Organisation for Economic Co-operation and Development

EDU/EDPC/VET/RD(2019)1

For Official Use **English text only**

22 January 2019

DIRECTORATE FOR EDUCATION AND SKILLS
EDUCATION POLICY COMMITTEE

Group of National Experts on Vocational Education and Training

The Economics of Apprenticeships for Adults

By Prof. Dr. Samuel Muehlemann, LMU Munich, Munich School of Management

Apprenticeship training in countries with an initial vocational education and training (VET) system is largely targeted at young individuals without qualifications at the upper secondary level. Incentives to invest in apprenticeships for adults, however, not only differ for individuals, but also for training firms and governments. This paper provides a theoretical framework with a focus on the economics of apprenticeships for adults. Furthermore, it provides a discussion about the importance of apprenticeships for adults in a selected number of OECD member countries. In particular, the paper focuses on economic aspects including the costs and benefits of apprenticeships, and government efforts which provide financial incentives for individuals and firms. Finally, it discusses organisational aspects, such as a shorter duration of apprenticeships for adults with relevant skills and qualifications.

Anthony Mann, Head of OECD VET and Adult Learning Team, Tel: (33-1) 45 24 74 78
Anthony.Mann@oecd.org

JT03442041

Table of contents

1. Introduction 4

1.1. Definition – what is an apprenticeship for adults? 4
1.2. Who are adult apprentices? 5
1.3. How this study is structured 7

2. Trends and contextual factors 7

2.1. Trends 7
2.2. Demography (decreasing youth cohort) 7
2.3. Many adults lack upper secondary qualification 7
2.4. Migration 8
2.5. Changing demand for skills 8

3. Employer perspective 10

3.1. Benefits 10
3.2. Costs 10
3.3. Financial incentives for training firms 14

4. Individual perspective 15

4.1. Benefits 15
4.2. Costs 16
4.3. Financial incentives for individuals 17

5. State perspective 17

5.1. Benefits 17
5.2. Costs 18
5.3. The role of social partners 19

6. Empirical evidence on adult apprenticeships 19

6.1. Germany 20
6.2. Switzerland 23
6.3. Austria 27
6.4. Denmark 28
6.5. Australia 30
6.6. Canada 31
6.7. United Kingdom 35
6.8. United States 38

7. Conclusions 40

References 42

Tables

Table 1.1. Different types of apprenticeship training for adults, by initial skills and tenure at training firm 6
Table 3.1. Costs and benefits of training for firms 11
Table 4.1. Costs and benefits of training for individuals 16
Table 5.1. Costs and benefits of training for the state 18
Table 6.1. How apprentices age 25+ obtain a vocational qualification in Switzerland (2012) 24
Table 6.2. VET tracks for adults (age 25+) in Denmark 29
Table 6.3. Annual income after apprenticeship training in Australia, by age and recognition of prior experience and skills (2011-2013), in AUD 31
Table 6.4. Training tax credits for apprentices in British Columbia, in CAD 34
Table 6.5. National minimum wage by age and apprentice status, 2017, United Kingdom 36

Figures

Figure 6.1. Share of new apprenticeships in Germany, by age of apprentices (2014) 21
Figure 6.2. Apprentices in Switzerland, by age (2014/15) 23
Figure 6.3. Share of new apprenticeships in Austria, by age of apprentices (2015) 27
Figure 6.4. Apprentice age at the time of enrolment (2013) 32
Figure 6.5. Apprenticeship starts by age group, England, United Kingdom (2016/17) 36

1. Introduction

1. Apprenticeship training is often praised as an educational track that facilitates the transition from school to work for young individuals, resulting in low youth unemployment rates. In many countries with a traditional vocational education and training (VET) system, such as Austria, Denmark, Germany or Switzerland, the vast majority of apprentices obtain their VET qualification either as part of, or shortly after compulsory schooling. However, in other countries, such as Australia, Canada or the United States, where apprenticeship training is much less common, the majority of apprentices are adults who previously accumulated work experience.

2. Although there is an extensive literature on education and training for older employees, apprenticeship training for adults only plays a minor role in recent research. The focus of this paper is thus to provide a theoretical framework to review existing empirical evidence on apprenticeship training for adults with a formal work-based component.

1.1. Definition – what is an apprenticeship for adults?

3. The International Labour Organisation (ILO) defines apprenticeships as "Systematic long-term training for a recognised occupation taking place substantially within an undertaking or under an independent craftsman that should be governed by a written contract of apprenticeship and be subject to established standards." (R117 Apprenticeship Recommendation, 1962). Similarly, Wolter and Ryan (2011: 523) define apprenticeships as "…programs that comprise both work-based training and formal education, in most countries at upper-secondary level, and lead to a qualification in an intermediate skill, not just to semiskilled labour." The authors also highlight the distinction of apprenticeships to full-time vocational education, on-the-job training without a formal education component and labour market programmes. Different countries, however, have a different understanding of apprenticeships in the context of the national education system. Defining the term "adult apprenticeship" is consequently rather difficult as well, as noted by Fuller et al. (2015), because the definition of "adult" varies from country to country, and the term "adult apprentice" is only used in the United Kingdom and Australia. However, German-speaking countries (Austria, Germany, and Switzerland) also use a similar terminology for older apprentices (*Berufsbildung für Erwachsene*), and Denmark recently introduced a new VET track specifically for individuals age 25 and older. Thus, the topic of apprenticeships for adults is relevant even in countries with an extensive initial VET system.

4. In some countries, such as Australia, Canada or the United States, almost all apprentices are older than 20 years and thus no longer part of an initial education system. A main distinction between young and adult apprentices can arise because adult apprentices may have already completed 12 years of schooling, i.e., they graduated with an upper-secondary degree or equivalent around age 18. Thus, while 15 to 17-year-old

apprentices in initial VET countries typically attend general education classes in mathematics and languages in publicly funded vocational schools, adult apprentices who already possess an educational qualification at the upper-secondary level commonly no longer need such courses. Instead, adult apprentices typically attend occupation-specific courses. As a result, countries with an initial VET system often allow adult apprentices to obtain a VET qualification in a shorter period than a regular apprenticeship, taking into account previous work experience and educational qualifications (Kis and Windisch, 2018).

1.2. Who are adult apprentices?

5. Another issue with regard to apprenticeship training for adults is whether potential adult apprentices are existing employees of their employer (known as the 'training firm') or hired externally. Incumbent employees, even when performing unskilled or semi-skilled work, may have accumulated substantial firm-specific human capital[1] prior to training. External hires, however, may first need to acquire this type of human capital, which is costly to the firm. Table 1.1 summarises the training requirements for the firm, depending on the level of previously acquired skills, and whether or not an apprentice was previously employed with the training firm. Consideration of such prior experience allows the development of a typology of adult apprenticeship.

6. In a situation where an adult apprentice has low levels of transferable and firm-specific skills prior to training, an apprenticeship would look rather similar compared to an apprenticeship programme in an initial VET system (Type 1 in Table 1.1). Therefore, requiring the highest level of investment from the training firms (e.g. an individual without upper-secondary education who performed unskilled tasks for several years). Thus, Type 1 refers to adult apprentices who are recruited externally and simply enrol as a regular apprentice.

[1] Firm-specific human capital is defined according to Becker (1962), i.e., human capital that is not valued by other firms in the labour market.

Table 1.1. Different types of apprenticeship training for adults, by initial skills and tenure at training firm

	Level of firm-specific (not transferable) skills prior to training	
Level of occupation-specific and/or general (transferable) skills prior to training	Low	High
Low	**TYPE 1** **'Apprenticeship training'** for external employees or unemployed individuals with initially low levels of transferable skills	**TYPE 4** **'Upskilling'** of incumbent employees with initially low levels of occupation-specific and/or general skills
High	**TYPE 3** **'On-the-job training'** and validation of an individual's initial stock of transferable skills	**TYPE 2** **'Conversion'** [2] of incumbent employees through validation of their initial stock of transferable skills

Note: Transferable skills refer to general and/or occupation-specific skills that are required to carry out tasks of a skilled worker in a particular occupation.

7. In the case where an adult apprentice is an incumbent employee who has high levels of relevant firm-specific human capital and high levels of transferable skills, the training investment for a firm will be rather low, as existing skills are largely converted to a VET qualification (Type 2). An example could be a migrant who obtained a similar educational qualification and relevant work experience in his or her country of origin. Such apprentices may – possibly after taking some preparatory classes – directly apply for the final examinations or validate their skills to directly obtain a VET qualification, because they already acquired the relevant skills. Other may not need to complete general education courses in a vocational school but still require occupation-specific knowledge, and thus complete a formal apprenticeship programme, but in a shorter period.

8. Hybrid cases arise in a situation where apprentices largely require non-formal on-the-job training (Type 3), e.g. university dropouts who already hold an educational qualification at the upper-secondary level, and upskilling (Type 4), where apprentices largely require transferable skills (e.g., an employee with long tenure in a particular firm who never completed any type of upper-secondary education).

9. Taking into consideration that adult apprentices can be a very heterogeneous group in terms of previously acquired skills, a "one-fits-all" scheme for apprenticeships for adults does not seem appropriate. Indeed, some countries have established different tracks for adults to acquire a VET qualification. Moreover, the four types might not always be clearly separable in reality, as individuals who worked in a firm for many years not only acquire firm-specific human capital, but also develop occupation-specific human capital. Nonetheless, in terms of its value on the labour market, occupation-specific human capital that is not certified (by a VET qualification) is likely much less recognised by outside firms due to information asymmetries.

[2] cf. Unwin and Fuller (2015).

1.3. How this study is structured

10. Chapter 2 briefly discusses relevant trends and contextual factors with relation to adult apprenticeship. Chapter 3 discusses the perspective of employers, with regard to the cost and benefits of providing apprenticeship training for adults, and highlights some differences compared to apprenticeship training for young individuals and non-formal workplace training. Chapter 4 takes an (adult) individual's perspective and discusses the corresponding costs and benefits from completing an apprenticeship. Chapter 5 discusses the costs and benefits from the perspective of the state, including an analysis of existing subsidy schemes with the aim to increase training activities alongside a brief discussion of the role of institutions in the context of apprenticeship training. Chapter 6 contains empirical evidence, wherever possible with a focus on apprenticeship training for adults, for a selected number of OECD countries where adult apprenticeship training involves a significant amount of learning that takes place at the workplace. In particular, the chapter contains country-specific information about the importance of adult apprenticeships, the return on investment and the role of state subsidies for employers and individuals, apprenticeship duration, and apprentice pay. Chapter 7 concludes.

2. Trends and contextual factors

2.1. Trends

11. The share of adults who enrol and graduate with a vocational qualification increased in many, but not all OECD countries in recent years. The observed outcome in the apprenticeship market, i.e. the number of new apprenticeship contracts, is the result of changes in the demand for and the supply of apprentices (cf. Muehlemann, 2016). While the demand for apprentices may strongly be associated with a firm's demand for skilled workers in the corresponding training occupation, the supply of apprentices is determined by factors such as demographic change, or the availability of other educational pathways.

2.2. Demography (decreasing youth cohort)

12. In a number of countries, such as Austria and Germany, the number of school leavers decreased significantly in the last decade, and therefore the number of apprenticeship contracts decreased as well. At the same time, the share of young people pursuing an academic education increased in a number of countries, with an adverse effect on the supply of qualified apprenticeship applicants. Thus, demographic and societal change potentially are major determinants of the number of youth apprenticeships contracts and of the attractiveness of adult apprentices to employers.

2.3. Many adults lack upper secondary qualification

13. In many OECD countries, moreover, there is still a considerable share of adult employees (and unemployed individuals) without a formal qualification beyond

compulsory schooling. Against this background, apprenticeship training might be a viable pathway for adult employees to acquire the necessary skills to get (or retain) a job with decent pay, and to increase future employment opportunities.

2.4. Migration

14. In recent years, migration has increased in a number of OECD countries. The share of migrants who possess educational qualifications in host country varies over time and by the corresponding countries' immigration laws. Refugees in particular might not have the formal credentials to provide the legally required information about their previous work experience and educational qualification. Thus, for adult migrants, adult apprenticeships might be a particularly suitable pathway to obtain an educational qualification and thus increase their employability in the host country.

2.5. Changing demand for skills

15. In light of the ongoing technological change and automatisation of work processes, it may be expected that many routine tasks currently carried out by low and semi-skilled individuals will eventually be replaced by technology, as the costs of implementing such technology is likely to decrease in the coming years. The important question, which is difficult to answer *ex-ante*, is whether future technological change will be a substitute for, or complementary to skilled or semi-skilled labour (cf. Bresnahan et al., 2002). To the extent that technology complements skills (which is also referred to as skill-biased technological change), firms will more heavily invest in workplace training.

16. In case of skill-biased technological change, we would expect firms to have a higher demand for skilled, rather than semi-skilled workers. Young people – anticipating the future changes in a firm's demand for skills, might decide to pursue an academic education, thereby adversely affecting the supply of talented apprenticeship candidates. Although technological change usually decreases the employee's share of routine activities, it is not necessarily clear whether high, middle or low-skilled workers are more prone to such substitution effects. Recent studies reported evidence for job polarisation, i.e. more demand for high skilled employees at the cost of middle skilled employees (Goos et al., 2014; Michaels et al., 2014) and that it may be largely middle skilled jobs that are lost due to automatisation. However, this is by no means certain: empirical evidence suggests that the situation is different for workers with a VET qualification in Germany. As apprenticeships prepare individuals to work in an occupation, rather than providing narrow job-specific skills, technological change may lead to a reassignment of tasks within occupations, rather than substituting entire occupations, as has been argued with regard to Germany (Spitz-Oener, 2006). Thus, to the extent that middle-skilled employees obtained a VET qualification that equips them with a wider set of skills to work in a broadly defined occupation, rather than performing just a few narrowly defined tasks, adult apprenticeship training may equip individuals with the necessary skills that makes them complementary to technological change.

17. While in some countries, a main issue is that firms do not find adequately skilled workers on the labour market, other countries may face the problem that even highly skilled workers do not find appropriate jobs, because there is not a sufficient demand. As argued by the OECD (2012), governments can potentially address this issue by developing economic-diversification strategies and supporting inward investment. Sung

and Ashton (2014) highlight the importance of a firm's strategy and the organisation of the production process. A firm's demand for skills is a derived demand and depends on its production processes. Thus, increasing the availability of skilled workers only results in more skilled employment if tasks that need to be carried out in firms actually require skilled workers with a VET qualification.

18. Fuller et al. (2015) make a similar point in relation to their concept of expansive vs. restrictive apprenticeships. Depending on the competitive strategy, and how a firm organises the production process, some employees may only require a very narrow skill set that can be learned through a limited amount of on-the-job training, while other types of training are restricted to a limited share of employees.[3] Conversely, when firms compete for quality and offer career opportunities within the company, then it becomes much more important that training incorporates a more holistic component. Sung and Ashton (2014) argue that it is up to the managers of a firm to carry out a job analysis and decide on a job design that essentially determines the skill set that is required for a particular position. In a recent study of workplaces in the United Kingdom, Bilanakos et al. (2018) report evidence that firms who face a high sensitivity of product demand with respect to product quality provide more intensive workplace training.

19. Recent evidence for the United States shows that jobs requiring high levels of social skills increased substantially between 1980 and 2012 (Deming, 2017).[4] Edin et al. (2017) find similar results for Sweden, and in addition show that high levels of non-cognitive skills increase the probability of a promotion. As social skills become more a more predominant requirement to succeed in the labour market, an important question is whether there is an increased role for workplace training to develop such skills.

20. More than two decades ago, in assessing President Clinton's apprenticeship initiative, Heckman (1993) already raised the question whether the skills that employers demand would be better taught in schools or at the workplace, and whether employers would indeed have the capabilities to provide such skills. He argued that employers may not have a competitive advantage in offering such skills compared to (vocational) colleges, particularly after decades of focusing on mass production. Not much empirical evidence addresses this issue directly. A notable exception is Bolli and Renold (2017). They investigate which skills should best be taught at the workplace rather than in school and find that soft-skills (defined similarly like social skills in Deming, 2017) are most effectively taught at the workplace. Thus, to the extent that firms place a higher importance on social skills in the future, workplace training, and apprenticeship training in particular, may have advantages to develop such skills compared to a pure classroom environment. Consequently, adults lacking such skills might gain long-term benefits from apprenticeships structured to enhance their soft- or social-skills.

[3] In line with this argument, Seyda and Werner (2014) report for Germany that continuing VET is available for all employees in 81% of all firms that offer continuing VET – but the remaining firms with restricted training opportunities have a considerably higher share of unqualified workers.

[4] Similar developments could be expected for many OECD countries.

3. Employer perspective

21. This chapter addresses the benefits and the costs of providing an apprenticeship to adults from the employer's perspective. Subsequently, Chapter 4 addresses the individuals', and Chapter 5 the state's perspective.

3.1. Benefits

22. The potential benefits from training older employees are generally similar compared to benefits from training younger employees. However, human capital theory (Becker, 1962) suggests that the return on investment is lower for older employees, because the wage level is higher compared to younger individuals (which increases opportunity costs), and expected tenure may be lower (which decreases training benefits). As a result, firms are predicted (*ceteris paribus*) to be less willing to provide training to older, compared to younger employees. Indeed, training statistics consistently show that participation in firm-sponsored training is lower for older employees.[5]

23. Firms typically offer training because employees do not have the required competences to carry out their current tasks, or tasks that employees are expected to perform at some point in the future. Thus, essentially, training is aimed at increasing the current and/or future productivity of employees (Table 1.1).

24. However, productivity increases may not only result from increases in skills and knowledge, but also from higher levels of employee engagement, meaning that employees are willing to put in more effort and are more motivated to do "a good job" (for a literature review of the corresponding training effects on such outcomes, see e.g. Aguinis and Kraiger, 2009). Similarly, training provision may reduce turnover, which in turns increases the payoff period during which training benefits are accrued. With regard to adult employees in particular, it may well be possible that expected tenure is lower compared to younger individuals who might still actively search for better suited employment opportunities (and at the same time may have lower mobility costs associated with changing employer).

25. Training may also be instrumental in increasing the probability of product or process innovation, which in turn positively affects the future profits of the firm (e.g. Bauernschuster et al., 2012; Dostie, 2014; Rupietta and Backes-Gellner, 2019).

3.2. Costs

26. Providing training comes at a cost, which typically includes expenses for training instructors (internal or external), training materials and infrastructure, and wages for

[5] Clearly, other explanations, such as individual employee characteristics (as discussed in Chapter 5) are consistent with such statistics as well.

apprentices. Training costs may not necessarily differ strongly by the age of the apprentice, although apprentice wages might – also depending on institutional factors – be considerably higher for adult compared to young apprentices (Kis and Windisch, 2018). Conversely, previous experience may accelerate the learning process (reducing costs), while the ease of learning typically diminishes with age (increasing costs). Thus, it is *ex-ante* not unambiguously clear whether the training costs differ by the age of the apprentice.

27. When evaluating the training decision in monetary terms, firms would be willing to pay for training as long as the benefits outweigh the costs. Classical human capital theory (Becker, 1962) predicts that employers never invest in general skills when labour markets are competitive, because employees will leave the firm for a better-paid job when they do not receive a wage according to their productivity in the training firm. Thus, even in the case when training does result in the benefits as outlined in Table 3.1, the firm will not be able turn these benefits into a profit, because employees require to be compensated with a corresponding wage increase (and can credibly make a threat to leave the firm otherwise). As a result, the firms are left only with the training costs, and anticipating this outcome, they will not invest in training in the first place. Conversely, firms will pay for part of firm-specific human capital that is of limited or no use in competing firms (i.e., not transferable), and in return share the benefits (productivity increase) in the form of higher wages with their employees.

Table 3.1. Costs and benefits of training for firms

Costs	Benefits
Costs for training instructors	Higher post-training productivity (through increased competences and employee engagement)
Materials, infrastructure	Lower post-training turnover, compared to external hiring
Apprentice wages	Savings on total labour costs (savings on hiring costs)
	Increase future innovation rates
	State subsidies

Source: Adapted from Sachverständigenkommission Kosten und Finanzierung der beruflichen Bildung (1974), "Kosten und Finanzierung der ausserschulischen beruflichen Bildung", Bielefeld, Bertelsmann, Abschlussbericht and Mühlemann, S. (2016), "The cost and benefits of work-based learning", *OECD Education Working Papers*, No. 143, https://doi.org/10.1787/5jlpl4s6g0zv-en.

28. Apprenticeships are considered as mainly general regarding the type of human capital they develop, as training curricula require firms to provide skills that are useful in other firms as well, at the very least in the particular training occupation of interest. Thus, human capital theory suggests that firms would never hire apprentices and pay for their education, because training firms could not expect to get a return on their investment after graduation. However, apprentices have the possibility of indirectly paying for their apprenticeships by accepting a sufficiently low apprentice wage. As apprentices spend the majority of their time at the workplace, it is possible that the productive value of their work exceeds the sum of both training costs and apprentice wages (Kuczera, 2017; Muehlemann, 2016).

29. The observation that German employers make a net investment (among other examples) in apprenticeship provision led to the extension of the classical human capital theory. Different theoretical models about the labour market were required to explain such empirical findings. A number of authors contributed to this development of human capital theory, in particular Katz and Ziderman (1990), Stevens (1994), Acemoglu and

Pischke (1998, 1999), as extensively reviewed in Leuven (2005), acknowledge the role of frictions in the labour market.

30. The level of apprentice pay is a potentially difficult hurdle to overcome for both employers and individuals. Evidence from cost-benefit surveys in Austria, Germany, and Switzerland reveals that apprentice pay for young apprentices account for half or more of a firm's gross training costs, even though apprentice pay is only a relatively small fraction of the going wage for unqualified workers (Strupler and Wolter, 2012; Jansen et al., 2015, Schlögl and Mayerl, 2016). Conversely, apprentice pay is close to the typical pay of unqualified workers for apprentices age 18 and younger, and at least equal to the minimum wage for apprentices older than 19 years in the United Kingdom, or may even exceed the going minimum wage in Canada (as discussed in Chapter 6). Thus, having to pay apprentices a salary that is close to that for employees without a VET qualification during training may result in training costs that are too high to bear for the firm, unless the amount of (general) training provided to apprentices is low, or if the training duration is extended accordingly.

31. Firms may use payback clauses to ensure that employees do not leave the firm for some time after training, even though legal enforcement of such contracts may prove difficult and costly in court, and in some countries a minimum threshold of training costs and/or training duration must be exceeded to make use of payback clauses (Cedefop, 2012a). However, in the case of apprenticeship training, the firm's investment in training is often considerably higher compared to on-the-job training. Therefore, the payback period where the firm can generate income based on the difference between the productivity and the wage would have to be much longer unless wages can adjust during training. While employees might be willing to commit to payback clauses for some time, it would probably be difficult to find employees who agree to very long-term payback clauses, particularly if the penalty for breaking the contract is high. As a result, high investments from employers, as in the case for adult apprenticeship training, are unlikely to yield a sufficiently high expected payoff within a reasonable post-training period, unless wages during training adjust accordingly. Thus, firms may prefer to split training expenditures and offer smaller packages of training over a period of several years - and therefore prefer on-the-job training compared to apprenticeships for adults.[6]

32. Nonetheless, if employers perceive it is attractive to employ individuals with a VET qualification who are not currently available on the labour market, they might not have another choice but to invest heavily in apprenticeship training (as small investments of a few days or weeks in on-the-job training may not yield the desired increase in skills, (cf. Mayhew and Rijkers, 2004). The reason is that alternative options may be expensive too, either due to high costs in hiring externally when skilled labour is scare (Muehlemann and Strupler, 2018), or from lost profits from not filling vacancies. With demographics in many OECD member countries leading to fewer individuals leaving school, at a time when a large share of experienced qualified workers approaches retirement, employers may find it more difficult to find suitable young apprentices and may therefore consider offering apprenticeship training to older individuals.

[6] In line with this argument, statistics show that on average, EU-28 firms spend PPS 1356 per participant for continuing training courses (Eurostat, 2015), which is considerably less compared to a firm's investment in initial VET (cf. Muehlemann, 2016).

3.2.1. Apprenticeships for adults vs. continuing training for adults

33. Nothing prevents a firm from offering their semi-skilled employees the same type of training that it provides to young apprentices in a non-formal setting (particularly in workplaces that already offer apprenticeships to young individuals). Such training could simply be labelled on-the-job training that does not lead to a VET qualification. The lack of a skills certification would in turn limit the probability of trained employees leaving the firm soon after training, because they could not credibly signal training participation to outside firms. Thus, to the extent that firms can recruit a sufficient number of suitable individuals to participate in such non-formal training, there is not necessarily a need to provide formal apprenticeships for adults, unless a VET qualification is required by law. Kis (2018) provides an overview of how widespread a country's institutional regulations required employees to have a VET qualification, which is often the case in the health or education sectors but differs quite strongly across countries in various crafts occupations.

34. The literature on on-the-job training typically finds that wages of employees do not decrease during the training period, but wages also do not increase as much afterwards. This leaves room for firms to recoup their training expenses, to the extent that productivity growth due to training is higher than the corresponding wage increase (e.g. Konings and Vanormelingen, 2015).

3.2.2. Apprenticeships for adults vs. youth apprenticeships

35. To the extent that firms face difficulties in hiring qualified personnel from the external labour market, providing apprenticeships for adults (Type 1 in Table 1.1) might be viable recruitment strategy. While the training duration for young apprentices is typically no less than two or three years in most initial VET systems, older apprentices may be able to obtain the qualification in a shorter period, because previous experience may count towards a VET qualification (Kis and Windisch, 2018). A number of countries with initial VET systems, such as Austria, Denmark, Germany, or Switzerland, have regulations that allow individuals with prior experience in the profession (or in a similar vocation) to obtain a VET qualification in less time. For example, such individuals may not need to attend the entire curriculum at vocational school, can complete an apprenticeship in two rather than three years, or have the possibility to proceed directly to their final examinations.[7] Thus, training adult apprentices may be an option for employers seeking to satisfy their future labour demand in a timelier manner compared to training younger apprentices. Moreover, some countries offer an accreditation of existing skills and knowledge (see also Kis and Windisch, 2018 for a comprehensive overview) so that a VET qualification may be awarded directly without the requirement to complete the regular final VET examinations (cf. Type 2 Table 1.1, which essentially does not require the involvement of a training firm).

36. For adult apprenticeships, probably the most important cost factor is the wage of adult apprentices. Regular on-the-job training typically requires rather modest investments from the employer compared to an entire apprenticeship programme. For instance, training costs for providing continuing training financed by German employers in 2013 amounted on average to EUR 1 132 per employee, including both formal and

[7] Kis and Windisch (2018) provide a detailed summary about the requirements across countries to gain direct access to final examinations to obtain a VET qualification. More information on country-specific arrangements are also provided in Chapter 6 of this paper.

informal training investments, for an average annual duration of 32.7 hours (Seyda and Werner, 2014), which corresponds to less than half of a monthly salary of a skilled worker with a vocational qualification.[8] However, a three-year apprenticeship requires a much higher investment and commitment from the training firm, as it includes more than 200 hours of instruction time per apprentice per year at the workplace in addition to formal education in a VET school (Jansen et al., 2015; Strupler and Wolter, 2012).[9] In Germany and Switzerland, for example, firms invest the equivalent of almost three months of skilled worker pay per apprentice annually (in addition to apprentice pay), i.e. about six times the amount that a firm usually invests in continuing VET. Thus, the role of apprentice pay becomes potentially much more important for the case of providing an entire apprenticeship programme for adults, compared to offering continuing training. Training costs are particularly important for Type 2-4 (Table 1.1), because individuals with high levels of firm-specific and/or transferable skills were likely to have earned higher wages prior to entering training compared to individuals with few relevant skills (who, for example, might have been expected to have been paid the national minimum wage). This also highlights the advantage of initial VET system, as young apprentices find it easier to manage their life with low pay, in part because their potential earnings would be low or even zero in alternative educational tracks in a classroom environment.

3.3. Financial incentives for training firms

37. Another motivation for firms to offer apprenticeship training is the availability of public subsidies for offering formal training, or financial penalties for not offering training (Table 3.1). Dostie (2015) provides empirical evidence from a Canadian pay-or-train scheme regarding formal training and shows that firms indeed respond to such incentives. Exploiting a policy reform, he finds that medium-sized firms in the Province of Quebec reacted to the removal of a train-or-pay scheme by reducing the amount of formal training. However, these firms did not abolish workplace training altogether, but instead increased the provision of informal training by an equivalent amount. Dostie cannot infer whether formal or informal training has stronger effects on the desired training outcomes for employers. However, based on human capital theory, we would expect that employees have lower outside options when training is largely informal, as it

[8] Concerns about reverse causation may arise, as training may not only lead to higher productivity, but higher productivity employees may be selected for training as a reward for good performance of older employees (Lazzara, 2013).

[9] Konings and Vanormelingen (2015) report similar figures for continuing training in Belgian firms, where continuing VET in firms on average lasts 39.1 hours per trained worker at a cost of EUR 1 414 p.a. between 1997 and 2006. They find that an hour of workplace training increases productivity by 0.76%, and wages by 0.44%, yielding a (statistically significant) difference between the productivity and the wage of 0.32% per hour of training. To the extent that the marginal productivity effect can be extrapolated in the context of apprenticeship training (that includes about 200 hours per year of direct instructor supervision time p.a.), a productivity increase of roughly 150% per year of apprenticeship training would be expected. In Switzerland, the relative productivity of an apprentice in a three-year apprenticeship averages about one-third to that of a skilled worker on average in the first year of training (Strupler and Wolter, 2012). Thus, increasing that relative productivity by 150% after each year of training results in a ballpark estimate of relative productivity of about 75% on average in the third year of training, which roughly matches the observed average relative productivity in three-year apprenticeships in Switzerland and Germany (Jansen et al., 2015; Strupler and Wolter, 2012).

becomes more difficult to signal the training content to other potential employers. Fuller et al. (2015) also raise concerns for the financial incentives in the United Kingdom (the training levy). As many apprentices in the United Kingdom were previously employed with the training firm (Type 2 and Type 4 in Table 1.1), Fuller et al. argues that this raises doubts as to how much additional training is provided compared to a situation without a training levy.

38. Summing up, to the extent that an employer needs skilled workers to produce goods and services, it has several incentives to offer apprenticeship training. In the case where a firm trains apprentices predominantly to satisfy its future demand for skilled labour, the labour market environment largely determines whether it is cheaper to recruit externally or develop skills internally (cf. Stevens, 1994; Blatter et al., 2016), and if internally, whether a firm prefers to train young or adult apprentices. Conversely, to the extent that a firm's production process solely requires employees with a rather limited skill set, a firm likely has a lower demand for employees with a VET qualification. However, given that the number of young school-leavers who are interested in taking up apprenticeship is currently rather low or declining in a number of OECD countries, such as Germany, there might be an increasingly important role for apprenticeship training of adults.

4. Individual perspective

4.1. Benefits

39. From the perspective of an individual, investing in an apprenticeship might have several benefits.[10] Compared to not having such a qualification, an apprenticeship may yield higher post-training earnings, higher employability and better career opportunities, particularly with external employers. Moreover, apprenticeships may result in increased job satisfaction, because individuals may be able to carry out more advanced and thus more interesting tasks after having acquired a VET qualification (Table 4.1). Training itself could also yield consumption benefits to those individuals who enjoy learning new skills, while it could possibly constitute psychological cost to others.

[10] Holmes (2017) and Grugulis et al. (2017) provide recent comprehensive reviews of the individual, and economic and social benefits of skills, respectively, for all age groups. Moreover, Loretto et al. (2017) provide a recent review on skills and training for older individuals who are over 50 years old.

Table 4.1. Costs and benefits of training for individuals

Costs	Benefits
Opportunity costs (forgone earnings during training)	Higher post-training earnings
Direct training costs (tuition, books)	Higher post-training employability
Psychological costs	Higher post-training career opportunities
	Higher post-training job satisfaction, self-esteem, and health
	Consumption benefit during training

40. The benefits from investing in VET increase with the payoff period, i.e. the expected number of years and individuals will work as skilled workers in a particular occupation. The payoff period is strongly associated with age, so that older individuals have a considerably lower net present value from obtaining a VET qualification compared to younger apprentices. However, the value of future benefits also depends on an individual's time preferences and personality traits, and the motivation to learn (e.g. Fouarge et al., 2013; Noe and Wilk, 1993; Major et al., 2006; Tharenou, 2011). In Germany, for example, a third of the firms that do not offer workplace training report that the reasons for not doing so is a lack of interest and motivation of their employees (Seyda and Werner, 2014). Older employees themselves are (un)willing to participate in training for a number of reasons, as summarised in Canduela et al. (2012).

41. Fuller et al. (2015) raise the question whether apprenticeships for adults should focus on obtaining a VET qualification mainly through validation of existing skills (Types 2 and 3 in Table 1.1), or through providing a significant amount of new transferable skills to adult apprentices (Types 1 and 4 in Table 1.1). The validation of existing skills, however, does not necessarily require much involvement of employers, as it could be arranged by state institutions, e.g. as in Denmark or Switzerland (Maurer and Wettstein, 2014; SBFI, 2014). Moreover, to the extent that labour markets are rewarding higher skills in the form of higher pay, semi-skilled individuals (without a VET qualification) who acquired many skills through informal learning may earn a wage that is very close to the wage they could expect with a corresponding VET qualification. Thus, in that case, individual wage returns to obtaining a VET qualification may be rather low, at least in the short-run. Conversely, in occupations, industries or countries where wages (or promotions) depend strongly on the qualification level (e.g. in countries with pronounced labour market segmentation, or in occupations such nurses, electricians or plumbers that legally require a VET qualification as a license to practice), acquiring a corresponding formal VET qualification may likely result in significant individual gains.[11]

4.2. Costs

42. Acquiring an apprenticeship also results in significant costs for individuals, largely because of forgone earnings during the training period (Table 4.1). Particularly adult apprentices could earn substantially higher wages (depending on the level of apprentice pay) when working as an employee without any formal qualifications beyond compulsory schooling. Thus, the longer the training duration, the more important become the corresponding opportunity costs. In addition, there may be direct training costs, such as travel costs to vocational school, books, or exam fees. Moreover, participating in

[11] Kleiner and Krueger (2013) provide an empirical analysis of wage-effects associated with occupational licensing in the United States and estimate an average wage premium of 18%.

apprenticeship training and vocational education may put pressure on individuals, takes away from available leisure time for hobbies, friends and family, and can in addition result in psychological costs.

43. Individuals who are more patient will value future benefits more compared to impatient individuals. To the extent that former educational choices depended on time preferences, we might expect that older workers without a VET qualification may be characterised as more impatient compared to those who obtained a VET qualification at a younger age. Thus, in combination with a shorter payoff period, the net present value of investing in an apprenticeship is considerably lower for adults compared to school leavers. Moreover, adults typically have higher financial obligations during an apprenticeship, as they are likely to live independently or have family obligations. Financial obligations, and credit constraints in particular, may be other factors that are more important for adults compared to young individuals when it comes to educational choices.

4.3. Financial incentives for individuals

44. Many countries have various subsidy or tax-deduction systems in place or offer training vouchers for older individuals who want to invest in further education and training, and many of them are income-dependent and may also account for an individual's family situation. Thus, to the extent that subsidies reduce opportunity costs during training, the net present value of a training investment can increase substantially from an individual's perspective. The next two chapters will discuss corresponding government programmes targeted at increasing training participation of individuals and firms.

5. State perspective

5.1. Benefits

45. In countries with an initial VET system, governments typically fund vocational schools, similar to funding full-time schools in other educational tracks at the upper secondary level. In countries without an initial VET system, institutions who provide vocational education to adults often receive substantially less (if any) public funding. Similar to apprenticeships for school leavers, apprenticeships for adults are expected to increase employability and at the same time reduce the probability of becoming unemployed, yielding savings on welfare expenditure for the government (Table 5.1). To the extent that a VET qualification increases wages, a government will also receive higher income tax revenues in the future, which is particularly important in the case of progressive income tax systems. A well-qualified national workforce, moreover, may enable employers to produce high-quality goods and services and to compete in world

markets, which positively affects economic growth and leads to an increase in corporate tax revenue.[12]

46. Apprenticeships for adults may also be part of active labour market policies to increase the employability of the unemployed. Such policies often support individuals by covering (part of) the difference between the training wage and their previous wage (or the wage they could earn as an unskilled employee).

5.2. Costs

47. States may fund the corresponding costs for teachers and infrastructure in vocational schools, bear the costs from reduced income tax revenue for the time when individuals participate in apprenticeships (to the extent that apprentice pay is lower than unqualified pay) and subsidise trainees or training firms.

Table 5.1. Costs and benefits of training for the state

Costs	Benefits
Financing training programmes in workplaces	Reduced spending on unemployment benefits
Subsidies and scholarships for trainees	Higher tax revenue from individuals due to increased post-training income
Lower tax revenue (based on reduced earnings of apprentices) during the training period	Higher tax revenue from employers if a better skilled workforce leads to higher firm profits

48. With regard to the provision of adult apprenticeships, evidence on the return on investment of such programmes is rather limited, even though many countries have subsidy schemes in place that provide financial incentives for employers to offer workplace training for adults. An important question is not only whether such programmes are effective, but also whether the associated programme benefits exceed the corresponding costs that a government bears. Chapter 6 discusses the current evidence that is available regarding the provision of adult apprenticeships in a number of selected OECD countries.

49. Besides offering financial incentives to employers, an increasingly popular policy instrument to grow adult training participation are training vouchers that are made available directly to individual employees to help financing training courses. Evidence on training vouchers, i.e. so that individuals directly obtain financial resources to participate in adult training (outside the firm), is not very encouraging. A recent systematic literature review by Tomini et al. (2016) concludes that even though vouchers may indeed increase training participation, the causal labour market effects of voucher-induced training are often zero (or even negative) in the short run. The authors point out, however, that there may be longer-term effects to training, particularly for classroom and on-the-job training programmes, as shown in an earlier meta-analysis of active labour market programmes by Card et al. (2010). Card et al. (2010: F475) also state that "…it appears that programmes for older adults only are less likely to succeed – especially in the medium run – than more broadly targeted programmes." Even when programmes show small positive effects, the costs also need to be considered. Tomini et al. (2016) conclude based on the systematic review that the deadweight loss ranges from 30% to 59%, meaning that a substantial part

[12] Further indirect benefits to the government and society as a whole might include increased health and reduced crime rates, both of which would reduce corresponding government spending.

of voucher recipients would have also used their own resourced to finance training in the absence of a voucher programme.

50. These results are rather discouraging from a policy perspective, indicating that tax-payer money might be spent better elsewhere. Similar to training vouchers, adult apprentices could be supported by financing (part of) the difference between the former salary that they earned as an unqualified employee and the apprentice wage that they receive during training. Subsidies targeting older adults, however, may provide incentives for firms to delay or displace training, as shown for the case of age-dependent training subsidies for employees older than 40 years in the Netherlands (Oosterbeek and Leuven, 2004). Although they found that the share of 40+ old employees receiving training increased significantly compared to the situation before the subsidy scheme was in place, the increase in training was largely due to a postponement of training for workers who had not yet turned 40 years old. Therefore implying that there was no net impact of the subsidies on training, at least in the short-run.

5.3. The role of social partners

51. Institutions play an important role in skills development (e.g. Busemeyer and Trampusch, 2012; Streek, 2009). On the one hand, unions may want to ensure that employees have access to training and development opportunities, even though conflicts of interest may arise in order to preserve benefits accruing to union members, so that some unions may restrict access to training for non-union members (for a detailed discussion and references, cf. Stuart and Huzzard, 2017).

52. On the other hand, employer associations are important, particularly with respect to providing occupation-specific or industry-specific (and thus transferable) training (cf. Martin, 2017). To the extent that employers' associations provide training that is also accessible for adult apprentices, such institutions can have a substantial impact on the private returns to apprenticeship training for adults (as part of the training costs are covered by employers' associations), and at the same time reduce a firm's training investments.

53. Some countries may also have legal constraints with regard to work status of young individuals. For example, in Israel, apprentices under age 18 in principle are not allowed to receive wage payments. Such legislation clearly prevents the development of an initial VET system where the work-based learning plays a significant role – but at the same time serves to foster apprenticeships for adults.

6. Empirical evidence on adult apprenticeships

54. This chapter presents empirical evidence regarding the prevalence of apprenticeships for adults. Depending on the corresponding country, older individuals are defined differently, thus we cannot make general statements about "adult apprentices" in a cross-national context. The purpose of this chapter is to discuss empirical evidence concerning the costs and benefits of adult apprenticeship training for employers,

individuals, and states. Countries with predominantly school-based VET are not taken into consideration in this chapter.

55. First, evidence is presented for four countries in Europe where dual apprenticeships as part of an initial VET system are most common – Germany, Switzerland, Austria and Denmark. Subsequently, other countries are discussed where apprenticeships are less common in general, but adult apprenticeship is commonplace.

6.1. Germany

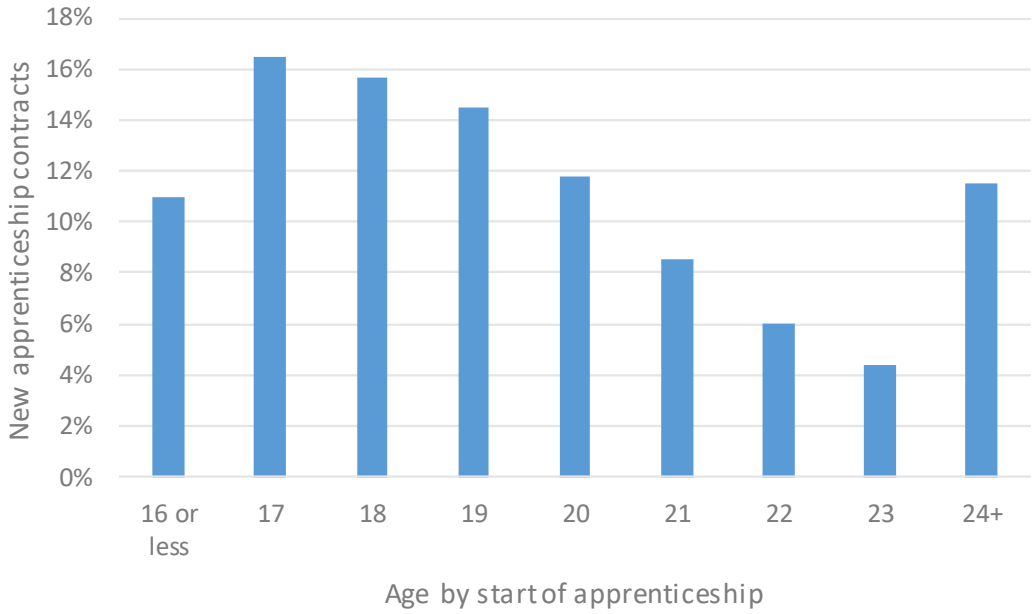
6.1.1. Importance of adult apprenticeships

56. In Germany, 14% of young adults (about 2 million individuals) between age 20 to 34 do not have a post-compulsory education (Troltsch, 2013). Based on the BIBB-Qualifizierungspanel, a representative survey of German firms with information regarding the qualification and competences of a firm's employees, Troltsch (2013) reports that about 45% of all firms reported that they anticipated future difficulties in recruiting skilled workers from the external labour market. When asked about their willingness to train adults, roughly 20% of all employers in the survey (about 300 000 employers in Germany) reported that they expected to take on individuals without a VET qualification in the future when facing hiring difficulties for skilled workers. The willingness to take on older individuals is much higher for larger firms. Troltsch (2013) reports a correlation between unfilled apprenticeship positions and a firm's willingness to train older individuals, as more than 40% of firms with unfilled apprenticeship positions are willing to take on young adults as apprentices. As could be expected, firms are most willing to take on young adults as apprentices in occupations where they expect future hiring difficulties, such as retail clerks, cooks, hairdressers, painters, and a number of technical occupations in metalworking or engineering occupations.

57. Almost 12% of all apprentices in Germany are older than 24 years when starting an apprenticeship (Figure 6.1). This share has been increasing steadily since 1993, when the share was as low as 3.4% (BIBB, 2016).[13] Another 19% of all apprentices were between 21 and 23 years old when starting an apprenticeship in Germany in 2014, while only 1 248 (or 2.5%) out of a total of 518 394 apprentices were older than 40 years old when starting their apprenticeship. In Germany, about 20% of apprentices have obtained a high school degree prior to beginning an apprenticeship, which partly explains the higher average age of apprentices compared, for example to Switzerland, where considerably fewer apprentices obtain a high school qualification prior to starting an apprenticeship.

[13] While the reasons for this development have not been clearly identified, a possible explanation is the increased share of individuals who first obtain a university access diploma (*Abitur*), and subsequently decided to enrol in apprenticeship training. Second, a recent decrease in the number of young school leavers in many German states also contributes to an increase in the relative importance of older apprentices.

Figure 6.1. Share of new apprenticeships in Germany, by age of apprentices (2014)



Source: Adapted from BIBB (2016), "Datenreport zum Berufsbildungsbericht", BIBB, Bonn, Table A4.5-1.

6.1.2. Apprenticeship duration

58. In Germany, apprenticeship training lasts 3 or 3.5 years. However, the training duration in a given apprenticeship occupation can be shortened for a number of reasons (§ 8 Berufsbildungsgesetz). Thus, in line with Types 2 and 3 in Table 1.1, apprentices with a medium-level compulsory schooling degree can reduce the duration by 6 months, while those with a baccalaureate as well as individuals older than 21 years can expect reductions of up to 12 months. Apprentices with a prior vocational qualification can also request a reduction of the training duration by 12 months. An additional requirement to take the final examination early is that both the training firm and the vocational school attest to an apprentice is performing at above-average levels.

6.1.3. Contract and apprentice pay

59. In Germany, the apprenticeship contract ends on the day when an apprentice officially receives confirmation about having successfully passed the final examination. Thereafter, a former apprentice will have the status of a regular skilled worker (and earn a corresponding skilled worker wage) if she continues to work with the training firm. For an older apprentice, a shorter training duration may often be desirable, as this lowers opportunity costs from lost income. A firm may also prefer a shorter training duration, particularly at times of skilled labour shortages, so that apprentices can start working as fully skilled workers as soon as possible. Apprentice wages are subject to collective bargaining at the sectoral level. Firms for which the collective agreements are not legally binding may offer apprentice wages of no less than 20% below the minimum wage. There are no detailed statistics available with regard to apprentice pay for adult apprentices.

6.1.4. Return on Investment (ROI) and state funding to employers

60. Empirical estimates about the return on investment to employers are not available for adult apprentices separately. Initial apprenticeship programmes, however, result in average net costs to employers of EUR 5 400 per year (Jansen et al., 2015). To the extent that adult apprentices earn higher training wages, net training costs are likely higher, unless previous (labour market) experience of adult apprentices lower a firm's training investment in terms of instruction hours, or increase training benefits because older and more experienced apprentices may create more value in productive tasks.

61. Germany provides financial incentives in relation to adult apprenticeships. The initiative Zukunftsstarter is mainly targeted at individuals age 25-35 to pursue an apprenticeship (see below) and employers are also eligible for financial support towards the employer's share of social security contributions (BA, 2016).

6.1.5. ROI and state funding to individuals

62. Rates of return to education for obtaining a vocational qualification are not available by the age of apprentices. Overall rates of return to a VET qualification are estimated around 12% before and 5% p.a. after taxes and transfers (Pfeiffer and Stichnoth 2015). As the rates of return over an individual's career depends strongly on the time left on the labour market, the age when a qualification is obtained matters. Clearly, after a certain age, the wage-return to apprenticeship training alone might not be sufficient to make such an investment. Moreover, the estimated returns to a VET qualification are not strictly causal, because they rely on observational data. To the extent that there exists a positive selection into a VET qualification, observed returns may overestimate the true expected returns to a VET qualification.

63. Ekert et al. (2017) analyse whether the validation of existing skills for migrants in occupations that do not legally require a formal qualification improve their labour market outcomes (N=131). They find that the validation increased wages (N=54), employment and the probability to work in the occupation where an individual obtained their qualification in his or her country of origin, while decreasing the probability to work on a temporary basis.[14]

64. Policy initiatives, such as Zukunftsstarter, try to encourage individuals between 25 and 35 years old to pursue a vocational qualification. The aim of the initiative Zukunftsstarter is to support 120 000 individuals older than 25 years to start an apprenticeship by 2020, by providing financial incentives to participants when they successfully pass mid-term and final examinations (BA, 2016). The initiative also grants adult apprentices financial support for educational expenses, travel costs, childcare costs, and tutoring expenses, and subsistence money may be provided during the training phase. No assessment about the effectiveness and the efficiency of such measures has so far been undertaken.

[14] The authors note that only migrants who already obtained a vocational qualification from their country of origin could participate in the validation process. Moreover, unsuccessful applicant and applicant with a formal qualification who did not apply for the validation procedure are not observed in the data. It is also important to note that a large majority of recent migrants to Germany do not hold any post-compulsory qualification.

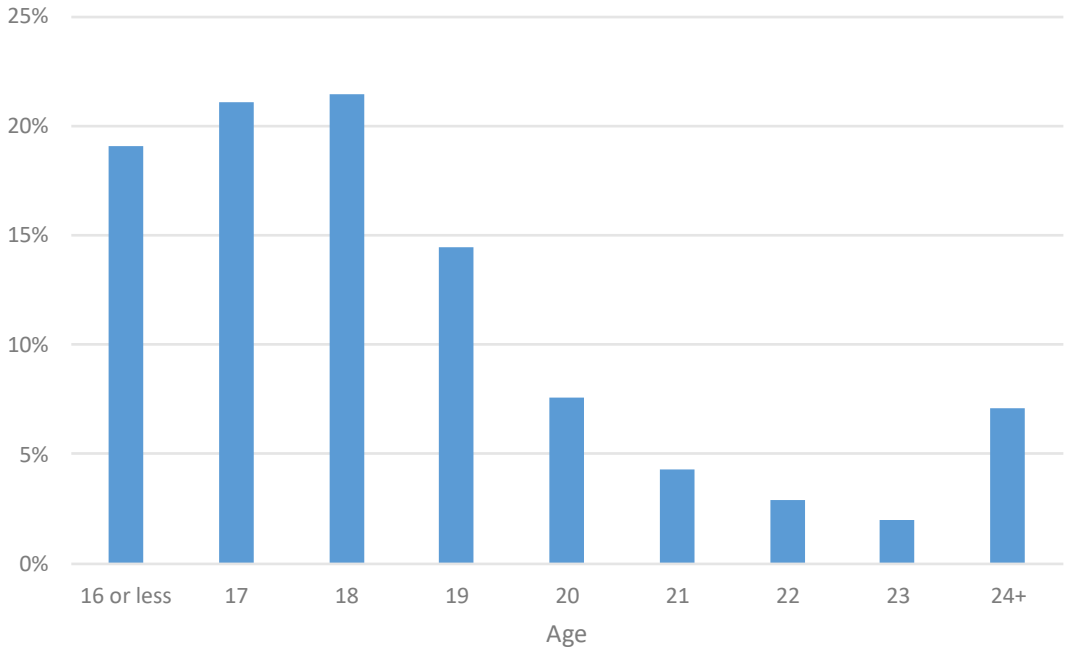
6.2. Switzerland

6.2.1. Importance of adult apprenticeships

65. In Switzerland, 15% of all apprentices are older than 20 years old (Lehrstellenbarometer, 2016), with a share ranging from 9% in administrative occupations and information technology (IT) to 27% in the service sector. Asked why they hired adult apprentices, 57% of employers in the same survey responded that there was no particular reason for doing so, and 26% said that they wanted to give older applicants a chance. Another 16% reported that older applicants could take on more responsibility compared to young applicants, while 15% responded they thought that older applicants would have a higher level of human capital and know-how. Among firms with young apprentices, 77% reported that they hired young apprentices for no particular reasons, and another 13% said that training for young individuals is their priority.

66. Moreover, as shown in Figure 6.2, roughly 8.5% of all apprentices in Switzerland are older than 24 years, which is lower than in Germany. However, the Swiss figures do not represent new apprenticeship contracts, but refer to apprentices in general, thus a significant fraction of 24+ year-old apprentices are already their last year of training. Finally, the share of a cohort of Swiss school-leavers not enrolling in an educational track at the upper secondary level decreased strongly in the last two decades to roughly 5% in recent years.

Figure 6.2. Apprentices in Switzerland, by age (2014/15)



Source: Adapted from Bundesamt für Statistik (BFS) (2016), Table "Lernende: Basistabellen 2014/15", https://www.bfs.admin.ch/bfsstatic/dam/assets/333526/master.

67. Among adult apprentices, who were at least 25 years old at the beginning of the apprenticeship, 58% had previously completed an apprenticeship training (Schmid et al., 2017). [15]

68. Among adult apprenticeship graduates who were 25 or older, 40% were between 25-29 years old, 17% between 30 and 24 years, 11% 35-39 years, and 10% between 40-44 years, 10% between 45-49 years, and 11% 50 years or older (Tsandev et al., 2017).

6.2.2. Apprenticeship duration

69. The most popular route for 41% of adult apprentices (in this case defined as apprentices older than 24 years) is to obtain their vocational qualification by participating in a regular apprenticeship programme (Table 6.1, corresponding to Type 1 or 4 in Table 1.1). Referring to Types 2 or 3 in Table 1.1, individuals with a prior vocational qualification or a baccalaureate (21%) can request a shorter training duration, similar to Germany. Another option, for example, for individuals with a vocational qualification from abroad, is to apply directly to undertake the corresponding final exam on the basis of at least five years of labour market experience, an option that was chosen by 34% of all graduates. Finally, relatively few individuals (4%) have their skills validated by authorities, and – when the validation is successful – directly obtain a vocational qualification without having to pass any further examinations (Maurer and Wettstein, 2014; SBFI, 2014).[16]

Table 6.1. How apprentices age 25+ obtain a vocational qualification in Switzerland (2012)

Route to obtain vocational qualification	Share of graduates (in %)
Regular apprenticeship	41
Apprenticeship with shorter training duration	21
Directly applied for final exam	34
Skills validation procedure	4

Source: Adapted from SBFI (2014), "Berufsabschluss und Berufswechsel für Erwachsene. Bestehende Angebote und Empfehlungen für die Weiterentwicklung", SBFI, Bern. Table 5.

6.2.3. Contract and apprentice pay

70. There is no representative information available about actual wages of apprentices by age, or by prior education. However, according to SBFI (2014), employers often pay adult apprentices the equivalent of the regular apprentice wage in the last year of training (about CHF 1 300 per month in 2012).

[15] Thus, the question arises whether the state should fund only an individual's initial education, or also subside a second or third education. In the context of continuous training in Switzerland, it is typically the case that the financing is borne by (or split between) individuals and firms. However, individual training expenditures for continuous training are tax-deductible in Switzerland since 2016 (for expenditures up to CHF 12 000 if the training content was work-related).

[16] A particular issue regarding the validation of prior skills may be low or missing quality standards in competence-based assessments that lead to a vocational qualification. Incentives for awarding organisations may be to lower quality standards in cases where financing depends on the number of individuals whose competences were validated (OECD, 2014). Thus, the OECD stresses the importance of corresponding quality standards (e.g. ISO standards).

6.2.4. ROI and state funding to employers

71. From the employer's perspective, assuming that (as suggested by SBFI, 2014, see below) they indeed offer an apprentice wage equal to that of the last year of "regular" training throughout the apprenticeship, the extra wage costs for adult apprentices amounts to CHF 10 000 for a three-year apprenticeship. Given that an average firm can offer training profitably (Strupler and Wolter, 2012), this might not necessarily be a major issue, although it might cause the return on investment to be closer to zero, or even slightly negative. However, prior working experience may result in a higher productivity in both skilled and particularly unskilled tasks during the apprenticeship compared to younger apprentices, so that the net effect of hiring adult rather than young apprentices on net costs may even be in favour of a training firm.

72. Tsandev et al. (2017) conducted interviews with 40 Swiss employers about their reasons to train adult apprentices. Many employers stated that they mainly train existing workers without a formal VET qualification, rather than hiring unqualified individuals for an adult apprenticeship externally. Although the interviews are not representative for Switzerland, it illustrates that Type 2 and 4 (Table 1.1) may be important in the context of adult apprenticeship training in Switzerland. Tsandev et al. (2017) also report that firms that train adult apprentices typically do not offer such training systematically, i.e. it is not part of a firm's human resource development strategy, but rather occurs due to random events. While some firms report that they would be willing to train adult apprentices, they report a lack of individuals who are interested in pursuing an apprenticeship (but at the same time, these employers do not actively target adult candidates for apprenticeship positions).

73. In Switzerland, there are no direct state subsidies targeted at firms that train (adult) apprentices. External training courses at the industry-level (often organised by employers' associations), however, are co-financed by the federal and state governments.

6.2.5. ROI and state funding to individuals

74. In Switzerland, all individuals under age 35 can apply for scholarships of a maximum of CHF 12 000 (EUR 10 430[17]) per year. To guarantee a minimum living standard, social assistance maybe be provided in addition to scholarships. Moreover, the state offers additional financing (*Ausbildungszuschüsse*) for up to three years for currently unemployed individuals who are older than 30 years, as long as they find an employer which is willing to offer an apprenticeship position. The additional financing covers the difference so that, including the apprentice pay, individuals can earn CHF 3 500 (EUR 3 040) per month, which is about 72% of the median wage of an employee without a VET qualification in 2012. According to SBFI (2014), only 473 individuals received such contributions in 2012.

75. From an individual's perspective, the income loss during two years of apprenticeship training would amount to about CHF 48 000 (EUR 41 740) before income tax for a three-year apprenticeship programme, when being able to take advantage of the public financial assistance (which in such a case would amount to 36 months times CHF 2 200, equalling CHF 79 200, or EUR 68 870). Thus, when setting discount rates to zero and ignoring taxes, individuals would simply need to earn an additional CHF 48 000

[17] Based on a CHF/EUR exchange rate of 1.15.

(EUR 41 740) due to the obtained vocational qualification before retiring. However, the higher the discount rates, the longer the required the time period will be to break even. Calculations about wage differences due to a VET qualifications in general (SKBF, 2010) predict wage returns of around 6% per year of VET compared to no compulsory schooling.[18] A three-year apprenticeship would yield a wage increase of roughly 18%, or a wage increase of CHF 10 500 (EUR 9 130) per year. Thus, an individual would need to work at least 4.5 years as a skilled employee to generate a positive return to education, and considerably more when taking into account a progressive income tax system and positive discount rates. Conversely, the unemployment risk may become lower due to having obtained a formal vocational qualification. Nonetheless, at least for Switzerland, it becomes quite clear that opportunity costs play an important role when it comes to enrolling in adult apprenticeships. Without public assistance, the investment in an adult apprenticeship would increase to CHF 127 200 (EUR 110 610) from the perspective of an individual, and the role of discount rates and remaining years left in the labour market would likely become much more important. However, at reasonably low discount rates, individuals could still generate a positive return on investment given that they are not already too close to retirement.

76. For Swiss adult apprentices, both extrinsic and intrinsic motivation matters. A recent online-survey of Swiss adult apprentices showed that important reasons to enrol in apprenticeship training as an adult include the expectation of wage increases and/or promotion opportunities, more interesting work, more responsibility, greater personal development, the achievement of long-term professional goals, and/or interest in the learning process (Schmid et al., 2017).[19] Major obstacles reported by those enrolled in adult apprenticeships were the time required to complete an apprenticeship, work-life balance, childcare and family responsibilities, and exam anxiety (due to high opportunity costs of training, i.e. failure is costly). Although 89% of respondents reported positive effects due to adult apprenticeship training (such as feeling more competent at work, or increased self-esteem, higher pay, more responsibility), 10% remained unemployed one year after completing training (Schmid et al., 2017).

77. Schmid et al. (2017) also conducted 11 case study interviews with individuals who were initially interested, but who in the end did not participate in adult apprenticeship training. Major obstacles were manifold, including (at the individual level) opportunity costs in the form of low pay during training, the social environment, low expected training benefits, anxiety associated with performance at work and exams, age, opportunity costs in the form of less leisure time, and the lack of motivation to cope with the high work and learning requirements during the apprenticeship programme (Schmid et al. 2017). Individuals also reported a lack of financial aid, insufficient employer support and a lack of information about and support for adult apprenticeship training (Schmid et al., 2017).

78. According to Giger (2016), the public costs for a VET qualification with shorter training duration, or by directly enrolling in the final exams, are about CHF 25 000

[18] Note that due to selectivity issues, this estimate may overstate the true expected returns to a VET qualification to the extent that ability or motivation positively correlate with the decision to enrol in an apprenticeship.

[19] N=2314, see Schmid et al. (2017) for more details.

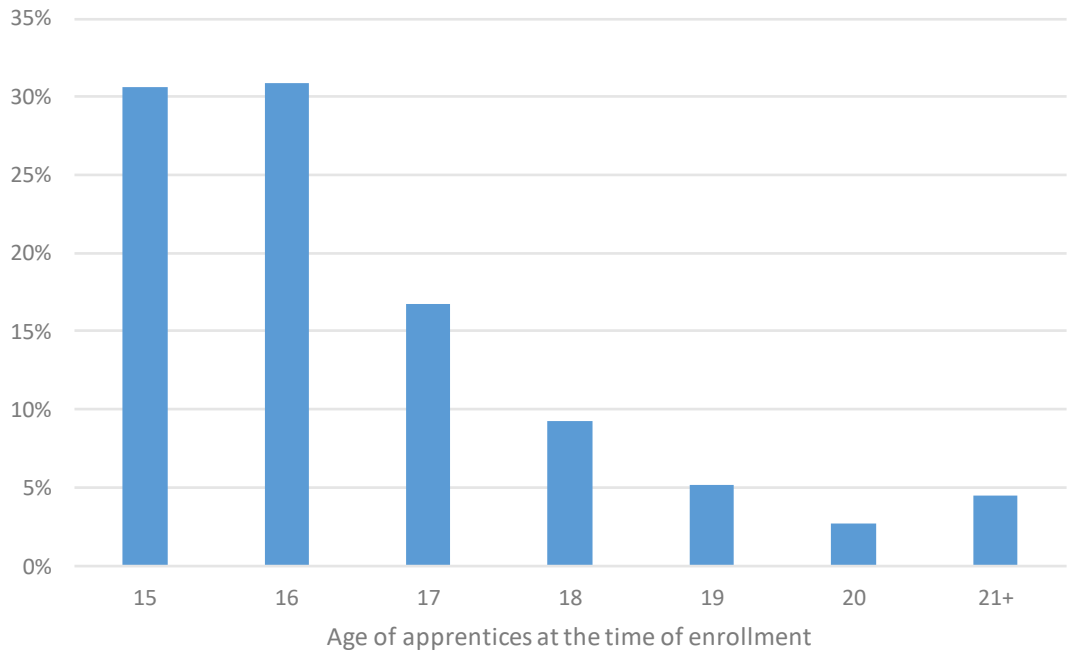
(EUR 21 740) while a regular apprenticeship results in costs of about CHF 50 000 (EUR 43 480), without considering direct financial assistance to adult apprentices.

6.3. Austria

6.3.1. Importance of adult apprenticeships

79. In Austria, the share of individuals age 21 and older who enrol in a first-year apprenticeship programme is less than 5% in 2015 (Figure 6.3). Over 60% of apprentices are 15 or 16 years old.

Figure 6.3. Share of new apprenticeships in Austria, by age of apprentices (2015)



Source: Adapted from Dornmayr, H. and Nowak, S. (2016), "Lehrlingsausbildung im Überblick 2016", *ibw-Forschungsbericht* No. 188, Table 11, https://www.ibw.at/resource/download/299/ibw-forschungsbericht-188.pdf.

6.3.2. Apprenticeship duration

80. The duration of apprenticeship training in Austria is 3 – 3.5 years.

81. In Austria, it is also possible to apply directly for the final apprenticeship examinations. The requirements are to demonstrate relevant work experience, so that there is a high probability that an individual has already acquired skills similar to that of an apprentice in the corresponding training occupation (referring to Type 2 in Table 1.1). Such skills can be acquired through internships, non-formal training in a company, other practical experience or enrolling in schooling that amounts in total to at least half of the duration of a regular apprenticeship (§ 23 Abs. 5 lit.a BAG, see also WKO, 2017). Compared to all apprenticeship completers, the share of individuals successfully acquiring a VET qualification by directly applying to final examinations was 17% in 2015 (Dornmayr and Nowak, 2016). Austria has engaged in the process of publishing a

national skills validation strategy, as outlined in BMBF (2015) and more recently, in Schlögl (2017).

6.3.3. Contract and apprentice pay

82. Apprentice pay in Austria is subject to collective bargaining. The minimum apprentice pay is determined for each occupation and by year of training. There are no detailed statistics available with regard to apprentice pay for adult apprentices.

6.3.4. ROI and state funding to employers

83. In Austria, employers obtain wage subsidies when offering apprenticeships to adults, defined as individuals who are at least 18 years old when signing the apprenticeship contract. In the first year of training, the subsidy amounts to three months of wages for unqualified workers according to the collective wage (or at most 20% above the collective wage, and the actual wage up to that amount in the absence of a collective wage), two months' pay in the second year, and one month's pay in the third year of training.

84. It should be noted that all Austrian firms providing apprenticeships receive subsidies, but in the case of "regular" apprentices who are younger than 18 years when signing the contract, the corresponding subsidies instead refer to apprentice pay (rather than the collective wage for unqualified workers) (Bundeskanzleramt, 2017).

85. The most recent cost-benefit study for Austria (Schlögl and Mayerl, 2016) reports average net training costs from the employer's perspective for all training years (N=581). The study does not allow distinguishing costs and benefits between young and adult apprentices. However, Schlögl and Mayerl (2016) report that only 38% of all training firms in the sample are aware of the state subsidies for adult apprentices. Correspondingly, 38% of all training firms also indicated that such subsidies were important for securing and developing apprenticeships, although another 32% of employers reported that such measure were "somewhat important".

6.3.5. ROI and state funding to individuals

86. No statistics are available with regard to ROI of apprenticeship training specifically for individuals who started an apprenticeship as an adult. Studies investigating the private returns to apprenticeship training in general found an average wage premium of 4-5% per year of apprenticeship training (Fersterer et al., 2008). State funding of apprenticeship training in Austria is largely provided to employers (as discussed above) rather than to individuals.

6.4. Denmark

6.4.1. Importance of adult apprenticeships

87. In Denmark, about 35% of all apprentices are older than 25 years (ILO, 2012). The average age of an apprentice enrolling in the initial VET system is 21, but the average age at time of graduation is 28, even though training itself only lasts between three and four years. According to Cedefop (2012b), transition into VET is often not as straightforward compared to the transition into general upper secondary education. Apprentices may be inactive for some time, leading to prolonged training duration.

88. Non-completion rates in Denmark are also high, as only 48% of those who initially start out as apprentices also successfully graduate (Cedefop, 2012b). However, dropout statistics by the age of an apprentice are not available.

6.4.2. Apprenticeship duration

89. The duration of apprenticeship training in Denmark is typically 3 – 3.5 years.

90. Denmark recently introduced a new VET track for adults aged 25 and older. Based on an individual competence assessment (lasting between half a day and ten days), individuals can enrol in three different tracks, according to work experience and previous education (Table 6.2). Adults with no prior education or relevant work experience can still enrol in VET, but without a reduction of the programme duration.[20]

6.4.3. Contract and apprentice pay

91. Apprentice pay in Denmark is subject to collective bargaining agreement at the sectoral level, and averages between 40 and 60% of skilled worker pay (Brunello, 2009; ILO, 2012).

6.4.4. ROI and state funding to employers

92. In Denmark, employers are reimbursed through a training fund (funded by all employers, as they had to make a contribution of EUR 407 per full-time employee in 2014, cf. CEDEFOP, 2014) for the apprentice wages for the time when apprentices are in a vocational college.

Table 6.2. VET tracks for adults (age 25+) in Denmark

	Track 1	Track 2	Track 3
Basic course	No	Up to 20 weeks	Same as for young people
Main course	Shortened	Shortened	Same as for young people
On-the-job training	No	Up to 2 years	Same as for young people
Requirements	2 years relevant experience	Relevant work experience or previous education and training	Same as for young people

Source: Adapted from Danish Ministry of Higher Education and Science (2017), "Admission to vocational education and training (VET)", http://ufm.dk/en/education-and-institutions/recognition-and-transparency/recognition-guide/admission-vet.

93. No studies on the costs and benefits of apprenticeship training for employers are available to this date. Given that employers are reimbursed for apprentice wages for the time that apprentices spend in a vocational college, the return on investment to employers is likely sufficient to recover a substantial share of training expenses by the time of graduation. However, more information about the productive activities of apprentices in the workplace, particularly the shares of skilled and unskilled work and productivity estimate in skilled tasks, would be required properly assess this question.

[20] Adult vocational training is another option available for adults, although the length of these programmes is rather short, with an average duration of one week (CEDEFOP, 2014).

6.4.5. ROI and state funding to individuals

94. Returns to initial apprenticeship training for individuals are somewhat lower (6%) compared to general education at the upper secondary level, as reported in Hanushek et al. (2017).

95. Dohlmann Weatherall (2009) empirically investigated whether apprentice wage subsidies for adults (older than 25 years) increased the attendance rate. The adult apprenticeship subsidy started in 1997 and increased the income of adult apprentices by about 30% during the entire programme duration. However, the author only found a significant and positive effect of the wage subsidy programme on the attendance rate in the first year after its introduction, but none thereafter.

6.5. Australia

6.5.1. Importance of adult apprenticeships

96. In Australia, adults have been able to enrol as apprentices since 1992 (Karmel, 2006). Hargreaves and Blomberg (2015) provide a recent overview of adult trade apprentices in Australia. As in many other OECD countries, adult apprenticeships are becoming of increasing importance in Australia. In 2013, 40.1 % of all new apprentices were 25 years of age or older, compared to only 14.9% in 2004.

6.5.2. Contract and apprentice pay

97. Apprentice pay is a ratio of skilled worker pay (tradesperson rate), which increases by year of training (from 37.5% - 58% in the first year, to 82-95% in the last year of training in four-year apprenticeships). Adult apprentices' pay is typically identical to that of younger apprentices, although there are cases where adult apprentices receive higher pay (NCVER, 2011). There are regulations in some trades that guarantee existing workers that they will not face a wage decrease when starting an apprenticeship. In Western Australia, adult apprentices receive at the minimum the third-year apprentice wage in four-year apprenticeships in the metal industry, whereas in South Australia adult apprentices receive at least the adult minimum wage (NCVER, 2011). Nonetheless, completion rates of apprenticeship programmes in Australia are low, averaging around 50%.

6.5.3. Apprenticeship duration

98. While regular apprenticeships in Australia last three or four years, more than half of adult apprentices complete their programme within two years.

6.5.4. ROI and state funding to employer

99. Estimates about the costs and benefits of apprenticeship training by Dockery et al. (1997) indicate that firms on average make a net investment of AUD 22 000, although the data are dated and refer only to 59 firms in traditional trades. Employers that train adult apprentices (age 25 or older, certificate III/IV) in an occupation listed on the National Skills Needs List receive a subsidy of AUD 4 000 (Australian Government, 2017). However, based on the currently available empirical data for Australia, no assessment with regard to the returns to adult apprenticeship training for firms is possible.

6.5.5. ROI and state funding to individuals

100. Table 6.3 shows the annual income after completing apprenticeship training in Australia for adult apprentices, by prior skills and experience. However, these figures do not allow for a calculation of a wage return to apprenticeship training, because these income figures would need to be contrasted with the income (and future income) of individuals who did not enrol in an apprenticeship programme. Nonetheless, the figures in Table 6.3 illustrate that previous experience is valuable in the Australian labour market, as older apprentices earn significantly more after completion of training compared to younger individuals, even when comparing salaries of graduated apprentices without any prior skills or experience before enrolling in an apprenticeship programme.

Table 6.3. Annual income after apprenticeship training in Australia, by age and recognition of prior experience and skills (2011-2013), in AUD

	24 years and under	25 years and over
Apprentices with RPL	45 800	60 000
Apprentices with prior experience but without RPL	46 000	59 200
Apprentices with no prior experience and skills related to the training	45 100	55 600

Note: RPL refers to "RPL is based on whether the training provider shortened training based on relevant skills and experience" (Hargreaves and Blomberg 2015).
Source: Adapted from Hargreaves, J. and D. Blomberg (2015), *Adult Trade Apprentices: Exploring the Significance of Recognition of Prior Learning and Skill Sets for Earlier Completion*, https://files.eric.ed.gov/fulltext/ED560578.pdf.

6.6. Canada

6.6.1. Importance of adult apprenticeships

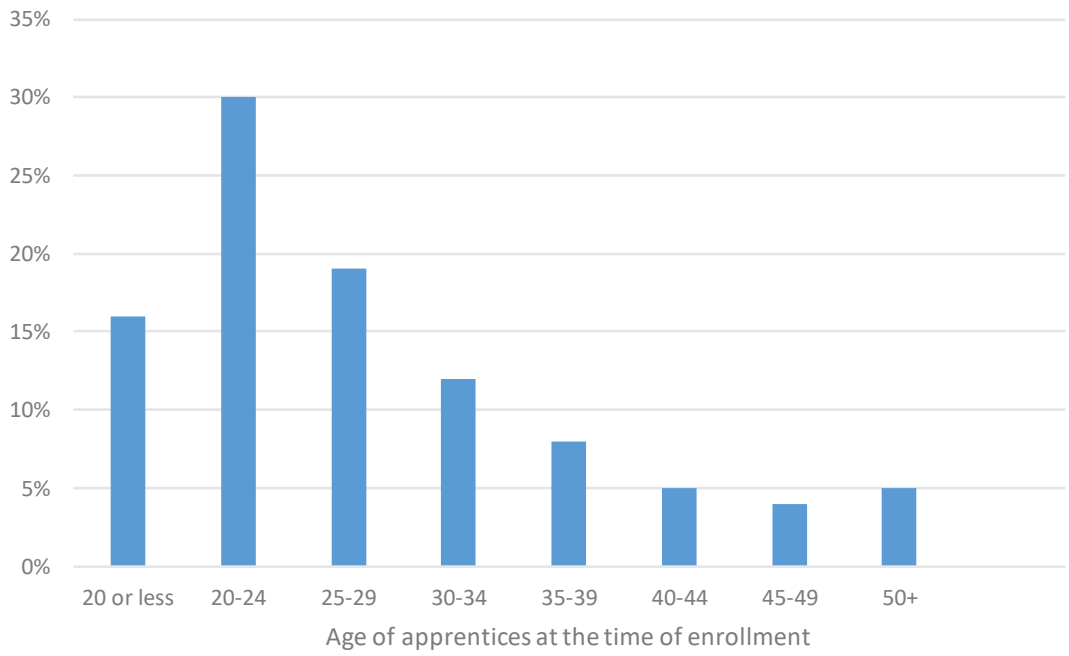
101. In Canada, apprentices (who are about 90% male) enrolling in one of the over 300 apprenticeship trades accounted for 18.6% of total post-secondary enrolment in 2013 (Gunderson and Krashinksy, 2016). At the time of first enrolment, most apprentices are older than 20 years (Figure 6.4). Apprenticeship enrolment increased significantly in recent years, from about 50 000 per year in 2000 to almost 100 000 per year in 2013 (CAF, 2016). The most important trades are automotive service technician, carpenter, construction electrician, cook, hairstylist, heavy-duty equipment technician, information technology support associate, plumber, steamfitter/pipefitter and welder (CAF, 2016).

6.6.2. Contract and apprentice pay

102. Apprentice wages in Canada vary by trades, and are subject to regulations, e.g. specified in terms of ratios to journeyperson wages, but on average start around 50% of a journeyperson's wage (Meredith, 2011). Apprentice wages are typically higher than the provincial minimum wage.

103. Gunderson and Krashinsky (2016) argue that low apprentice pay might be particularly problematic for older employees with changing family commitments. Unfortunately, direct empirical evidence linking apprentice pay to drop out rates is not yet available.

Figure 6.4. Apprentice age at the time of enrolment (2013)



Source: Adapted from CAF (2016), *Apprenticeship in Canada, 2016 Report*, Canadian Apprenticeship Forum, Forum canadien sur l'apprentissage (CAF-FCA), Ottawa.

6.6.3. Apprenticeship duration

104. However, low apprenticeship wages might be particularly important in the Canadian context, as the actual average completion time is about five years (and thus considerably longer compared to Austria, Germany or Switzerland, where adult apprentices can expect to complete most apprenticeship programmes in three years or less).

105. Apprenticeship dropout rates in Canada are high, with less than half of all apprentices complete the programme within 11 years (Gunderson and Krashinsky, 2015; Gunderson and Krashinsky, 2016; Prasil, 2005). However, in Canada it is also possible for workers who already have the necessary skills to write a trade-qualifying exam without having to enrol in an apprenticeship (Types 2 and 3 in Table 1.1).[21]

106. The high dropout rate also raises questions as to how the system could be improved. Coe (2013) finds that completion rates are 10%-points higher in apprenticeships with mandatory certification but does not find a correlation with training duration. Provinces decide whether a certified apprenticeship is required to work in an occupation, regulate the training duration, and how many apprentices a firm can hire

[21] In 2007, more than 40% of certificates were acquired by individuals who had not previously enrolled in an apprenticeship programme, many of them in construction and electrical trades (Desjardins, 2010). However, the requirements regarding previous relevant work experience are high, so that individuals who acquire their certificate without an apprenticeship are on average 10 years older compared to apprenticeship completers, and almost half of them were over 40 years old when receiving their certificate in 2007.

(Brydon and Dachis, 2013). Brydon and Dachis argue that skilled worker shortages are most pronounced in Canadian provinces where apprenticeship regulations are strict, as they lead to a low number of graduated apprentices (although those who managed to obtain a vocational qualification in a corresponding trade enjoy a high income). A main concern of the authors is the high number of journeypersons required to supervise apprentices, and how the requirement changes with the number of trained apprentices. While one journeyperson is required to supervise the first apprentice for boilermakers in Saskatchewan (a ratio of 1:1), the firm must have five journeypersons for every subsequent apprentice (a ratio of 5:1). Conversely, the ratio for welders in the same province is 1:3, i.e., one journeyperson can supervise three apprentices (Brydon and Dachis, 2013:8). Such regulations can strongly limit the number of apprenticeships provided in certain trades, particularly within small firms.

6.6.4. ROI and state funding to employers

107. From the employer's perspective, CAF (2006) report an average benefit-cost ratio of 1.38 without tax credits for the duration of an apprenticeship programme, and 1.44 including tax credits based on a sample size of 433 firms across 15 different trades. However, the results differ quite strongly by the trade, as the benefit-cost ratio ranges from 1.03 (Mobile crane operator) to 1.67 (Tool and Die Maker), when excluding tax credits.

108. According to CAF (2006), the main reasons given by Canadian employers to offer apprenticeships were their need to ensure that the company has skilled labour (importance of 8.9/10), wanting to support the trade (8.5/10), the need to replace the ageing workforce (7.5/10), to reduce turnover (7.5/10), and because apprenticeship pays for itself (7.1/10). Moreover, in relation to hiring from the external labour market, Canadian employers also indicate that apprentices offer a better fit with the organisation (8.5/10), enable risks of skills shortages to be avoided (8.2/10), provide greater overall productivity (8.0/10), potential for career advancement (7.8/10), better relations with customers (7.8/10), fewer mistakes (7.8/10) and better health and safety performance (7.7/10). Based on a qualitative assessment, almost 90% of training firms reported that the benefit from training already exceeds the costs before the last (fourth) year of training, indicating that providing apprenticeships in Canada yields sufficient benefits to cover the firm's investment in the short run. However, this does not necessarily mean that other firms that currently do not train apprentices could expect the same cost-benefit structure.[22]

109. Although the provision of apprenticeship training is profitable according to the survey of CAF (2006), employers can claim an apprenticeship job creation tax credit equal to 10% of apprentice wages, up to a maximum of CAD 2 000 per year for each eligible apprentice (defined as working in a trade in the first two years of their apprenticeship contract, see Government of Canada, 2017). A number of provincial programmes provide additional wage subsidies for employers. Examples include an apprentice wage subsidy of 75% (up to CAD 14 per hour) in Newfoundland and Labrador (Government of Newfoundland and Labrador, 2018) , an Apprenticeship Training Tax Credit for training firms for up to CAD 4 000 per year during the first three years of training (20% of apprentice wages) in British Columbia (Government of British

[22] Wolter et al. (2006) show that even though Swiss training firms make a net benefit from training apprentices on average, expected net benefits for non-training firms are negative.

Columbia, 2018a), and a Graduated Apprenticeship Grant for Employers of up to CAD 19,200 in Ontario (Government Ontario, 2018).

110. Thus, there are many financial incentives in place for Canadian firms to offer apprenticeships. However, we know very little regarding their effectiveness and efficiency, as no rigorous evaluations of such subsidies have been carried out. As Meredith (2011:339) argues: "If there is little evidence that the present subsidies induce weak employers to train, it is also doubtful that strong employers need them", such knowledge would be important to justify the large sums of tax-payer money that is used for the various subsidies that are currently in place.

6.6.5. ROI and state funding to individuals

111. There are several financial incentive programmes in place. The Canadian Government offers apprenticeship grants for up to CAD 4 000 to individuals (regardless of age), thereby addressing the issue of low apprentice pay. First, individuals who are registered as an apprentice in a Red Seal Trade[23] can apply for apprenticeship grants (a taxable cash incentive of CAD 1 000) after successfully completing the first and/or the second year or level in a corresponding trade (Government of Canada, 2018). Second, individuals who successfully acquired the journeyperson certification in a designated Red Seal Trade can further apply for a one-time taxable cash grant of CAD 2 000. In 2018, the Canadian Government additionally introduced an Apprenticeship Incentive Grant for Women of CAD 3 000 per year and level, up to a maximum of CAD 6 000 per person. Individuals can also claim further subsidies at the provincial level, e.g. Training Tax Credits for Apprentices in British Columbia, including in non-Red Seal trades, both during an apprenticeship and upon successful completion of an apprenticeship (Government of British Columbia, 2018b). Enhanced tax credits are available for First Nations Individuals and persons with disabilities (Table 6.4).

Table 6.4. Training tax credits for apprentices in British Columbia, in CAD

		Non-Red Seal	Non-Red Seal	Red Seal	Red Seal
	Tax credit level	Regular	Enhanced	Regular	Enhanced
Basic	1	1 000	1 500	Federal	500
Basic	2	1 000	1 500	Federal	500
Completion	3	2 000	3 000	2 000	3 000
Completion	4	2 500	3 750	2 500	3 750

Source: Adapted from: Government of British Columbia (2018b), Training Tax Credit for Apprentices Website, https://www2.gov.bc.ca/gov/content/taxes/income-taxes/corporate/credits/training/apprentice.

[23] A Red Seal Trade is part of the Red Seal Program, which refers to the Canadian standard of excellence for skilled trades (previously Interprovincial Standards Red Seal Program), with the aim to harmonize regional processes and requirements for certification and standards, develop and maintain interprovincial standards for Red Seal Trades, facilitate collaboration with industry to build a skilled trades labour force, and to increase mobility of skilled tradespersons: http://www.red-seal.ca/about/pr.4gr.1m-eng.html. Currently there are 56 designated Red Seal Trades in Canada, covering only about 25% of apprenticeship trades, but 90% of all apprentices (Gunderson and Krashinsky, 2016).

112. Individual wage returns to certified apprenticeships in terms of higher post-training wages compared to not enrolling in a post-secondary education are almost 20% for males, compared to not having a post-compulsory degree (and roughly 10% compared to a high school degree or other non-certified trades), while low for females who primarily work in lower-wage industries (Gunderson and Krashinsky 2015).[24] Certification is only required in some trades, and requirements vary across provinces. Brydon and Dachis (2013) report that a large share of regulated trades require certification, while the province of British Columbia does no longer require certification in any trade, even for occupations such as electricians or plumbers.

6.7. United Kingdom

6.7.1. Importance of adult apprenticeships

113. In 2016/17, 46% of all new apprenticeship contracts (about 229 000 in total) were signed with individuals who were at least 25 years old (Figure 6.5), thus the share of older adult apprentices in relation to all apprenticeship contracts is considerable higher in the United Kingdom compared to other countries that also have an initial VET system. Only 20% of apprentices age 25+ were recruited into apprenticeships, i.e. 80% were existing employees prior to starting an apprenticeship.

114. The highest share of adult apprentices is observed in the health sector (where 58% of apprentices are aged 25 or older), education (56%), business (44%), and retail (40%).[25] On average, 65% of apprentices remain with the training firm after training.[26]

6.7.2. Apprenticeship duration

115. The minimum apprenticeship duration is 12 months. The duration of level 2 apprenticeships is typically between 12-18 months, but some more advanced programmes may take up to 24 months at advanced level 3 apprenticeships. Adult apprentices age 25+ are largely satisfied with the duration of training (79%), and the figure does not differ from those with age 19-24 (although younger apprentices aged under 19 report an even higher satisfaction with a share of 84%, cf. DFE, 2017b). The recognition of prior learning is also possible, so that the training duration can be shortened accordingly, as long as the regular training duration is at least 12 months.

6.7.3. Contract and apprentice pay

116. Regulations on apprentice pay differ by age. In the United Kingdom, the minimum apprentice wage in the first year, at the time of writing, is GBP 3.50 per hour.

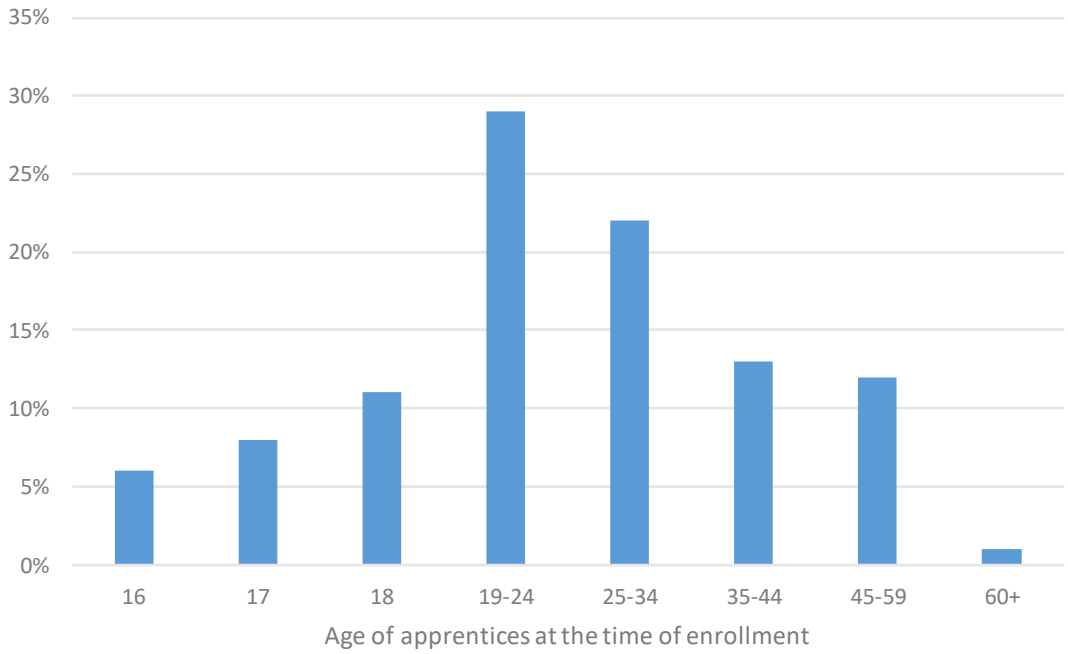
[24] The wage returns reported in Gunderson and Krashinsky (2015) are based on an instrumental variables regression approach take takes ability bias into account (using the lagged share of certified journeypersons in a region as an instrument). Boothby and Drewes (2010) report similar estimates based on the same data source.

[25] Based on level 2 and level 3 apprenticeships (DFE, 2017b, Figure 2.3). Fuller et al. (2015) provide an extensive report on the situation of adult apprenticeships in the United Kingdom, including a number of case studies that incorporate the perspective of both the employers and the apprentices.

[26] Statistics on retention rates by the age of apprentices are not available (DFE, 2017a).

Thereafter, apprentices who are older than 19 years must be paid at least the national minimum wage (Table 6.5).

Figure 6.5. Apprenticeship starts by age group, England, United Kingdom (2016/17)



Source: Adapted from House of Commons Library (2019), "Apprenticeship statistics: England", *Briefing Paper,* No. 06113, http://researchbriefings.files.parliament.uk/documents/SN06113/SN06113.pdf.

Table 6.5. National minimum wage by age and apprentice status, 2017, United Kingdom

Year	25 and over	21 to 24	18 to 20	under 18	Apprentice
April 2017	GBP 7.50	GBP 7.05	GBP 5.60	GBP 4.05	GBP 3.50

Source: Adapted from: UK Government (2017), "National minimum wage and national living wage rates", https://www.gov.uk/national-minimum-wage-rates.

117. In intermediate and advanced level apprenticeships, apprentices must receive about 5.5 hours of weekly training ("Guided Learning Hours") over a period of 12 months, of which about two hours should be provided off-the-job (DFE, 2017b). The results of the most recent apprenticeship evaluation show that training hours of apprentices age 25+ were 8.7 hours per week on average, compared to 19.9 hours per week for apprentices aged under 19. These figures, however, also include a substantial amount of informal learning "training during usual activities" (which accounts for about 50% of total training on average), thus adult apprentices appear to receive considerably less formal training in the workplace or at external providers compared to young apprentices (although the exact shares are not reported by age group). Relating this finding to apprentice pay regulations, it becomes apparent that the reduction in training

hours correlates with the increasing level of apprentice pay for older apprentices (Table 6.5).[27]

6.7.4. ROI and state funding to employers

118. Gambin et al. (2012) estimate the costs and benefits from the firm's perspective in the United Kingdom, based on a non-random sample of 41 firms across five sectors. They find that while on average, the costs of providing the training outweigh the benefits in the short-run, firms on average recoup their training costs within one to three years. However, as in other cost-benefit studies, no distinction can be made between young and adult apprentices.

119. New data sources will allow increased analysis of the effects of publicly funded apprenticeship training (Conlon et al., 2017). Thus, according to the authors, it will be possible to assess the effects of the apprenticeship training levy, which was introduced in April 2017. The levy allows firms to spend up to GBP 15 000 on formal apprenticeship training courses offered by accredited external training providers. A possible reaction of firms to the levy might be that the money from the levy is used for the existing adult workforce (Types 2 and 4 in Table 1.1), rather than taking on young apprentices. The UK government anticipates such a behaviour, and thus offers the training providers and the employer an additional payment of GBP 1 000, to account for the fact that training younger apprentices age 16-18 may be more time consuming. In addition, the training provider receives another 20% uplift based on the funding band maximum of a particular framework (DfE, 2017:5).

120. The most recent statistics, at the time of writing, on apprenticeship enrolment show a very strong increase in apprenticeship enrolment in the quarter immediately before the start of the training levy (an increase of 55 000 apprenticeships compared to the same quarter in the previous year). However, enrolment fell sharply in the subsequent quarter compared to the previous year (by 70 000 apprenticeships) (c.f. House of Commons Library, 2018). Thus, the training levy does not seem to have generated additional training opportunities, at least in the short-run. Overall, apprenticeship enrolments in England, United Kingdom, fell in 2016/17 to the lowest level since 2010/11.

6.7.5. ROI and state funding to individuals

121. Recent estimates of wage premia related to having a VET qualification in the United Kingdom support this argument, as analysis of Level 1 and Level 2 qualifications over the period 1997-2015 have not yielded any statistically significant wage returns (McIntosh and Morris, 2016)[28]. Level 3 apprenticeships (or higher) are associated with higher and statistically significant wage gains, and there is heterogeneity within sectors,

[27] Empirical estimates for Switzerland also show a negative association between training hours and apprentice pay, i.e., apprentice pay is lower in firms that offer higher levels of training hours, and vice versa (Muehlemann et al., 2013).

[28] Most English apprenticeships are at NVQ level 2, which is defined as: "Competence, which involves the application of knowledge and skills in a significant range of varied work activities, performed in a variety of contexts. Some of the activities are complex or non-routine, and there is some individual responsibility or autonomy. Collaboration with others, perhaps through membership of a work group or team, may often be a requirement."(BIS, 2016, p.5).

as they report the highest wage-premiums in engineering and construction occupations. With regard to apprenticeship training for adults, however, McIntosh and Morris 2016 do not differentiate by the age at which an apprentice started (or completed) a vocational qualification.[29] The most recent apprenticeship evaluation reports that 86% of apprentices age 25+ who were workers at the training firm prior to beginning apprenticeship training did not receive a pay increase from having completed the training, suggesting that wage returns to apprenticeships are limited, at least in the short-run (DFE, 2017b). Subjectively measured impacts reveal a similar pattern, as only 44% of apprentices age 25+ (compared to 73% of those age <19) reported that they benefitted from their apprenticeship in all of five of the impacts that were measured in the most recent apprenticeship evaluation ("better at doing job", "career prospects have improved", "more satisfied with job", "given/taken on more responsibility", "more secure in job").

6.8. United States

6.8.1. Importance of adult apprenticeships

122. Apprenticeships currently only play a minor role in the United States, yet a number of recent political initiatives aim to increase their number. In 2016, there were more than 505 000 individuals enrolled in registered apprenticeship programmes (206 000 new enrolments), compared to a total of 375 000 apprentices in 2005 (DOL, 2017).

123. Although the number of new apprentices increased steadily from 133 000 in 2008 to 206 000 apprentices in 2016, the number of apprenticeship completers remained relatively constant during the same period and fluctuated around 50 000 apprentices per year, suggesting that non-completion rates are substantial.

124. According to Lerman (2012), the average age of an apprentice is 30 years, with about 20% of apprentices being younger than age 25.

6.8.2. Apprenticeship duration

125. The duration of apprenticeships varies from 1-6 years (DOL, 2018).

6.8.3. Contract and apprentice pay

126. On average, the apprentice starting wage is USD 15 per hour (DOL, 2018). Depending on the state and training occupation, apprentices may earn a minimum wage, a proportion thereof, or a share of skilled worker pay.

6.8.4. ROI and state funding to employers

127. Although political interest in apprenticeship training in the United States increased substantially in recent years, little empirical evidence about costs and benefits of apprenticeship training is available, except for case study evidence. Lerman et al. (2009) report that majority of training providers have subjective beliefs that training is profitable. While the finding is in line with expectations, it cannot be generalised to all firms, because employers that do not believe in the effectiveness and efficiency of their

[29] It should also be noted that selectivity issues are not accounted for in these estimates, although the authors state that they will explore such issues in the future, using different data sources.

apprenticeship programmes are unlikely to continue their training efforts (and thus would not take part in such a survey in the first place). More recently, Helper et al. (2016) also provided a favourable evaluation of 13 businesses in the United States, reporting positive returns on investment for the firms in their sample.

128. Employers can benefit from grants and state-based tax-credits (Helper et al., 2016) to set up registered apprenticeship programmes.

6.8.5. ROI and state funding to individuals

129. Reed et al. (2012) analyse the earnings differences of participants in registered apprenticeship programmes across ten states. They find that life-time earnings differentials associated with participating in apprenticeship training amount to about USD 300 000. However, such differences may not necessarily reflect causal effects, as positive selection effects (i.e. more able and more motivated individuals participate in training) may account for part of the observed wage differential. Such selection effects are likely very important, given that many apprentices never complete the training programme. Estimations about retention rates in registered apprenticeships are high for those who successfully graduate, as 91% of apprentices still work with the training firm 9 months after completion of training (DOL, 2018).

130. More recently, Hollenbeck and Huang (2017) have used a matching approach to create a control group of non-participants as similar as possible to apprenticeship participants (i.e. the control group consisted of individuals who would have qualified for a corresponding programme but decided not to participate). The authors report that the training benefits of various workplace-training programmes in Washington, including registered apprenticeships, outweigh the corresponding costs for individuals and the public, at least in the long-run (9-12 quarters after exit of the training programme). For registered apprenticeships, they estimate a net quarterly earnings premium of USD 3 447 in 2014. As initial costs to participate in a registered apprenticeship programme are estimated at USD 51 039 it becomes clear that the benefits of an apprenticeship programme eventually outweigh the costs (after three to four years, on average). Moreover, Hollenbeck and Huang (2017) also estimate costs and benefits for the public, and find that for registered apprenticeships, the benefits clearly outweigh the costs already in the short run.

131. Summing up, the current empirical evidence on apprenticeship training in the United States is rather limited. However, as The Workforce Innovation and Opportunity Act of 2014 (WIOA) mandates assessments and evaluations similar to the study of Hollenbeck and Huang (2017) for all states, future research will likely provide more solid evidence to assess the effects of apprenticeships in the United States (Hollenbeck and Huang, 2017, p. 4).

7. Conclusions

132. Apprenticeship training for older adults is becoming an increasingly relevant topic, including in countries with an initial VET system, because an ageing workforce and technological change can lead to a lack of available workers possessing the vocational skills demanded by the labour market. Thus, to the extent that finding suitable employees becomes more difficult and consequently more costly, firms may have incentives to invest in skills of not only younger, but also older employees.

133. Conversely, older individuals have incentives to obtain a VET qualification in order to increase wages, retain their employability, and to increase their chances of carrying out meaningful and interesting work.

134. From the government's perspective, benefits arise to the extent that a VET qualification for adult employees results in a lower unemployment probability, and consequently lower spending of government resources on social insurance, and possibly higher economic growth (to the extent that a highly skilled workforce is positively associated with a firm's demand for skilled labour).

135. However, as the available empirical evidence indicates, there is a paucity of credible evidence with regard to the effectiveness and efficiency of apprenticeship training for adults. A major issue in establishing causal effects of apprenticeships for older adults is self-selection into this type of training. In most countries, the share of adult apprenticeship contracts is low, and older individuals who enrol in such apprenticeships may differ in a number of characteristics (such as motivation, previously acquired skills, expected benefits, family situation) from those individuals who decided not to get involved. Moreover, employers that offer training opportunities for adult apprentices may also differ in many dimensions from firms who do not offer such training.

136. The focus of this paper has been on highlighting the various incentives that arise with regard to providing and participating in apprenticeship training for adults. Given the heterogeneity of apprenticeship programmes across countries, both in quantity and quality, it is difficult to draw general conclusions. Nonetheless, the share of adult apprentices has increased in many countries in recent years, indicating that providing apprenticeships for adults is an increasingly important pathway to obtaining a VET qualification.

137. It is helpful to categorise potential adult apprentices by prior levels of transferable (general or occupation-specific) and non-transferable skills, where the latter are only relevant with the current employer. For individuals with extensive labour market experience in a relevant occupation, an apprenticeship qualification may not require a three-year programme, but instead existing skills may count towards a VET qualification. Under some conditions, individuals may only have to attend a preparatory course before they can take the final exam, or competencies may be directly validated by a national accreditation system. Such a short cut may drastically reduce opportunity costs for individuals in terms of lost wages during an apprenticeship, although validation procedures may themselves be costly.

138. Individual wage-returns linked to obtaining a VET qualification as an adult also depend on whether having completed an apprenticeship is required to work in a certain occupation, e.g. as a nurse, or grant access to certain skilled trades. In occupations without such a requirement, semi-skilled workers with extensive relevant work experience may therefore not expect a large wage-return to obtaining a VET qualification (because they are likely remunerated according to their initial skill level), and consequently refrain from obtaining a VET qualification in the first place.

139. Non-completion rates in adult apprenticeship training are often high and are an important issue in a number of countries, although clear empirical evidence about the causes of dropout rates is still rare.

140. From an employer's perspective, investing in apprenticeship training for adults is not necessarily less beneficial compared to younger apprentices, at least to the extent that adult apprentices are equally motivated to learn new skills. While young individuals clearly have more time left in the labour market, this is not necessarily true with regard to expected tenure at the individual training firm. Young employees are typically more mobile than adult apprentices who may already have family obligations, and thus face higher mobility costs. Moreover, even though training wages for adult apprentices may be higher compared to young apprentices, previous experience may be complementary to the acquisition of new skills.

141. Finally, empirical evidence with regard to the effectiveness and efficiency of government efforts to promote adult apprenticeship training is very limited. However, evaluations of other types of work-based learning programmes are not very promising, as particularly active labour market programmes targeted at adults are often not very effective. Thus, government efforts to promote apprenticeship training for adults should allow for an empirical evaluation for at least two reasons: First, empirical evidence about what type of programs are effective would be helpful for other countries that may consider implementing similar programmes. Second, public wage subsidies for adult apprentices to cover the wage loss during training are potentially very large, and in addition dropout rates tend to be high. Thus, it is important to not only consider the effectiveness of government efforts, but also their efficiency in terms of their cost-benefit ratio.

142. While the current paucity of studies with regard to adult apprenticeship training may be disappointing, it is anticipated that better (longitudinal) data to analyse credible effects of apprenticeship training programmes for adults will become available in a number of countries. In Germany, for example, the National Education Panel Study currently allows to investigate labour market outcomes for young apprentices, but as more data points become available, it will also become possible to investigate the outcomes of individuals who only participated in apprenticeship training at an older age. In Switzerland, register data recently became available to observe individuals and their educational choices over their entire career, and it will also become be possible to analyse how educational choices of older individuals are associated with individual labour market outcomes. In the United Kingdom, improved matched data using information from the Individualised Learner Record (ILR), Employer Data Service (EDS) and Inter Departemental Business Register (IDBR) will allow to use individual and employer information to analyse outcomes of apprenticeship training (Conlon et al., 2017). Thus, at least for some countries, research should soon be able to provide more solid empirical evidence on the outcomes related to apprenticeships for adults.

References

Acemoglu, D. and J.S. Pischke (1999), "Beyond Becker: Training in imperfect labour markets", *Economic Journal*, Vol. 109, pp. 112–142, http://onlinelibrary.wiley.com/doi/10.1111/1468-0297.00405/abstract.

Acemoglu, D. and J.S. Pischke (1998), "Why do firms train? Theory and evidence", *Quarterly Journal of Economics*, Vol. 113/1, pp.79–119, http://www.jstor.org/stable/2586986.

Aguinis, H., and K. Kraiger (2009), "Benefits of training and development for individuals and teams, organizations, and society", *Annual Review of Psychology*, Vol. 60, pp. 451-474.

Australian Government (2017), Australian Apprenticeships Incentives Programme website, https://www.australianapprenticeships.gov.au/publications/summary-australian-government-australian-apprenticeships-incentives-programme (accessed 5 April 2017).

BA (2016), "BMAS und BA unterstützen „Zukunftsstarter": Initiative „Erstausbildung junger Erwachsener "wird verlängert und das Engagement ausgebaut", press release, https://www.gib.nrw.de/service/gib-newsletter/newsletter_archiv/g.i.b.-newsletter-nr.-330/wege-in-arbeit/initiative-erstausbildung-junger-erwachsener-wird-verlaengert-und-das-engagement-ausgebaut (accessed 16 January).

Bauernschuster, S., O. Falck and S. Heblich (2009), "Training and innovation", *Journal of Human Capital*, Vol. 3/4, pp. 323-353.

Becker, G. (1962), "Investment in human capital: A theoretical analysis", *Journal of Political Economy*, Vol. 70/5, pp. 9-49, http://dx.doi.org/10.1086/258724.

BIBB (2016), "Datenreport zum Berufsbildungsbericht", BIBB, Bonn.

Bilanakos, C. et al. (2018), "Does demand for product quality increase worker training? ", *Journal of Economic Behavior & Organization*, Vol. 155, pp. 159-177.

BIS (2016), "Vocational Qualifications", Department for Business Innovation & Skills, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/510013/VocationalQualificationsNote2016.pdf (accessed 30 December 2018).

Blatter, M. et al. (2016),"Hiring costs of skilled workers and the supply of firm-provided training", *Oxford Economic Papers*, Vol. 68/1, pp. 238-257, http://ftp.iza.org/dp6344.pdf.

BMBF (2015), Konsultationsdokument Validierung nicht-formalen und informellen Lernens Entwicklung einer nationalen Strategie zur Umsetzung der Ratsempfehlung vom 20.12.2012 (2012/C 398/01), https://ec.europa.eu/epale/sites/epale/files/konsultationspapier_beilage_.pdf.

Bolli, T. and U. Renold (2017), "Comparative advantages of school and workplace environment in skill acquisition: Empirical evidence from a survey among professional tertiary education and training students in Switzerland", *Evidence-based HRM: A Global Forum for Empirical Scholarship*, Vol. 5/1, pp. 6-29, http://dx.doi.org/10.1108/EBHRM-05-2015-0020.

Boothby, D., T. Drewes (2010), "Returns to apprenticeship in Canada. Canadian labour market and skills", *Researcher Network Working Paper,* No. 70, http://www.clsrn.econ.ubc.ca/workingpapers/CLSRN%20Working%20Paper%20no.%2070%20-%20Boothby%20and%20Drewes.pdf.

Bresnahan, T. F., E. Brynjolfsson and L. M. Hitt (2002), "Information technology, workplace organization, and the demand for skilled labor: Firm-level evidence", *The Quarterly Journal of Economics*, Vol. 117/1, pp. 339-376.

Brydon, R. and B. Dachis (2013), "Access denied: The effect of apprenticeship restrictions in skilled trades", *C.D. Howe Institute, Commentary,* No. 380, https://www.cdhowe.org/sites/default/files/attachments/research_papers/mixed/Commentary_380_0.pdf.

Bundesamt für Statistik (BFS) (2016), Table "Lernende: Basistabellen 2014/15", https://www.bfs.admin.ch/bfsstatic/dam/assets/333526/master.

Bundeskanzleramt (2017), "Basisförderung und Förderung der Lehre für Erwachsene", https://www.help.gv.at/Portal.Node/hlpd/public/content/207/Seite.2070102.html.

Busemeyer, M.R. and C. Trampusch (Eds.) (2012), *The Political Economy of Collective Skill Formation*, Oxford University Press, Oxford.

CAF (2016), *Apprenticeship in Canada, 2016 Report*, Canadian Apprenticeship Forum, Forum canadien sur l'apprentissage (CAF-FCA), Ottawa.

CAF (2006), *Apprenticeship – Building a Skilled Workforce for a Strong Bottom Line. Return on Apprenticeship Training Investment for Employers – A Study of 15 Trades*, Canadian Apprenticeship Forum, Forum canadien sur l'apprentissage (CAF-FCA), Ottawa, http://www.wi-cwi.org/council/2014/morgan_apprenticeship_canada_roi_2006_011514.pdf.

Canduela, J. et al. (2012), "Ageing, skills and participation in work-related training in Britain: Assessing the position of older workers", *Work, Employment and Society*, Vol. 26/1, pp. 42–60.

Card, D., Kluve, J., and Weber, A. (2010), "Active labour market policy evaluations: A meta-analysis", *The Economic Journal*, Vol. 120/548, F452-F477.

Cedefop (2014), *Denmark. VET in Europe – Country Report*, https://cumulus.cedefop.europa.eu/files/vetelib/2014/2014_CR_DK.pdf.

Cedefop (2012a), "Payback clauses in Europe: Supporting company investment in training", Final report, *Research Paper,* No. 23, Publications Office of the European Union, Luxembourg.

Cedefop (2012b), "Vocational education and training in Denmark. Short description". Luxembourg: Publications Office of the European Union, www.cedefop.europa.eu/files/4112_en.pdf.

Coe, P.J. (2013), "Apprenticeship programme requirements and apprenticeship completion rates in Canada", *Journal of Vocational Education & Training*, Vol. 65/4, pp. 575-605.

Conlon, G. et al. (2017), "The incidence of publicly funded training in England", *CVER Briefing Note*, No. 003, Centre for Vocational Education Research, http://cver.lse.ac.uk/textonly/cver/pubs/cverbrf003.pdf.

Danish Ministry of Higher Education and Science (2017), "Admission to vocational education and training (VET)", http://ufm.dk/en/education-and-institutions/recognition-and-transparency/recognition-guide/admission-vet (accessed 30 December 2018).

Deming, D. J. (2017), "The growing importance of social skills in the labor market", *The Quarterly Journal of Economics*, Vol. 132/4, pp. 1593–1640, https://doi.org/10.1093/qje/qjx022.

Desjardins, L. (2010), "Trade qualifiers in the skilled trades in Canada: An overview", *Education Matters: Insights on Education, Learning and Training in Canada,* Vol. 7/5.

DfE (2017), *Apprenticeship Funding. Apprenticeship funding in England from May 2017*, Department for Education, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/730064/Apprenticeship_funding_from_May_2017.pdf.

Dockery, A. M. (1997), "The cost of training apprentices in Australian firms.", *Australian Bulletin of Labour*, Vol. 23/4, p. 255.

Dohlmann Weatherall, C. (2009), "Do subsidized adult apprenticeships increase the vocational attendance rate?", *Applied Economics Quarterly*, Vol. 55/1, pp. 61-81.

DFE (2017a), "Apprenticeships evaluation 2017: Learners", Research report, November 2017, IFF Research, Department for Education.

DOL (2018), *Apprenticeship Toolkit, United States Department of Labor*, https://www.dol.gov/apprenticeship/toolkit/toolkitfaq.htm (accessed 30 December 2018).

DOL (2017), *Data and Statistics, United States Department of Labor*, https://www.doleta.gov/OA/data_statistics.cfm (accessed 30 December 2018).

Dornmayr, H. and Nowak, S. (2016), "Lehrlingsausbildung im Überblick 2016", *ibw-Forschungsbericht,* No. 188, https://www.ibw.at/resource/download/299/ibw-forschungsbericht-188.pdf.

Dostie, B. (2015), "Do train-or-pay schemes really increase training levels?", *Industrial Relations: A Journal of Economy and Society*, Vol. 54/2, pp. 240-255.

Dostie, B. (2014), "Innovation, productivity, and training", IZA Discussion Paper, No. 8506, IZA, Bonn.

Dustmann, C. and U. Schönberg (2012), "What makes firm-based vocational training schemes successful? The role of commitment", *American Economic Journal: Applied Economics*, Vol. 4/2, pp. 36-61, www.aeaweb.org/articles?id=10.1257/app.4.2.36.

Dustmann, C. and U. Schönberg (2009), "Training and union wages", *Review of Economics and Statistics*, Vol. 91/2, pp. 363–376, http://www.mitpressjournals.org/doi/abs/10.1162/rest.91.2.363#.V9abs_l96Uk.

Edin, P-A. et al. (2017), "The rising return to non-cognitive skill", *IZA Discussion Paper*, No. 10914, http://ftp.iza.org/dp10914.pdf.

Eurostat (2015), *Vocational Education and Training Statistics*, http://ec.europa.eu/eurostat/statistics-explained/index.php/Vocational_education_and_training_statistics#Cost_of_continuing_vocational_training_courses (accessed 23 December 2018).

Ekert, S., R. Knöller and K. Raven (2017), "Anerkennung ausländischer Berufsabschlüsse – Verbesserung der Arbeitsmarktchancen auch in nicht reglementierten Berufen? ", Berufsbildung in Wissenschaft und Praxis (BWP), Vol. 46, pp. 20-24, Federal Institute for Vocational Education and Training, Bonn.

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

Field, S., et al. (2012), *A Skills beyond School Review of Denmark*, OECD Reviews of Vocational Education and Training, OECD Publishing, Paris, https://doi.org/10.1787/9789264173668-en.

Fouarge, D., T. Schils, A. de Grip (2013), "Why do low-educated workers invest less in further training?", *Applied Economics*, Vol. 45/ 18, pp. 2587-2601. http://www.tandfonline.com/doi/abs/10.1080/00036846.2012.671926.

Fuller, A., et al. (2015), *Does Apprenticeship Work for Adults? The Experiences of Adult Apprentices in England, Project Report*, Institute of Education, University College London, http://www.nuffieldfoundation.org/sites/default/files/files/Adult%20Apprenticeship.pdf.

Gambin, L., C. Hasluck and T. Hogarth (2010), "Recouping the costs of apprenticeship training: Employer case study evidence from England", *Empirical Research in Vocational Education and Training,* Vol. 2/2, pp. 127-146.

Giger, S. (2016), "Auch für Erwachsene lohnt sich ein Berufsabschluss", Die Volkswirtwirtschaft Vol. 10/2016, pp. 22-24.

Goos, M., A. Manning and A. Salomons (2014), "Explaining job polarization: Routine-biased technological change and offshoring", *American Economic Review*, Vol. 104/8, pp. 2509-2526.

Government of British Columbia (2018a), Training Tax Credit for Employers Website, https://www2.gov.bc.ca/gov/content/taxes/income-taxes/corporate/credits/training/employer (accessed 30 December 2018).

Government of British Columbia (2018b), Training Tax Credit for Apprentices Website, https://www2.gov.bc.ca/gov/content/taxes/income-taxes/corporate/credits/training/apprentice (accessed 30 December 2018).

Government of Canada (2018), Apprenticeship Grants Website, https://www.canada.ca/en/employment-social-development/services/apprentices/grants.html (accessed 30 December 2018).

Government of Canada (2017), Apprenticeship Job Creation Tax Credit Website, http://www.cra-arc.gc.ca/tx/ndvdls/tpcs/ncm-tx/rtrn/cmpltng/ddctns/lns409-485/412/jctc-eng.html (accessed 5 April 2017).

Government of Manitoba (2017), Provincial Minimum Wages, https://www.gov.mb.ca/tce/apprent/forms/pdf/provincial_wage_table.pdf (accessed 5 April 2017).

Government of Newfoundland and Labrador (2018), https://www.aesl.gov.nl.ca/lmda/apprenticeship.html (accessed 5 April 2017).

Government of Ontario (2018), Graduated Apprenticeship Grant Website, https://www.ontario.ca/page/graduated-apprenticeship-grant-employers (accessed 30 December 2018).

Grugulis, I., C. Holmes and K. Mayhew (2017), "The economic and social benefits of skills", in: Warhurst C, K. Mayhew, D. Finegold, and J. Buchanan (eds.), *The Oxford Handbook of Skills and Training*, Oxford University Press, Oxford.

Gunderson, M. and H. Krashinsky (2015), "Returns to apprenticeship based on the 2006 Canadian census", *ILR Review,* Vol 68/ 5, pp. 1078 – 1101. http://journals.sagepub.com/doi/10.1177/0019793915591990.

Gunderson, M. and H. Krashinsky (2016), "Apprenticeship in Canada: An increasingly viable pathway?", *Challenge*, Vol. 59/5, pp. 405-421, http://dx.doi.org/10.1080/05775132.2016.1226095.

Hanushek, E. et al. (2017), "General education, vocational education, and labor-market outcomes over the lifecycle", *Journal of Human Resources*, Vol. 52/1, pp. 48-87.

Hargreaves, J. and D. Blomberg (2015), *Adult Trade Apprentices: Exploring the Significance of Recognition of Prior Learning and Skill Sets for Earlier Completion*, NCVER, Adelaide, https://files.eric.ed.gov/fulltext/ED560578.pdf.

Heckman, J. (1993), "Assessing Clinton's program on job training, workfare, and education in the workplace", *NBER Working Paper,* No. 4428, National Bureau of Economic Research, Cambridge.

Helper, S., et al. (2016), "The benefits and costs of apprenticeships: a business perspective", Office of the Chief Economics, Economics and Statistics Administration. https://www.esa.gov/sites/default/files/the-benefits-and-costs-of-apprenticeships-a-business-perspective.pdf.

Hollenbeck, K. and W.-J. Huang (2017), "Net impact and benefit-cost estimates of the workforce development system in Washington State", *Employment Research*, Vol. 24/1, pp.1-4, https://doi.org/10.17848/1075-8445.24(1)-1.

Holmes, C. (2017), "The Individual benefits of investing in skills", in Warhurst C, K. Mayhew, D. Finegold, and J. Buchanan (eds.), *The Oxford Handbook of Skills and Training*, Oxford University Press, Oxford.

House of Commons Library (2019), "Apprenticeship statistics: England", *Briefing Paper,* No. 06113, http://researchbriefings.files.parliament.uk/documents/SN06113/SN06113.pdf.

ILO (2012), *Overview of Apprenticeship Systems and Issues - ILO Contribution to the G20 Task Force on Employment*, http://www.ilo.org/wcmsp5/groups/public/---ed_emp/---ifp_skills/documents/genericdocument/wcms_190188.pdf.

Konings, J. and S. Vanormelingen (2015), "The impact of training on productivity and wages: Firm-level evidence", *The Review of Economics and Statistics*, Vol. 97/2, pp. 485-497.

Jansen, A., et al. (2015), "Apprenticeship training in Germany remains investment-focused – results of BIBB Cost-Benefit Survey 2012/13", BIBB Report 1/2015, https://www.bibb.de/en/25852.php (accessed 15 February 2015).

Karmel, T. (2006), *Older Workers in Apprenticeships and Traineeships*, NCVER, Adelaide, https://www.ncver.edu.au/__data/assets/file/0017/6713/olderworkers.pdf

Kis, V. and H. Windisch (2018), "Making skills transparent: Recognising vocational skills acquired through work-based learning", *OECD Education Working Papers*, No. 180, OECD Publishing, Paris, https://doi.org/10.1787/5830c400-en.

Kleiner, M. M., and A. B. Krueger (2013), "Analyzing the extent and influence of occupational licensing on the labor market.", *Journal of Labor Economics*, Vol. 31/S1; pp. S173–202. https://doi.org/10.1086/669060.

Kuczera, M. (2017), "Striking the right balance: Costs and benefits of apprenticeship", *OECD Education Working Papers*, No. 153, OECD Publishing, Paris, https://doi.org/10.1787/995fff01-en.

Lazazzara, A., K. Karpinska and K. Henkens (2013), "What factors influence training opportunities for older workers? Three factorial surveys exploring the attitudes of HR professionals", *The International Journal of Human Resource Management,* Vol. 24/11, pp. 2154-2172.

Lehrstellenbarometer (2016), "Lehrstellenbarometer August 2016 Detaillierter Ergebnisbericht. Umfrage bei Jugendlichen und Unternehmen im Auftrag des Staatssekretariats für Bildung, Forschung und Innovation SBFI", https://www.sbfi.admin.ch/dam/sbfi/de/dokumente/2016/11/lb-august-16-ergebnisbericht.pdf.download.pdf/lb_august_2016_ergebnisbericht_d.pdf.

Lerman, R. I. (2012), "Can the United States expand apprenticeship? Lessons from experience", *IZA Policy Paper*, No. 46, IZA, Bonn, http://ftp.iza.org/pp46.pdf.

Lerman, R., L. Eyster and K. Chambers (2009), *The Benefits and Challenges of Registered Apprenticeship: The Sponsors' Perspective*, US Department of Labor, Employment and Training Administration, Washington, DC, http://www.urban.org/UploadedPDF/411907_registered_apprenticeship.pdf.

Loretto, W., C. Phillipson and S. Vickerstaff (2017), "Skills and training for the older population. Training the New Work Generation", in Warhurst C, K. Mayhew, D. Finegold, and J. Buchanan (eds.), *The Oxford Handbook of Skills and Training*, Oxford University Press, Oxford.

Major, D. A., J.E. Turner and T.D. Fletcher (2006), "Linking proactive personality and the Big Five to motivation to learn and development activity", *Journal of Applied Psychology*, Vol. 91/4, pp. 927.

Mayhew, K. and B. Rijkers (2004), "How to improve the human capital of older workers or the sad tale of the magic bullet", Paper prepared for the joint EC-OECD Seminar on Human Capital and Labour Market Performance, http://www.oecd.org/dataoecd/3/39/34932028.pdf.

Martin, C. J. (2017), "Skill builders and the evolution of national vocational training systems", in Warhurst C, K. Mayhew, D. Finegold, and J. Buchanan (eds.), *The Oxford Handbook of Skills and Training*, Oxford University Press, Oxford.

Maurer, M. and E. Wettstein (2014), "Berufsbildung für Erwachsene in der Schweiz – die Bedeutung informell erworbener Kompetenzen", *BWP*, Vol. 5/2014, pp. 24-27.

McIntosh, S. and D. Morris (2016), "Labour market returns to vocational qualifications in the labour force survey", *CVER Discussion Paper*, No. 002, Centre for Vocational Education Research, London School of Economics, http://cver.lse.ac.uk/textonly/cver/pubs/cverdp002.pdf.

Meredith, J. (2011), "Apprenticeship in Canada: Where's the crisis?", *Journal of Vocational Education and Training,* Vol. 63/3, pp. 323-344.

Mühlemann, S. (2016), "The cost and benefits of work-based learning", *OECD Education Working Papers*, No. 143, OECD Publishing, Paris, https://doi.org/10.1787/5jlpl4s6g0zv-en.

Muehlemann, S. and H. Pfeifer (2016), "The structure of hiring costs in Germany", *Industrial Relations,* Vol. 55/2, pp. 193-218, http://onlinelibrary.wiley.com/doi/10.1111/irel.12139/full.

Muehlemann, S. et al. (2010),"The financing of apprenticeship training in the light of labor market regulations", *Labour Economics*, Vol. 17/5, pp. 799-809, www.sciencedirect.com/science/article/pii/S0927537110000382.

Muehlemann, S., P. Ryan and S.C. Wolter (2013), "Monopsony power, pay structure and training", *Industrial and Labor Relations Review*, Vol. 66/5, pp. 1095-1112, http://ilr.sagepub.com/content/66/5/1097.short.

Muehlemann, S. and M. Strupler Leiser (2018), "Hiring costs and labour market tightness", *Labour Economics,* Vol. 52, pp. 122-131.

Noe, R. A. and S.L. Wilk (1993), "Investigation of the factors that influence employees' participation in development activities", *Journal of Applied Psychology*, Vol. 78/2, pp. 291.

Karmel, T. (2006), "Older workers in apprenticeships and traineeships", NCVER, Adelaide, https://www.ncver.edu.au/__data/assets/file/0017/6713/olderworkers.pdf.

NCVER (2011), *NCVER: Report 3. The Apprenticeship and Traineeship System's Relationships with the Regulatory Environment*, NCVER, Adelaide, http://hdl.voced.edu.au/10707/360.

OECD (2014), *Skills beyond School: Synthesis Report*, OECD Reviews of Vocational Education and Training, OECD Publishing, Paris, https://doi.org/10.1787/9789264214682-en.

OECD (2005), *Promoting Adult Learning*, Education and Training Policy, OECD Publishing, Paris, https://doi.org/10.1787/9789264010932-en.

Oosterbeek, H. and E. Leuven (2004), "Evaluating the effect of tax deductions on training", *Journal of Labor Economics*, Vol. 22/2, pp. 461-488.

Pfeifer, H. (2016), "Firms' motivation for training apprentices: An Australian–German comparison", *NCVER Occasional Paper*, NCVER, Adelaide, https://www.ncver.edu.au/__data/assets/pdf_file/0018/60138/Firms-motivation-for-training-apprentices.pdf.

Pfeiffer, F. and H. Stichnoth (2015), "Fiskalische und individuelle Bildungsrenditen–aktuelle Befunde für Deutschland", Perspektiven der Wirtschaftspolitik,, Vol. 16/4, pp. 393-411.

Prasil, S. (2005), "Registered apprentices: The class of 1992, a decade later", Ottawa, Statistics Canada, No. 81–595 MIE, No. 035.

Reed, D., A. et al. (2012), *An Effectiveness Assessment and Cost-Benefit Analysis of Registered Apprenticeship in 10 States*, Office of Apprenticeship, US Department of Labor, Washington, DC, http://wdr.doleta.gov/research/FullText_Documents/ETAOP_2012_10.pdf.

Rupietta, C., and U. Backes-Gellner (2019), "Combining knowledge stock and knowledge flow to generate superior incremental innovation performance—Evidence from Swiss manufacturing", *Journal of Business Research*, Vol. 94, pp. 209-222.

Sachverständigenkommission Kosten und Finanzierung der beruflichen Bildung (1974), "Kosten und Finanzierung der ausserschulischen beruflichen Bildung", Bielefeld, Bertelsmann, Abschlussbericht.

SBFI (2014), "Berufsabschluss und Berufswechsel für Erwachsene. Bestehende Angebote und Empfehlungen für die Weiterentwicklung", SBFI, Bern.

Schlögl, P. and M. Mayerl (2016), "Betriebsbefragung zu Kosten und Nutzen der Lehrausbildung in Österreich. Teilbericht im Rahmen der ibw-öibf-Studie „Hintergrundanalyse zur Wirksamkeit der betrieblichen Lehrstellenförderung (gemäß §19c BAG)", ÖIBF, Vienna.

Schlögl, P. (2017), "Schaffung eines strategischen Rahmens zur Validierung nicht formaler und informeller Lernergebnisse - Eine Zwischenbilanz aus Österreich", *Berufsbildung in Wissenschaft und Praxis (BWP),* Vol. 46, pp. 28-31, Federal Institute for Vocational Education and Training, www.bibb.de/bwp-6-2017.

Schmid, M., S. Schmidlin and D.S. Hischier (2017), "Berufsabschluss für Erwachsene: Sicht von betroffenen Erwachsenen", final report, SERI, Bern, https://www.sbfi.admin.ch/dam/sbfi/de/dokumente/2017/09/schlussbericht-bae-absolventinnenbefragung.pdf.download.pdf/Schlussbericht_BAE_Absolventinnenbefragung_across_PH-FHNW_dt.pdf.

Seyda, S. and D. Werner (2014), "IW-Weiterbildungserhebung 2014 – Höheres Engagement und mehr Investitionen in betriebliche Weiterbildung", https://www.iwkoeln.de/fileadmin/publikationen/2014/201454/IW-Studie_Betriebliche_Weiterbildung.pdf.

Spitz-Oener, A. (2006), "Technical change, job tasks, and rising educational demands: Looking outside the wage structure", *Journal of Labor Economics*, Vol. 24/2, pp. 235-270.

Stevens, M. (1994), "An investment model for the supply of training by employers", *Economic Journal*, Vol. 104, pp. 556–570, http://www.jstor.org/stable/2234631?seq=1#page_scan_tab_contents.

Streeck, W. (2009), "Re-forming capitalism: Institutional change in the German political economy", Oxford University Press, Oxford.

Strupler, M. and S.C. Wolter (2012), "Die duale Lehre eine Erfolgsgeschichte - auch für Betriebe. Ergebnisse der dritten Kosten-Nutzen-Erhebung der Lehrlingsausbildung aus der Sicht der Betriebe", Glarus/Chur:,Rüegger Verlag.

Stuart, M. and T. Huzzard (2017), "Unions, the skills agenda, and workforce development", in Warhurst C, K. Mayhew, D. Finegold, and J. Buchanan (eds.), *The Oxford Handbook of Skills and Training*, Oxford University Press, Oxford.

Sung, J. and D. N. Ashton (2015), "Skills in business. The role of business strategy, sectoral skills development and skills policy", SAGE, London.

Tsandev, E. et al. (2017), "Berufsabschluss für Erwachsene: Sicht von Arbeitgebenden", SERI, Bern, https://www.sbfi.admin.ch/dam/sbfi/de/dokumente/2017/09/schlussbericht-bae-sicht-arbeitgebende.pdf.download.pdf/Schlussbericht_dt_EHB_final.pdf.

Tharenou, P. (2001), "The relationship of training motivation to participation in training and development", *Journal of Occupational and Organizational Psychology*, Vol. 74, pp. 599 – 621.

Tomini, F., W. Groot and H. Maassen van den Brink (2016), "The effectiveness of the voucher training programs: A systematic review of the evidence from evaluations", *Tier Working Paper Series*, No. 16/08, http://www.tierweb.nl/tier/assets/files/UM/Working%20papers/TIER%20WP%2016-08.pdf.

Troltsch, K. (2013), "Berufliche Nachqualifizierung von zwei Millionen jungen Erwachsenen ohne Berufsabschluss - Welche Bereitschaft gibt es in Betrieben?", BIBB, Bonn, https://www.bibb.de/de/15992.php.

UK Government (2017), "National minimum wage and national living wage rates", https://www.gov.uk/national-minimum-wage-rates (accessed 30 December 2018).

WKO (2017), "Ausnahmsweise Zulassung zur Lehrabschlussprüfung (LAP)", www.wko.at/service/noe/bildung-lehre/2017_INFOBLATT---Intranet.pdf (accessed 23 December 2018).

Wolter, S.C. and P. Ryan (2011), *Apprenticeship. Handbook of Economics of Education, Vol. 3*, Elsevier North-Holland, Amsterdam.

Wolter, S. C., S. Muehlemann and J. Schweri (2006), "Why some firms train apprentices and many others do not.", *German Economic Review*, Vol. 7/3, pp. 249-26.