treat each trainee equally, independent of his or her intake quality, firms may alternatively also provide more training to less able individuals or focus on the most able ones. We develop a theoretical framework that illustrates under what circumstances a firm chooses a particular training strategy. We use representative administrative survey data for more than 1400 Swiss establishments. To test our theoretical predictions about a firm's training strategy, we apply multivariate and instrumental variable (IV) regression models. In addition, we use case study evidence from a large Swiss retailer, allowing us to analyze how different instructors in a specific firm react when confronted with apprentices of different intake qualities. We find that a firm's training strategy depends on a trainee's intake quality and the expected net costs of a particular training occupation. Although firms generally provide less training to less qualified trainees, we find that a firm is willing to compensate low-ability trainees with additional training when training is on average profitable in the short run. When training regulations force firms to follow an investment-oriented training strategy (net costs in the short run), then low-ability trainees will not receive additional instruction time and the dropout risk increases. Generating a regulatory framework that allows firms to achieve a net benefit from work-based training is crucial for low-ability trainees to have the opportunity to receive additional training investments that compensate for a lack of competences at the time of the start of training.

Keywords: Work-based training, heterogeneous trainee ability, apprenticeship training, firm-sponsored training

JEL-Codes: J24, M53

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*Corresponding author: E-Mail: stefan.wolter@vwi.unibe.ch. This research has partly been funded by the OPET through its Leading House on Economics of Education: 'Firm Behaviour and Training Policies'.

1. Introduction

Apprenticeship training is the most important type of post-compulsory education at the upper secondary level in Switzerland, with two thirds of a cohort enrolling into this type of training. As a consequence the group of apprentices is very heterogeneous in terms of both cognitive and non-cognitive ability. So far, however, little is known about how firms adapt their training policies when confronted with trainees of different ability. Given that trainees in apprenticeship spend on average three quarter of their time with the firm, a deeper understanding of how a firm treats trainees, in particular in regards to their intake quality, is of both scientific and practical importance.

In this paper we apply the theoretical framework of family economics (Becker and Tomes, 1986) to the context of apprenticeship training. While Becker and Tomes have analyzed the question, how parents allocate their scarce resources to children with different abilities, the same question arises when firms are confronted with trainees of different ability. According to Becker and Tomes parents have three options to deal with children of different ability: they either a) treat all children the same, irrespective of their needs or b) use additional resources for the children who need more support (compensation strategy) or c) invest their limited resources in their most talented children because this maximize the return on their investment (efficiency strategy). A firm faces a similar situation when training youngsters of different intake quality. Even though apprenticeship training by law requires a minimum amount of training provision at the workplace, firms can always exceed the required minimum.

Our hypothesis tested in this paper is that the choice of the training strategy regarding the heterogeneity in the ability of apprentices depends mainly on the reasons why a firm chooses to train apprentices in the first place. Two motivations for apprenticeship training predominate: production-oriented and investment-oriented reasons (see Lindley, 1975 and Merrilees 1983, or Wolter and Ryan 2011 for a survey of the more recent literature). According to the production-oriented motivation, a firm's primary reason for training apprentices is to use them as substitutes for skilled or unskilled workers. Thus the productive contribution of trainees is paramount, meaning that a firm has an incentive to compensate the less able ones to prevent them from dropping out (and missing out on

their productive contribution). While dropping out per se does not necessarily cause a firm to lose previous human capital investments (in case of a net benefit in each year of training), there may still be time costs associated with formally terminating an apprenticeship contract and engaging in mediating discussions with a trainee's parents or local authorities. In addition, repeated dropouts may damage the reputation of a training firm in the long run and thus make the firm less attractive for future trainees.

Instead of having trainees primarily to substitute skilled and unskilled workers, a firm may train apprentices to fill vacant positions for skilled workers within the firm (investment strategy). Due to asymmetric information and employer learning (see, e.g., Acemoglu and Pischke 1998, or Lange 2007), a firm will not immediately be able to determine the productivity of a trainee. However, as training progresses, a firm will learn about the individual productivities of trainees (screening hypothesis) and thus be able to target its training investments on the most talented ones, who it wishes to retain after training. In Switzerland, training occupations are typically characterized by specific cost structures, which then determine whether a firm will apply an investment or a production strategy. The reason is that training regulations define minimum training standards, the length of the apprenticeship, as well as other factors that determine whether training in a certain occupation is profitable – or requires a net investment from the firm.

We contribute to the literature by analyzing for the first time the determinants and consequences of a firm's training behavior in regard to the heterogeneity of trainees' abilities, using two unique and particularly suitable data sets.[1] The first one is a large-scale representative survey on 1400 training firms with detailed information about training input (training hours, recruitment costs and training infrastructure), intake quality of trainees (grades in compulsory schooling), and output measures (trainee productivity, dropout rate, performance at final examination)

As a firm may typically try to recruit a homogenous group of apprentices, much of the variance will be found between firms. However, some variation in the quality of apprentices within a firm may remain, a variation which we will analyze within a case-study framework. The case-study was explicitly designed to test our hypotheses by interviewing 34 instructors of a large retail company in Switzerland. Within that firm, we observe how each instructor adjusts his or her training strategy when faced with apprentices of different intake quality.

The results show that firms following a production-oriented strategy provide an additional 45 hours of training each year to apprentices who had below-average grades in compulsory schooling. Due to the compensating training behavior, the difference in relative productivity of trainees with bad grades compared to apprentices with good grades continuously decreases with the duration of the training program. Additionally, we find that dropout rates are unrelated to prior scholastic achievement, which can be interpreted as a positive impact of the additional training hours spent on apprentices with a low intake quality. Our case study results confirm these findings, based on within-firm observations of the training strategy of individual instructors, as we find not a single instructor who applies an efficiency strategy when a firm trains for production-oriented reasons.

In investment-oriented occupations, however, firms provide on average 50 hours of additional training to those apprentices with above-average grades in compulsory schooling, thereby following an efficiency strategy. As a consequence, dropout rates in firms applying an efficiency training strategy are significantly higher for trainees with bad grades in compulsory schooling relative to those with good grades.

The paper is organized as follows: Section 2 briefly describes the Swiss apprenticeship training system. Section 3 presents the data. Section 4 discusses the empirical estimation strategies, and Section 5 presents the results. Section 6 concludes.

2. The Swiss dual apprenticeship system

Dual apprenticeship programs in Switzerland are the most widely applied approach to educating students at the upper-secondary level. Each year, more than 60 % of a cohort of school-leavers, those typically at the age of 15 or 16, enroll in a dual apprenticeship training program. There are more than 230 different training professions (OPET 2012) from which they may choose, requiring each three or four years of training.

The Swiss federal government is responsible for strategic management and development and works together with the cantons and professional organizations. The cantons are in charge of implementing training regulations and the supervision of training firms. Professional organizations

contribute, e.g., to the definition of apprenticeship curricula and the development of new training opportunities (see also OPET 2012 for more details).

The apprentice and the training firm need to sign a written contract before the start of the training program. This contract is binding for the duration of the apprenticeship period, specifies the apprentice's wage, vacation time (which must be at least 5 weeks per year) and regular weekly working hours. Neither the firm nor the apprentice is able to unilaterally terminate the contract. In the case where both parties agree, however, the training contract can be terminated at any time. The length of the program is determined by federal regulations for each training profession, therefore a firm cannot influence the duration of a training program.

An apprenticeship training program usually consists of the following two learning sites: The first learning site is the public vocational school, which is organized by the state (i.e. cantons). In vocational school, an apprentice receives a formal education and is usually required to attend classes in mathematics, languages, and occupation-specific fields for one to two days per week (throughout the training program). During the training period, apprentices also attend some industry-wide courses, where additional occupation and industry-specific skills are taught. This education usually takes place in training centers that are run by professional organizations.

The second learning site is the work environment at the training firm, where an apprentice receives practical as well as further theoretical training. As a firm is required to have special training personnel, this education is much more than simple on-the-job training. The training instructor needs to have acquired a formal permit from the canton that allows him to train apprentices. The majority of instructors are occupied only part-time with apprenticeship training.

A final exam, which is organized and regulated by the cantonal authorities, takes place at the end of the apprenticeship period. Both the theoretical and practical knowledge and skills of the apprentice are tested and evaluated. Apprentices who successfully complete the final exam receive a nationally recognized certificate that attests the skills of the apprentice in his trained occupation.

After graduation, the apprentice's apprenticeship contract automatically ends. Therefore, a new employment contract has to be negotiated if the firm and the apprentice wish to continue their employment relationship.

3. Data

Quantitative survey

The principal data for our analysis was collected in a large-scale administrative survey of 2413 Swiss training firms in 2004, conducted by the Centre for Research on the Economics of Education at the University of Bern, and in collaboration with the Swiss Federal Statistical Office.[2] To obtain a more homogenous sample of trainees, we restrict our sample to firms that train apprentices enrolled in medium- or high-level tracks in compulsory schooling. Thus the final analytical sample for this study consists of 1427 firms.[3]

Descriptive statistics of all variables used in our estimations appear in Table 1. Our first variable of interest is the firm's annual training volume, which stems from the total time that instructors (both full-time and part-time) are unable to pursue their regular work activities because they are engaged in instructing apprentices. On average, the annual training volume per apprentice is equal to 325 hours.

{Table 1 about here}

The second main variable of interest is the intake quality of trainees, as measured by the pre-apprenticeship grades in compulsory schooling. We sorted the grades into two categories, either above or below the regional average, in both mathematics and language (German, French, or Italian; depending on the language region). Grades are reported by the person in charge of apprenticeship training in the firm and represent the average grades of all apprentices that were employed with a firm on September 30, 2004. We then define a new variable that takes on the value 1 if grades in both mathematics and language class were below the regional average, and the value 0 otherwise. On average, 30% of all firms hired apprentices with below-average grades in both subjects. Two reasons make us believe that school grades at the end of compulsory schooling are an important measure of intake ability. First, school-grades are highly correlated with qualitative measures of social and

vocational skills as reported in our data set. Therefore, school grades are well suited to mirror other relevant cognitive and non-cognitive abilities. Second, cognitive skills as measured by prior school grades are a good predictor of school grades and school-related problems during the apprenticeship, which in turn are an important reason for additional training provision in a company.

The share of firms that offer apprenticeships in occupations that on average generate a net training benefit is 77%.[4] We also have information on trainee pay and skilled worker pay, as well as 24 occupation control variables and 25 industry control variables.

Case study of a large retail firm

As our survey data only allows us to test how instructors react to heterogeneous trainee quality between but not within a firm, we specifically conducted a large case study for the purpose of analyzing the behavior of instructors within a large retail firm in Switzerland. Although a single case study is limited in its external validity, analyzing training strategies within a firm is a powerful tool to avoid problems of unobserved heterogeneity between firms.

The firm that we chose for the case study is an important player in the local retail industry and was founded more than a hundred years ago. The firm has about 500 employees and has been offering apprenticeship programs in retailing, administration and decoration for more than 40 years. The training occupations are typically generating a net benefit for the training company and the firm should therefore follow a production oriented training strategy.

The firm employs one full-time employee as the head of apprenticeship training, and 35 part-time instructors to train the apprentices. The case study was conducted in 2009, at which time the firm employed 26 apprentices in retailing, 5 apprentices in the administration, and 4 apprentices as decorators.

To measure the quality of apprentices, we relied on the evaluations of instructors during apprenticeship training, which are standardized and required by training regulations twice a year.[5] In retailing, the maximum score that an apprentice can achieve in an evaluation is 40 points. We define all apprentices with more than 29 points (72.5%) as high quality trainees, whereas those with 29 or fewer points are defined as low quality trainees.[6] For apprentices in administration, the maximum

score is 144 points, and we define those with more than 107 points (74.3%) as high quality trainees. An important requirement for our analysis is that apprentices actually differ in their quality. The evaluations show considerable variation in test scores. In retailing, where the average apprentice scored 72.5% of the maximum points, we find that 5% of the firm's apprentices achieve less that 50% and another 5% of apprentices achieve more than 90% of the maximum number of points (table 2). Our results based on a subjective assessment of trainee quality show that 50% of instructors state that they partly agree that apprentices differ by quality, and an additional 13.5% of instructors strongly agree with that statement.

{Table 2 about here}

To identify possible determinants of an instructor's strategy to deal with apprentices with different intake qualities, we asked the instructors to fill out a questionnaire.[7] First, we asked them how they would react in the hypothetical situation when confronted with two apprentices of different quality. The possible answers were "allocate more time for the weaker trainee" (compensation strategy), "allocate more time for the better trainee" (efficiency strategy), or "allocation of time is independent from the quality of the trainee" (equal treatment). The results show that not a single instructor stated to apply an efficiency strategy, while the majority of instructors stated to apply a compensation strategy (table 3).

{Table 3 about here}

Second, we also asked how much time they actually spent instructing individual trainees during a typical work week in March 2009. The descriptive statistics show that instructors actually allocated more time to low quality trainees (table 4).[8] In retailing, instructors spend on average 1.3 hours with high quality trainees and 1.7 hours with low quality trainees.

{Table 4 about here}

4. Empirical strategy and hypotheses

Our empirical analysis consists of two parts: first, an empirical analysis of representative survey data of Swiss establishments with information on average trainee quality and training volume, and second, a case study analysis of a large Swiss retail firm with information on both the instructors training style and the quality of apprentices.

Quantitative survey

Using representative data of 1421 Swiss firms that offer apprenticeship training, we first classify each training occupation either as production-oriented or investment-oriented, depending on whether average firms in that occupation generate net benefits or incur net costs during apprenticeship training. We then test whether a firm's training volume is associated by the cost-benefit ratio of a particular training occupation, i.e., whether training is profitable or not. To make analyses less prone to unobserved heterogeneity between firms we also define two particular subsamples. First, we analyze solely commercial employees in administration (and occupation that generates on average net-benefits for the training company already during the training period), and second we consider four-year technical occupations (leading to high net costs for a firm). Thus we can test whether training strategies differ between firms that offer training in the same occupation (or occupational cluster) if they are faced with trainees of different ability.

We run ordinary least squares regressions of a firm's training volume on school grades, and control for firm characteristics, sectors, and training occupations and test the following hypothesis.

Hypothesis 1: Instructors apply a compensation strategy (provide more training to low quality trainees) in occupations that on average generate a net benefit of training, whereas they apply an efficiency strategy (provide more training for the most talented trainees) in occupations that on average result in net costs.

A potential endogeneity problem may arise if firms that hire trainees with bad grades in compulsory schooling are different from firms that hire trainees with good grades. However, our analyses are based on the assumption that for a given training occupation a firm faces – to a large extent – an exogenous cost structure, which is mainly determined by the legal and prescriptive training requirements. As our observable firm characteristics (including firm size, sector, and the wage for skilled workers) control for most of the remaining differences between firms, instructors will have to adjust their training strategy according to the trainee's intake quality.

We further analyze how apprentice quality and a firm's training strategy influence training outcomes. Because, the training investment is not exogenous, but rather depends on the intake quality of trainees, we apply instrumental variable (IV) regressions in order to identify the causal effects of providing additional training on the performance of apprentices. In a first step, we regress the training volume on our measure of apprentice quality in a firm and a set of control variables. In the second step, we regress the apprentices' outcome on the linear prediction (based on the first-step estimates) of a firm's average training volume.

The first outcomes to analyze are the productivity during training and the probability of dropping out (which leads us to hypotheses 2 and 3). As training requirements differ substantially across different occupations, we analyze these questions only within the two subgroups of commercial apprenticeships and four-year technical apprenticeships. We expect that the quality of apprentices has direct and positive effects on their productive contribution, and a negative effect on the dropout probability. However, the observed relation between quality and productivity, and quality and dropout probability, also depends on the training style of the instructor. While a compensating behavior will increase productivity and reduce dropouts for low ability trainees, we expect opposite effects when instructors apply an efficiency strategy.

Hypothesis 2: Dropout rates of low quality apprentices increase when instructors apply an efficiency strategy et vice versa when instructors apply a compensating strategy.

Hypothesis 3: The productivity of low quality apprentices is initially lower than that of high quality apprentices, but that productivity difference disappears over time when instructors apply a compensation strategy et vice versa if an efficiency strategy is applied.

Finally, we analyze the effects of providing additional instruction time to low (high) quality trainees on their performance at the final apprenticeship examinations.

Hypothesis 4: Additional instruction time increases the performance of apprentices at final examinations.

Case study of a large retail firm

The case study uses information from qualitative and structured interviews with 36 training instructors in a large Swiss retail company. For the case of apprentices in retailing, the instructors face exogenous differences in the intake quality of trainees across different establishments that are located in three different regions. For the case of commercial apprenticeships, the training is centralized at the firm's headquarters; however, we still find variation in the evaluation scores of those apprentices (table 3).

Using information on the training style of instructors and the quality of the individual apprentices they train, we can test for the type of training strategy within a single company. We carry out tests based on an instructor's actual training provision, as well as on a measure that is based on how instructors themselves describe their training strategy when faced with apprentices of different quality. Thus the information from the case study allows us to carry out further tests related to hypothesis 1: analyzing an occupation that on average generates a net benefit in a particular firm, we expect that instructors facing low quality trainees will apply a compensation strategy.

5. Results

Quantitative survey

The results for the full sample show that a firm's average training volume depends both on a trainee's prior grades in compulsory schooling and on the costs-benefit structure in the corresponding training

occupation. Apprentices with below-average grades in mathematics and language class receive on average 32 hours less instruction time per year (table 5, column 1). In addition, the training volume in occupations that are profitable for a firm (production-oriented training strategy) is 75 hours of training per year lower than in occupations where a firm follows an investment-oriented training strategy. However, the coefficient of the interaction term between the variables "bad school grades" and "profitable training occupation" is negative and statistically significant at the 5% level. Thus in each year, firms following a production-oriented strategy compensate trainees with bad grades in compulsory schooling with an additional 45 hours of instruction time (compared to firms following a production-oriented strategy that hired apprentices with good grades in compulsory schooling). The results therefore provide evidence that training instructors apply a compensation strategy in those occupations where training is – on average – profitable for the firm.

Further results show that larger firms provide on average less training per apprentice, a finding that may be explained by economies of scale. More skilled workers in the training occupation reduce the average training volume but at a decreasing rate, as shown by the significant coefficient of the squared term (table 5, column 1). Similarly, the number of trainees within an establishment is negatively associated with the average training volume, but also at a diminishing rate. Thus instructing several trainees simultaneously lowers the per capita instruction time required for equipping apprentices with the necessary skills.[9]

{Table 5 about here}

Focusing on the predominant apprenticeship occupation in Switzerland – the commercial employee (see also OPET 2012) — that on average generates a net benefit of almost 2000 Swiss francs in each year of training, we find results similar to that for the full sample. Commercial apprentices with below-average school grades receive on average an additional 44 hours of training each year (table 5, column 2). Thus the results provide evidence for a compensating training style of instructors, thereby providing evidence to support hypothesis 1. Interestingly, all other control

variables remain statistically insignificant, thereby leaving apprentice quality the sole explanatory variable that significantly affects the training volume for commercial apprentices.

Conversely, for four-year technical apprenticeships (e.g, in metalworking or computer sciences) that typically result in a substantial net investment for the training firm, we can show that trainees with above-average grades in compulsory schooling receive an additional 48 hours of training each year. Thus we can also provide evidence that firms apply an efficiency strategy in those occupations where firms bear net costs for training apprentices.

In the next step we analyze whether different training strategies also have an impact on training outcomes. In the case of commercial apprenticeships (where instructors apply a compensation strategy), we expect that providing additional training should reduce dropout rates. Applying instrumental variables regressions, we find a statistically significant first-stage effect of school grades on training volume (table 6, column 2). The second stage regression shows a negative coefficient indicating a reduction of dropouts, but due to large standard errors the coefficient is not statistically significant from zero (table 6, column 3). For the four-year technical apprenticeships (where instructors apply an efficiency strategy), we find a statistically significant and positive association between good school grades and training volume, because firms focus their training efforts on the most talented apprentices. The second stage results then show a statistically significant (at the 10% level) and negative effect of additional training on a firm's dropout rate (table 6, column 5).

{Table 6 about here}

While additional training hours can prevent dropouts, we also expect that more training will increase the productivity of an apprentice (hypothesis 3). For commercial apprentices, we find that additional training has no impact on the relative productivity of apprentices in the last year of training (table 7, column 3).[10] Conversely, for the four-year technical apprenticeships, where additional training goes to above average intake quality apprentices, we find that providing additional training

has a statistically significant and positive effect on the relative productivity of apprentices in the last year of training (table 7, column 5).

{Table 7 about here}

Finally, we test whether providing additional training hours has a causal impact on the performance at the final (practical) examinations. Our variable of an apprentice's performance at the final examination stems from the subjective evaluation of the training instructors. We find a statistically significant first-stage effect of school grades on training volume (table 8, columns 2,4). The main results show that those apprentices receiving more training are significantly more likely to achieve an above-average performance at the final apprenticeship examinations (table 8, columns 3,5).

For the case of commercial apprentices, we find that an increase in the yearly training volume by 50 hours increases the probability to achieve an above-average grade at the final examinations by 30%. Similarly, an increase in the annual training volume by 50 hours in the group of four-year technical apprenticeships increases the probability for an above-average grade by 45%. Interestingly, we find positive effects of additional training for both groups of apprenticeships, even though for the group of commercial apprentices only those with bad school grades benefit from additional training.

{Table 8 about here}

Case study of a large retail firm

Our case study results broadly confirm the empirical findings of the survey data for the case of a specific firm. Conducting interviews in two (profitable) training occupations shows that not a single training instructor follows an efficiency strategy.[11] The validity of this result is not sensitive to the definition of the training style. Both the actual training behavior (i.e., hour of training provided to the apprentices) and the subjective self-assessment of training instructors based on the case-study survey questions show that none of the instructors follows an efficiency strategy (table 4).

Looking at the actual training volume of individual instructors in retailing, we find that the weekly instruction time is 1.4 hours for high quality apprentices, but 1.7 hours for low quality trainees. The difference in training volume is even more pronounced for commercial apprentices working at the company headquarters. While high quality trainees receive 2.25 hours of training each week, low quality trainees receive double that amount (although this results should be interpreted with some caution, as we only have information on four apprentices

{Table 9 about here}

Summing up, the results based on case study evidence confirm the survey results which are based on between-firm variance and provide additional evidence that the effects are indeed related to a firm's training strategy, and not driven by unobserved firm heterogeneity.

6. Conclusions

We analyze the training strategy of firms when the quality of apprentices is heterogeneous. Our results show that firms generally provide less training to apprentices with a below-average intake quality (measured in by school grades). However, depending on the cost-benefit structure of the training occupation, firms adjust their training strategy, altering the training volume provided to apprentices with a poor schooling background. Our results show that a firm is willing to compensate apprentices of low intake quality with additional training only in those occupations where training is on average expected to be profitable (production-oriented training motivation). In occupations that require a firm to make a substantial net investment (investment-oriented training motivation), such as four-year technical apprenticeships, firms apply an efficiency strategy and thus focus their training efforts on the most talented apprentices. As a result, apprentices with below-average grades in compulsory schooling receive an additional 45 hours of training each year only in firms that train for production-oriented reasons. Further analyses show, that the training style may have consequences for training outcomes, as measured in terms of drop-out risk, relative productivity of apprentices, and their performance at the final examinations.

The survey results that are based on between-firm variations in the quality of apprentices are confirmed by a case study looking at the within-firm heterogeneity in the quality of apprentices. The case study is based on interviews with 34 training instructors in a large Swiss retail firm that offers apprenticeships in occupations that are, on average, profitable for the firm. As expected, we find evidence of instructors compensating low quality apprentices with additional training time. Finally, while some instructors provide equal treatment to all apprentices, we find not a single instructor who applies an efficiency strategy.

Our findings show that firms offering training in a flexible labor market such as Switzerland focus their training effort on the most talented apprentices in general, but are willing to compensate weak apprentices with additional training hours provided that they can on average expect a net benefit from training by the end of the apprenticeship program. Thus in order to help low-quality trainees to make up for bad starting conditions (school grades in compulsory schooling), it is essential that training regulations allow firms to generate a net benefit from work-based training in the short run — otherwise firms may even refrain from training low-quality school leavers in the first place.

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Table 1: Descriptive statistics for the quantitative survey

VARIABLES	Mean	Std.dev.	Min	Max
Training volume (in hours per year)	324.958	126.675	91	723
Bad school grades	0.290	0.454	0	1
Profitable training occupation	0.759	0.428	0	1
Dropout rate	4.815	8.473	0	100
10-49 employees	0.308	0.462	0	1
50-100 employees	0.060	0.237	0	1
100+ employees	0.084	0.278	0	1
Italian-speaking part of Switzerland	0.038	0.190	0	1
French-speaking part of Switzerland	0.172	0.377	0	1
Number of apprentices	2.729	5.028	1	327
Number of skilled workers in training occ.	13.418	81.933	1	8000
Share of apprentices with professional bac.	0.194	0.396	0	1
Monthly skilled worker wage (in CHF)	5392.987	1002.213	3000	10000

Table 2: Case study of instructors' training strategies

	Compensation strategy	Equal treatment of apprentices	Efficiency strategy
Retailing in location A	15 (68%)	7 (32%)	0
Retailing in location B	3 (75%)	1 (25%)	0
Retailing in location C	5 (83%)	1 (17%)	0
Administration (Headquarters)	7 (100%)	0	0

The data is based on interview in a large Swiss retail company in 2009.

Table 3: Case study of trainee quality, first annual evaluation

Competences (measured by points)	Average evaluation score (Retailing Apprenticeship)	Average evaluation score (Commercial apprenticeship)
Professional competences	73.3% (Std.dev.=10.0%)	79.2% (Std.dev.=7.5%)
Methodological competences	70.8 % (Std.dev.=12.3%)	75.0 % (Std.dev.=10.1%)
Social Competences	75.0% (Std.dev.=11.9%)	83.3% (Std.dev.=10.8%)
Total	72.5% (Std.dev.=10.0%)	78.5% (Std.dev.=8.1%)
Observations	26	5

The data is based on interview in a large Swiss retail company in 2009.

Table 4: Case study of instructors' training perceived and their actual training strategies

Perceived instruction style / observed instruction style	Compensation strategy	Equal treatment of apprentices	Efficiency strategy	Total
Compensation strategy	11	1	0	12
Equal treatment of apprentices	3	6	0	9
Efficiency strategy	5	0	0	5
Total	19	7	0	26

The data is based on interview in a large Swiss retail company in 2009.

Table 5: Apprentice quality and training hours

VARIABLES	(1) All firms	(2) Commercial apprenticeship	(3) Industrial apprenticeships
Bad school grades	-32.986*	43.619**	
	(18.556)	(21.126)	
Good school grades			47.618**
			(21.801)
Profitable training occupation	-75.488***		
	(21.106)		
Profitable occupation x bad school grades	44.705**		
	(21.282)		
10-49 employees	-10.032	23.612	21.018
	(13.202)	(22.850)	(31.034)
50-99 employees	-12.887	29.442	-41.474
	(23.057)	(43.149)	(33.203)
100+ employees	-29.946*	2.604	-52.686*
	(15.829)	(24.467)	(28.486)
French-speaking region	24.157	10.270	49.429**
	(15.528)	(20.337)	(23.060)
Italian-speaking region	33.440	59.126	90.588
	(30.909)	(49.014)	(64.299)
Number of trainees	-2.479***	-0.918	-0.609
	(0.688)	(0.558)	(0.726)
(Number of trainees)^2	0.010***		
	(0.003)		
Number of skilled workers	0.100**	0.014	-0.023**
	(0.043)	(0.025)	(0.011)
(Number of skilled workers)^2	-0.000***		
	(0.000)		
High share of baccalaureate	-2.046	-9.617	0.382
	(13.086)	(18.257)	(20.978)
Sector controls	Yes	Yes	Yes
Constant	406.637***	287.277***	331.422***
	(42.238)	(34.570)	(25.768)
Observations	1427	527	290
R-squared	0.265	0.125	0.164
F-statistic	7.581	9.496	4.837

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

Table 6: Dropouts (2 stage least square regressions)

	Commercial apprenticeships		*Industrial apprenticeships*	
VARIABLES	First stage (Training volume)	Dropout rate	First stage (Training volume)	Dropout rate
Training volume		-0.014		-0.115*
		(0.054)		0.685
Bad school grades	42.628**			
	(20.136)			
Good school grades			48.890**	
			(20.960)	
10-49 employees	22.267	-1.007	28.349	4.788
	(21.699)	(3.209)	(29.829)	(5.499)
50-99 employees	27.464	-1.001	-15.458	-4.075
	(42.053)	(4.559)	(32.569)	(5.061)
100+ employees	-0.340	-1.109	-9.163	-2.743
	(23.421)	(2.987)	(29.809)	(5.758)
Italian-speaking region	10.680	8.870***	87.600	27.013***
	(19.574)	(2.977)	(69.374)	(10.239)
French-speaking region	58.307	15.931**	47.542**	23.176**
	(48.043)	(7.605)	(22.645)	(4.473)
Number of trainees	-0.846	0.036	-6.725	-1.124**
	(0.543)	(0.055)	(1.535)	(0.573)
Number of skilled workers	0.012	-0.002	-0.077	-0.003
	(0.025)	(0.002)	(0.018)	(0.002)
Foreign firm	26.758	4.578*	36.768*	7.202**
	(23.972)	(2.510)	(19.744)	(3.289)
Constant	286.788***	-2.702*	344.475***	39.047*
	(33.552)	(1.475)	(23.151)	(24.942)
Log likelihood	-216,332.85		-177626.32	
Observations	527		290	

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7: Apprentice productivity relative to skilled workers in the same occupation (2 stage least square regressions)

VARIABLES	*Commercial apprenticeship* First stage (Training volume)	*Commercial apprenticeship* Productivity last year of training	*Industrial apprenticeship* First year (Training volume)	*Industrial apprenticeship* Productivity in last year of training
Training volume		-0.112		0.080*
		(0.091)		(0.048)
Bad school grades	43.618**			
	(21.147)			
Good school grades			48.818 **	
			(21.799)	
10-49 employees	23.612	10.998 ***	20.229	-0.751
	(22.872)	(4.527)	(30.943)	(3.778)
50-99 employees	29.442	12.120 **	-45.083	9.454 **
	(43.192)	(5.734)	(33.243)	(4.725)
100+ employees	2.604	10.001 ***	-56.257**	13.425***
	(24.491)	(4.414)	(28.409)	(4.306)
Italian-speaking region	59.126	11.358	93.565*	-2.654
	(49.063)	(9.659)	(64.334)	(4.824)
French-speaking region	10.269	0.137	42.322	-9.127**
	(20.357)	(4.543)	(22.253)	(3.992)
Number of trainees	-0.9184	0.060	-0.742	0.119
	(0.558)	(0.119)	(0.754)	(0.130)
Number of skilled workers	0.014	-0.007*	-0.020	-0.004*
	(0.025)	(0.004)	(0.011)	(0.002)
Foreign firm	26.518	5.416	30.327	-3.578
	(24.631)	(4.453)	(24.055)	(5.586)
Sector controls	Yes	Yes	Yes	Yes
Constant	287.277***	91.984***	287.277***	91.984***
	(34.605)	(27.282)	(34.605)	(27.282)
Observations	527	527	290	290
R-squared	0.100		0.125	

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

Table 8: Above-average performance at final examinations (2 stage least square regressions)

VARIABLES	*Commercial apprenticeship*		*Four-year technical apprenticeships*	
	First stage (Training volume)	Final examination	First stage (Training volume)	Final examination
Training volume		0.006***		0.009***
		(0.002)		(0.001)
Bad school grades	44.121**			
	(20.784)			
Good school grades			54.704***	
			(19.318)	
10-49 employees	23.482	-0.222	29.796	-0.052
	(22.384)	(0.257)	(28.659)	(0.329)
50-99 employees	27.998	-0.115	-12.866	0.180
	(42.073)	(0.401)	(30.918)	(0.308)
100+ employees	-5.726	-0.252	-14.384	-0.211
	(25.102)	(0.314)	(28.179)	(0.274)
Italian-speaking region	63.678	-0.833**	110.920	-0.962***
	(50.782)	(0.400)	(71.795)	(0.243)
French-speaking region	11.219	0.224	58.944**	-0.976***
	(19.461)	(0.236)	(23.553)	(0.358)
Number of trainees	-0.511	-0.003	-5.492***	0.038
	(0.769)	(0.008)	(1.520)	(0.041)
(Number of trainees) ^2	-0.004	0.000	0.056***	0.000
	(0.005)	(0.000)	(0.018)	(0.001)
Number of skilled workers	0.042	-0.000	-0.024***	0.002
	(0.038)	(0.000)	(0.007)	(0.001)
Foreign firm	23.765	-0.004	42.711**	-0.282
	(23.947)	(0.260)	(19.816)	(0.280)
High share of baccalaureate	-10.719	0.128	12.042	0.666**
	(17.881)	(0.184)	(17.914)	(0.337)
Sector controls	Yes	Yes	Yes	Yes
Constant	290.429***	-1.415*	364.188***	-2.679***
	(33.603)	(0.763)	(21.597)	(0.589)
Log pseudolikelihood	-185608.63		-149615.30	
Observations	522		324	

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

Table 9: Case study of instructors' training volume

	Average weekly instruction time for high quality trainee	Average weekly instruction time for low quality trainee
Retailing (N=22)	1.39 (0.38)	1.72 (0.42)
Commercial apprentices (N=4)	2.25 (0.75)	4.75 (0.75)

The data is based on interview in a large Swiss retail company in 2009. Standard deviation in parentheses.

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[1] An extensive review of the general training literature is provided by Leuven (2005), or more specifically for apprenticeships by Wolter and Ryan (2011).

[2] A detailed description of the survey methods is provided in Muehlemann (2010).

[3] Our main findings do not change when using the full sample. The results are available upon request.

[4] For details on the calculation of costs and benefits of apprenticeship training see Muehlemann (2010) or Wolter and Ryan (2011).

[5] We also have information on two alternative measures on trainee quality: results from "Multicheck" test (a standardised aptitude test), and school grades. We find a correlation of 0.57 between school grades and the results from the evaluation in the firm, whereas the correlation between the Multicheck scores and the evaluation is only 0.24. These results are in line with the findings of Siegenthaler (2011), who shows that the Multicheck scores have a low predictive value for success in apprenticeship training.

[6] A score of 30 points is equal to a grade 5 of a scale from 1 to 6, which corresponds to a „good performance" in the Swiss school system. The same logic applies for apprentices in administration.

[7] The response rate to the questionnaire was 83%.

[8] Instruction time is defined as the time that instructors were not able to pursue their regular work activities because they were instructing apprentices. This definition of training time is identical to that in the quantitative survey.

[9] We further find that the wage of skilled workers is unrelated to the training volume. This result suggests that high-wage firms—that are possibly more productive than low-wage firms—do not provide more training when controlling for the training occupation and other firm characteristics).

[10] However, we find that commercial apprentices with bad grades in prior schooling are initially less productivity, but that difference in productivity becomes insignificant by the end of the training period.

[11] We also asked trainees to assess their instructors' training styles. About half of the assessments were identical to those of the instructors; however, not a single apprentice rated an instructor as pursuing an efficiency strategy.