A Roadmap to Vocational Education and Training in Industrialized Countries[1]

Published: Industrial and Labor Relations Review, 2015, Vol. 68 (2), 314-337

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Prepublication: August 2014

Abstract

With young people among the biggest losers of the recent financial crisis, vocational education and training (VET) is often seen as the silver bullet to the youth joblessness problem. This paper provides a better understanding of VET in industrialized countries, proposing a typology with three types of vocational systems: (i) vocational and technical schools, (ii) formal apprenticeships and (iii) dual apprenticeship systems combining school training with a firm-based approach. We first describe the strengths and challenges of each system. We subsequently review the evidence of the effectiveness of VET versus general education and between the different VET systems. There are clear indications that VET is a valued alternative beyond the core of general education, while various forms of apprenticeships combined with institutional learning tend to be more effective than school-based VET.

Keywords: vocational education and training, apprenticeships, dual VET, vocational schooling, developed countries

JEL classification: J24, I25, O17

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[1] We thank Costanza Biavaschi, Corrado Giulietti, Michael Kendzia, Alexander Muravyev, Victoria Finn and Janneke Pieters for their input and support. A related study (Zimmermann, Biavaschi, Eichhorst, Giulietti, Kendzia, Muravyev, Pieters, Rodríguez-Planas, and Schmidl 2013) connects vocational training with youth unemployment around the world, including developing countries. The novel feature of our paper is the systematic and updated review of the major vocational training systems from a policy perspective.

Unemployment rates among youths have soared since the Great Recession of 2008, doubling the adult unemployment rate in many developed countries. While many young people have responded to the sluggish labor market prospects by continuing tertiary education and investing in their human capital, others have altogether withdrawn from education, training and employment. According to OECD data (OECD 2013), youth unemployment rates now go beyond 35 percent in countries such as Portugal and Italy and even beyond 50 percent in Spain and Greece while they are still below 10 percent in countries like Germany, Switzerland and Austria. The share of youths (aged 15 to 24) in neither employment nor education (NEET) in 2012 ranged from four to seven percent in the Netherlands, Denmark and Switzerland to up to 18 percent or more in Greece and Italy.[2] Regarding the situation of young labor market entrants, the 2008 crisis and its aftermath clearly highlighted the interaction of a cyclical development with long-standing institutional features governing the transition from school to work. The situation deteriorated particularly in those countries where young people already had difficulties in entering the labor market before the crisis, whereas other countries could keep youth unemployment low.

Against this background, this paper takes a closer look at the role of various types of vocational education.[3] Vocational education and training (VET) is frequently perceived as *the* solution to improve the opportunities of youths who lack the resources, skills or motivation to continue with higher education. For example, in countries such as the United States, the recent economic crisis has reignited an earlier discussion of building up a larger and more effective apprenticeship system (Harrhof and Kane, 1997, Lerman 2012).[4] In particular, it is often argued that VET provides useful skills to prepare youths for a smooth entry into the labor force (Quintini and Martin 2006) by aligning initial education more closely to particular vocations and tasks demanded in the labor market.

After classifying VET in industrialized countries into distinct systems, this paper reviews the evidence on their effectiveness in facilitating transitions into employment and raising earnings, and highlights the relevant institutional features, supporting the effectiveness.[5] With this, we aim

[2] NEET rates are taken from the OECD employment database and are based on national labor force surveys.
[3] In this article, we use the term "vocational education and training" (VET) to refer to qualifying education paths that provide individuals with occupation-specific knowledge and practical skills, independent of the place, content and educational provider. Our focus is on *initial* VET, in contrast to vocation-specific education and training as part of life-long learning (see Arulampalam, Booth, and Bryan 2004; Bassanini, Booth, Brunello, De Paola, and Leuven 2007 for workplace training in Europe).
[4] Of course, VET is complementary to the various policies boosting labor demand (typically industrial policies) in its goal to improve youths' transition into employment.
[5] In medium-income countries and in the developing world, an alternative classification is appropriate; see Zimmermann et al. 2013 and Eichhorst, Rodriguez-Planas, Schmidl, and Zimmermann 2013.

to provide evidence that can be crucial in designing programs to counteract the labor market problems exacerbated by the Great Recession.

A Typology of VET Provision

This section provides a typology of VET provision, reflecting the various country VET models found in practice. This topology focuses on two dimensions. First, differences in provision may be viewed along a continuum, reflecting the relative importance of institutional learning and workplace training. At one extreme, vocational schools can provide VET that is not complemented by work-based training; at the other, older union-dominated apprenticeships did not include formal theoretical institutional learning. A second dimension is whether institutional-based learning is provided within formal secondary school frameworks (part of the education system) or at vocational training centers (which often have close ties to industry). Below we review the three systems introduced earlier.

Vocational and Technical Secondary Schools

At one extreme, many countries maintain a large vocational schooling system as part of their upper secondary education. In these countries, the initial schooling system is characterized by the duality between general and vocational education. While the former aims to provide youth with general, often academically oriented knowledge as the basis for further (higher) education and training, VET provides youth with practice-oriented knowledge and skills required in specific occupations. Most frequently, VET follows a formal curriculum that combines general and occupation-specific knowledge. Compulsory schooling integrates VET as an alternative to an academically oriented schooling track, or as part of several post-compulsory education options. Similar to academic education, the skills that vocational schools provide are mostly general in the sense that they are transferable between employers (Becker 1964). However, there might be differences in the degree of transferability across occupations. While some countries have a VET system that transmits skills that are not restricted to one particular occupation, others provide vocational schooling for specific types of occupations (Shavit and Müller 1998).

Why do governments offer school-based vocational training?

The supply of VET by governments through the educational system can be justified as a means to improve the opportunities of youths who lack the skills demanded in the labor

market, the ability or motivation to continue with higher education, or the funding to pursue higher education. Furthermore, individuals might prefer this option to academic education as it implies a shorter human capital investment and facilitates earlier entry into the labor market. Many countries providing a vocational schooling option during compulsory schooling perceive this as an alternative for poor academic performance or at-risk youths (Neuman and Ziderman 1999), as well as a safety net for early school dropouts and those who are less academically inclined. The close link to work tasks and hands-on practical experience should motivate practical-oriented youths to continue training and remain in school longer. Furthermore, it has frequently been argued that establishing a vocational education track during school is a means to reduce the influence of parental background on educational choices, thereby increasing intergenerational mobility. Given that the educational decisions of youths are often linked to the educational attainment level of their parents, participation in a vocational track might allow those from working-class backgrounds to pursue educational attainment beyond the compulsory level, hence increasing their chances of attaining skilled rather than unskilled employment (Shavit and Müller 1998).

In most cases, participation in either vocational or academic courses during school is operationalized by tracking students in the two different education pathways. The benefits of such a tracking system are not clear, as leaving school with vocational qualifications often translates into reduced options of further post-compulsory education, particularly the academic type. The incentive effect of learning more practice-oriented skills might therefore be mitigated by high costs of later switching to academic education. Although the technical possibility of transferring to academic education might exist, earlier tracking will lead to strongly divergent levels of skills and competences (Woessmann 2008). Furthermore, through separating higher and lower performing students, VET might counteract the equalizing potential of vocational education (Shavit and Müller 2000). Given that very few youth manage to enter academic education after vocational schooling (Kogan 2008), populations in many countries often have a low regard of the vocational schooling option since they perceive it as a dead-end track and second-choice education.

Southern European Countries

Most of the vocational training in Spain takes place in school instead of within a firm: Only four percent of those in vocational upper-secondary education in Spain combine school- and work-based training (CEDEFOP 2010). Similarly, three in four young people in vocational training in France participate in school-based vocational training as opposed to the

apprenticeship alternative. Also in Italy, firm-level vocational training is not very widespread since it is only used in crafts, retail and large manufacturing companies, and is based on fixed-term employment contracts.

Youths in these countries face particular difficulties when trying to enter the labor market, especially since the recent economic crisis has aggravated these long-standing problems. In addition to having above-average NEET rates, labor market entry is difficult for both low- and high-skilled young people. One major factor is the deep labor market segmentation between permanent and fixed-term contracts, which can be attributed to strict dismissal protection and largely liberalized temporary employment. Another issue is wage compression in low-skilled occupations by collective bargaining. For instance, collective bargaining in Spain, which is centralized at the province and industry level, sets "entry minimum wage" above the legal minimum wage, inflating the lower part of the wage distribution and resulting in relatively high earnings for young workers and those least qualified. Together, employment protection and wage compression make it difficult in Spain for youth to get established in the labor market and transition to a permanent position. Such effects on youth employment have been found in previous international work such as Bertola, Blau and Kahn 2007 and Kahn 2007.

In some of these countries, the relatively marginal role of vocational training can be explained by a limited interest of employers in more formal vocational training (given the dual-employment structure), but also by strong expectations of upward social mobility on behalf of young people and their families, which creates strong preference in favor of academic training (Planas 2005). Moreover, there is a long tradition in these countries to subsidize temporary employment and training contracts as part of Active Labor Market Policies (ALMP). However, the effectiveness of these measures is questionable as explained by Felgueroso (2010) in Spain, Roger and Zamora (2011) in France and Tattara and Valentini (2009) in Italy.

Evidence from cross-country comparisons in Europe, which have attempted to implement vocational schooling systems, points to several systematic elements of success, as described below (Gambin 2009; Woessmann 2008):

1. **Ensure curricula relevance:** All stakeholders (government, employers, social partners, educational institutions) need to be involved in its development, with a clear assignment of responsibilities. The weight of the respective voices might differ across countries.

2. **Maintain close labor market contact:** A system of continuous feedback from employers and private-sector institutions is required to allow for continuous adaptation of the training content to labor market needs. This requires a high degree of employer involvement.

3. **Ensure high-quality training:** Sufficient funding is required to guarantee the appropriate teaching material and the availability of well-trained teachers. A decentralized system of quality assurance and local competition amongst training centers, in combination with output-based funding and licensing, needs to be established.

4. **Establish qualification frameworks:** Centralized accreditation of training contents creates transparency and promotes acceptance amongst employers.

5. **Limit the risk of establishing a dead-end vocational schooling track:** The competences and qualifications acquired should be comparable and creditable to academic qualifications to promote transferability between the two, and avoid stigmatization of vocational schooling participants.

Formal Apprenticeship

In some countries, VET is provided through formal apprenticeships, with institutional instruction complementing workplace training. This is mostly the case in the UK, the US and Australia.

The United Kingdom

In the 1980s traditional apprenticeships lost their appeal in the UK because of “the recession, the removal of supports and the introduction of cheaper, less-valued alternative training schemes such as the Youth Training Scheme (YTS) and its successors” (McIntosh 2007: 4). However, with the relative shortage of intermediate (Level 2 and Level 3) vocational skills in the mid-1990s, apprenticeships were reintroduced as Modern Apprenticeships at Level 3 and National Traineeships at Level 2. Nonetheless, despite considerable public interest in their expansion, the overall participation rates remained rather low during the early 2000s. Possible explanations for this include: (i) the lack of a central and rigorous assessment of the apprentices’ qualification obtained, (ii) the high costs of apprentices to employers, relative to other countries such as Austria, Germany or France, among others (Steedman 2010), and (iii) a shift towards offering apprenticeships to older youths who had previously worked at the company (Wolf 2011).

The 2009 reform, the Apprenticeship, Skills, Children and Learning Act, aimed to address some of these issues, in particular tightening the link between the apprenticeships and employers and offering larger incentives for employers to increase training activities. Subsequently, the number of youth below the age of 25 who participated in apprenticeships increased from 387,000 in 2007–2008 to about 460,000 in 2011–2012. In 2010, the UK implemented the Specification of Apprenticeship Standards for England (SASE), harmonizing the qualifications of the different apprenticeships and increasing transparency in training activities. In addition, the UK offered employers a grant of 2,500 pounds per apprentice aged 16 to 17 years old . In 2012, they extended the grant to incentivize training of those up to 24 years old. Moreover, they started the National Apprenticeship week, a yearly public event aiming to draw media attention to the benefits of offering and learning in apprenticeships, as well as to increase the acceptance of apprenticeships. Further government reforms are currently underway that aim to improve training quality and transferability and ensure continuous adaption of the qualifications and skills to align with economic demand (Department for Education, Department for Business and Skills 2013).

The United States of America

In the US formalized apprenticeships have a limited role and are largely confined to adult education in so-called "Registered Apprenticeships'' in the construction industry (e.g. such as electricians, carpenters, plumbers, among others). Through the combination of time spent in theoretic instruction and work-based training, the apprenticeship system aims at imparting both general and occupation-specific knowledge; however, the place of training is concentrated in the firm, as the apprenticeship system operates without any close links to formal education.[6]

The Office of Apprenticeship (OA) in the US Department of Labor (DoL) is in charge of the registration and evaluation of VET. Thereby, the "Advisory Committee on Apprenticeship" (ACA) supports the OA. Across 26 states, State Apprenticeship Agencies (SAAs) are responsible for the apprenticeship programs, including the provision of technical assistance. Currently, there are around 21,000 apprenticeship programs registered in the US. Participation numbers from the DoL count approximately 290,000 active apprentices in 2012.

[6] An alternative to apprenticeships in the US are specific programs targeting at-risk youth and training students for careers in specific sectors, combining high-school classes, training and work experience (see Holzer 2012 for a thorough review).

Since 2008, the number of active apprentices has been steadily decreasing, largely due to a steep decline in the number of new apprentices. However, this figure only accounts for apprenticeships not offered by the military (currently around 70,000) and those registered with the labor office. Lerman (2012) suggests that the actual number of total apprentices is higher, given that not all apprenticeships have to be registered. Contrary to the European model, US apprentices are in their mid- to late-20s and have most likely already gained some work experience.

Australia

Although the majority of VET participation is school-based (80 percent in 2011), there also exists a comprehensive Australian Apprenticeship system. This system differentiates between two types of contracts: apprenticeship contracts and traineeship contracts. Apprenticeships refer to technical occupations and the traditional trades, whereas traineeships apply to all other occupations (Karmel, Blomberg, and Vnuk 2010). These traineeships are comparable to further qualifying training in other countries due to their short duration (typically less than one year). The contracts are structured in both work-based learning with an employer and school-based education with certified training providers. Contrary to apprenticeships, which have a long tradition in Australia, traineeships were introduced in 1985 to counteract youth unemployment of those aged 15 through 19 with low levels of schooling. The participation in apprenticeships and traineeships has significantly increased across *all* age groups over the past years due to supportive policies, such as financial hiring incentives, part-time training, minimum training wages and lifting age restrictions (*Ibid.*). Particularly due to specialized subsidies encouraging the training of workers aged 25 and over and mature workers (45 and above), nowadays the share of adults amongst participants increased to one-third (two-thirds) of all new entries into apprenticeships (traineeships).

Dual System

In Austria, Denmark, Germany, and Switzerland, the dual VET accommodates between 40 percent (Austria) to 80 percent (Switzerland) of all school leavers. The dual apprenticeship systems in these four countries share the following four key institutional elements:

1. **A high degree of formalization:** They only provide training in centrally accredited occupational qualifications and the training content is continuously adapted to meet the changing labor market requirements.
2. **Strong involvement of social partners:** Representative advisory boards assist in developing and maintaining curricula at the governmental and federal level. Regional trade or occupational committees, or a combination of the two, undertake implementation and monitoring.
3. **Vocational colleges provide the school-based part of dual apprenticeships:** Colleges cover both general and occupation-specific education. The government bears the costs of training in the schools.
4. **Firms must meet certain technical standards:** Otherwise, the training firm will not obtain accreditation. Offering apprenticeships is optional for companies, but those who choose to offer them follow standard application procedures in order to match the firm with trainees. The training companies cover the training costs within the firm.

Why would firms invest in general training?

While dual training exhibits several advantages from a societal and individual perspective, establishing an efficient dual apprenticeship system crucially depends on the willingness of firms to participate. To ensure post-apprenticeship skill transferability across firms, the training should provide a sufficient amount of general schooling. However, as Becker (1964) noted, in a perfectly competitive labor market, in which workers are paid according to their marginal productivity, firms have no incentives to invest in general schooling. This is because workers could leave directly after the training period in order to reap all the benefits of their acquired general skills.[7] Hence, in order for firms to provide both specific and general training, the worker must bear the general training costs. Implementation would include state-funded school-based general education or firm-based general training, along with workers paying for their training costs. Alternatively, firms could be incentivized to participate, if they were able to recoup part of their investments by contractual arrangements ensuring that either: (i) apprentices accept a wage lower than their marginal productivity during the training period, or (ii) apprentices continue to work for the firm beyond the training period (Malcomson, Maw, and McCormick 2003). In fact, what we can see in countries like Germany, Switzerland, and Austria is a specific collective agreement reached between unions and employer associations or wage recommendations issued by professional associations

[7] As discussed below many firms do invest in their employees' general training. Some reasons that explain this are informational asymmetries regarding workers' productivity, search costs and market frictions, or monopsony power.

setting a generally applied rate for apprentice remuneration. This wage is significantly below the earnings of a full-time low-paid job and thus can be seen rather as a part-time wage or some basic income support during the training period.

In practice, this model seems to explain firms' incentives to offer training. In some countries such as Switzerland, the low level of wages and the strong involvement of apprentices in the productive activities during the apprenticeship allows firms to incur a net benefit during the training period (Lerman 2014). However, in other countries such as Germany, some firms are found to incur a net cost during the training period (Harhoff and Kane 1997; Dionisius, Mühlemann, Pfeifer, Walden, Wenzelmann, and Wolter 2009).

Several theories hence attempt to find alternative explanations of the training activities of firms (for an excellent overview, see Wolter and Ryan 2011). In particular, Acemoglu and Pischke (1998, 1999, 2000) develop and extend the framework of Katz and Ziderman (1990) where informational asymmetries regarding the abilities of workers and the quality of training received can lead to sufficient incentives for firms to invest in general training. Given that firms are able to learn the ability of the worker during the training period, the additional presence of a compressed market wage allows firms to pay high-ability workers less than their marginal product, hence reaping part of the benefit of training. A compressed wage structure might arise due to: (i) information asymmetries and complementarity between ability and training in the production function (Acemoglu and Pischke 1998), or (ii) search costs combined with market frictions such as collective bargaining, minimum wages and firing costs, which are higher for high-skilled workers (Dustmann and Schönberg 2009). Booth and Zoega (2004) point out that wage compression is not a necessary condition for the emergence of firm-based training, but suggest that all set ups resulting in a situation where training increases the worker's productivity more than their wage are expected to stimulate the investment in training. In particular, factors reducing the propensity to quit after the apprenticeship increase the willingness to invest in training.

Another set of models aims to explore the deterring effect of poaching, which implies that firms not investing in training might hire apprentices from the training firm by offering them higher wages. Hence firms are more likely to engage in training if they are able to enjoy some monopsony power arising from industry- and occupation-specific skill requirements, dispersed regional location of firms, and lower product market competition (Lazear 2009; Smits 2007; Gersbach and Schmutzler 2006). While the incidence and relevance of poaching is difficult to measure, recent evidence from Germany suggests that only 3 percent of training firms in Germany are poaching victims. Firms in bad economic situations that are hence

unable to make counter-offers are particularly affected (Mohrenweiser, Zwick, and Backes-Gellner 2013).

A further potential reason to participate in training might be that firms would prefer to ensure their own future skill supply through providing training. However, some countries, such as Switzerland, maintain a large dual system and a high turnover rate after training (Wolter and Schweri 2002). It might be the case that firms train apprentices to use them in current production. Although firms might incur a net cost for the average productive apprentice, some high-productivity apprentices might also be paid less than their marginal productivity, given that the overall wage level for apprentices tends to be low (Mohrenweiser and Zwick, 2009). In particular, if there are few outside options for youth, they might be willing to engage in such a payment scheme since they would benefit afterwards from the acquired skills.

Why is the dual system not readily transferable?

The dual VET depends on some essential preconditions. For instance, it relies on strong cooperation between government and employers to develop the VET institutional framework, design and adjust curricula, certify competences, and co-fund the plant-based and school-based elements. In addition to these regulatory and budgetary issues, the dual system also depends on sustained and active support from a sufficiently large number of actors:

1. **Trade unions** must accept that apprenticeship contracts have lower payments compared to regular contracts;
2. **Employers** must be willing to provide training (not primarily in an informal manner but according to occupational curricula), to send apprentices to vocational school leading to certified occupational qualification, and to provide them with a credible prospect of sustainable employment;
3. **Government** support for providing vocational schools and teachers and also for preparatory training for young people who fail to enter apprenticeships;
4. **Youth and parents** must accept VET as a solid alternative to academic education.

These elements tend to being mutually reinforcing. As they have developed over a long time, these conditions cannot easily be transplanted across different institutional and historical contexts. However, many countries have tried to develop dual VET programs. For example, as regards to the US, both the National Youth Apprenticeship Act under the administration of

George Bush and the School-to-Work Opportunity Act under President Clinton were two attempts to implement the dual system. However, according to Lerman and Rauner (2012), widespread participation in the youth apprenticeship could not be reached due to: (i) the inability of employer organizations to coordinate long-term training plans, (ii) the federalist division of responsibilities that impedes a binding national framework for the training systems, (iii) a general mistrust in the idea of imparting specific human capital, as it is likely perceived to lose its value more quickly in a continuously changing labor market (Krueger and Kumar 2004), and (iv) a lack of employer interest in participating in this exchange. Despite the futile efforts at the federal level, some states were able to establish and maintain a functioning small-scale dual apprenticeship system, particularly in the construction industry (Bilginsoy 2003).

Complementary to the previous analysis outlining the incentives of firms to provide training, a further important point of concern is a sufficiently high level of training quality to ensure that students are willing to participate in apprenticeship training. Acemoglu and Pischke (2000) highlight the existence of external certification of training content that increases the value of training in the overall labor market, and hence the willingness of students to invest a high level of effort during the apprenticeship. At the same time, Dustmann and Schönberg (2012) point out that the external certification and occupation-specific binding standards for the content of training are important commitment devices for firms to invest in high quality training. In the absence of these two conditions, firms may exploit students as cheap laborers, which thus reduces the willingness for students to participate in training, and lowers the reputation of apprenticeship training in general. Dustmann and Schönberg (2012) suggest that the abolishment of mandatory, external training boards in the UK in the 1980s, which centrally decided on the training content, was responsible for the decline of the relevance of the UK apprenticeship system. This further highlights the need for a specific institutional framework when aiming to establish a mainstream dual VET system, since it is not easy to replicate its complexity.

Empirical Evidence

Identification Problems

Is school-based vocational training as effective as general-based education? How useful are apprenticeships in helping youth transition into the labor market? How does the dual system

compare to general-based education or other types of vocational training? Which type of VET best prepares workers for the labor market? Researchers have attempted to answer some of these questions for different countries and here we summarize the findings. As will become apparent, there is no easy answer to these questions given variation both across and within countries and studies. Countries' institutional and cultural differences, as well as the available amount of information on workers, jobs, and labor market characteristics in the different datasets used explain some differences, yet several identification problems within the literature are difficult to overcome.

Most of the literature compares the employment outcomes of VET students with an alternative group, namely general-based education students, other VET tracks, school dropouts, or college graduates in the same country, after controlling for all observable characteristics available. However, we acknowledge that unobserved heterogeneity may still prevail given that youth deciding to study VET may have different abilities, tastes and preferences about work from those who choose an alternative education system or no education. If there are unobserved quality differences between both types of youth, results from cross-sectional studies will reflect an omitted variable bias. For instance, given that VET is frequently intended for youth with lower motivation and ability than those who pursue general-based education, non-causal estimates of the returns to vocational education relative to general-based education will be downward biased (Willis and Rosen 1979; Tuma 1994; McCormick, Tuma, and Houser 1995). By contrast, the opposite is likely to be true when comparing students from vocational education to school dropouts. Furthermore, a related concern arises due to different occupations requiring diverse mixes of academic and practical skills. If youth self-select into different occupations based on their skills, evaluating the effectiveness of the different systems becomes a difficult task given that the employment patterns, payment structures, and union coverage in the occupations themselves may not be comparable.

Unable to exploit exogenous changes in the institutional setting, the majority of country studies conduct descriptive analyses controlling for students' characteristics; this is to capture the expected opportunity of the alternative forms of schooling, including grades and test scores achieved prior to accessing VET or remaining in general education, family background, and local economic conditions. Additional confounders include subjective statements of preferences for VET or academic studies (Bishop and Mane 2004), subjective self-assessments of ability (Hotchkiss 1993) and information concerning the vocational orientation of the school captured by full-time vocational teachers and the schooling choice

of previous cohorts (Meer 2007).

In addition to the aforementioned problems, one has to add measurement issues in studies comparing the effectiveness of two types of VET systems across countries. Indeed, the covariation of other relevant institutional factors, the absence of a unified framework for defining the respective training options, as well as the difference in data collection and quality frequently bias cross-country studies analyzing the relative effectiveness of school-based VET and the dual system (Hoeckel 2008). In an attempt to avoid this problem, some studies exploit the two systems' coexistence within countries in order to evaluate their relative effectiveness. However in most countries one system prevails over the other, and the reason why it is so is likely correlated with the labor market structure, thus adding yet another source of endogeneity.

One way to address the selection problem is to exploit some exogenous change that lengthens or shortens one educational system versus the other. For instance, several researchers have exploited institutional changes increasing the duration of general schooling in the vocational schooling tracks of those respective countries (Oosterbeek and Webbink 2007; Pischke and von Wachter 2008; Hall 2012; Felgueroso, Gutiérrez-Domènech and Sergi Jiménez-Martín 2014), whereas others have used an instrumental variable approach (Fersterer, Pischke, and Winter-Ebmer 2008). Furthermore, an alternative way to address the endogeneity is to use propensity score matching that addresses the selection problem (Lee and Coelli 2010) or, even better, conduct randomized controlled experiments designed before the VET program implementation (Díaz and Jaramillo 2006; Attanasio, Kugler, and Meghir 2011; Card, Ibarrarán, Regalia, Rosas-Shady, and Soares 2011). The concerns with randomized controlled experiments are their external validity and their costs.

Evidence of Vocational and Technical Secondary Schools

Rigorous quantitative evidence on the returns to school-based vocational education is scarce primarily due to the lack of informative data. Most countries experience a negative selection into vocational schooling tracks, leading to a systematic underestimation of vocational training effects when the selection issue is unaccounted. Here we review some of the existing evidence on the relative benefits of participating in vocational schooling relative to general schooling. We thereby focus on studies that somehow aim to control for the selection. Clearly, however, the lack of evidence based on random variation is quite unfortunate and raises accountability concerns, as discussed earlier.

Overall, the evidence described below indicates that youth completing school-based VET do as well (and sometimes better) than if they had instead remained in purely academic studies (Tansel 1994, 1999; Mane 1999; Tunali 2002; Bishop and Mane 2004, 2005; Meer 2007). Some evidence finds that school-based VET is most efficient when the area of vocational training is matched with the occupation of employment, whereas no significant differences arise for unmatched groups (Neuman and Ziderman 1991, 1999). Additionally it is efficient when offered to low-ability individuals and to those who work in lower skilled jobs (Dearden, McIntosh, Myck, and Vignoles 2002).

A number of studies provide evidence on labor market returns to vocational curricula in the US, showing a positive effect in the short to medium run. They also find that for later cohorts, returns to attending technical schooling have increased over time. While Hotchkiss (1993) finds no return to vocational schooling on employment and wages of high-school graduates in 1980, even after controlling for training-related occupation choice, Mane (1999) identifies differences in the returns to vocational training of high-school graduates who do not attend college during the 1970s, 1980s and 1990s, finding a positive trend over time. Whether this is due to an increasing quality in education or an increase in the demand for these skills remains unclear. The positive wage and employment effects of participating in the vocational track are confirmed by Bishop and Mane (2004), using data from the National Education Longitudinal Survey of 1988, and Bishop and Mane (2005) using high-school transcripts. They note that a growing need for these types of skills during the 1980s and 1990s most likely explain the increasing returns to vocational training in the US. They use a multinomial logit selection model to account for self-selection in track choice, and find that those on the technical or academic track are best off following the path they chose, suggesting that VET provides a valuable alternative for youth aiming to work in technical occupations.

Using data on high-school qualifications in Israel, Neuman and Ziderman (1991, 1999) find that school-based VET yields higher returns than general schooling, but only when the occupation of the VET and the occupation of employment are matched. In case where the occupation of training and employment are matched, the authors estimate that vocational high-school graduates earn between 8 to 10 percent more than those with solely academic qualifications. No significant earnings differences between vocational high-school graduates arise with unmatched jobs and academic high-school graduates. The probability to find a matching occupation varied substantially across occupations. Taking the average of 37.5% this indicates that the overall wage gain of the vocational occupation was still at 3%.

Some studies provide evidence of the differential rates of return to vocational education. After using a variety of datasets, accounting for the time taken to acquire different qualifications, and controlling (when possible) for ability bias and measurement error, Dearden et al. (2002) find that the returns to UK school-based vocational education vary with the type of qualification obtained. These authors find that the returns to academic qualifications are higher if individuals subsequently acquire a skilled rather than an unskilled job. Heterogeneity also occurs among individuals' ability. The returns to vocational qualifications are significantly higher for low-ability individuals. In a different setting, Tansel (1994, 1999) and Tunali (2002) find differential returns to vocational (relative to general schooling) by gender in Turkey. Controlling for the differential selectivity into the different tracks, they find that women who participate in vocational education benefit from a higher employment probability, while men experience higher wages. Furthermore, women seem to benefit predominantly in urban areas, while males benefit in both rural and urban settings, suggesting that females face further participation constraints besides educational ones.

It is interesting to note that recent studies that exploit a reform to identify the effectiveness of school-based vocational training relative to general education do not find any effects of increasing the general education for students in the vocational training track by one year. Oosterbeek and Webbink (2007) investigate the increase in duration of the vocational schooling track in the Netherlands in 1975 by one year, with the additional year designated only to general schooling. Adopting a difference-in-difference strategy, they analyze the effect of the change on wages 20 years later and do not find any effect. Most recently, Malamud and Pop-Eleches (2011) evaluate a Romanian reform that postponed the tracking of students into vocational and academic schools. Using a regression discontinuity design, they find no effects of this reform on university completion, labor market participation, or earnings. Pischke and von Wachter (2008) exploit the gradual adoption of a one-year increase in compulsory schooling in the lowest schooling track in Germany between the 1950s and 1970s to study its effects on long-term wages, and likewise find no effects of the policy.

Hall (2012) assesses a policy change in Sweden in 1991 that increased the general education content of the vocational schooling at the upper secondary level by one year in duration, after which students were eligible to enroll in tertiary education. Exploiting random differences in time and the regional implementation of a policy pilot, Hall does not find any effects on subsequent study take up, nor any increase in the wages earned up to 16 years after the beginning of upper secondary school. However, she finds that low-achieving students are significantly more likely to drop out of upper secondary education.

Using an instrumental variable approach, Cappellari (2004) assesses differences in early labor market outcomes for participants in vocational or general secondary schooling in Italy. Observing that the selection into the respective tracks is strongly related to parental background and ability, he uses grandparents' school participation as an instrument, arguing that this is exogenous to the pupil's labor market outcomes once controlling for parental characteristics, but relates to the decision on whether to select into general or vocational schooling. He finds that participating in the vocational track increases the early career employment and labor market participation rates, while general schooling increases the probability of attending university. Unfortunately, the study only analyzes short-term effects. An interesting French study estimates both short- and long-run effects of vocational versus general schooling tracks (Margolis and Simonnet 2003). Controlling for non-random selection using a Heckman selection correction model, these authors find that technical education has a similar effect as general education on the speed of entry into the first job. However, they find that five years after entering the labor market, youth with lower levels of vocational schooling earn less than those who graduated from the academic schooling track. They further find that one channel through which participants of the lower- or medium-level vocational schooling track experience a fast entry into employment is the increased probability of finding the first job via social networks—although, this network effect fades over time.

Evaluating Apprenticeships

Although apprenticeships seem to improve both social and occupational skills of apprentices (Rose 2004; Halpern 2009), rigorous quantitative evidence on their effectiveness is meager, even in countries where apprenticeships are widespread (Lerman 2013). Overall, studies indicate apprenticeship effectiveness varies with the counterfactual to which they are compared. When compared to other types of VET or post-school study, it seems that apprenticeships work better than the alternative (Bonnal, Mendes, and Sofer 2002; McIntosh 2004, 2007; Lee and Coelli 2010; Alet and Bonnal 2011).

McIntosh (2004) analyzes the returns to apprenticeships in the UK prior to the 2004 reform. Using the 1996–2002 Labour Force Survey (LFS) he finds that while completing an apprenticeship increases males' wages by around five to seven percent (controlling for other qualifications held and personal characteristics), it has no effect for women. He also finds that there are sectoral differences, with higher returns among men working in manufacturing industries rather than in the service sector. Most recently, McIntosh (2007) evaluated the

government-funded apprenticeships established in the UK in 2004. Using Labor Force Survey and OLS estimates, he compares the effectiveness of these apprenticeships to other types of vocational qualifications in the UK. He finds that in 2004–2005, individuals who completed apprenticeships earned around 18 percent more at Level 3 and 16 percent more at Level 2 than individuals whose highest qualification is at Level 2, or at Level 1, respectively. However, as McIntosh acknowledges, these estimates may be biased because employers may be creaming the best applicants, as there is excess demand for apprenticeships.

According to Lerman (2013: 12), "few rigorous studies have examined how entering and completing apprenticeships in the United States affects the education, job skills, non-academic skills, and job market outcomes of young people." Orr (1995) analyzes the effects of participating in a Wisconsin youth apprenticeship in printing and finds that apprentices earned substantially higher earnings that those of similar youth. Ethnographic evidence from 24 programs involving nearly 500 apprentices—conducting over 300 hours of observation and over 90 interviews with adult mentors, staff, program directors, and students—suggests that apprentices learn both non-cognitive and occupational skills (Halpern 2009). Non-cognitive skills include problem solving, self-confidence, teamwork, discipline and the ability to take direction and take initiative, among others. Similarly, Rose (2004) finds that apprentices learn from their mentors and aim at mastering an occupation and becoming part of a community practice.

Lee and Coelli (2010) analyze the labor market returns to vocational education in Australia, using propensity score matching methods, and find substantial differences for individuals who completed 12 years of schooling and those who did not. While the effect of participating in VET on wages and employment probability is zero or even negative for the first group, it is significantly positive for the latter group. This is in line with previous literature, suggesting that vocational education options seem to provide a safety against low labor market attachment.

Bonnal et al. (2002) study the relative performance of apprenticeship training versus school-based training in France. Correcting for the negative selection of youths into apprenticeships, they find that apprenticeships perform significantly better in integrating youths into their first employment relationship. However, this advantage fades over time and is not associated with higher wages. In addition, a recent study by Alet and Bonnal (2011) shows that young people integrated into the apprenticeship system rather than vocational schooling in France are more likely to successfully complete their final exam and undertake further education.

One of the first studies to use an instrumental variables (IV) approach to measure the returns of apprenticeships is that of Fersterer et al. (2008) using Austrian data from 1975 to 1998. These authors exploit the different lengths of apprenticeship periods completed for some apprentices in failed firms. Perhaps surprisingly, they find that the estimated returns for apprentices affected by the firm failure are low, at around 2.6 percent. These returns are also not very different from the OLS returns in the same sample, suggesting that the selection problem is not particularly important in this case.

Evaluating the Dual System

As with apprenticeships, the dual system seems to outperform other types of vocational schooling; but in this case, the benefits focus on employment opportunities, as opposed to earnings, and are concentrated at the beginning of individuals' professional lives (Winkelmann 1996; Plug and Groot 1998; Parey 2009). In addition, recent causal estimates of the returns to dual training find that there are no differences in wage returns relative to the academic track (Krueger and Pischke 1995; Winkelmann 1996; Fersterer and Winter-Ebmer 2003; Pischke and von Wachter 2008).

An extensive area of research exploits the coexistence of the dual VET system and other types of vocational schooling within countries to infer their relative effectiveness and more specifically the relevance of firm-specific skills. For the case of Germany, studies by Winkelmann (1996) and more recently Parey (2009) show that participation in the dual VET has a particular advantage compared with other options of the vocational schooling system since it improves early labor market attachment and shows a faster and more structured integration into the labor market. However, this advantage fades over time as other education participants find a foothold in the labor market. Furthermore, these studies show that the fast initial transition does not hinge on finding employment in the training firm, suggesting that firm-specific skills do not play a major role in the German apprenticeship system. Investigating wage differentials, Parey (2009) does not find any significant differences in return to the training options in the early working life. Studies regarding the performance of apprenticeship training versus school-based training by Plug and Groot (1998) show similar results for the Netherlands.

When comparing the dual system with purely academic studies, several papers have found that wage returns to apprenticeship training on wages in Germany and Austria range between 15 and 20 percent, based on OLS estimates (see Krueger and Pischke 1995; Winkelmann 1996; Fersterer and Winter-Ebmer 2003). Given that dual vocational training lasts around three years

on average, this implies a return of around five percent a year, which is not far from other forms of school-based education. However, selection into the dual system once again raises concerns that OLS wage estimates will be biased (Soskice 1994). In particular, Soskice finds that much heterogeneity is due to firm size, given that the wages for apprenticeship-trained workers strongly increase along with the training firm size.

Recently, Adda, Dustmann, Meghir, and Robin (2006) use a structural approach to compare the career path of apprentices relative to unskilled workers (pure on-the-job training). They model the entire career path, starting with the original apprenticeship choice then follow period-by-period employment transitions, job mobility, and wages. Using 15 years of German data, they find that apprenticeships lead to more wage growth upfront, while wages in the pure on-the-job (unskilled) training grow at a lower rate but for longer. Overall, they find that wages are higher following an apprenticeship qualification, with the job arrival rates very high and destruction rates very low after some years of experience. These findings contrast with Heckman's suggestions that qualified apprentices are harder to reallocate following a job loss (Heckman 1993).

Hanushek, Woessmann, and Zhang (2011) also analyze the life-cycle employment patterns of people with different educational backgrounds, using data on the labor-market experiences of individuals at various ages in 18 OECD countries, collected in the mid-1990s as part of an OECD-sponsored venture. They find a higher initial employment rate for vocational education participants at labor market entry, which reverses by the age of 50. These results suggest the hypothesis that occupation-specific knowledge quickly becomes outdated and thus leads to lower employment opportunities later in life. However, we need more reliable evidence concerning the perceived trade-off since both occupation-specific labor market segregation as well as limited long-term panel data impede the causal interpretation of these findings.

Conclusion and Policy Perspectives

In this paper, we have classified vocational education and training (VET) in industrialized countries into three distinct systems: (i) vocational and technical schools, (ii) formal apprenticeships, and (iii) dual apprenticeship systems combining school training with a firm-based approach. After reviewing the particular strengths and weaknesses of these distinct types, we evaluated the empirical evidence on their effectiveness. Beyond the general education core, youth completing school-based VET do as well (and sometimes better) than if they had instead

remained in purely academic studies, especially when there is a match between the vocational training and the future occupation of employment. Rigorous studies evaluating the effectiveness of vocational training show that vocational training makes the transition to gainful employment easier, and may improve wage and employment outcomes, in particular for low ability youths and those working in low-skill jobs. In particular, it was shown in several settings, that an extension or prolongation of the academic schooling for these youth, does not result in additional gains in terms of labor market entry, but may entail an increased risk of drop-out. Comparing across types of VET, the dual system, which is most prominent in a number of continental European countries, is more effective at helping youth transition into employment than alternative academic or training education, though there are no wage differences. Hence, it seems fair to say that vocational training elements generate some added value both to training employers and to the trainees and facilitate the timely entry into more stable and better paid jobs at the beginning of the working life.

Yet, given the fact that economic and institutional conditions are highly diverse across industrialized countries, when it comes to furthering vocational education and training, policy makers need to take into account the resources available and build upon them. The ideal type of a dual VET model relies on three demanding preconditions:

1. ***Support from employers (and their associations).*** Employers and their associations ought to consider training as an investment in favor of competitiveness, productivity and offering sustainable employment prospects, and thus offer vocational training in a systematic and certifiable fashion.

2. ***Support from young people, their families, and trade unions.*** Young people, their families, and trade unions ought to accept apprenticeships as a phase of lower earnings in exchange for skill acquisition to ensure that it is not seen as a second-best alternative to tertiary education.

3. ***Support from the government.*** The government ought to provide vocational schooling, including funding, a binding regulatory training framework (agreed with employers) and external monitoring to ensure the timely adaptation and labor market relevance of the curricula, and that the quality standards of training provided within firms are met.

Obviously, governance and the involvement of core actors—in particular government at different levels, employers' associations, and unions—play a crucial role in implementing

dual VET. The organizational capacities of governments and social partners are essential, given that a critical mass of supply and demand of dual VET cannot be created artificially and needs time to develop.

This explains why a complex system such as the dual vocational training has hardly been transplanted at a significant scale outside continental Europe. But given that most countries have some forms of vocational training—school-based, firm-based, or mixed—they can in principle start with those elements and reform their systems to bring VET closer to employer and labor market needs. Experiences with pilot projects, regional or sectoral clusters of employers or traditional apprenticeships can be instructive. The main challenge is to make on-the-job learning more systematic and to bring school-based vocational training or general education closer to labor market needs. In this respect, employer participation and some more systematic vocational training are crucial. Hence, elements of dual VET closer to employers' demand and real work experience can be developed within the other types of VET discussed in this paper.

For example, if a number of employers in some region or sector is able to identify a joint interest in dual VET as a way to promote the productivity of their workforce, it could be realistic to start with a dual VET cluster. This would probably entail support from the government, which would need to take a supporting role regarding vocational schooling parts and initial employer investment in training capacities; the government would partake in exchange for the expectation of lower youth unemployment. A basic agreement regarding funding, management and curricula could be a good starting point in such a case.

However, vocational education and training should not be seen as a panacea to combat high youth unemployment. It is important to keep in mind that VET systems are appropriate to prepare young workers for only certain types of jobs. VET may be less appropriate for specific high-tech sectors and to access the highest managerial level positions in both the public and private sectors. Here, general academic training is certainly relevant. To address the problem of rising youth unemployment rates since 2008, VET is complementary to structural reform policies that help revive the economy and reduce entry barriers to employment such as dismissal protection or minimum wages. Improving VET systems remains relevant even if structural and institutional changes need to interact with attempts to increase certain types of job opportunities (Cahuc, Carcillo, Rinne, and Zimmermann 2013).

But other elements may be equally important in order to create labor market

conditions that are more conducive to a smoother transition from school to work. In this context, along with the strengthening of vocational training, the highly dualized structure of labor markets observed in some countries such as Italy, Spain, and France needs to be addressed. Where there is a strong divide between employment protection for permanent contracts on the one hand and the regulation of temporary contracts or self-employment on the other, young people typically remain stuck in fixed-term employment spells or in other forms of flexible employment. Employers are very reluctant to hire youths on a permanent basis, particularly in the absence of vocational training. In this respect, reducing the rigidity of dismissal protection while increasing employment security for labor market entrants according to tenure could be a solution. Practical work experience and training could then further ease the successful integration of young people into stable jobs.

Finally, a recent line of research has focused on studying the life-cycle impact of vocational education, motivated by the returns to vocational training potentially varying at labor market entry compared to returns after spending several years in the labor market. The differences lie in the fact that skills have to adapt to technological change and be mobile across time, firms, occupations and space. While some studies so far support the conjecture that general education still provides a more solid base for such adjustments (Hanushek et al. 2011), others suggest that vocational training is better than pure on-the-job (unskilled) training (Adda et al. 2006). However, the long-term counterfactuals of low-skilled individuals with general or vocational education considering the risk of early unemployment have not yet been well investigated. Future evaluations need to study the long-run consequences better, a challenge that also has to do with the (non-)availability of long-term panel data.

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