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Regional Effects on Employer Provided Training: Evidence from Apprenticeship Training in Switzerland

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REGIONAL EFFECTS ON EMPLOYER PROVIDED TRAINING: EVIDENCE FROM APPRENTICESHIP TRAINING IN SWITZERLAND

Abstract

This paper uses regional variation in labor markets, the industry structure and the educational system to explain the training decisions of firms. Using a representative firm-level data set, the results show that firms are less likely to offer training if the number of competing firms situated in the same geographical area is high. Furthermore, the supply of potential apprentices affects the training decision positively through an improved matching process. In addition, the expected ability of apprentices also has a positive impact, whereas a more developed system of full-time schooling options for school leavers reduces the likelihood of a firm to offer training.

JEL Code: I28, J24, J42.

Keywords: apprenticeship training, regional labor markets.

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1 Introduction

Apprenticeship training is believed to be a very efficient form of training, providing skills to young people, such that they have less problems in the transition into the labor market, e.g. OECD (2000).[1] The precondition for a successfully operating apprenticeship training system is, however, that there is a sufficiently high number of firms willing to train young people. The factors influencing the willingness of firms to train have been analyzed in a limited number of empirical studies. This study adds to the existing literature by analyzing the firms training decision with the help of data on regional labor market conditions and the structure of the regional education system.

This paper contributes to the training literature in different ways. Firstly, regional variance in the data is used within one national training system. This is an advantage, because local effects on the training decision can be captured, which would not be possible if one performs an analysis on the national level. Furthermore, unobserved time effects, that would almost certainly be present in a longitudinal study, can be avoided. Secondly, this study differs from the few existing studies using data on a regional level, e.g. Brunello and de Paola (2004), Brunello and Gambarotto (2004) or Niederalt (2005), by using travel distances rather than political borders in defining the regional area. Thirdly, a representative firm-level data set is at our disposal that has been designed explicitly to analyze questions related to the training decision of firms. This enables us to make use of detailed information that are relevant in this context, such as variables including the number of skilled workers in the training profession of (potential) apprentices as well as the retention and quit rates of apprentices in training firms.

Two main questions will be addressed in this paper. Firstly, the effect that the possibility of trained workers quitting after graduation has on the training decision is analyzed with information about the local industry structure. And secondly, we analyze the impact of the ability of potential apprentices on the training decision by using different proxy variables, which also contributes to the existing literature. Both sets of information; industry structure and the supply of school-leavers, show a large degree of regional variation and are therefore suited to be used in an inter-regional comparison.

The paper is organized as follows: Section 2 briefly describes the Swiss apprenticeship system. Section 3 discusses the theory on firm training and presents the empirical hypotheses in the framework of a theoretical model. Section 4 introduces the data and the sample design. In Section 5, the training probability of firms is estimated and the results are discussed. Section 6 concludes.

[1] There is evidence that the apprenticeship training is even efficient in countries, where this form of training has a lesser tradition, see e.g. Bonnal et al. (2002)

2 The apprenticeship system in Switzerland

The apprenticeship system is still the backbone of the upper secondary level educational system in German speaking countries. In Switzerland, about 60 percent of school leavers choose an apprenticeship training program each year. The so called "dual-education" provides them with formal and on-the-job training within their firm, and one to two days of formal schooling in a vocational school. The two main types of apprenticeship training programs last either three or four years. As an alternative to the apprenticeship training, school-leavers could also opt for full-time education at upper secondary level. Almost half of the remaining 40 percent of young people who do not choose an apprenticeship program attend grammar school (Gymnasium), which prepares them for university and a more academic career. Although one of the virtues of the apprenticeship system is its inclusiveness for not so academically prone school leavers (Switzerland has one of the lowest percentages of the over-16 population not having attended any form of non-compulsory schooling in the OECD), apprentices can qualify for further education at the tertiary level. The proportion of apprentices continuing their education at the tertiary level has steadily risen over the last decade. From the perspective of an individual educational career, an apprenticeship training is therefore in no way a dead end road.

Apprentices graduate with a diploma recognized throughout Switzerland attesting their professional qualification. The national certification and the substantial share of formal education during the training program gives the apprentices a guarantee for vertical and horizontal mobility after they graduate. The quality of the training provided in Switzerland is recognized internationally as meeting the highest standards. International comparisons show, in terms of scholastic and professional qualifications, that Swiss apprentices are more than a match for their upper secondary level peers attending school full-time (Bierhoff and Prais, 1997).

The employment period ends automatically on completion of training. Any extension of the employment period must be negotiated in a separate contract. Mobility is fairly high among young people who complete their apprenticeship, with only 36 percent still working at their original training site one year later (Schweri et al., 2003).[2]

3 Theory

In this section, the hypotheses and the choice of empirical variables will be described. We begin by briefly discussing the implications of the human capital theory and its refinements on the decision of firms to train apprentices. Then the question of how the expectations of firms about the ability of apprentices influences the training decision will be addressed. Subsequently, the arguments will be presented in a more formal manner, following the model

[2]In Germany, the corresponding figure is closer to 70 percent, see Winkelmann (1996) or Euwals and Winkelmann (2002).

of Acemoglu and Pischke (1998) and extending it to allow for interregional variations in labor market conditions and educational systems.

3.1 Competitive vs. frictional labor markets

According to the classical human capital theory, firms will not pay for general training (Becker, 1964). The recent training literature, however, has focused on the reasons why firms might pay for general training of their workers, which is a frequently observed phenomena and in contradiction to the human capital theory. The main result of this literature states that a firm is willing to pay for general training, if there is a positive probability that the apprentice will remain within the firm after the training period, and that he will accept a wage below his productivity, at least for some time. The necessary condition for this to happen, is that there are frictions on the labor market. Frictions give the training firms enough monopsony power to keep their trainees from switching to a competitor, even if the training firm is paying a wage below the trainees' productivity. In addition, the difference between wage and productivity must be higher for skilled workers than for unskilled workers [Acemoglu and Pischke (1998, 1999) refer to this as compressed wage structure], otherwise firms would still not have an incentive to invest in training their workforce. Compressed wage structure occurs if there are either search costs, asymmetric information, firm-specific human capital, efficiency wages, minimum wages or other wage floors. Although a compressed wage structure induces firms to pay for general training, there will still be under-investment because not all returns to training are internalized. Stevens (1994) also shows that if the trained skills are transferable, there will be externalities leading to under-investment in training. For a comprehensive summary of the literature on firm training see Leuven (2005).

The labor market in Switzerland is considered to be rather competitive by international standards. Hence, one would expect that the costs of an apprenticeship training program would have to be borne by the apprentices themselves in order for firms to provide training. Consistent with this hypothesis, a Swiss survey shows that on average, an apprenticeship program results in a net profit for the training firm (Wolter and Schweri, 2002). In other words, the productive contribution of an average apprentice is high enough to cover the company's training expenses and the salary of the apprentice. Hence, the possibility to cover all training expenses already within the contract period of the apprenticeship program is a necessary condition for firms to offer training posts in the context of a highly competitive labor market.[3] However, not all firms have the structure which would guarantee that their expenses were covered if they would decide to train apprentices. Wolter et al. (2006) show that differences in the expected net costs of training during the training period can explain why a great number of firms decide not to train apprentices. Finally, Muehlemann et al.

[3]Consistently with these findings for Switzerland, research in Germany, where labor market frictions are high, has shown that on average training firms have significant net costs after training (Beicht et al., 2004)

(2005) show that the elasticity with which firms react to the expected net costs of training is substantial for the training decision, yet, the offer of apprenticeship positions by training firms would not be increased by a marginal reduction in the net costs of training.

Despite the observation that an average apprenticeship program has no uncovered training expenses at the end of the training period, about a third of training companies face positive net costs after an apprentice has graduated. Therefore, at least a part of the training companies must be able to use frictions in the labor market to recoup their training expenses. The hypothesis tested in this paper is that within a region, a greater number of firms in the same industry will lower the likelihood of a firm to train apprentices. We argue that an increasing number of competitors that are geographically close will increase the probability that the trained workers will leave the training company.[4] Reason being the threat that the training company can loose its trained workers, the training companies will have a lower probability to make a gain by paying wages below productivity once the training is completed.

Overall, firms only offer apprenticeship positions if it is already profitable during the training period, or if they are able to recoup their investments after the training period.

3.2 The expected ability of apprentices

The expected ability of apprentices is of twofold interest for training companies. On the one hand, more able school leavers will lower the net costs of training, because they need less training hours to reach the required training levels. On the other hand, if a company decides to employ an apprentice after training, and labor market frictions allow the company to pay wages below productivity, the gain is higher in the case of more able workers (apprentices). In line with these hypotheses, one would expect that the easier it is for a company to recruit able school-leavers, the more likely it will decide to engage in training. Since we cannot directly observe the ability of an apprentice, we will test three types of proxy variables. All of them vary substantially between regions, should theoretically have an independent impact on the training decision and therefore be suitable for our empirical analysis. For the first variable, we argue that the number of school-leavers (within a region) per company is a proxy for the quality of the match between apprentices and training firms. If there are more young people per firm, then a firm should also find more suitable applicants to fill their training posts. Therefore, independent of the average quality of school leavers in a region, the number of school leavers per firm in a region should increase the quality of the match. Secondly, PISA tests (OECD, 2002, 2004) have shown that pupils with a foreign mother tongue are on average less qualified than native speakers. As a proxy for this effect, the share of pupils of foreign nationality in the region is used to capture the average quality of potential apprentices. Thirdly, the structure of the education system at an upper secondary level is

[4]Franz and Zimmermann (2002) showed for Germany that outside options have a significant influence on the probability that apprentices leave the training company after the apprenticeship period.

taken into account. It is assumed that the existence of a well developed full-time school system in the region will attract the more able school leavers into these forms of education and detract them from an apprenticeship training. Full-time schooling programs require a costly infrastructure, thus they are regionally concentrated, and not all pupils have the same access to these programs because they might live in more secluded region. Furthermore, because the infrastructure cannot be adjusted at will in the short run, there are fluctuations in the admission standards due to demographic changes. In times where many young people finish compulsory school at the same time, admission standards rise because the schools have a limited number of classrooms and teachers available. On the contrary, if the number of school leavers is low, then it will be easier to enroll in a full-time program, since the school might not want to lay off teachers or have many empty classrooms. Furthermore, because the academically oriented programs (grammar schools) at upper secondary level offer a high social prestige, these programs are generally preferred to apprenticeship programs (at least by the parents of school leavers). One can assume that if the infrastructure for full-time schooling in a region is well developed, a training firm will have a smaller pool of able applicants for an apprenticeship program. Consequently, full-time schooling programs will have an exogenous affect on the firms training decision. As a proxy for the size of the full-time schooling offer in a region, we use the share of school-leavers that opted for grammar schools in 1995.[5]

3.3 The Model

The model consists of two periods. Firms are risk neutral and they can hire workers at the beginning of either period. Also, there are constant returns to scale in the production process and there is no discounting between the two periods. The amount of training offered to the hired apprentices is t and, like the firms, apprentices are assumed to be risk neutral and do not discount between periods. They are working productively in the firms and produce a standardized output of zero in the training period. The output during the second period is $y = \alpha(t)\eta$, where $\alpha(t)$ is defined as general human capital and η as worker's ability. Since we distinguish between geographic labor markets r, we allow the distribution of the apprentices ability to be different in each region, based on our arguments in the preceding section. Hence, the distribution of ability is $F_r(\eta)$.

During the first period, firms incur training costs t and pay the apprentice a wage W. At the end of the first period, the firm learns about the ability η of each worker, which is independent of training, and offers a post-training wage $w(t)$. If the workers quits, he will receive an outside wage $v(t)$ in any other firm. Workers exogenously quit due to a disutility shock θ_r, which can be interpreted as disutility to stay with the firm. However, if an apprentice would like to quit because of that shock, he might incur mobility costs if finding a new job

[5] As the firm survey covers training and non-training firms at the end of the year 2000, one can rule out the possibility that the number of grammar school students in 1995 might be endogenous.

requires to change the place of residence. The relevant size of θ_r is therefore not only the disutility from staying with the firm but also includes the disutility from moving to another firm. The probability of workers receiving such a shock is λ, which does not differ between regions, but the probability distribution of $G_r(\theta)$ is regionally different.[6] Hence, a higher θ_r will induce more exogenous quits (1). Consequently, higher quits in a region lead to lower expected profits of training apprentices and thus a lower training probability.

If the ability level is observed, the outcome is the Becker model. Workers who quit get paid according to their marginal product which, depends on ability η, so the salary is $v(t) = \alpha(t)\eta$. Every apprentice will quit if the firm does not offer a wage $v(t)$. As a result, the worker reaps all the benefits yet also pays for the training costs. If W is constrained to be nonnegative, there will be no training, and $t^0 = 0$. On the other hand, if W is unconstrained, then the first best amount of training is $t^c = argmax \int \eta\alpha(t)dF(\eta) - t$ and the training wage is $W = -t^c$.

The probability that a worker with training t quits is $q_r[w(t), v(t)]$, and he will receive an outside wage $v(t)$. If the worker remains within the firm, the wage offered is $w(t)$, but he will suffer from disutility θ_r with probability λ. It is optimal to quit if $v(t) - w(t) + \theta_r \geq 0$. The probability of quitting is therefore

$$q_r[w(t), v(t)] = \lambda[1 - G_r[w(t) - v(t)]] \tag{1}$$

Since the firm has to pay the same wage to all remaining workers with the same apprenticeship certificate, the firm will lay off all workers below a certain skill level $\hat{\eta}(t)$. Given the minimal skill level $\hat{\eta}(t)$, below which workers would be laid off, a higher ability of apprentices increases the chances that a firm will keep an apprentice as a worker. In addition, the higher the expected ability, the higher the difference between the workers productivity and his salary. Therefore, all variables in our empirical model that capture regional differences in the expected ability of apprentices will have an impact on the training intensity in a region. Since firms offers W first, and then decide on the amount of training, retention and wage policies, the profit maximization problem can be written as:

$$\max_{w(t),\hat{\eta}(t),t} \Pi = [1 - q_r[w(t), v(t)]] \int_{\hat{\eta}(t)}^{\infty} [\alpha(t)\eta - w(t)]dF_r(\eta) - t - W \tag{2}$$

The first order conditions are:

$$\hat{\eta}^*(t) = \frac{w^*(t)}{\alpha(t)}, \tag{3}$$

[6]The probability that a worker has to change the place of residence is much lower in regions with many firms in the particular industry. Therefore, the probability that θ_r is large, is smaller in a more secluded region with few firms, because a change the workplace is more likely to require a change of residence, which in turn reduces the net disutility of staying with the training firm. Consequently, exogenous quits should be an increasing function of the number of firms.

$$- [1 - q(w^*(t), v(t))][1 - F_r(\hat{\eta}^*(t))] - \frac{\delta q_r[w^*(t), v(t)]}{\delta w(t)} \int_{\hat{\eta}^*(t)}^{\infty} [\alpha(t)\eta - w^*(t)] dF_r(\eta) = 0, \quad (4)$$

$$[1 - q_r[w^*(t^*), v(t^*)]] \int_{\hat{\eta}^*(t^*)}^{\infty} [\alpha'(t^*)\eta - v'(t^*)] dF_r(\eta) = 1 \quad (5)$$

For the equilibrium outcome, profits $\Pi = 0$. Therefore,

$$W^* = \max\{0; [1 - q[w^*(t^*), v(t^*)]] \int_{\hat{\eta^*}(t^*)}^{\infty} [\alpha(t^*)\eta - w^*(t^*)] dF_r(\eta) - t^*\}. \quad (6)$$

Hence, outside wages are

$$v(t) = \frac{q(w^*(t^*), v(t))\alpha(t)\bar{\eta} + [1 - q[w^*(t), v(t)]] \int_0^{\hat{\eta^*}(t)} \alpha(t)\eta \; dF_r(\eta)}{q[w^*(t), v(t)] + [1 - q[w^*(t), v(t)]] F_r(\hat{\eta^*}(t))} \quad (7)$$

Summing up the theoretical implications of the model, both the quit rate of apprentices, which is influenced by the number of firms within a region, and the expected ability of apprentices, which depends on the quality of the matching between applicants and firms, the average ability of school-leavers and the alternative schooling options for school-leavers, have an impact on the training decisions of firms.

4 Data

4.1 Survey design and data

The data used here is from a representative survey conducted in Swiss firms in the year 2001 by the Center for Research in Economics of Education at the University of Berne and the Swiss Federal Statistical Office.[7] The original data set contains 2352 training firms and 2230 non-training firms, but firms that cannot make independent decisions about training, because they are part of a larger enterprize were excluded.[8] Furthermore, firms that operate in the whole country and use a centralized training scheme were excluded from the sample. The final data set used in this paper has a total of 4090 firms. Detailed data on the number of workers, skilled workers in the (potential) training profession, training profession, retention and quit rates of apprentices and the personnel situation is available at the firm level.

[7] For details on the survey characteristics see (Wolter and Schweri, 2002)

[8] The results do not change if public firms are excluded from the sample.

4.2 Regional labor markets

We have constructed regional labor markets to accommodate the geographic structure of Switzerland. Regions were defined as follows: The largest Swiss cities were taken as centers of each region. All towns and communes that could be reached within half an hour by car constitute the area of a region.[9] In total, there are 67 different regions that cover all of the country; especially in densely populated areas, the regions can be overlapping. This definition of a region captures the economic and geographic reality in a much better way than using political and administrative entities, such as cantons or districts. For each region, all relevant data was collected at the community level, then aggregated to the regional level and finally matched to our data set. The variables include the number of firms within an industry, the population size by age group, the number of pupils and their origin as well as the number of students on different levels of secondary education. The descriptives of the regional data can be found in the appendix (Table 4).

5 Econometric models and empirical analysis

In order to estimate the effect of our variables of interest on the training decision, a probit model was used. The variables on the regional level influence all companies within a region in the same way. Therefore, the variance of variables on the regional level should be treated differently than the variance of the firm-level data. Hence, the standard errors are adjusted for clustering to accommodate this type of data structure.

5.1 Estimation of the effects on the training decision

We assume that the decision to offer training depends on firm characteristics j and on some regional variables r. Let

$$y_{jr} = \begin{cases} 1 & \text{if firm } j \text{ trains} \\ 0 & \text{if firm } j \text{ does not train} \end{cases} \tag{8}$$

then the probability that a firm offers training is

$$P(y_{jr} = 1|x_{jr}) = P(y_{jr}* > 0|x_{jr}) = \Phi(x_{jr}\beta), j = 1, ..., 4090; r = 1, ...67. \tag{9}$$

We use the following probit regression model for the training decision:

$$y_{ir} = 1[x'_{jr}\beta_j r + \varepsilon_{jr} < 0] \tag{10}$$

where x_{ir} contains regional variables r concerning the number of firms in a certain industry, the percentage of young people of the whole population, the percentage of young people in

[9] To measure the travel time, we used the software "Microsoft Autoroute 2005"

high school and the percentage of foreign pupils in elementary school. As well, there are variables on the firms level i about the firm size, number of skilled workers in the training profession, firm ownership, industry, training profession and a variable indicating whether the firm has difficulties to recruit skilled workers on the external labor market.

5.2 Results

5.2.1 The influence of the number of firms within a region

The results show that the number of firms in a regional labor market has a significant and negative effect on the provision of training. The firm effect is largest when we exclude the other regional variables we have available (Model 1). The training decision of firms reacts to the number of firms per industry in a region with an elasticity of -0.19.[10] In other words, the effect of a 10% increase in the number of firms in the region and industry reduces the training probability by 1.9%.[11] Once the number of young people and the schooling variables are introduced, the firm effect becomes smaller but remains negative and significant. In our preferred specification (Model 4), an increase in the number of firms by 10% reduces the training probability by 1%. Therefore it can be argued that the outside options for workers are important for the firm's training decision, at least at the regional level. Our results are in line with the findings of Harhoff and Kane (1997), Brunello and de Paola (2004), Brunello and Gambarotto (2004). A further indication that the number of firms within a region influences the training decision can be found by analyzing only the training firms. We find that a firm is more likely to suffer from a high exogenous quit rate if there are more firms in the same industry within a region; although the effect is only marginally significant, an increase in the number of firms by 10% increases the probability of a high exogenous quit rate by 2 percentage points (Table 2).[12]

5.2.2 The influence of the firm's expected ability of apprentices

As discussed in section 3.2, the effect of the ability of apprentices on the firm behavior cannot be observed directly. Instead, proxy variables for the firms expectations about the ability of potential apprentices were used. We find that these variables are important determinants of a firm's decision process. The size of the cohort, the quality of pupils and the structure of the education system influence the training decisions of firms significantly.

[10] All elasticities reported in the text are significantly different from zero. For reasons of space they are not shown specifically in table 1.

[11] The average training probability in the sample is 29.8%, see also table 3 in the appendix.

[12] The quit rate within a firm is a binary variable defined to be high, if at least half of the trained apprentices quit the firm after training, despite the firm offered them a contract as a skilled worker.

Table 1: Probit regression: Training decision of firms

Variable	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Number of firms in the region (in '000)	-0.121**	-0.107**	-0.094**	-0.066**
	(0.018)	(0.017)	(0.018)	(0.022)
Number of young people per firm (in '000)		0.485**	0.519**	0.560**
		0.111	0.110	0.113
Percentage of young people with college degree			-1.894**	-1.183*
			0.608	0.568
High rate of foreigners in elementary school				-0.168*
				0.075
Large metropolitan area				-0.069
				0.073
1-4 employees	-0.440**	-0.352*	-0.35*	-0.376*
	(0.159)	(0.161)	(0.162)	(0.160)
5-9 employees	-0.270	-0.182	-0.177	-0.200
	(0.168)	(0.170)	(0.171)	(0.170)
10-49 employees	-0.231	-0.147	-0.138	-0.160
	(0.137)	(0.136)	(0.136)	(0.134)
50-99 employees	-0.060	-0.063	-0.049	-0.076
	(0.197)	(0.197)	(0.197)	(0.197)
Log number of skilled workers	0.461**	0.463**	0.463**	0.461**
	(0.048)	(0.048)	(0.048)	(0.048)
French part of Switzerland	-0.245**	-0.23**	-0.120	-0.097
	(0.068)	(0.068)	(0.072)	(0.068)
Italian part of Switzerland	-0.368	-0.327	0.029	-0.050
	(0.210)	(0.209)	(0.242)	(0.241)
Foreign-owned firm	-0.608**	-0.614**	-0.606**	-0.605**
	(0.150)	(0.152)	(0.154)	(0.153)
Difficulties to find skilled workers on labor market	0.282**	0.279*	0.28**	0.277**
	(0.053)	(0.053)	(0.052)	(0.052)
Intercept	-0.576**	-0.714**	-0.514*	-0.489*
	(0.202)	(0.208)	(0.224)	(0.224)
Job & Industry dummies	Yes	Yes	Yes	Yes
N	4090	4090	4090	4090
Log-likelihood	-2086.573	-2075.034	-2069.438	-2062.791

Significance levels : $*$: 5% $**$: 1%. Standard errors in parentheses are adjusted for clustering. Number of clusters: 67

First, the number of young people per firms within a region and industry has a significant and positive effect on training. If the number of young people increases by 10%, then the training probability of a firm increases by 0.8% (Model 4). The reason why the number of young people has a separate effect on the training decision lies in the improved matching between firms and candidates. If a firm has a larger pool of applicants, then it is more likely that there will be somebody suitable amongst those who apply for an apprenticeship position.

Second, an increase in the percentage of foreign children in elementary schools reduces the training provision of firms. If a firm is located within a region with more than 20% of foreigners in elementary schools, then the training probability is reduced by 5.6 percentage points (Model 4). This reflects the fact that firms expect higher training costs because of lower abilities of the average potential apprentice, which is in line with the results from student achievement tests, e.g. OECD (2002, 2004).

Third, firms are less likely to offer training in regions with a well developed full-time school system at the upper secondary level. Again, firms expect the ability of an average applicant to be lower, because the more able school leavers are more likely to opt for the full-time schooling instead of a (sophisticated) apprenticeship training program. The results show that an increase in the ratio of the high school enrollment rate by 10 percentage points decreases the training probability by 3.8 percentage points.

In conclusion, it can be shown that the firm's expectations about the ability of apprentices influences their training decision. The behavior of training firms (Table 2) also seems to be consistent with the model, which predicts that a firm only keeps an apprentice as a skilled worker if the ability is above a minimum threshold $\hat{\eta}^*$. The variable used to approximate ability is the average relative productivity of the firm's apprentices in the last year of the training program. The results show that the lower the relative productivity, the higher the likelihood that a firm lays off their apprentices after training.[13]

The effects of the firm-level variables are, after the inclusion of regional variables, similar to previous studies, e.g. Wolter et al. (2006) or Muehlemann et al. (2005). The number of skilled workers in the profession to be trained in a firm has a very strong and positive influence on the training decision. The firm size has an additional impact; given the number of skilled workers, small firms are still less likely to train apprentices. The reason for this behavior could be that small firms face a higher uncertainty about the quality of an apprentice and his quit behavior (small firms are usually the last in the chain when school leavers apply for apprenticeship posts). At the same time, they are very often too small and too specialized to provide all the required training lessons and content at reasonable costs. Firms in the construction sector and the public administration are more likely to train apprentices.

The only important difference to the cited studies above is that the effect of language

[13]The dependent variable "high layoffs" is defined as a binary variable with the value 1, if more than 50% of apprentices are laid off within a firm.

regions in Switzerland disappears, once we control for the structure of the education system. It is exactly the more developed secondary school system in the French part of Switzerland that is in competition with the dual education system. Due to the fact that a larger proportion of more able students at age 15-16 continues a school-based education, the expected training costs of an apprentice are higher in the French part and thus the average training probability is lower.

Table 2: Probit regression: Quits and layoffs of apprentices after training

Dependant variable:	High quits‡	High layoffs
Number of firms in the region (in '000)	0.060†	
	(0.035)	
Relative productivity in last year of training		-0.335†
		(0.179)
Training duration 3 years	0.227	0.635**
	(0.198)	(0.189)
Log number of skilled workers	-0.195**	0.080
	(0.056)	(0.060)
1-4 employees	-0.022	0.363
	(0.265)	(0.267)
5-9 employees	-0.153	0.231
	(0.233)	(0.214)
10-49 employees	-0.027	0.042
	(0.169)	(0.178)
50-99 employees	-0.041	0.132
	(0.176)	(0.203)
Foreign-owned firm	-0.169	0.027
	(0.161)	(0.199)
French part of Switzerland	-0.069	0.038
	(0.130)	(0.134)
Italian part of Switzerland	0.023	0.188
	(0.449)	(0.319)
Intercept	-0.173	-0.890**
	(0.290)	(0.303)
Job & Industry dummies	Yes	Yes
N	1718	1516
Log-likelihood	-998.815	-966.296

Significance levels: †:10% ∗:5% ∗∗:1%. ‡Standard errors adjusted for clustering. Number of clusters: 67.

6 Concluding remarks

The results described in this paper provide insights insofar that regional aspects of the labor market and the educational system influence the training decision of firms. The factors singled out in the analysis have several consequences for policy making.

The negative effect of a high density of firms (of the same industry) on the likelihood to train apprentices underlines the importance of regulations. Firms need to be able to train apprentices in a cost efficient manner if the labor markets are competitive. Otherwise, firms will not engage in training, because the probability to recoup the training expenses after the training period would be too low.

The variables related to the supply of potential apprentices have several implications. Firstly, the quality of the school system directly impacts the cost-benefit ratio of an apprenticeship program. Therefore, measures which improve the competencies of school leavers will affect the apprenticeship training system positively. Secondly, the importance of a high number of potential applicants for the training decision of firms indicates, that the current problem of a fraction of school leavers to find an apprenticeship post will not automatically be solved due to future demographic changes. The predicted reduction in school leavers will result in a lower number of applicants for an apprenticeship position per firm. Hence, the probability of a good match between the firm and the apprentice will be lower, and thereby the likelihood that a firm will offer apprenticeship posts will be reduced. Finally, the public investments in full-time schooling options at upper secondary level are - intentionally or not - a threat to the dual apprenticeship training system. The more attractive and accessible full-time schooling programs are, the more difficult it will be for firms to find apprentices with sufficiently high competencies. Therefore, even schooling programs that were initially created to solve cyclical imbalances on the apprenticeship market can cause the destruction of apprenticeship posts in the long run.

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7 Appendix

Table 3: Summary statistics

Variable	Mean	Std. Dev.	N
Training firm	0.298	0.458	4090
Number of firms in the region (in '000)	1.234	1.496	4090
Number of young people per firm (in '000)	0.116	0.378	4090
Large metropolitan area	0.557	0.497	4090
Percentage of young people with college degree	0.141	0.057	4090
High rate of foreigners in elementary school	0.653	0.476	4090
High quit rate	0.349	0.477	1718
High retention rate	0.832	1.888	1874
High layoff rate	0.735	1.314	1874
Training duration 3 years	0.615	0.487	3861
Training duration 4 years	0.26	0.439	3861
1-4 employees	0.324	0.468	4090
5-9 employees	0.398	0.49	4090
10-49 employees	0.23	0.421	4090
50-99 employees	0.025	0.157	4090
$>$ 100 employees	0.021	0.145	4090
Log number of skilled workers	0.972	0.901	4090
French part of Switzerland	0.228	0.42	4090
Italian part of Switzerland	0.03	0.172	4090
Construction sector	0.112	0.316	4090
Industrial sector	0.128	0.334	4090
Public sector	0.062	0.241	4090
Foreign-owned firm	0.11	0.313	4090
Difficulties to find skilled workers on labor market	0.398	0.489	4090
Commercial employee	0.199	0.399	4090
Polymechanics technician	0.018	0.132	4090
IT specialist	0.027	0.161	4090
Cook	0.07	0.254	4090
Electromechanics technician	0.019	0.135	4090
Mason	0.024	0.152	4090
Architectural draftsperson	0.028	0.166	4090
Salesperson (2 years)	0.058	0.235	4090
Auto mechanic	0.019	0.137	4090
Carpenter	0.023	0.151	4090
Salesperson (3 years)	0.024	0.154	4090
Office worker	0.036	0.186	4090
Assistant in doctor's office	0.021	0.142	4090
Structural draftsperson	0.01	0.097	4090
Hairdresser	0.016	0.125	4090
Automation technician	0.004	0.061	4090
Electronics technician	0.004	0.062	4090

Table 4: Descriptives of regional variables

Region	Training yes/no	avg. pop. age 15-20 per firm & industry	share population in high school	share foreign pupils > 0.2
1	0.160	53.145	0.293	1.000
2	0.192	32.010	0.171	0.000
3	0.271	62.234	0.046	0.000
4	0.036	110.956	0.264	1.000
5	0.290	7.760	0.198	0.000
6	0.184	41.499	0.132	1.000
7	0.408	131.486	0.142	0.000
8	0.306	75.118	0.070	1.000
9	0.510	119.304	0.091	0.000
10	0.374	85.572	0.098	0.000
11	0.402	74.129	0.079	0.000
12	0.243	257.718	0.279	1.000
13	0.257	51.985	0.182	1.000
14	0.480	178.746	0.161	1.000
15	0.429	73.119	0.118	0.000
16	0.511	291.014	0.118	0.000
17	0.283	73.646	0.107	0.000
18	0.268	63.971	0.300	1.000
19	0.252	72.230	0.118	0.000
20	0.197	63.889	0.137	1.000
21	0.214	138.116	0.166	1.000
22	0.292	159.682	0.105	0.000
23	0.209	106.217	0.161	1.000
24	0.354	81.003	0.200	1.000
25	0.266	44.078	0.162	1.000
26	0.357	86.007	0.088	0.000
27	0.342	241.410	0.160	1.000
28	0.596	261.747	0.122	1.000
29	0.635	74.005	0.044	0.000
30	0.177	37.896	0.316	1.000
31	0.136	75.358	0.357	1.000
32	0.476	92.031	0.117	0.000
33	0.464	201.821	0.107	0.000
34	0.314	92.602	0.100	1.000

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35	0.289	64.474	0.130	1.000
36	0.352	129.352	0.118	0.000
37	0.388	116.962	0.183	0.000
38	0.170	75.957	0.165	1.000
39	0.187	118.780	0.127	1.000
40	0.261	45.238	0.173	1.000
41	0.219	104.280	0.121	0.000
42	0.344	47.054	0.150	0.000
43	0.343	105.825	0.130	0.000
44	0.334	126.792	0.092	0.000
45	0.390	193.676	0.128	1.000
46	0.422	109.860	0.104	0.000
47	0.395	182.530	0.153	1.000
48	0.468	185.096	0.038	0.000
49	0.333	225.867	0.088	1.000
50	0.454	185.160	0.108	1.000
51	0.526	58.004	0.106	0.000
52	0.464	10.888	0.119	0.000
53	0.375	54.595	0.047	1.000
54	0.259	67.131	0.091	1.000
55	0.106	259.048	0.169	0.000
56	0.561	267.450	0.164	0.000
57	0.304	122.452	0.157	0.000
58	0.589	267.996	0.171	1.000
59	0.537	332.895	0.108	0.000
60	0.214	85.377	0.098	0.000
61	0.271	76.899	0.079	0.000
62	0.391	408.374	0.063	0.000
63	0.230	224.648	0.143	1.000
64	0.253	358.340	0.150	1.000
65	0.540	275.156	0.090	1.000
66	0.256	283.890	0.113	1.000
67	0.336	196.990	0.146	1.000