Swiss Leading House
Economics of Education · Firm Behaviour · Training Policies

Working Paper No. 137

So similar and yet so different:
A comparative analysis of a firm's net costs and post-apprenticeship training benefits in Austria and Switzerland

Luca Moretti, Martin Mayerl, Samuel Muehlemann, Peter Schlögl & Stefan C. Wolter

Universität Zürich
IBW – Institut für Betriebswirtschaftslehre

u^b

b
UNIVERSITÄT
BERN

Working Paper No. 137

So similar and yet so different:
A comparative analysis of a firm's net costs and post-apprenticeship training benefits in Austria and Switzerland

Luca Moretti, Martin Mayerl, Samuel Muehlemann,

Peter Schlögl & Stefan C. Wolter

October 2017; this version: April 2018

So similar and yet so different:
A comparative analysis of a firm's net costs and post-apprenticeship training benefits in Austria and Switzerland[*]

Luca Moretti[a], Martin Mayerl[b]
Samuel Muehlemann[c], Peter Schlögl[d], Stefan C. Wolter[e]

[a] University of Bern, Switzerland
[b] Austrian Institute for Research on Vocational Training (ÖIBF), Vienna, Austria.
[c] LMU Munich, Germany & IZA Bonn.
[d] Alpen-Adria-Universität Klagenfurt & ÖIBF, Vienna, Austria.
[e] University of Bern, Switzerland, CESifo Munich & IZA Bonn.

April 2018

The authors compare a firm's net cost and post-apprenticeship benefits of providing apprenticeship training in Austria and Switzerland: two countries with many similarities but some critical institutional differences. On average, a Swiss firm generates an annual net benefit of €3,400 from training an apprentice, whereas a firm in Austria incurs net costs of €4,200. The impetus for this difference is largely a higher relative apprentice pay in Austria. However, compared with Swiss firms, Austrian firms generate a higher post-training return by retaining a higher share of apprentices and savings on future hiring costs.

1 Introduction

Apprenticeship training has received considerable interest from policy makers around the world in recent years because it represents a promising educational pathway that ensures a smooth transition from school to work; however, there is still a paucity of research that addresses the underlying mechanisms of how apprenticeship systems generate positive outcomes for individuals, firms, and the broader society. Many comparative studies have discussed the importance of institutions for the functioning of an apprenticeship system in the context of Germany and often compare German institutions to those of more liberal economies, such as the United States or United Kingdom (e.g. Hall and Soskice 2001, Thelen 2004). The institutional setting in the two other Germanic apprenticeship systems, Austria and Switzerland, has been studied to a much lesser extent, despite both countries' apprenticeship systems being among the three largest in the world.

Austria and Switzerland are two small countries that share a number of similarities, including the overall importance of its vocational education and training (VET) system, training curricula, monitoring of training firms, certification for graduated apprentices, and cultural aspects. However, potentially important institutional differences exist regarding minimum wages for apprentices, public subsidies for training firms, and the control of employer associations. Such differences may affect training outcomes: the focus of our analysis. Our data provide comparable measures for firms in Austria and Switzerland regarding the costs and benefits of apprenticeship training, retention rates of apprentices, and the costs of hiring qualified workers from the external labour market—parameters paramount to explaining a firm's willingness to train apprentices (Becker 1962, Soskice 1994). Unlike the comparative studies in the literature, we explicitly calculate a type of post-training benefit, that is, a firm's savings from not having to incur hiring costs for external hires when successfully retaining former apprentices.

We apply nearest-neighbour matching techniques to compare firms in Austria and Switzerland of similar size that offer training in the same occupation, or occupations viewed as similar by the relevant employer associations. Thus, we simulate a situation where an Austrian firm faces the training and labour market environment of a Swiss firm while holding other factors constant. Our main result shows that an Austrian firm makes on average a significant net investment of greater than €4,200 per year and apprentice, whereas a comparable Swiss firm generates a net benefit of €3,400 in the same occupations. We observe that a different wage structure explains much of this difference in net training costs, that is, a higher apprentice wage in relation to unskilled and skilled workers' wages.

The relatively high apprentice wage in Austria, however, likely also contributed to the survival of firm-based apprenticeship training because, in Austria, apprenticeship training and the school-based VET system (which is fully subsidised by the state) are in direct competition. Thus, if training firms set apprentice wages at a low level, the outside option for Austrian apprentices to enrol in school-based VET programmes becomes more attractive and puts upward pressure on wages to ensure a sufficient supply of suitable apprentices. Switzerland has school-based VET programmes too, but their limited scope forces the large majority of apprentices to enrol in dual apprenticeship programmes. Culpepper (2007) explains this outcome by the strong support for apprenticeships from Swiss employer associations, that is, their interest in combining traditional apprenticeships with the possibility of accessing higher education at the tertiary level, whereas in Austria, particularly large employers favoured a school-based VET system.

Although direct public subsidies are granted to Austrian training firms with the goal of increasing the supply of apprenticeship positions, we observe that firms can also recoup a significant part of their net training costs by retaining former apprentices. An Austrian training firm can generate post-training benefits in the form of saved hiring costs for skilled workers (opportunity

costs), which equals €8,500 on average, or 3.5 months of wages for skilled workers (compared with 1.1 months for Swiss training firms). Thus, we can show empirically that the sum of post-training benefits and public subsidies for apprentice wages cover on average the entire net training costs of an Austrian training firm.

The next section briefly discusses the relevant literature. Section 3 describes the similarities and differences between the Austria's and Switzerland's VET systems. Section 4 describes the identification strategy. Section 5 provides descriptive statistics, and Section 6 discusses the empirical results. Section 7 concludes.

2   Relevant literature

The starting point for many economic discussions on training activities is the human capital theory (Becker, 1962). Central to Becker's theory is that training represents an investment in future productivity. In competitive markets, a worker's salary is equal to their marginal productivity; thus, from an employee's perspective, training results in a higher future income, and individuals invest in the socially optimal level of training. Conversely, a training firm would not be willing to pay for general skills, because it could not expect to generate any post-training benefits to recoup its initial training investment.

As extensively summarised in Leuven (2005) or Wolter and Ryan (2011), a number of reasons have explained why labour markets are not competitive, including asymmetric information, industry- or occupation-specific monopsonies, product market competition, or hiring costs for skilled workers (cf., among others, Acemoglu and Pischke 1998, Acemoglu and Pischke 1999a, Acemoglu and Pischke 1999b, Bassanini and Brunello 2011, Stevens 1994).

Regarding apprenticeship training, certain frictions are likely more important than others. Certification of skills, apprenticeship contracts, and grade statements about an apprentice's

performance in vocational school reduce the importance of asymmetric information about the individual ability of apprentices and content of training.[1]

In our analysis, we focus on a particular type of labour market frictions: the costs of hiring qualified skilled workers from the external labour market. The literature on hiring costs for skilled workers indicates that such costs are substantial, even in Switzerland's occupational labour markets, where all workers previously acquired a vocational qualification (Blatter et al. 2012). Unfortunately, such data was previously not available for Austria, but as explained in Section 6, hiring costs are higher in Austria than in Switzerland. Thus, as suggested by Soskice (1994), such costs may have an important role in explaining the willingness of a firm to offer and pay for apprenticeship training. In his seminal analysis of the German apprenticeship system, Soskice asserted that markets and institutions are crucial in explaining a firm's willingness to offer apprenticeships. In particular, offering apprenticeships depends (i) on a firm's ability to hire qualified employees that match a firm's skill requirements from the external labour market, (ii) the net costs to train apprentices, (iii) a firm's ability to retain suitable apprentices as skilled workers, and (iv) the costs of internal training and successful retention of apprentices compared with the costs of qualified external hires (Soskice 1994, pp. 36).

As noted by Soskice, data on net training costs, retention rates, and external hiring costs are typically not available in large-scale surveys or administrative data.[2] Only recently, have data from the cost–benefit studies on apprenticeship training in Switzerland been used to demonstrate the (positive) association between external hiring costs and a firm's supply of training positions

---

[1] Empirical evidence for Switzerland suggests that apprenticeship training contains largely transferable skills useful in other firms too. Mueller and Schweri (2015) show that apprentices who leave the training firm but do not switch occupation do not incur any wage losses compared with stayers, even when accounting for the possibility that movers are a selective group in terms of unobserved ability. Moreover, they find that cognitive ability (as measured by PISA test scores) is not significantly associated with the probability to remain with the training firm after graduation.
[2] Stevens (1994) showed that the number of apprenticeships provided in the UK was strongly associated with an index of skill shortages, but her data did not include direct cost measures of training apprentices or external hiring.

(Blatter et al. 2016), providing empirical evidence that firms facing high external hiring costs train and retain more apprentices. According to our review of the literature, no comparative studies have investigated the effects of different national training and labour market institutions on such post-training benefits; instead, these studies have analysed the differences in net training costs between Germany and Switzerland (Dionisius et al. 2009, Muehlemann et al. 2010, Jansen et al. 2015) but neither included the retention rates of apprentices nor the costs for external hires in the training occupation.

3   Austria and Switzerland's vocational education and training systems

In this section, we briefly outline the most important similarities and differences of Austria and Switzerland's VET systems.

Education system

In Austria and Switzerland, compulsory schooling has a duration of nine years. In Austria, the vocational education path offers a wide variety of choices. In addition to dual apprenticeships with a substantial (formal) work-based learning component (*Duale Berufsausbildung),* the Austrian VET system features two types of full-time VET schools: the VET college (*Berufsbildende höhere Schule*) and the VET school (*Berufsbildende mittlere Schule*). According to the Austrian economic chamber, 76% of 15-year old students chose the vocational education path, and roughly half of them decided to pursue an apprenticeship in 2015. The other half enrolled either in a VET college or a VET school. The duration of the VET college is five years, leading to a higher-level vocational qualification and full access to universities. Conversely, the duration of VET schools is between one to four years, and when completing at least a three-year programme, students earn an initial vocational qualification.

In Switzerland, pupils choose one of two major educational pathways: the general or vocational education paths. Approximately two-thirds of a cohort choses the vocational education path, and within that path, a large majority of approximately 90% pursue a firm-based apprenticeship programme, which consists of work-based learning and productive work in the firm and, depending on the training occupation, one to two days per week of vocational school. Apprenticeship training is further supplemented by external training courses (*Überbetriebliche Kurse*) in which job and industry-specific skills are taught outside the training firm. In Austria and Switzerland, vocational schools are financed by the public.

Access to higher education after apprenticeship training

Both countries offer the possibility for apprentices to access higher education at the tertiary level. Austrian apprentices, since 2008, have had the opportunity to attain full access to universities by taking the corresponding examinations (*Lehre mit Matura*, cf. Graf et al. 2012). Swiss apprentices can acquire a vocational baccalaureate (*Berufsmaturität*) during or after their apprenticeship, which provides them with access to universities of applied sciences. To enrol in a regular university, Swiss apprentices must pass an additional examination (*Passerellenprüfung*).

Monitoring and certification

In both countries, external agencies monitor the quality of apprenticeship training and enforce minimal standards regarding a firm's training obligation in the workplace. Instructors must complete a train-the-trainer course before they train apprentices. Successfully completing apprenticeship training results in an initial VET qualification at the upper secondary education level, which is nationally recognised in both countries. Individual rates of return for apprenticeship training are also similar in both countries, approximately 4%–6% on average (cf. Fersterer et al.

2008 for Austria, and SKBF 2011 for Switzerland).

Apprenticeship contracts

Apprentices' wages in Austria are subject to collective bargaining agreements. For each training occupation, minimum wages are binding for each training year. Apprentices' wages in Switzerland are not subject to collective bargaining agreements, although in some sectors employers' associations (non-binding) recommend apprentices' wages for a particular occupation.[3] In both countries, the apprenticeship contract terminates automatically and must be renegotiated in case the training firm prefers to retain a former apprentice as a skilled worker. In our sample, we observe that approximately 60% of Austria's apprentices remain in the training firm within one year of completing their training (Table A.3), whereas approximately two-thirds of Switzerland's apprentices leave the training firm within a year after training.

Subsidies to training firms

In the late 1990s, Austria experienced a shift from an oversupply of apprenticeship positions to a supply shortage. This phenomenon prompted various types of subsidies. Initially, the focus was on a purely quantitative increase in apprenticeship positions, but subsequently an increasing number of qualitative aspects became important, and the policy instruments were adjusted on several occasions (Dornmayr et al., 2016). Currently, the most important subsidy is an apprentice wage subsidy (*Basisförderung*), which applies to all apprenticeship contracts in the non-public sector. Firms receive a subsidy equivalent to three monthly (gross) wage payments for an

---

[3] Muehlemann et al. (2013) provide a detailed treatment of apprentice pay in Switzerland and show that while firms have some degree of monopsony power over apprentices, it is limited for firms in more rural areas with thin local labour markets. Thus, in Switzerland, apprentice wages are largely subject to market forces.

apprentice in the first year, two in the second year, and one in the third and fourth years (but only during the first half of the fourth year if the apprenticeship's duration is 3.5 years). In 2014, a total of €150 million in subsidies were paid to training firms (Schlögl, 2016).[4]

Switzerland also suffered from a shortage of apprenticeship positions, but in the early 2000s, largely due to demographic change: many more school-leavers entered the apprenticeship market compared with previous years. In 2003, a public vote rejected the creation of an apprenticeship fund to increase the supply of training positions (*Lehrstelleninitiative)*. Unlike Austria's government, Switzerland's government did not offer any direct subsidies to training firms as a reaction to a shortage of training places. Nonetheless, indirect subsidies are in place, including the possibility for employers to create funds to promote apprenticeship training (*Berufsbildungsfonds*). Participation in those funds can be made compulsory by the Federal Council for all firms of a corresponding sector. In 2008, a total of 49,000 firms were subject to participate in a total of 13 compulsory funds, representing 16% of all firms in Switzerland. The annual revenue of these funds was between 140,000 and 3.2 million Swiss francs (Kägi and Frey, 2008) and rather low in comparison with other countries.[5]

4 Cost–benefit methodology and data

All the surveys presented here are based on the cost–benefit methodology developed by the German Expert Commission on Costs and Financing of Vocational Education and Training (Sachverständigenkommission 1974). This section explains the methodology of these cost–benefit

---

[4] A yearly apprentice salary is on average approximately 10,000 euro; thus, the subsidies are equivalent to approximately 15,000 yearly apprentice salaries. Given a total 115,000 apprentices in Austria in 2014, the subsidies comprise approximately 13% of total apprentice wage payments in 2014 (or 1,300 euro per apprentice).

[5] The possibility for cantons to initiate such funds that are compulsory all firms located within a particular canton (rather than sectors) also exists, and often such funds are partly financed by municipalities and the state itself (Kägi and Frey 2008).

surveys and describes the data.

4.1 Cost–benefit model

A firm incurs average yearly cost c for training an apprentice i. These costs largely consist of an apprentice's annual wage w_i^a, and the wage costs for the training personnel. The latter is divided into six categories j: full-time trainers, management, skilled workers in the commercial sector, skilled workers in the technical sector, skilled workers in the service sector, and unskilled workers. For each category, the average yearly instruction hours h_{ij} are multiplied with the corresponding within-firm wage of that worker category w_j^t. As apprentices may spend a significant amount of time at the workplace observing their training instructor perform skilled work, the time that an apprentice accumulates human capital may be considerably higher compared with the time when workplace training actually prevents a (part-time) instructor from performing their regular tasks.[6]

This methodological aspect is important because, in earlier cost–benefit studies, the measure was related to the total time that an instructor spent with an apprentice, which would overestimate training costs if instruction (at least partly) occurs during slack periods, as noted by Soskice (1994, p.52). In the current cost–benefit studies in Austria, Germany, and Switzerland, only the time that an instructor is prevented from performing their regular work tasks is considered a relevant cost factor. Furthermore, X_i includes the remaining training costs, such as expenses for infrastructure, materials, external courses, administration. The total gross costs to train an

---

[6] Training instructors in Austria and Switzerland, skilled workers in the corresponding training occupation, and only spend part of their time instructing apprentices.

apprentice in a particular year of training are thus given by the following:

$$c_i = w_i^a + \sum_{j=1}^{6} h_{ij} * w_j^t + X_i \tag{1}$$

The average annual benefits b_i are calculated in a similar fashion. An apprentice spends

the productive working hours h_i one of two ways, either with unskilled tasks, valued at the wage

of an unskilled worker w_u, or with skilled tasks, valued at the wage of a skilled worker w_s. For

the latter tasks, we must consider that an apprentice's productivity is only a fraction γ of the

productivity of a skilled worker. In our survey, γ is an estimate by the training instructor in charge

of the corresponding apprentices in the workplace. Following Dionisius et al. (2009), we denote

the fraction of productive hours that an apprentice spends with unskilled labour with α:

$$b_i = h_i * [\alpha * w_u + (1-\alpha) * \gamma_i * w_s] \tag{2}$$

Finally, the net cost of apprenticeship training C_i is the difference between the average

yearly benefits and the average yearly costs:

$$C_i = c_i - b_i. \tag{3}$$

4.2 Data

Our analysis is based on the surveys by Strupler and Wolter (2012) for Switzerland, and by Schlögl and Mayerl (2016) for Austria. The Swiss data were collected by the Centre for Research in Economics of Education at the University of Bern, although the questionnaires were sent to the firms by the Swiss Federal Statistical Office.[7] The Austrian data were collected by the Austrian Institute for Research on Vocational Education and Training by using an online survey tool. The Austrian survey consists of 581 establishments that train apprentices in at least one of the 20 most frequent occupations. Although the Austrian sample is not representative, the key distribution of firms in the sample is very similar compared with the population distribution of the Austrian firms.

The Austrian survey is based on the Swiss questionnaire, with minor lingual adaptations necessary in the context of Austria's education system. The combined sample initially contained 1,280 Swiss and 450 Austrian establishments in 15 apprenticeship occupations. Due to a small number of within-occupation observations, we did not analyse occupations with a duration of 3.5 years in Austria and 4 years in Switzerland. To ensure that Swiss occupations were comparable to those in Austria, we sent the curricula of the Austrian training occupations to the corresponding Swiss employers' associations. Our final sample comprises 306 Austrian firms that offer three-year apprenticeships in 10 occupations, and we compare that with 730 Swiss firms that offer training in the same occupation.[8]

---

[7] More information about the Swiss survey, including how to obtain access to the data, is provided by FORS, the Swiss data repository hosted by the University of Lausanne, and supported by the Swiss National Science Foundation: https://forsbase.unil.ch/project/study-public-overview/12533/0/.

[8] The 10 occupations are administrative clerk, car mechanic, cook, hairdresser, hotel and restaurant clerk, mason, pharmaceutical assistant, plumber, retail clerk, heating and ventilation systems technician. We also conducted our analysis for the full sample and obtained qualitatively similar results, which are available upon request.

4.3 Descriptive statistics

In this subsection, we provide descriptive statistics based on our restricted sample of Austrian and Swiss firms for the 10 training occupations comparable between the two countries. Therefore, the results are not identical (but qualitatively similar) compared with the results based on the full sample of the corresponding countries (i.e., Strupler and Wolter 2012, and Schlögl and Mayerl, 2016). The descriptive statistics of the key variables are reported in Table A.3. To account for differences in the firm structure between Austria and Switzerland, the remaining statistics we report in this section represent the observed averages for the sample from Austria and the matched averages for Switzerland within the corresponding training occupation and firm size cells, that is, the Swiss statistics correspond to training firms in the same occupations and having the same firm size structure as in Austria.[9]

Austrian and Swiss apprentices receive almost the same nominal wages, despite the price level being significantly lower in Austria than Switzerland.[10] Austrian skilled workers, however, only earn €2,331 compared with the corresponding wage of €4,671 in Switzerland. Thus, the apprentices' pay as a fraction of the skilled workers' pay is almost twice as high in Austria compared with Switzerland. In the first and last training year, an Austrian apprentice earns 27% and 46% of a skilled worker's wage, respectively; for Swiss apprentices, the corresponding first- and last-year percentages are only 14% and 24%.

---

[9] As the Swiss survey was conducted in 2009, but the Austrian survey in 2015, we adjust the Swiss cost parameters for inflation by using the Consumer Price Index, and we adjust wages using the Swiss Wage Index. Moreover, we converted Swiss Francs to Euro based on the exchange rate on October 1st, 2014, which is the reference date for the Austrian survey. At that time, 1 CHF traded for €0.8284.

[10] In 2015, Switzerland's overall price level was 63% above the EU-28 average, while the price level in Austria was only 4% above the average(http://ec.europa.eu/eurostat/web/purchasing-power-parities/data/database).

Table 1: Descriptive statistics

	1st year	2nd year	3rd year
Apprentice Wage			
Austria	604.24	791.13	1042.02
Switzerland	626.65	811.00	1079.92
Pay Ratio (apprentices' wage/skilled workers' wage)			
Austria	27.4%	34.8%	45.7%
Switzerland	13.6%	17.0%	23.4%
Vocational School			
Austria	46.34	46.17	46.40
Switzerland	54.87	52.95	46.09
External Courses (in days)			
Austria	1.10	1.46	1.63
Switzerland	9.40	8.68	9.12
Total Days in the Workplace			
Austria	167	166	165
Switzerland	149	151	157
Instruction Hours in the Workplace			
Austria	293	264	247
Switzerland	190	161	154
Share of Unskilled Tasks			
Austria	59.9%	54.7%	45.2%
Switzerland	53.9%	43.8%	31.8%
Share of Skilled Tasks			
Austria	18.6%	29.3%	43.4%
Switzerland	26.3%	41.7%	55.2%
Share of Tasks with no Direct Productive Value			
Austria	21.5%	16.0%	11.5%
Switzerland	19.8%	14.6%	13.0%
Relative Productivity of Apprentices Compared with Skilled Workers			
Austria	25.7%	44.2%	67.4%
Switzerland	34.5%	52.4%	72.4%

Notes: Matching based on firm size and training occupation. Prices denoted in euros at the exchange rate on 1 October, 2014. N = 306 (Austria), N = 730 (Switzerland).

Austrian apprentices spend more time in the workplace. During a three-year apprenticeship, an Austrian apprentice spends approximately 41 days more in the workplace compared with a Swiss colleague. Although an extended time spent in the workplace may result in a higher productive contribution of an apprentice, a firm may also have to invest additional resources in work-based training. Austrian apprentices receive almost 300 hours more instruction in the workplace over a three-year period.

Austrian and Swiss apprentices spend roughly the same share of their time with tasks that do not directly yield a monetary benefit to the training firms, such as exercises or simulations. Austrian apprentices, however, perform relatively more unskilled tasks compared with Swiss apprentices, that is, tasks typically performed by workers without a VET qualification. Consequently, Austrian apprentices spend relatively less time with skilled tasks compared with Swiss apprentices during a typical week in the workplace.

Finally, to the extent that an apprentice's average productivity in skilled tasks compared with a skilled worker in the first year is an appropriate measure for ability, we provide empirical evidence indicating a negative selection in the Austrian apprenticeship system, compared with Switzerland, because the reported relative productivity of an Austrian apprentice is 26% in the first year, compared with the 35% of a Swiss apprentice (Table 1, last two lines).

5 Identification strategy

We aimed to identify a treatment effect of having a training firm in Austria operate under the conditions of Switzerland's labour market (apprentices' pay relative to skilled workers' pay) and institutions (VET regulations that determine how much time apprentices spend with the firm, and the amount of workplace training), and how firms allocate tasks to their apprentices in the workplace (share of productive vs. non-productive tasks). We follow the simple procedure of

14

Dionisius et al. (2009) and match firms based on firm size and the training occupation.

The distinction between large and small firms is important for at least two reasons. First, in Austria small and medium-sized enterprises (SMEs) are controlling the relevant employer association (The Austrian Federal Economic Chamber), whereas large employers are more powerful in Switzerland (Culpepper 2007, Graf et al. 2012, Mayer et al. 2000). Second, SMEs, compared with larger firms, are typically characterised as more cost-sensitive than large firms in much of the institutional literature (e.g. Soskice 1994, Culpepper 2007, Nikolai and Ebner 2012); therefore, comparing training firms of similar size in the same training occupation is crucial.

We apply a simple nearest-neighbour estimator to obtain treatment effects for the corresponding cost and benefit parameters of interest (cf. Rubin, 1974). Following Abadie et al. (2004), we denote the observed outcome by Y_i as follows:

$$Y_i = Y_i(W_i) = \begin{cases} Y_i(0), & \text{if } W_i = 0 \\ Y_i(1), & \text{if } W_i = 1 \end{cases} \tag{4}$$

where $W_i \in 0,1$ is the treatment indicator ($W_i = 0$ if the firm's location is in Switzerland, and $W_i = 1$ if the firm's location is in Austria). We are interested in the average treatment effect on the treated (ATT), that is, $ATT_i = E[Y_i(1) - Y_i(0) | W_i = 1]$. We therefore estimate the outcome in the cost and benefit parameters in a hypothetical situation where an Austrian firm faced the institutional setting of an otherwise similar Swiss firm that trains apprentices in the same occupation.

For Austrian firms, we observe $Y(1)$ but not $Y(0)$; thus, we need an estimate for the latter outcome:

$$\hat{Y}(0) = \frac{1}{\#J_M(i)} \sum_{l \in J_M(i)} Y_l \qquad (5)$$

where $J_M(i)$ denotes the set of indices for the matches of firm i.

The critical assumption we must make is that W is independent of $(Y(0), Y(1))$ conditional on $X = x$, also known as the unconfoundedness assumption. In our case, this assumption holds as long as a firm chooses its location (i.e. Austria or Switzerland) independently from unobservable factors influencing the costs and benefits of apprenticeship training. As training apprentices is typically not the core business of an enterprise, we believe it is reasonable to assume that this assumption holds.

Moreover, we also must assume that the probability of assignment to the treatment group is between zero and one (common support assumption). The assumption holds because we have a wide variety of firms from both countries (i.e. Austria or Switzerland) in our sample.

First, we perform a nearest-neighbour matching procedure to obtain counterfactual values for all relevant parameters in the cost–benefit model.[11] We then recalculate the costs and benefits based on the counterfactual values for Austrian firms in a step-wise procedure to show the importance of the individual parameters, that is, the counterfactual wage structure, instruction time, time in the workplace, and the allocation of productive and non-productive tasks to apprentices. The next section presents the results of our matching procedures.

---

[11] We do not report the ATT for the individual parameters, but the results are available upon request.

6 Results

In this section, we first present the results of our matching procedure for the costs and benefits of apprenticeship training. Subsequently, a particular type of post-training benefit, that is, the costs a firm can save from not having to hire skilled workers from the external labour market, is discussed.

6.1 Costs and benefits of apprenticeship training

Table 2 shows the initially observed net training costs for Austria, ranging from €3,317 in the first year of training to €5,428 in the third year. As the first step, we simulate changes in the observed net costs by simulating a scenario where Austrian training firms pay apprentices according to the counterfactual value in Switzerland, that is, the corresponding fraction of a skilled worker's wage that an apprentice in Switzerland working in the same training occupation and firm size category would receive.

The results highlight the potentially important role of apprentice pay, because Austrian firms could (ceteris paribus) offer training profitably when implementing a Swiss wage structure (Table 2, line 4).[12] In contrast with Switzerland, where the apprenticeship wage is determined bilaterally between the apprentice and the firm, apprentices wages in Austria are subject to collective bargaining, which likely has a positive impact on wages (Medoff and Freeman 1984, or for a recent survey see Bryson 2014) because apprenticeships are largely considered an employment relationship (Trampusch, 2014).[13] The almost full unionisation in Austria, therefore,

---

[12] Notably, the wage subsidies for Austrian firms in these calculations were excluded.

[13] Collective bargaining agreements, in general, are much more prevalent in Austria than in Switzerland. The overall coverage rates of collective bargaining agreements in 2013 were 98% in Austria but 48.6% in Switzerland (OECD iLibrary, http://dx.doi.org/10.1787/growth-2016-graph54-en). Ryan et al. (2013, p.215) also argue that Swiss apprentice wages are low, primarily due to low bargaining coverage and trade union passivity.

at least in part, accounts for the observed differences in apprenticeship wages.

Arguing that by solely adjusting apprentice pay one could increase the demand for apprentices in Austria is, however, too simple of a story to tell. As Austria's apprentices spend more time in the workplace compared with Switzerland's apprentices, wages must be adjusted (upwards) accordingly. Accounting for time spent in the workplace, we observe that an Austrian firm would break even in the first year of training and generate moderate net benefits in the second and third years (Table 2, line 5).

Table 2: Development of net costs when adding one treatment after the other

	1st year	2nd year	3rd year
Austria (observed)	3317	3902	5428
Matching parameters:			
Pay ratio	-1496	-2525	-2915
+ Time in the workplace	-281	-1178	-1734
+ Task allocation	907	4	-748
+ Training	-57	-1086	-1716
+ Productivity	-810	-2145	-2625
Switzerland (observed)	-1052	-3902	-5227

Notes: Matching based on firm size and occupation. Prices denoted in euros at the exchange rate on 1 October, 2014. Pay ratio: apprentices' pay/skilled workers' pay; time at the firm: number of days per year; task allocation: share of skilled, unskilled, and non-productive tasks in the workplace; training: hours of instruction time per apprentice in the workplace; productivity: relative productivity of an apprentice in skilled tasks compared with a skilled worker in the firm. Parameter matching is performed sequentially. N = 306 Austrian firms matched with 730 Swiss firms.

Additionally, accounting for differences in the task allocation and number of training hours at the workplace in sum do not result in large changes (lines 6 and 7 in Table 2), although the individual effects have the expected signs. In a last step, we calculate the scenario where in addition to the previously adjusted parameters, the relative productivity of Austria's apprentices is the same as observed for Switzerland's apprentices. As a result, the net benefit for an Austrian firm for an entire thee-year apprenticeship programme would equal €5,580 (compared with €10,180 for the

average Swiss firm) (the last two rows of Table 2). Thus, productivity differences between Austria and Switzerland's apprentices, as measured by the relative productivity in skilled tasks compared with a skilled worker in the same occupation, also partly contribute to the higher net training costs in Austrian firms.

In line with our results, Graf et al. (2012) and Lassnigg (2011) have argued that VET colleges and VET schools are more selective regarding the cognitive skills of pupils than apprenticeships. Moreover, as apprenticeships in Austria have no formal requirements regarding school grades, we might expect apprentices to be at the lower end of the distribution of cognitive skills. Consequently, Austrian firms must pay higher wages to attract talented students that could otherwise have chosen a full-time vocational school (which is funded with public subsidies).[14] In Switzerland, there is less competition for potential apprentices between full-time vocational schools and apprenticeships because the supply of full-time apprenticeship opportunities is very limited in general, which can be attributed to the ongoing support for apprenticeships (rather than full-time VET) by Swiss employer associations (Culpepper 2007).[15]

To provide reassurance that the differences between Switzerland and Austria are not due to differences in the training curricula, we include two robustness checks. First, we restrict our analysis to commercial apprentices, because this occupation conveys a very similar set of skills (Table A.1). Second, we restrict our sample to firms that train in occupations that are 'almost'

---

[14] The results of Schmid and Hafner (2011) also provide evidence regarding a negative selection into apprenticeship training in Austria in terms of cognitive skills. They compared the PISA results of students on the different paths and found that underachieving students visit mostly pre-vocational schools, followed by apprenticeships and VET schools. VET colleges, however, have a significantly lower fraction of underachieving students. Conversely, in Switzerland, approximately 50% of all apprentices have similar PISA results as pupils attending academic upper-secondary programs (Gymnasium).

[15] To the extent that an apprentice's average productivity in skilled tasks compared with a skilled worker in the first year is an appropriate measure for ability, we do observe some empirical evidence indicating a negative selection in Austria's apprenticeship system, compared with Switzerland, because the reported relative productivity of an apprentice in Austria is 26% in the first year, compared with the 35% of an apprentice in Switzerland (Table 1, last two lines).

identical rather than just 'similar', based on the analysis of the Swiss employers' associations (Table A.2). Both robustness checks show that our results remain qualitatively similar compared with using the full sample with 10 training occupations.

Although we now understand the major reasons why the net costs differ between Austria and Switzerland, we still must explain why Austrian firms make a net investment in apprenticeship training in the first place (whereas Swiss firms do not).

6.2 Saving future hiring costs as a post-training benefit

To the extent that a training firm can retain graduated apprentices, it can save on potential hiring costs for recruiting and training a new hire (Soskice 1994, Stevens 1994, Blatter et al. 2016). In this subsection, we therefore analyse the cross-country differences in hiring costs that a firm incurs to successfully fill a skilled worker vacancy in a particular occupation, including the costs for job advertisements, selecting applicants, and conducting interviews. Moreover, a firm incurs post-hire vacancy costs including a productivity loss during the adaptation period until a new hire becomes fully productive, costs for external training courses, and disruption costs due to incumbent employees providing informal training to new hires.[16]

However, because apprentices might leave the training firm voluntarily or not be considered a good match by the training firm, simply looking at the actual costs for an external hire would overestimate this type of benefit.[17] In addition, apprentices might drop out before graduation, leaving the firm without the possibility to recoup its training investment. Thus, to account for such

---

[16] As explained in detail by Muehlemann and Strupler Leiser (2015), selection and interview costs are obtained by multiplying the corresponding time spent for the recruitment process with the wage, while the productivity loss is estimated based on the duration of the adaptation period and a relative productivity measure of a new hire compared to incumbent workers. Finally, disruption costs capture the value of the time spent by incumbent employees for informal training of a new hire.

[17] E.g., if a firm can expect to retain one out of every two apprentices it trains, then post-training benefits only amount to half of the costs to fill a skilled worker vacancy with an external hire.

factors, we calculate the opportunity costs of training an apprentice as follows:

$$c^o = c^h(1-d)[r/(1-s)] \qquad (6)$$

where c^h refers to hiring costs, d is the fraction of dropouts during apprenticeship training, r is the fraction of former apprentices who remain with the firm for at least one year after training, and s is the one-year separation rate of external hires. Thus, low dropout rates and high retention rates clearly increase a firm's opportunity costs (i.e. post-training benefits from savings on hiring costs). Moreover, opportunity costs also increase with the risk that an external hire results in an early separation (s), that is, a 'bad hire'. We report the corresponding opportunity costs, that is, the benefit that firms on average generate by retaining former apprentices in Table 3 (the penultimate row). Nominal hiring costs are higher in Switzerland than in Austria. This phenomenon might be counter-intuitive at first, but because much of the hiring costs are essentially wage costs, this difference is due to the overall higher wage level in Switzerland. In terms of skilled workers' monthly wages, hiring costs in Austria are 1.4 times higher than in Switzerland (Table 3, line 9).

Finally, opportunity costs are considerably higher in Austria than in Switzerland. This phenomenon is largely because retention rates are higher in Austria but also due to a higher fluctuation rate of new external hires in Austria (suggesting that the risk of a mismatch when hiring from the external labour market is higher in Austria compared with Switzerland). Consequently, an Austrian training firm with the intention to retain graduated apprentices can expect to recoup on average approximately €8,500 from saved future hiring costs (3.6 months of skilled worker's wages), which is considerably higher than in Switzerland (1.1 months of skilled worker's wages).

Table 3: Hiring and opportunity costs in Austria and Switzerland

	Austria	Switzerland
Job advertisement	497	1231
Selection and interview costs	983	1553
External consulting agencies	153	745
Productivity loss	5509	6429
External training courses	593	1008
Disruption costs	2628	3553
Average hiring costs to fill a vacancy	10,362	14,518
Average hiring costs/monthly skilled worker's wage	4.44	3.11
Opportunity costs	8474	5041
Opportunity costs/monthly skilled worker's wage	3.64	1.08

Notes: Matching based on firm size and occupation. Prices denoted in euros at the exchange rate on 1 October, 2014. The top and bottom 5% were excluded to account for outliers. N = 302 (Austria), N = 730 (Switzerland).

Thus, given that training costs in Austria average €12,650 (Table 2), training firms can roughly recoup two-thirds of their initial net training investment due to savings on future hiring costs. However, training firms also receive subsidies for apprentice wages that cover an additional 5 months of wage payments over a three-year period, which equals on average €4,400, thereby covering the remainder of an average firm's initial training investment.

7   Conclusions

Our comparative analysis focuses on the importance of VET and labour market institutions regarding the net costs of apprenticeship training and a firm's ability to recoup post-training

benefits. We compare firms in Austria that train apprentices in the 10 most important three-year training occupations with comparable firms in Switzerland that offer training in the same occupation. We observe that apprenticeship training in Austria constitutes a significant net investment for a training firm by the end of the training period. Conversely, comparable Swiss firms on average generate a return on their training investment of almost 10%.

In Austria, the collective bargaining is associated with higher apprentice wages and the competition of its publicly financed school-based VET system (mainly supported by large employers) puts upward pressure on wages. Conversely, generous substantial public subsidies compensate training firms for several months of apprentice wages.

Our results suggest that to the extent a government finances a school-based VET system that allows individuals to acquire the same qualification as in a dual apprenticeship system, wages are likely to be a deciding factor for a successful apprenticeship system. Low apprentice wages increase the relative attractiveness of school-based VET, whereas high apprentice wages may prevent firms from offering apprenticeships.

We also observe that firms in Austria find it costlier to hire skilled workers externally, and the fluctuation rate of new hires is approximately twice as high compared with Switzerland. Moreover, as many Austrian training firms are successful in retaining former apprentices, they can recoup their initial training investment in the long run.

By contrast, the Swiss VET system is a more market-driven approach, in the sense that firms do not receive direct subsidies. Moreover, although a school-based VET system also exists in Switzerland, its importance is limited because employer associations tend to favour apprenticeship programmes. Although the apprentices' wages in Switzerland are low compared with the wages of skilled, accepting low pay during training eventually results in benefits because the skills acquired are largely transferable to other firms; thus, future earnings increase accordingly.

In conclusion, our results demonstrate that apprenticeship systems can exist under different institutional environments. For countries currently in the process of establishing or expanding apprenticeship systems, our comparative analysis clearly shows that policymakers should consider more than just one country's particular apprenticeship model.

References

Abadie A, D Drukker, Leber Herr J and Imbens GW (2004) Implementing matching estimators for average treatment effects in Stata. *Stata Journal 4* (3): 290-311.

Acemoglu D and Pischke J-S (1998) Why do firms train? Theory and evidence. *The Quarterly Journal of Economics 113* (1): 79-119.

Acemoglu D and Pischke J-S (1999a) Beyond Becker: training in imperfect labour markets. *The Economic Journal 109*: 112-142.

Acemoglu D and Pischke J-S (1999b) The structure of wages and investment in general training. *Journal of Politcal Economy 107* (3): 539-572.

Achleitner D and Wallner J (2012) *Die Lehre. Duale Berufsausbildung in Österreich. Moderne Ausbildung mit Zukunft* (12. ed). Wien: Bundesministerium für Wirtschaft, Familie und Jugend.

Bassanini A and Brunello G (2011) Barriers to entry, deregulation and workplace training: A theoretical model with evidence from Europe. *European Economic Review 55* (8): 1152-1176.

Becker GS (1962) Investment in human capital: A theoretical analysis. *The journal of political economy 70*(5): 9-49.

Beicht U, Walden G and Herget H (2004) *Kosten und Nutzen der betrieblichen Berufsausbildung in Deutschland*. Bielefeld: W. Bertelsmann.

Blatter M, Muehlemann S and Schenker S (2012) The costs of hiring skilled workers. *European Economic Review*, *56*(1): 20-35.

Blatter M, Muehlemann S, Schenker and Wolter SC (2016) Hiring costs for skilled workers and the supply of firm-provided training. *Oxford Economic Papers 68* (1): 238-257.

Bryson A (2014) Union wage effects. *IZA World of Labor 35*: 1-10.

Culpepper PD (2007) Small states and skill specificity: Austria, Switzerland and interemployer cleavages in coordinated capitalism. *Comparative Political Studies*, 40(6): 611-37.

Dionisius R, Muehlemann S, Pfeifer H, Walden G, Wenzelmann F and Wolter SC (2009) Costs and benefits of apprenticeship training. A comparison of Germany and Switzerland. *Applied Economics Quarterly 55*(1): 7-37.

Dornmayr H, Petanovitsch A, and Winkler B (2016) *Kontext-und Implementationsanalyse der betrieblichen Lehrstellenförderung (gemäß 19c BAG). Teilbericht im Rahmen der ibw-öibf-Studie „Hintergrundanalyse zur Wirksamkeit der betrieblichen Lehrstellenförderung (gemäß 19c BAG)".* Vienna: öibf.

Fersterer J, Pischke, J-S and Winter-Ebmer R (2008) Returns to apprenticeship training in Austria: Evidence from failed firms. *The Scandinavian Journal of Economics*, *110*(4): 733-753.

Graf L, Lassnigg L and Powell JW (2012) Austrian corporatism and institutional change in the relationship between apprenticeship training and school-based VET. In: Busemeyer MR and Trampusch C (Eds.), *The political economy of collective skill formation*, 150-178. Oxford University Press.

Hall PA and Soskice D (2001) *Varieties of capitalism: The institutional foundations of comparative advantage*. Oxford: Oxford University Press.

Jansen A, Strupler Leiser M, Wenzelmann F and Wolter SC (2015) Labour market deregulation and apprenticeship training: A comparison of German and Swiss employers. *European Journal of Industrial Relations 21* (4): 353-368.

Kägi W and Frey M (2008) *Wirkungsanalyse: Allgemein verbindlich erklärter Berufsbildungsfonds im Sozialbereich. Schlussbericht.*

Lassnigg L (2011) The 'duality' of VET in Austria: institutional competition between school and apprenticeship. *Journal of Vocational Education & Training*, 63(3): 417–438.

Leuven E (2005) The economics of private sector training: a survey of the literature. *Journal of economic surveys* 19(1): 91-111.

Mayer K, Lassnigg L and Unger M (2000) Social Dialogue on Training: Case Study of Austria. Research Report. Vienna: Institute for Advanced Studies.

Medoff, JL and Freeman R (1984) *What do unions do*. New York: Basic Books.

Muehlemann S, Ryan P and Wolter SC (2013) Monopsony power, pay structure, and training. *Industrial & Labor Relations Review 66* (5): 1097-1114.

Muehlemann S and Strupler Leiser M (2015) Ten facts you need to know about hiring. Technical report. IZA Discussion Papers No. 9363.

Mueller B and Schweri J (2015) How specific is apprenticeship training? Evidence from inter-firm and occupational mobility after graduation. *Oxford Economic Papers 67* (4), 1057-1077.

Nikolai R and Ebner C (2012) The Permeability between Vocational Training and Higher Education in Switzerland, Austria, and Germany. In: M. R. Busemeyer and C. Trampusch (Eds.), *The political economy of collective skill formation*, pp. 150-178. Oxford University Press.

Ryan P, Backes-Gellner U, Teuber S and Wagner K (2013) Apprentice pay in Britain, Germany and Switzerland: Institutions, market forces and market power. *European Journal of Industrial Relations*, *19*(3): 201-220.

Rubin DB (1974) Estimating causal effects of treatments in randomized and nonrandomized studies. *Journal of Educational Psychology 66* (5): 688-701.

Sachverständigenkommission (1974) *Kosten und Finanzierung der ausserschulischen beruflichen Bildung*. Abschlussbericht. Bonn: Bundesinstitut für Berufsbildung.

Schlögl P and Mayerl M (2016) *Betriebsbefragung zu Kosten und Nutzen der Lehrausbildung in Österreich. Teilbericht im Rahmen der ibw-öibf-Studie Hintergrundanalyse zur Wirksamkeit der betrieblichen Lehrstellenförderung.*Vienna: ÖIBF.

Schmid K and Hafner H (2011) Reformoptionen für das österreichische Schul- wesen: Internationaler Strukturvergleich und notwendige Reformen aus Sicht der Unternehmen, *ibw-Forschungsbericht* 161. Vienna: Institut für Bildungsforschung der Wirtschaft.

Schönfeld G, Jansen A, Wenzelmann F and Pfeifer H (2016) *Kosten und Nutzen der dualen Ausbildung aus Sicht der Betriebe: Ergebnisse der fünften BIBB-Kosten-Nutzen-Erhebung*. Bielefeld: W. Bertelsmann.

SKBF (2011) Swiss Education Report. Aarau: SKBF.

Soskice D (1994) Reconciling markets and institutions: The German apprenticeship system. In: Lynch, L.M. (Ed.), *Training and the private sector: International comparisons* (pp. 25-60). Chicago and London: University of Chicago Press.

Stevens M (1994). An Investment Model for the Supply of Training by Employers. *Economic Journal 104* (424): 556-70.

Strupler M and Wolter SC (2012) *Die duale Lehre: eine Erfolgsgeschichte - auch für die Betriebe: Ergebnisse der dritten Kosten-Nutzen-Erhebung der Lehrlingsausbildung aus der Sicht der Betriebe*. Chur and Zurich: Rüegger Verlag.

Thelen K (2004) *How institutions evolve: The political economy of skills in Germany, Britain, the United States, and Japan*. Cambridge University Press.

Trampusch C (2014) Berufsausbildung, Tarifpolitik und Sozialpartnerschaft: Eine historische Analyse der Entstehung des dualen Systems in Deutschland und Österreich. *Industrielle Beziehungen/The German Journal of Industrial Relations 21*(2):160-180.

Tritscher-Archan, Sabine (2009) *VET in Europe. Country report Austria. Report within the framework of ReferNet Austria*. Vienna.

Wenzelmann F, Schönfeld G, Dionisius R, Pfeifer H and Walden G (2010) *Kosten und Nutzen der dualen Ausbildung aus Sicht der Betriebe: Ergebnisse der vierten BIBB-Kosten-Nutzen-Erhebung*. Bielefeld: W. Bertelsmann.

Wolter SC and Ryan P (2011) Apprenticeship. In: Hanushek EA, Machin S and Woessmann L (Eds.), *Handbook of the Economics of Education*, Vol. 3: 521-576. The Netherlands: North-Holland.

A Tables

Table A.1: Matching, robustness check 1

	1st year	2nd year	3rd year
Austria	2,929	2,813	568
Pay ratio	-1483	-3,328	-6,487
+ Time at firm	901	-895	-5,672
+ Task allocation	2,661	832	-3,427
+ Training	2,148	742	-2,942
+ Productivity	-1,311	-395	-3,570
Switzerland	2,878	240	-5,268

Notes: Only commercial apprentices. Matching based on firm size and occupation. Prices denoted in euros at the exchange rate on 1 October, 2014. N = 86.

Table A.2: Matching, robustness check 2

	1st year	2nd year	3rd year
Austria	3437	3390	5124
Pay ratio	-1241	-3029	-3489
+ Time at firm	210	-1460	-2186
+ Task allocation	1898	76	-734
+ Training	573	-801	-1671
+ Productivity	-221	-1,965	-2715
Switzerland	-176	-3,346	-4831

Notes: When professional associations did not observe any important differences in the curriculum it was defined as an exact correspondence of the Austrian and Swiss occupation. Matching based on firm size and occupation. Prices denoted in euros at the exchange rate on 1 October, 2014. N = 225.

Table A3: Descriptives of three-year apprenticeships

	Austria				Switzerland			
	Mean	Std. dev.	Min	Max	Mean	Std. dev.	Min	Max
Gross monthly wage - Full-time instructor	2311.6	848.5	1100	5200	5203.6	608.5	3966	7208
Gross monthly wage - Management	3771.7	1838.5	1100	11000	7372.6	1247.4	5639	9405
Gross monthly wage - Commercial sector	2234.7	678.1	1100	5558	4718.1	399.0	3993	5490
Gross monthly wage - Technical sector	2576.7	833.8	1100	7417	5155.1	772.6	3942	6269
Gross monthly wage - Service sector	2085.3	669.2	1100	5700	4591.3	498.3	3366	5595
Gross monthly wage - Unskilled worker	1765.3	428.2	1100	3900	3627.7	276.6	3097	4186
Associated employer outlay (in %)	31.0	0.0	31	31	23.7	5.3	17	39
Typical work hours per week	39.2	0.8	35	40	41.9	0.8	40	45
Average monthly wage in the apprentice's occupation in that firm	2330.7	840.4	1100	7417	4671.2	567.6	3366	5805
Job advertisement (for skilled workers)	470.1	698.3	0	5000	1026.8	742.0	0	2675
Expenses for interviews (for skilled workers)	933.0	1449.5	0	11752	1684.4	895.1	0	3481
External consulting (for skilled workers)	243.9	876.1	0	6000	760.0	1022.4	0	3320
Cost of initial reduced productivity of newly hired skilled workers	4553.4	4479.9	0	28726	6042.0	2849.4	658	1550
Training courses (for newly hired skilled workers)	573.5	1177.0	0	6290	929.2	497.2	255	2919
Cost for other employees	2826.0	3820.3	0	22712	3677.3	1418.4	916	6041
Fraction of newly hired skilled workers that leave within one year	24.3	29.0	0	100	12.6	7.7	5	38
Fraction of apprentices that drop out of apprenticeship	8.6	17.0	0	98	6.6	3.6	1	20
Fraction of apprentices that remain within the firm after one year	59.9	38.6	0	100	33.4	15.6	1	70

Notes: Wage costs and advertisement costs in euros.