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Abstract

To deepen scholarly understanding of unfavourable youth labour market outcomes of vocational education and training (VET) programmes, this paper develops an empirical typology of VET programmes in developed countries. Building on a theoretical framework that draws on the theory of social systems, the paper analyses the linkage between actors from the education and employment systems in VET in preventing unfavourable youth labour market outcomes, such as unemployment and skills mismatch. Based on empirical data on the largest upper-secondary VET programmes in 18 countries or states within them, this paper identifies five real types of VET programmes. These real types represent different combinations of the education-employment linkage in any process phase of curriculum design, application, and updating. Importantly, this paper provides evidence that only real type VET programmes with a strong education-employment linkage throughout the entire curriculum process are associated with high youth labour market integration.

Keywords: Vocational Education and Training, Typology, Qualitative Comparative Analysis

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Introduction

Scholars and policymakers often promote vocational education and training (VET) as the 'silver bullet to the problem of youth joblessness' (Eichhorst et al. 2015, abstract; e.g. Chatzichristou et al. 2014; International Labour Organization (ILO) & Organisation for Economic Co-operation and Development (OECD), 2014). In contrast to general education, which is relevant for a wide range of occupational fields, VET is designed for and directly leads to a particular type of occupation (OECD 2004). Numerous scholars argue that VET better satisfies the needs of the labour market than general education, thereby facilitating young people's labour market entry (e.g. Quintini and Martin 2006; Wolbers 2007). Yet despite a clear mission, VET varies considerably across countries, regions, and occupations in terms of not only its relevance but also its effectiveness in facilitating the labour market entry of young people (e.g. OECD 2010; Wolter and Ryan 2011; Eichhorst et al. 2015). Therefore, what makes VET programmes successful with regard to the youth labour market is a key question for both scholars and policymakers.

This paper compares VET programmes worldwide to understand their relation to the youth labour market. One methodology for organising complex relations are typologies, such as that between VET programmes and labour market outcomes, which recently gained popularity for constructing and assessing causal explanations (Doty and Glick 1994; Elman 2005; George and Bennett 2005). Explanatory typologies 'are intended to predict the variance in a specified dependent variable because the […] types identified in typologies are developed with respect to a specified […] outcome' (Doty and Glick 1994, 232).

As much of the recent comparative literature on education and training does not derive its dimensions from a causal argument, this literature builds classifications rather than explanatory typologies (e.g. Greinert 2004; Dumas, Méhaut, and Olympio 2013; Eichhorst et al. 2015). Only Allmendinger (1989), Hannan, Raffe, and Smyth (1996), Müller and Shavit

(1998), and Lavrijsen, Nicaise, and Poesen-Vandeputte (2014) provide explanatory typologies. By combining the theoretical derivation of the comparative dimensions with empirical testing, these four studies build typologies that help explain the labour market outcomes of education and training. Even so, these typologies do not capture in-depth differences between VET programmes. This paper contributes to this literature by developing a theoretically well-founded empirical typology of VET programmes.

In addition, this VET typology helps explain how such programmes can prevent unfavourable youth labour market outcomes, such as skills mismatch und unemployment. The paper's in-depth analysis of the conditions that differentiate VET programmes reveals how these conditions relate to the youth labour market. I draw on Rageth and Renold (2017), who use Luhmann's (1995, 2009, 2013) theory of social systems to elucidate the significance of the linkage between actors from the education and employment systems in VET for a favourable youth labour market. Comparing the empirical types of VET programmes – which I call 'real types' (Weber 1949, 1968) – to the heuristically derived, pure ideal types of Rageth and Renold (2017), helps me discover which conditions may be related to unfavourable youth labour market outcomes (Fiss 2011). Moreover, Rageth and Renold's (2017) ideal types highlight such extreme positions that they do not expect to find them in the empirical data (Weber 1949, 1968).

In contrast, the real types of VET programmes represent the different configurations of the linkage between actors from the education and employment systems in any phase of curriculum design, application, and updating. To identify these configurations and determine the explanatory value of each, I apply qualitative comparative analysis (QCA; Ragin 2000, 2008b, 2014). As QCA combines in-depth case knowledge with formalized cross-case comparison, my analytical strategy contributes to the work of Allmendinger (1989), Hannan, Raffe, and Smyth (1996), Müller and Shavit (1998), and Lavrijsen, Nicaise, and Poesen-

Vandeputte (2014). I use data that measures the linkage between actors from the education and employment systems in the largest VET programmes in 18 developed countries or states within them (Renold et al. 2015; 2016; Bolli et al. 2018). Thus this paper focuses on formal VET programmes at the upper-secondary education level –generally corresponding to the final stage of secondary education, with a typical entry age of 15 or 16 years (OECD 2004).

This paper proceeds as follows: Section 2 summarises the literature, section 3 explains the theoretical framework, and section 4 discusses the analytical strategy, including the applied method and data. Section 5 presents the findings, and section 6 discusses them. Section 7 concludes and explores the implications.

Previous typologies of education and training

Although the comparative literature on VET is vast and growing (e.g. Biavaschi et al. 2012; Dumas, Méhaut, and Olympio 2013; Eichhorst et al. 2015), the potential of explanatory typologies remains underexplored. Rageth and Renold's (2017) study is the only one that develops an explanatory VET typology for understanding unfavourable youth labour market outcomes. By heuristically deriving ideal types of VET programmes, Rageth and Renold (2017) focus on the conceptual and documentation levels of the typological procedure (Bailey 2004) without identifying the real types at the empirical level.

In studies comparing education and training in general, four develop empirical typologies of education and training: Allmendinger (1989), Hannan, Raffe, and Smyth (1996), Müller and Shavit (1998), and Lavrijsen, Nicaise, and Poesen-Vandeputte (2014). These studies cover all three levels –conceptual, documentation, and empirical (Bailey 2004) – that a typological procedure requires, derive the dimensions along which they compare education and training from a theoretical argument on the relation between education and labour market outcomes. In addition, these studies use empirical data to identify existing combinations – their

real types – of the values of the comparative dimensions and derive hypotheses on their labour market outcomes.

While these four explanatory typologies differ in their samples and typological procedures, they show little variation in the applied theoretical arguments and comparative dimensions. They argue that four comparative dimensions are essential for building a typology that helps scholars understand the labour market outcomes of education and training: the existence of national standards, the stratification of the education and training system, the vocational specificity of the education and training system, and the relation between educational institutions and employers.

First, Allmendinger (1989), Hannan, Raffe, and Smyth (1996), and Müller and Shavit (1998) argue that education and training systems – covering all general education and VET programmes in a country – vary in the standardisation of educational provisions. According to these scholars, this dimension captures in how far teacher training, educational curricula, assessment, and certification meet the same standards nationwide. In highly standardised systems, employers can trust the certifications to reliably represent qualifications. Thus standardised education and training systems should improve youth labour market outcomes (e.g. Allmendinger 1989; Hannan, Raffe, and Smyth 1996).

Second, the explanatory typologies of Allmendinger (1989), Hannan, Raffe, and Smyth (1996), Müller and Shavit (1998), and Lavrijsen, Nicaise, and Poesen-Vandeputte (2014) include the stratification of educational opportunities. This dimension refers to the selection procedures into education programmes and the degree of differentiation within an educational level (e.g. the number of different pathways and programmes). In highly stratified education and training systems, students select early into different educational tracks and achieve distinct qualifications.

Third, Müller and Shavit (1998) and Lavrijsen, Nicaise, and Poesen-Vandeputte (2014) emphasise that education and training systems differ in their vocational specificity. They define vocational specificity, which they define as the extent to which an education and training system provides education programmes with a high share of vocational content. As vocational specificity represents a particular aspect of stratification, these two dimensions are highly correlated (Müller and Shavit 1998). Allmendinger (1989), Hannan, Raffe, and Smyth (1996), Müller and Shavit (1998), and Lavrijsen, Nicaise, and Poesen-Vandeputte (2014) argue that both high stratification and vocational specificity improve young people's labour market entry, thanks to detailed signals about their qualifications.

Fourth, Hannan, Raffe, and Smyth's (1996) typology builds on an additional dimension: the relationship between educational institutions and the labour market. By referring mainly to the participation of employers in the provision of education and training, they argue that this institutional relation ranges along a continuum from complete isolation to high interconnection. They state that countries with a strong relation between educational institutions and the labour market facilitate young people's school-to-work transitions. However, Hannan, Raffe, and Smyth (1996) acknowledge that their description of that relation needs further specification and that they do not clearly operationalize it. In contrast, Rageth and Renold's (2017) theoretical typology focuses on the same actor relation in VET programmes, and they develop a conceptual framework for measuring such a relation with observable features. Nonetheless, they do not test their framework empirically.

This paper contributes to this literature by developing an empirical VET programme typology that builds on the strong theoretical framework required for any explanatory typology. The following theory section explains that framework. Moreover, by focusing on VET programmes and their constitutive elements, this paper adds a VET typology to the previous empirical typologies of education and training systems.

Education-employment linkage in VET and the youth labour market

Fiss (2011) states that one of the challenges of a typology is to determine which conditions are important for understanding the causal structure of a type. In taking up this challenge, this paper builds on Rageth and Renold (2017), who identify the VET programme conditions that help scholars understand the labour market outcomes of such programmes. Building on Luhmann's (1995, 2009, 2013) theory of social systems and the later work of Eichmann (1989), Rageth and Renold (2017) demonstrate the importance of the linkage between actors from the education and employment systems in VET for a favourable youth labour market. They argue that unfavourable labour market outcomes, such as unemployment or skills mismatch, are the consequences of problems with coordination and control in the communication between the actors from the two systems.

In brief, Luhmann's (1995, 2009, 2013) theory of social systems states that functional differentiation characterises society. This functional differentiation organises communication processes around specific societal functions, leading to unique social systems – such as the education or economic systems (Luhmann 1995). While the function of the education system is socialising and educating individuals, the function of the employment system – a subsystem of the economic system – is allocating individuals to different kinds of employment (Luhmann 2009).

Luhmann (1995) posits that each social system has its own communication code, which follows from its function and thus includes all function-specific communication. While the code of the education system is passing or failing, the code of the economic system is payment or non-payment. For example, workplace learning that follows the code of payment and non-payment through the trainees' wages belongs to the employment system. Yet as long as the trainees learn and apply skills that are tested in a practical exam following the code of passing or failing, the unproductive hours of workplace learning belong to the education system.

According to Rageth and Renold (2017), the constitutive element of VET programmes is their connectivity to both an educational career and a professional career in the labour market. They argue that VET programmes can only ensure this connectivity to both kinds of careers by linking the education and employment systems. This linkage occurs through the communication of the actors from the two systems throughout the entire curriculum process. For example, the qualifications defined in a VET curriculum need to equip students with the skills and competencies necessary for both further education and labour market entry. Thus not only actors from the education system but also those from the employment system need to engage in determining the curriculum content. While employment-system actors are individual firms, employer associations, labour authorities, or even unions, education-system actors typically are educational institutions, schools, or teachers (Renold et al. 2016).

By exaggerating their main comparative dimension – the linkage between actors from the education and employment systems in VET – to its logical extremes, Rageth and Renold (2017) heuristically derivate three ideal types of VET programmes. As analytical constructs, such ideal types serve as yardsticks for 'the comparison with empirical reality in order to establish its divergences or similarities, to understand them with the most unambiguously intelligible concepts, and to understand and explain them causally' (Weber 1949, 43). The first ideal type of VET programmes entails equal power-sharing between actors from the two systems throughout the curriculum process, thereby creating a strong linkage between them, and leads to the most favourable youth labour market. In contrast, the other two ideal types, in which only one system has all the power result in either undesirable labour market outcomes or lack of access to further education.

According to Rageth and Renold (2017), the linkage between actors from the education and employment systems can occur in any phase of the curriculum value chain (CVC). The CVC defines the curriculum as a cyclical process with three phases: curriculum design,

application, and updating (Renold et al. 2015). Table 1 shows that the main dimension of the VET programme typology consists of the linkage between actors from the education and employment systems in these three phases. The first two rows show that Rageth and Renold's (2017) ideal types have either a strong linkage or no linkage throughout the entire CVC. The third column indicates that they expect only the first ideal type to result in favourable youth labour market outcomes. The last row shows that each real type represents a specific configuration of the linkage between actors from the two systems in any of the process phases.

Table 1. Types of VET programmes as configurations

DIMENSIONS			**OUTCOME**	
EEL in curriculum design	**EEL in curriculum application**	**EEL in curriculum updating**	**Favourable youth labour market**	**TYPES**
●	●	●	●	**Ideal type 1** (power-equilibrium)
○	○	○	○	**Ideal type 2 or 3** (education- or employment-led)
?	***?***	***?***	***?***	***Real types***

Note: EEL = linkage between actors from the education and employment systems; ● = strong linkage, ○ = no linkage.

In VET programmes, each curriculum process phase is relevant, and they build on one another. The 'intended curriculum' or 'planned curriculum' (Billett 2006; Kelly 2009) – determined in the curriculum design phase – captures the skills and competencies that students should learn in a VET programme. In the curriculum application phase, the 'enacted curriculum' states what is actually taught and how it is taught, while the 'experienced curriculum' (Billett 2006; Kelly 2009) refers to what students take away from their education and training. Moreover, as technological and other changes heavily affect the VET curriculum content, evaluating and updating the curriculum is also important for future-proof programmes (Renold et al. 2015; 2016).

This theoretical framework makes clear that VET programmes similar to the ideal type with equal power-sharing between actors from the education and employment systems in VET are less likely to have unfavourable youth labour market outcomes. However, the literature does not state in which process phases the linkage between actors from the education and employment systems (hereafter 'education-employment linkage (EEL)') is necessary or sufficient for preventing problems with coordination and control in VET. I argue that, on one hand, multiple paths – that is configurations of the education-employment linkage in any of the process phases – to a favourable youth labour market are possible. On the other hand, the interdependencies among the three process phases indicate that what matters for understanding the labour market outcomes of VET programmes is the combination of these conditions, rather than their isolated occurrence. For example, the qualification standards defined in the curriculum design phase are enacted and experienced in the application phase.

Moreover, drawing on the previous typologies on the labour market outcomes of education and training (e.g. Müller and Shavit 1998; Lavrijsen, Nicaise, and Poesen-Vandeputte 2014), this paper argues that the relation between the education-employment linkage in VET and the youth labour market is also connected to the education and training system's organizational characteristics. For example, in countries with a high vocational specificity, where VET accounts for a substantive share of upper-secondary education, I expect the education-employment linkage in VET to have a stronger relation to the youth labour market.

Analytical strategy

Method: qualitative comparative analysis

To identify the real types of VET programmes, this paper applies fuzzy-set qualitative comparative analysis (fsQCA) with the software 'FSQCA' (Ragin and Davey 2016). By

building on familiarity with cases and systematic cross-case comparison, this method bridges the gap between qualitative and quantitative research and is best suited to analysing small-to-intermediate sample sizes that allow for substantive case knowledge (Mahoney and Goertz 2006; Schneider and Wagemann 2006, 2010; Ragin 2014).

As a configurational approach, fsQCA compares cases as configurations of causally relevant conditions (Doty and Glick 1994; Ragin 2008b; Fiss 2011). When applying fsQCA, scholars think about causation in terms of necessity and sufficiency (Ragin 2014, 2000; Mahoney 2000). A *sufficient condition* or configuration can produce a certain outcome on its own, but the same outcome can also occur in cases that do not have that particular condition or configuration. A *necessary condition* occurs in every instance of the outcome but might not be sufficient to produce it (Ragin 2000, 2008b, 2014; Mahoney and Goertz 2006; Schneider and Wagemann 2012).

Associated with set theory, fsQCA conceptualises the conditions as sets based on predefined concepts and analyses set relations (e.g., Mahoney and Goertz 2006; Schneider and Wagemann 2012). When calibrating the original values of conditions into set membership scores, scholars use theoretical and substantive knowledge to determine whether a case is more *in* or more *out* of a set[1] (Ragin 2000, 2008b; Ragin and Pennings 2005). As the education-employment linkage is the main concept of this paper, the linkages in curriculum design, application, and updating are my conditions, and I present their calibration in the data section.

By applying Boolean algebra, fsQCA generates every possible configuration of the conditions (Ragin 2000, 2008b; Schneider and Wagemann 2012). In the 'truth table' (Ragin 2014), scholars lay out these configurations, assigning cases to them and reporting each configuration's consistency with the outcome. Importantly, fsQCA assumes multiple

[1] The point where cases are more in than out a set is known as the crossover point.

causation, so that different conditions and their configurations can result in the same outcome (Doty, Glick, and Huber 1993; George and Bennett 2005; Ragin 2014). This assumption allows me to explore multiple paths – that is different configurations of the education-employment linkage in any process phase – towards a favourable youth labour market.

Although Schneider and Wagemann (2010) mention the construction of empirical typologies as one of the possible aims of fsQCA, scholars have thus far rarely applied this methodology to reach that aim. Exceptions are the pioneering studies of Kvist (2006, 2007) and Fiss (2011) or the more recent applications of Hotho (2014) and Büchel et al. (2016). These studies show the analytical capacity of fsQCA for identifying empirical real types as configurations of conditions and for comparing them to ideal types.

Data: sample, outcome, and conditions

Sample

My data stems from Renold et al. (2015; 2016; see also Bolli et al. (2018)), who provide data on the linkage between actors from the education and employment systems in VET by measuring their power-sharing in designing, applying, and updating the curriculum.[2] Their data stem from a survey among experts who are major VET actors and stakeholders and who represent governments, industry, or academia. The survey contains 37 questions on the average education-employment linkage in the largest VET programme in each country or state.[3]

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[2] Renold et al. (2016) mention two studies that develop VET governance indices containing elements related to the education-employment linkage: the World Bank's SABER index (The World Bank 2013) and the VET multilevel governance index of the European Training Foundation (ETF 2013). However, they do not focus on the education-employment-linkage.

[3] While Renold et al. (2016, 2017) sampled many experts in the seven focus cases – Austria, Colorado (US), Denmark, Hong Kong, the Netherlands, Singapore, and Switzerland – they only questioned one or two experts in the remaining 11 countries. As I aggregate the expert answers at

The sample covers the largest VET programmes in 18 countries and states: Austria, Colorado (US), Denmark, Estonia, Finland, Germany, Hong Kong, Island, Japan, the Netherlands, Norway, Poland, Shanghai (CN), Slovenia, Singapore, South Korea, Switzerland, and Taiwan.[4] In all but the three Asian countries of Hong Kong, South Korea, and Japan, VET constitutes a substantial part of the upper-secondary education level[5] with enrolment rates above 20 per cent (Renold et al. 2016, 2017). Although VET appears relatively important in most Asian countries, Taiwan and Singapore have VET enrolments of 50 and 65 per cent, respectively. In all cases except for Singapore, at least half the upper-secondary VET students are enrolled in the largest VET programme in that country or state (Bolli et al. 2018).

The advantage of a small-to-intermediate sample size of 18 cases is the in-depth case knowledge that allows me to substantiate the cross-case comparison with qualitative, case-oriented work (Mahoney and Goertz 2006). However, such a sample size also restricts the generalizability of the findings and induces selection bias (Shively 2006). Although the case selection is determined solely by data availability, Renold et al.'s (2016) comparison of top-performing countries allows modest generalisation (Thomann and Maggetti 2017), as the following subsection on the outcome illustrates. While the cases represent different cultural and political contexts, all are industrialized or transitional, with a high human development index (UNDP United Nations Development Programme 2016).

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the country or state level, the data is more reliable for the focus countries. For more information on the expert sampling, see Renold et al. (2016, 2017).

4 Due to too many missing values, I drop Luxembourg from the Renold et al.'s (2016) sample and add Colorado (US) from a later study (Renold et al. 2017).

5 As no VET programme at the upper-secondary education level exists in Singapore, the VET programme included is post-secondary (Renold et al. 2016).

Outcome

I measure the youth labour market outcome by the relative unemployment ratio, which relates the unemployment rate of the 15-24-year-olds to that of the adults older than 25. This unemployment indicator thus reflects the relative disadvantage of young people in the labour market compared to adults and partly controls for cyclical economic conditions (e.g. Breen and Buchmann 2002). The data, based on national labour force surveys, stem from the ILO (2016), which counts everyone who 'does not have a job, is available to work and is actively looking for work' (ILO 2016, 16) as unemployed.

The unemployment reporting of the cases meets international standards (ILO 2016), except for the data from the U.S. Bureau of Labour Statistics (U.S. BLS 2017) for Colorado. Importantly, these data sources use different definitions of youth unemployment (Sorrentino 2000). One is that the lower age limit of 15 years in the ILO data and of 16 years in the BLS data (U.S. Bureau of Labor Statistics 2013; ILO 2016) and another is their understanding of what constitutes an active job search: Whereas the ILO (2016) counts all activities aimed at gathering information on job opportunities, the U.S. Bureau of Labor Statistics (2013) needs the job search to be objectively measurable.

Table A2 in the appendix presents the relative unemployment ratio and the youth unemployment rate for all 18 cases, in which youth face a much higher risk of unemployment than adults. But while some countries or states constitute prime examples of high youth labour market integration (such as Colorado (US), Germany, and Japan) others have considerable difficulties integrating young people into the labour market (e.g., Poland and Finland, where one of every four adolescents is unemployed). However, those countries exhibiting high values in the two unemployment indicators – Taiwan, Estonia, Poland, Finland, and Shanghai (CN) – have a high performance on the 'Programme for International Student Assessment' (PISA; OECD 2017), indicating good school quality at the lower-secondary education level.

I calibrate the fuzzy membership scores in the set of high youth labour market integration with what Ragin (2008a) calls the 'indirect method'. This method uses regression techniques to estimate the degrees of set membership based on previously defined qualitative groupings.[6] In the appendix, figure A1 plots the original values against the calibrated memberships in the set of high youth labour market integration, and Table A4 reports all fuzzy membership scores.

In a most favourable youth labour market, unemployment should affect young people to the same extent as adults. With a relative unemployment ratio of 1.2 per cent, Colorado (US) comes closest to such a high integration. Moreover, with ratios below 2.5 per cent, Austria, Estonia, Denmark, Germany, Japan, the Netherlands, Slovenia, and Switzerland are also members in the set of high youth labour market integration. However, these cases vary considerably in their levels of youth unemployment, which is lowest in Japan (5.6 per cent) and highest in Slovenia (16.4 per cent). From a qualitative viewpoint, the cases with a relative unemployment ratio above three that is with unemployment affecting young people three times as hard as adults, are clearly out of the set of high labour market integration. These cases include Hong Kong, Poland, South Korea, and Taiwan. I classify the remaining five countries (Finland, Iceland, Norway, Shanghai, and Singapore) as more out than in that set, because their relative unemployment rates come close to the threshold of 3 per cent.

Conditions

For each process phase of the CVC, Renold et al. (2016, 2017; see also Bolli et al. (2018)) provide data for different features of the education-employment linkage, as outlined in Table A1 in the appendix. These features measure the education-employment linkage by observing

6 For a comprehensive discussion of the different calibration methods, see Ragin (2008a).

where actors from the education and employment systems share power. Given that, by definition, the education system is a main actor in every VET programme, Renold et al. (2016, 2017) asked about the involvement of the actors from the employment system for each feature. Renold et al. (2016, 2017), who specify these kinds of actors as firms and employer associations, collectively call them 'employers'.

To find the causal conditions that best represent the concept of the education-employment linkage, I rely on the 'significance approach' (Amenta and Poulsen 1994). For each process phase, I choose the statistically most important feature according to Bolli et al.s 2018) regression of all features on an overall assessment of the education-employment linkage (as reported in the 'weights' column in Table A1 in the appendix).

The first condition measures the education-employment linkage in the VET curriculum design by the employers' involvement in the definition of the qualification standards. As with the lowest value (1=employers are not all involved) and highest value (7=employers are the only actors involved) of this scale, only one kind of actor defines the qualification standards, with the two extremes indicating no linkage. For the relation between the employer involvement and the education-employment linkage, this scale suggests an inverted-U-shape in which optimal linkage is at some unknown equilibrium where the two actor groups share power.

As expected, in none of the cases do employers alone define VET curriculum content. I thus define all cases without employer involvement as full non-members in the set with strong linkage in VET curriculum design, whereas the ones in which employers are the main actors have full membership in that set.[7] Moreover, the threshold for set membership is set at 2.6

[7] A configurational analysis in which I tested different calibration cut-offs showed that having employers as main partners is more strongly related to a high youth labour market integration than

where employers are involved to more than only 'some' extent. To transform the original values into fuzzy set membership score, the direct calibration procedure then applies a logistic function (e.g. Ragin 2008a; Schneider and Wagemann 2012).

The second condition measures the education-employment linkage in the application of the VET curriculum by the share of workplace training relative to that of classroom education. Involving employers in students' education through workplace training with a predetermined curriculum is unique to VET programmes. As Renold et al. (2016, 2017) also consider less intensive forms of employer involvement in the students' training (e.g. site visits or job shadowing), none of the cases has only classroom education (value of 1). In addition, the sample includes no VET programme with only workplace training (value of 7).[8]

To define the optimal shares of workplace training and classroom education, that is the shares that ensure a strong linkage, I draw on Bolli et al.'s (2018) empirical finding that in top-performing VET programmes, students spend most of their time in the workplace, not in the classroom. Thus in VET curriculum application, full members in the set with strong education-employment linkage are those programmes in which learning mostly takes place in the workplace but in which students also spend some time in a classroom (value of 5.25). VET programmes with only minor workplace training are more out than in that set (value of 2), while programmes in which students spend at least some time in workplace training are more in than out of that set (crossover at 2.7).

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the equal involvement of the two partners. These results are available from the author upon request.

[8] This pattern is in line with the definition of VET programmes by the OECD (2004), which states that VET programmes must include at least 25 per cent workplace training and 10 per cent classroom education.

The third condition measures the education-employment linkage in the updating of the VET curriculum by the involvement of employers in setting the update timing. As with the first condition, this feature ranges from employers not being involved at all until being the only actors. I thus apply the same thresholds as I do for the curriculum design phase.

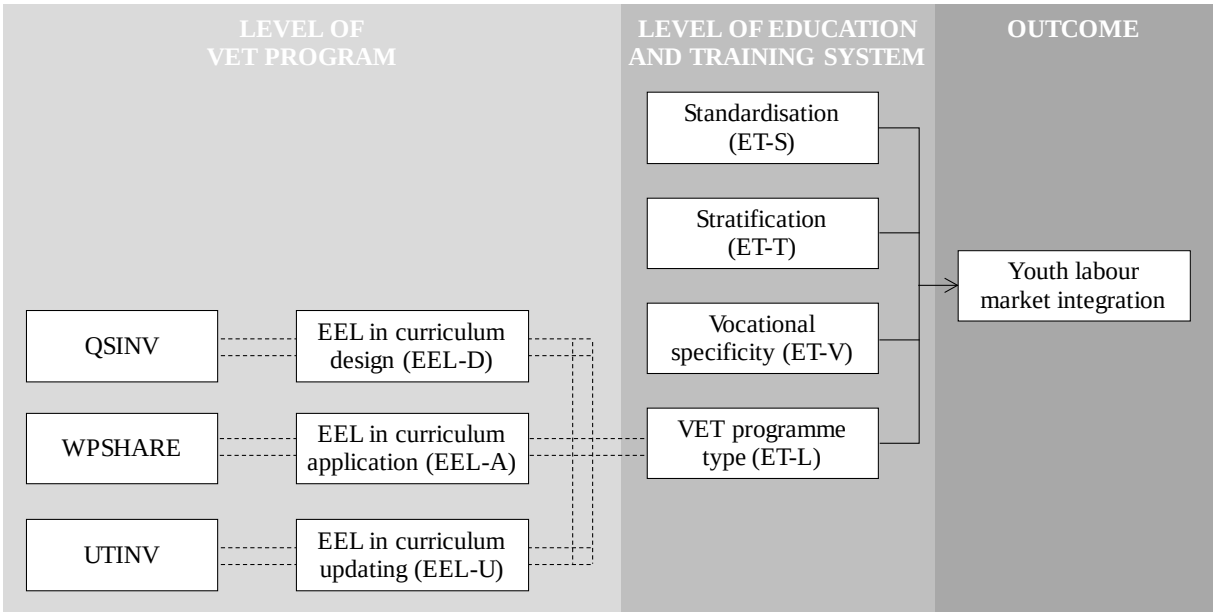
Building on Schneider and Wagemann's (2006) two-step approach, I also analyse how the real types of VET programmes are related to the education and training systems' organisational characteristics (e.g. Allmendinger 1989; Müller and Shavit 1998), which I call 'domain conditions'. First, to measure the set of highly standardised education and training systems, I use the 2012 PISA data (OECD 2014) on the extent to which schools are responsible for a list of tasks, such as choosing textbooks and course content (Bol and Van de Werfhorst 2013). Second, following Lavrijsen, Nicaise, and Poesen-Vandeputte (2014) and Bol and Van de Werfhorst (2013), I measure the set of high stratification by the age of first tracking (OECD 2005; International Bureau of Education (UNESCO-IBE) 2012; Renold et al. 2016; Center on International Education Benchmarking (CIEB) 2017). Third, I follow the literature (Müller and Shavit 1998; Bol and Van de Werfhorst 2013; Lavrijsen, Nicaise, and Poesen-Vandeputte 2014) by using the share of students enrolled in VET relative to all upper-secondary students to measure the set with high vocational specificity. This condition also accounts for the variation between cases in terms of the relevance of VET for the education and training system.

In the appendix, Table A3 presents the descriptive statistics of the causal and domain conditions and their calibration cut-offs. In addition, Figures A2 through A7 illustrate the distribution of the original values and the calibrated membership scores.

Figure 1 summarises the explanatory model. At the VET programme level, the boxes on the left represent the three features that I use to measure the education-employment linkage in each process phase of the CVC. These features include the employer involvement in

defining the qualification standards (QSINV), the share of workplace training in comparison to classroom education (WPSHARE), and the employer involvement in setting the update timing (UTINV). The configurations of the education-employment linkage in any process phase represent the VET programme real types. As these real types are embedded in different education and training systems, I analyse to what extent they are connected to the standardisation, stratification, and vocational specificity of education and training, and how these configurations relate to youth labour market integration.

Figure 1. Two-level structure of explanatory model



Note: QSINV=employer involvement in setting the qualification standards; WPHSARE=share of workplace training, UTINV=employer involvement in setting the update timing; EEL=education-employment linkage; dashed lines indicate an ontological relation, and arrows indicate a causal one.

Real types of VET programmes

Programme level: real types of VET programmes

This section identifies the configurations of the causal conditions and examines their relation to high youth labour market integration. Thus the rows in the truth table (table 2) display every logically possible configuration of the education-employment linkage in VET curriculum

design (EEL-D), application (EEL-A), and updating (EEL-U). Columns EEL-D, EEL-A, and EEL-U list memberships over 0.5 in the set with strong education-employment linkage as one, while those below 0.5 are zeroes. The column OUTCOME indicates for each configuration whether it combines with high youth labour market integration more often (value 1) than not (value 0). The Column 'Consistency' shows how consistent each configuration is with the argument of being sufficient for producing that outcome (Ragin 2006). The column 'N' indicates how many cases are in each row and the column 'cases' lists them.

Table 2. Truth table of the education-employment linkage in curriculum design (EEL-D), application (EEL-A), and updating (EEL-U) for high youth labour market integration (outcome)

	EEL-D	**EEL-A**	**EEL-U**	**OUTCOME**	**Consistency**	**N**	**Cases**
DAU	1	1	1	1	0.874	4	**AT, CH, DE, DK**
DAu	1	1	0	0	0.799	1	NO
Dau	1	0	0	0	0.751	5	**EE,** HU (CN), IS, PL, **SI**
dAu	0	1	0	0	0.762	4	FI, HK, **JP**, SG
dau	0	0	0	?	0.732	4	**CO (US)**, KR, **NL**, TW
dAU	0	1	1	?	-	0	-
DaU	1	0	1	?	-	0	-
daU	0	0	1	?	-	0	-

Data source: Renold et al. (2016, 2017).

Note: N=18; EEL-D measured by the membership in the set in which employers are the main actors in defining the qualification standards; EEL-A measured by the membership in the set in which learning takes place mostly at the workplace; EEL-U measured by the membership in the set in which employers are the main actors in defining the update timing; 'outcome' measured by the membership in the set of high youth labour market integration (low relative unemployment ratio), bold cases are members in this set.

Table 2 indicates that the sample covers five configurations of the education-employment linkage in any process phase. Cases with the configuration DAU[9] have the greatest consistency (0.874) for being sufficient for high youth labour market integration. In the sample, only VET programmes with a strong linkage throughout the entire CVC (configuration DAU) are always related to a favourable youth labour market. This finding confirms the interdependencies of the three process phases in producing that outcome. However, the low solution coverage of 0.592 suggests that the model does not explain a substantial number of cases where the outcome is present (Ragin 2006). That the truth table includes only conditions of VET programmes and no other domain conditions reinforces this limitation.

The other four empirically present configurations show inconsistent outcomes. In the two configurations with a strong education-employment linkage in either only the curriculum design (Dau) or only the curriculum application (dAu), most cases do not show the outcome. The outcome of the configuration with no linkage in either process phase (dau) is unclear, as half the cases have high youth labour market integration but half do not. Due to limited diversity, the three last rows of the truth table are 'remainders' (Ragin and Sonnett 2005), they are not on the sample.

Applying the logic of typologies, I argue that each empirically present configuration in the truth table stands for a real type of VET programmes. Figure 2 presents the five VET programme types covered by the sample: i) the all-linkage VET programmes (DAU); ii) the double-linkage ones (DAu); iii) the design-linkage ones (Dau); iv) the application-linkage ones (dAu); and v) the no-linkage ones (dau).

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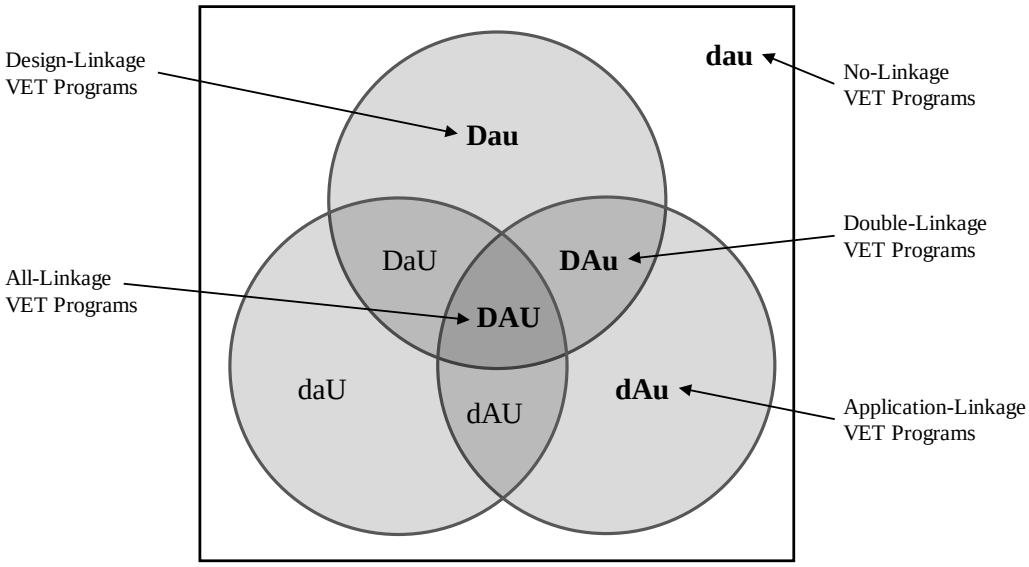
[9] In Boolean notation, capital letters stand for present conditions and lowercase letters denote their absence.

Figure 2. Real types of VET programmes



Note: A=strong education-employment linkage in curriculum application, D=strong education-employment linkage in curriculum design, U= strong education-employment linkage in curriculum updating; capital letters stand for present conditions; lowercase letters denote their absence.

The three German-speaking countries – Austria, Germany, and Switzerland – and Denmark have *all-linkage VET programmes* in which actors from the education and employment systems optimally cooperate throughout the entire CVC. These countries are well known for their dual VET programme, which some scholars also call 'apprenticeship programmes' (e.g. Wolter and Ryan 2011; Eichhorst et al. 2015). These programmes complement the learning of general education with occupation-specific skills and combine education and training in the school and workplace (e.g. OECD 2004; Wolter and Ryan 2011). In all-linkage VET programmes, employers are the main actors in setting the qualification standards and defining the update timing. Moreover, this employer involvement in curriculum design and updating is legally defined.

In the curriculum application phase, all-linkage VET programmes in these four countries combine a high share of workplace training with some classroom education. Moreover, periods of classroom education alternate weekly or semi-annually with workplace training in firms (Renold et al. 2016). This workplace training allows students to apply their skills in a practical setting (Wolter and Ryan 2011). In addition, as the two learning places

advance the acquisition of different kinds of skills – for example, students can acquire social skills more effectively in the workplace – these places are complementary (e.g. Aarkrog 2005; Bolli and Renold 2017; Baartman, Kilbrink, and de Bruijn 2018). In addition, the workplace training in Austrian, Danish, German, and Swiss VET programmes is mostly structured and regulated, with a curriculum that ensures the acquisition of legally prescribed practical skills (Billett 2011).

Norway is the only case in which the largest VET programme has a strong education-employment linkage in two out of three process phases, thus having a *double-linkage VET programme*. The 'Apprenticeship' programme in Norway consists of half workplace training and half classroom education, ensuring only a moderate education-employment linkage in curriculum application (Renold et al. 2016). In addition, the workplace curriculum in Norway is mostly but not completely implemented. While Norwegian employers are also important actors in defining the curriculum content, they are only somewhat involved in deciding on the update timing. While the law broadly specifies employer involvement in the curriculum design, it does not do so for update timing.

VET programmes with an education-employment linkage in only one process phase have a strong linkage either in the design or updating of the curriculum. *Design-linkage VET programmes,* in which actors from the education and employment systems optimally cooperate only in the curriculum design phase, appear in Estonia, Iceland, Poland, Shanghai (China), and Slovenia. While in these VET programmes, employers are the main actors in setting the qualification standards (an involvement also defined by law), no education-employment linkage appears in the application or updating phases. In the analysis, all VET programmes of the design-linkage type have only minor workplace training and thus are mostly school-based. Although the law in Estonia and Iceland defines employer involvement in deciding when VET curriculum updates are necessary, these laws do not ensure a strong linkage.

Application-linkage VET programmes include those that are members in the set with considerable workplace training but without a strong education-employment linkage in the other two process phases. The VET programmes represented by this real type are Finland, Hong Kong, Japan, and Singapore. In this real type, Finland is the only country that legally defines employer involvement in the curriculum design and updating, although employers are only somewhat involved.

In Hong Kong's 'Diploma in vocational education (DVE)' programme, only a small share of students participate in the new 'Earn & Learn' pilot, which combines school-based and workplace learning (VTC Vocational Training Council 2017). In contrast, most DVE students remain in simulated workplace environments within the school. The same applies to the Singaporean 'Institute of technical education (ITE)' programmes (Renold et al. 2016). The workplace training in Hong Kong's 'Earn & Learn' pilot and the VET programmes in Finland and Singapore are structured and regulated by a curriculum (Renold et al. 2016). However, in the three Asian countries, students' examinations take place almost exclusively in schools, and employers are only minimally involved. While the all-linkage VET programmes in Austria, Denmark, Germany, and Switzerland have more than 50 per cent workplace training, the workplace share is less than half in the application-linkage VET programmes (Renold et al. 2016). Nonetheless, in these application-linkage VET programmes, employers also provide site visits, job shadowing, and information about the world of work.

No-linkage VET programmes in Colorado (US), the Netherlands, South Korea, and Taiwan have no strong education-employment linkage in any of the curriculum process phases. First, in the curriculum design phase, employers are only somewhat involved in the definition of the qualification standards or the examination form. However, in all the cases except that of Colorado (US), the employer involvement in the curriculum design is legally defined. Second, in the curriculum application phase, students in no-linkage VET programmes spend only minor

time in workplace training and most of their time in a classroom. Only Colorado (US) and the Netherlands have a mostly implemented curriculum for the workplace training. Third, in the curriculum updating, employers are only somewhat involved in setting the update timing, although this involvement is slightly higher (and legally defined) in the Dutch 'MBO BOL' programme and also legally defined.

System level: VET programme types in different education and training systems

This section presents to what extent the real types of VET programmes are connected to those education and training system organisational characteristics mentioned in the literature (e.g. Hannan, Raffe, and Smyth 1996; Lavrijsen, Nicaise, and Poesen-Vandeputte 2014). Given my finding that only all-linkage VET programmes are sufficient for high youth labour market integration, I apply the 'weakest-link approach' (Dixon and Goertz 2006) to investigate VET programmes in different education and training systems. I therefore measure the membership in the set with strong education-employment linkage by the lowest membership in the three causal conditions. This approach shows that none of the causal conditions alone is sufficient for the outcome and that they therefore cannot compensate for one another.

Table 3 outlines the truth table with all empirically present configurations of the VET programme and the three domain conditions for the organisational structure of the education and training system. The table shows that VET programmes with a strong education-employment linkage exist either in cases with a highly standardised, stratified, and vocationally specific education and training system (LSTV), or in systems that are vocationally specific but not standardized nor stratified (LstV). In these two configurations, all cases display high youth labour market integration. Thus the high share of students enrolled in VET programmes at the upper-secondary education level in Austria, Denmark, Germany, and Switzerland – countries of the all-linkage real type – allows the education-employment linkage

in these countries largest VET programmes to substantially affect the labour market integration of young people. Moreover, their highly standardised and stratified education and training systems ensure a clear signalling of the values of the graduates' certificates (Allmendinger 1989; Hannan, Raffe, and Smyth 1996; Müller and Shavit 1998; Lavrijsen, Nicaise, and Poesen-Vandeputte 2014).

Table 3. Truth table of the education-employment linkage in VET (L) and the education and training system's standardisation (S), stratification (T), and vocational specificity (V) for high youth labour market integration

	OUTCOME	**Consistency**	**N**	**Cases**
LSTV	1	0.911	3	**AT, CH, DE**
LstV	1	0.914	1	**DK**
lsTV	1	0.864	1	**NL**
lstv	1	0.839	2	**JP**, **EE**
lSTV	0	0.735	3	HU (CN), SG, TW
lSTv	0	0.722	1	KR
lsTv	0	0.703	1	HK
lstV	0	0.829	2	IS, PL
lStV	?	0.760	4	**CO (US)**, **SI**, NO, FI

Data source: OECD (2005, 2014), UNESCO-IBE (2012), Renold et al. (2016, 2017), CIEB (2017).
Note: N=18; outcome measured by the membership in the set of high youth labour market integration (low relative unemployment ratio); bold cases are members in this set.

However, VET programmes without a strong education-employment linkage are associated with a favourable outcome. In the Netherlands, the largest VET programme is embedded in a highly stratified and vocationally specific education and training system (lsTV). Importantly, although the Dutch 'MBO BOL' programme belongs to the no-linkage real type, its membership scores in the set with strong linkage are very close to the crossover – except for

the share of workplace training. The VET programmes in Japan and Estonia are embedded in education and training systems that are neither standardised nor stratified nor vocationally specific (lstv) but are associated with high labour market integration. While the Estonian VET programme has only a strong education-employment linkage in the curriculum design phase, the Japanese one optimally links the two kinds of actors only in the application phase.

All other VET programmes without a strong education-employment linkage are non-members in the set with high youth labour market integration. The only exceptions are those VET programmes in highly stratified and vocationally specific education and training systems (lStV) with an unclear outcome. In this configuration, Colorado (US) and Slovenia have high youth labour market integration despite having VET programmes of the no-linkage or design-linkage type, respectively.

Comparing the VET programme real types to the ideal types

This section compares the real types identified in the previous section Rageth and Renold's (2017) VET ideal types. Rageth and Renold (2017) argue that the similarity of a real type to one of their ideal types helps us explain youth labour market outcomes. Using their ideal types as yardsticks thus allows me to identify the conditions important for understanding the causal structure of a real type (Fiss 2011).

All-linkage VET programmes come closest to the first ideal type, with a power-equilibrium – and thus a strong education-employment linkage in all three process phases. However, Germany displays comparably low membership scores in the two sets with a strong linkage in the curriculum design and updating. Increasing the employer involvement in these two process phases would make Germany's dual VET programme more similar to the first ideal type. However, as Germany has the highest youth labour market integration in my

sample, the high amount of workplace training may partially compensate for the improvable education-employment linkage in the other two process phases.

That no other real type is clearly connected to high youth labour market integration supports the argument that none of the causal conditions alone is sufficient for a favourable outcome. In comparison to the power-sharing ideal type, the double-linkage 'Apprenticeship' programme in Norway –connected to low youth labour market integration – lacks an education-employment linkage in curriculum updating. This finding points to the high relevance of update timing. A look at the set relation reveals that the set in which employers are the main actors in setting the update timing is quasi-sufficient[10] for the outcome (consistency=0.858; see figure A8 in the appendix). This set relation may explain Norway's difficulties in integrating young people into the labour market, despite its double-linkage and a highly standardised and vocationally specific education and training system.

VET programmes with a strong education-employment linkage in only one process phase deviate from the power-equilibrium ideal type in the other two phases. Nevertheless, three out of nine cases of the design-linkage and application linkage real types are members in the set with high youth labour market integration. For the design-linkage VET programmes, the nonconforming cases are Estonia and Slovenia. Despite alternating periods of work- and school-based learning, students in these VET programmes spend most of their time in school. While Slovenia's education and training system is standardized and vocationally specific, the one in Estonia is neither standardized nor stratified nor vocationally specific. Moreover, Estonia has weaker employment protection than the OECD average, whereas the one in

[10] 'Quasi-sufficient' in fsQCA means that consistencies are not yet sufficient for producing an outcome.

Slovenia is clearly above that average (despite recent measures to increase labour market flexibility according to Rokicka et al. (2018)).

However, with unemployment rates of 13 per cent and 16 per cent, respectively, youth unemployment is comparably high in Estonia and Slovenia. In addition, the formal education and training rate in Estonia is relatively low, showing that many young people receive no formal education after compulsory schooling (Pusterla 2017; Rokicka et al. 2018). In Slovenia, jobs for young people are often low quality as indicated by relatively high rates of atypical working hours and temporary jobs (O'Reilly et al. 2015; Eichhorst, Marx, and Wehner 2017; Pusterla 2017). These descriptions of young people's labour market situations in Estonia and Slovenia demonstrate a weakness of this paper: that because I measure the outcome by youth labour market integration, I consider only whether young people are employed or not, not factors such as working conditions or transition smoothness (e.g. Freeman and Wise 1982; Dewan and Peek 2007; Renold et al. 2014).

As in three of four cases, the application-linkage real type is not sufficient for a favourable youth labour market, a high amount of workplace training alone does not sufficiently prepare young people for labour market entry. Indeed, that employers are involved in defining the skills and competencies that VET students should learn in the curriculum application is equally important as is deciding when these qualifications need updating. Japan is the only country with both an application-linkage VET programme and high youth labour market integration. As in Estonia, Japan's education and training system is neither standardized nor stratified nor vocationally specific. However, Japan's labour market structure may explain its high outcome: Japanese firms hire workers directly out of school for near-lifetime employment (Hannan, Raffe, and Smyth 1996; Freeman 2007; Pilz and Alexander 2011).

As actors from the education system are always main partners in the curriculum design, application, and updating of formal VET programmes, programmes of the no-linkage real type must lack employer involvement. Thus VET programmes with no education-employment linkage, as represented by Colorado (US), the Netherlands, South Korea, and Taiwan, are closest to the education-led ideal type. Nevertheless, Colorado (US) and the Netherlands are members in the set with high youth labour market integration. While the Colorado 'High School Career and Technical Education (CTE)' programme scores low for all three process phases, the Netherlands, as mentioned earlier, represents a border case. In curriculum design and updating, the Dutch 'MBO BOL' programme nearly passes the crossover for being a member in the set with employers as main actors in setting the qualification standards and update timing. In addition, with 67 per cent enrolment in VET programmes, the Dutch education and training system is among the most vocationally specific, with its largest VET programme covering over half the upper-secondary enrolment (Renold et al. 2016).

Despite its high relative unemployment ratio, the Netherlands has comparably high youth unemployment (see table A2), temporary employment (Eichhorst, Marx, and Wehner 2017), and over-qualification (Quintini 2011; Pusterla 2017). Although the Dutch labour market has a well-developed 'flexicurity' system, with flexible working conditions and strong social security rights (Crowley et al. 2013), this system mostly applies to temporarily or self-employed young workers (De Lange, Gesthuizen, and Wolbers 2012; Gerritsen and Høj 2013). In contrast, the labour market for older and better skilled workers is still based on a rigid regulatory framework (Gerritsen and Høj 2013).

Although the 'high school career and technical education (CTE)' programme in Colorado (US) includes no education-employment linkage in either process phase, Colorado (US) has the highest relative unemployment ratio in the sample. However, according to Sorrentino (2000), the unemployment data from the United States have different standards than

those of the ILO (2016). Importantly, the U.S. Bureau of Labor Statistics (2013) has higher standards for what constitutes an active job search than the ILO (2016). Moreover, despite its favourable youth labour market, Colorado clearly suffers from a middle-skills gap (Skills2Compete-Colorado Campaign 2011; Renold, Bolli, and Caves 2017).

Conclusion

This paper identifies five real types of VET programmes that represent different configurations of the education-employment linkage in any curriculum process phase. The all-linkage type, with a strong linkage in curriculum design, application, and updating, constitutes the only path to high youth labour market integration. Hence, educational reform leaders and policymakers should consider that only those VET programmes in which actors from the education and employments systems optimally cooperate in all three process phases are associated with high integration of young people into the labour market. This finding both shows that the different curriculum process phases are interdependent and supports Rageth and Renold's (2017) theoretical argument that VET programmes need to ensure a strong linkage between actors from the two systems. However, the finding also calls into question the argument that multiple paths towards high youth labour market integration exist. Importantly, providing only enough workplace training in VET programmes is not consistently connected to a favourable outcome.

Although the set relations indicate that a strong education-employment linkage in deciding when a VET curriculum update needs to occur might be sufficient for the outcome, the sample does not include any case that clearly confirms this quasi-sufficient condition. Further research might therefore establish the relevance of the education-employment linkage in curriculum updating for the youth labour market integration.

By including the organisational characteristics of education and training systems, I show that all-linkage VET programmes exist only in vocationally specific systems in which the

share of students enrolled in upper-secondary VET programmes is above 45 per cent. Further research should investigate whether all-linkage VET programmes with lower enrolment rates exist and, if so, whether they are also connected to high youth labour market integration. In addition, my findings show that three of four cases with all-linkage VET programmes have a highly stratified and standardised education and training system, supporting the findings of Allmendinger (1989), Hannan, Raffe, and Smyth (1996), Müller and Shavit (1998), and Lavrijsen, Nicaise, and Poesen-Vandeputte (2014).

The other four real types – the double-, design-, application, und no-linkage VET programmes – are in most cases connected to low youth labour market integration. However, each of these real types also includes some nonconforming cases. Although the largest VET programmes in those cases do not provide a strong education-employment linkage in all three curriculum process phases, they successfully integrate young people into the labour market. However, the previous section shows that especially the different labour market structures and working conditions for young people possibly explain the nonconforming cases. Future studies should explore alternative indicators for measuring the situation of young people in the labour market, to also factor in their working conditions or formal education and training rates.

Importantly, generalisations beyond those from the largest VET programmes in the 18 countries and states presented here need to reflect on the 'scope conditions' (Schneider and Wagemann 2010) that delimit the sample analysed. First, the sample includes only developed countries that are top performers in terms of either the youth labour market or the school quality of lower-secondary education as measured by PISA (Renold et al. 2016, 2017). While these countries are comparable in terms of their development status, they may differ in their cultural and political contexts. Moreover, as the highest youth unemployment rate is 22 per cent in Finland, my sample does not include the countries that were most affected by the 2008

financial crisis, such as Spain and Greece, with over 50 per cent youth unemployment (Scarpetta, Sonnet, and Manfredi 2010; Eichhorst and Neder 2014; Pusterla 2017).

By analysing the relation between the education-employment linkage in VET and the youth labour market, this paper shows how educational reform leaders and policymakers might overcome problems with coordination and control in VET programmes. As only all-linkage VET programmes are connected to a favourable youth labour market, analysing those programmes helps both scholars and policymakers learn from these top performers. Moreover, to guide the design of future VET reforms, further research could observe the development of the linkage between actors from the two systems over time.

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Appendix

Table A1. Outline of features measuring the education-employment linkage

FEATURE	QUESTION	EMPIRICAL WEIGHT
CURRICULUM DESIGN PHASE		
Subjective Assessment		
	Overall, how much power do employers have during the process of VET curriculum development?	
Objective Assessment		
Qualification Standards		
Qualification Standards: Involvement	Are employers involved in defining qualification standards? *Qualification standards describe the content and level of complexity that a student should master to graduate, such as being able to machine a part within 0.5mm of its specified dimensions (not simply being able to machine a part of unspecified quality).*	15.8%
Qualification Standards: Decision Power	Are employers involved in final decisions on qualification standards? *Decision power is the authority to decide what the final curriculum should be when stakeholders disagree.*	0.0%
Examination Form		
Examination Form: Involvement	Are employers involved in defining the examination form? *The examination form includes whether the teacher or an external examiner gives the examination, where it takes place (e.g. school or workplace), and who writes it.*	11.8%
Examination Form: Decision Power	Are employers involved in the final decision of the examination form? *Decision power is the authority to decide what the final examination form should be when stakeholders disagree.*	0.0%
Involvement Quality		
Career vs Occupation vs Job	Does the VET curriculum seek to prepare students for the firm-specific job in which they train, for an entire occupation, or for having a career in general?	0.0%
Firms vs Employer Associations	How are employers involved in the VET curriculum development phase?	4.0%
Legal Def. of Involvement	Is the participation of employers in the process of VET curriculum development defined by law?	10.2%
Represented Firm Share	What share of firms is represented in the VET curriculum development process, either individually or through employer associations (e.g. in a working	0.1%

FEATURE	QUESTION	EMPIRICAL WEIGHT
	commission, through consultation, or in a reform commission)?	
CURRICULUM APPLICATION PHASE		
Subjective Assessment		
	Overall, how much power do employers have during the process of VET curriculum application?	
Objective Assessment		
Learning Place		
Classroom vs Workplace Share	What are the approximate average shares of time spent in VET classroom education and in workplace training?	13.2%
Site Visits *If no workplace training*	About how many students participate in site visits and job shadowing?	
Counselling *If no workplace training*	Are employers involved in providing students information about the world of work? Examples include job fairs, websites showing job opportunities, and student mentoring.	
Legal Def. of Share *If both school education and workplace training*	Are the shares of time spent in VET classroom education and in workplace training specified by law?	0.0%
Workplace Training Regulation		
Work Contract	Are student rights defined by a work contract?	1.7%
Workplace Training Curriculum: Existence	Is there a curriculum/training plan/syllabus for workplace training?	0.0%
Workplace Training Curriculum: Implementation *If workplace training curriculum exists*	Is the workplace training curriculum/training plan/syllabus implemented?	6.9%
Legal Definition Workplace Trainer: Existence	This set of questions involves the quality assurance of trainers and instructors in the workplace, i.e. those responsible for workplace training. Are employers legally required to have specific trainers/instructors responsible for workplace training?	0.0%
Legal Definition Workplace Trainer: Number *If workplace trainer number legally defined*	Is there a legally defined number of students per trainer/instructor?	
Legal Definition Workplace Trainer: Training	Are trainers/instructors in employers legally required to receive specific training?	

FEATURE	QUESTION	EMPIRICAL WEIGHT
If workplace trainer number legally defined		
Legal Definition Workplace Trainer: Continuous Training *If workplace trainer number legally defined*	Are trainers/instructors in employers legally required to continuously update their knowledge/skills?	
Cost Sharing		
Cost Sharing Classroom Education	For classroom education: Who bears the costs for VET classroom education? *To focus on linkage, we ask only about firms' part of the costs. When students or the education system bear all costs, firms bear none.*	1.5%
Cost Sharing Workplace Training	*For workplace training:* Who bears the costs for workplace training (e.g. equipment, training material, trainer salary, student salary)? *To focus on linkage, we ask only about firms' part of the costs. When students or the education system bear all costs, firms bear none.*	0.0%
Equipment Provision		
Employer Share Equipment Provision	Do employers provide equipment for VET classroom education?	0.0%
Employer Equipment Provision Quality *If firms provide equipment*	Is the equipment up to date (is it the best available technology)?	0.0%
Teacher Provision		
Classroom Education Teacher: Employer Provision	Do employers provide part-time teachers for VET classroom education?	3.2%
Classroom Education Employer Teacher: Training *If firms provide classroom education teachers*	Are classroom teachers provided by employers legally required to receive specific training?	
Classroom Education Employer Teacher: Continuous Training *If firms provide classroom education teachers*	Are classroom teachers provided by employers legally required to continuously update their knowledge/skills?	
Examination		
Practical Share of Examination	How much of final grades are defined by the practical part of the examination?	0.0%

FEATURE	QUESTION	EMPIRICAL WEIGHT
Practical Examination: Location *If practical examination exists*	How much of the grade for the practical part of the examination is defined by what happens at the workplace?	0.3%
Practical Examination: Employer Expert Share *If practical examination exists*	What share of experts in the practical part of the examination are provided by employers?	
Practical Examination: External Supervision *If practical examination takes place at workplace*	Is the exam overseen or given by external experts (e.g. members of national or regional commissions)?	7.7%
CURRICULUM UPDATING PHASE		
Subjective Assessment		
	Overall, how much power do employers have during the process of VET curriculum feedback?	
Objective Assessment		
Information Gathering		
Employer Surveys	Do any surveys ask employers whether graduates of the VET programme perform well in the workplace? *For example: Do graduate web-designers know how to design a website on their own? Do graduates generally perform well in the workplace?*	0.7%
Labour Force Surveys	Are there any labour force surveys on how graduates of the VET programme fare in the labour market? *For example: Do graduating web designers find jobs? Do they work in the web design industry?*	0.5%
Update Timing		
Employer Involvement	To what extent are employers involved in deciding when updates are necessary?	15.5%
Legal Def. Employer Involvement *If firms involved*	Is the involvement of employers in such decisions defined by law?	6.7%

Note: Items provided by Renold et al. (2016, 2017).

Table A2. Indicators for the youth labour market in the 18 cases

CASE	YOUTH UNEMPLOYMENT		RELATIVE UNEMPLOYMENT	
	Rate	Rank	Ratio	Rank
Colorado (CO (US))	6.500	3	1.161	1
Germany (DE)	7.222	4	1.664	2
Japan (JP)	5.590	2	1.741	3
The Netherlands (NL)	11.297	13	1.859	4
Slovenia (SI)	16.368	16	1.938	5
Denmark (DK)	10.804	12	2.036	6
Austria (AT)	10.536	11	2.111	7
Switzerland (CH)	8.592	5	2.182	8
Estonia (EE)	13.143	15	2.353	9
Shanghai (HU (CN))	10.466	10	2.791	10
Norway (NO)	9.854	8	2.886	11
Singapore (SG)	4.203	1	2.901	12
Island (IS)	8.661	6	2.941	13
Finland (FI)	22.293	18	2.975	14
Poland (PL)	20.634	17	3.265	15
Hong Kong (HK)	9.020	7	3.274	16
South Korea (KR)	10.465	9	3.408	17
Taiwan (TW)	11.993	14	4.078	18
Descriptive statistics				
Mean	10.980	-	2.559	-
St. Dev.	4.741	-	0.704	-
Min.	4.203	-	1.664	-
Max.	22.293	-	4.078	-

Data source: ILO-KILM 2015 (ILO 2016); the data of China is used as a proxy for Shanghai (HU (CN)); for Colorado, see U.S. Bureau of Labor Statistics (2017).

Note: The shadings mark the six qualitative groupings for the indirect calibration.

Table A3. Descriptive statistics and calibration cut-offs for the conditions

Condition	Mean	St. Dev.	Min.	Max.	Set name	Fully out	Cross-over	Fully in
Causal Conditions								
EEL in curriculum design[1]	2.75	0.79	1.00	4.00	Strong linkage in design	1.00	2.60	4.00
EEL in curriculum application[2]	3.33	1.20	2.50	5.50	Strong linkage in application	2.00	2.70	5.25
EEL in curriculum updating[1, 3]	2.29	0.82	1.00	4.00	Strong linkage in updating	1.00	2.60	4.00
Domain conditions								
Standardisation of ET system[4]	1.44	0.17	1.08	1.78	High stand-ardardisation	1.00	1.40	2.00
Stratification of ET system[5]	14.00	2.00	10.00	16.00	High stratification	16.00	14.50	10.00
Vocational speci-ficity of ET system[6]	45.98	19.46	7.00	80.00	High specificity	10	30	65

Data source: OECD (2005, 2014); UNESCO-IBE (2012); Renold et al. (2016, 2017); CIEB (2017).

Note: N=18; ET=education and training; [1]1=not at all involved, 2= somewhat involved, 3=equal partners, 4=main actors, 5=only actors; [2]scale from 1=no workplace training, 2.75=some workplace training, 3.5=half workplace training, 5.25=most workplace training, 7=only workplace training; [3]values imputed for Estonia and Poland based on the other features of the curriculum updating phase. [4]1=school has all responsibility, 3=national education authority has all responsibility; [5]age of first tracking; [6]share of students enrolled in VET of all upper-secondary students.

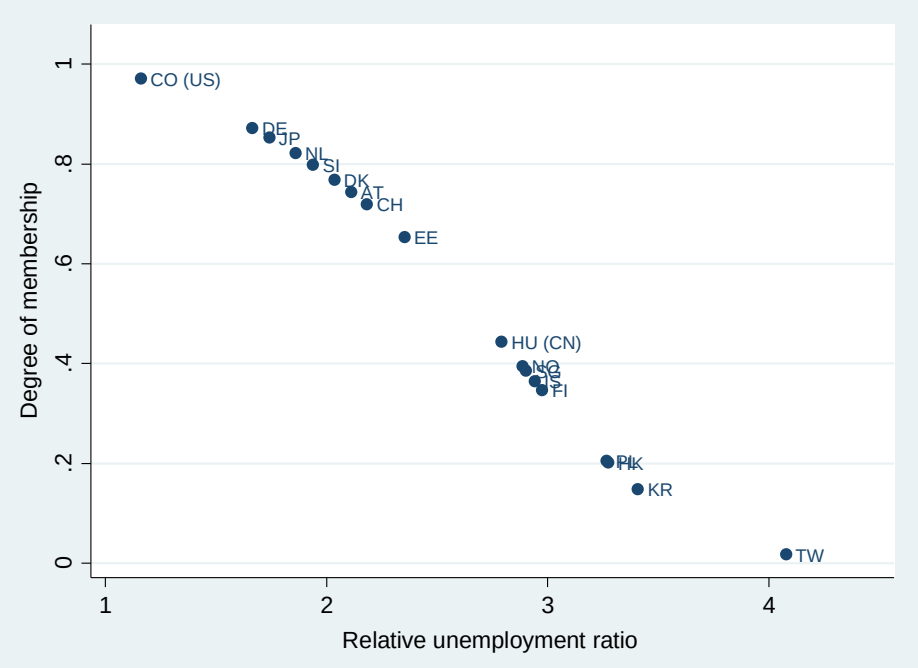
Table A4. Fuzzy membership scores for the largest VET programmes in 18 countries and states

CASE	OUTCOME	CAUSAL CONDITIONS			DOMAIN CONDITIONS		
	High youth labour market integration	**Strong EEL in curriculum design**	**Strong EEL in curriculum application**	**Strong EEL in curriculum updating**	**Standardisation of education and training system**	**Stratification of education and training system**	**Vocational specificity of education and training system**
CO (US)	0.971	0.204	0.263	0.188	0.352	0.047	0.667
DE	0.872	0.702	0.964	0.702	0.557	0.953	0.863
JP	0.853	0.047	0.515	0.047	0.328	0.269	0.295
NL	0.821	0.453	0.298	0.500	0.083	0.841	0.960
SI	0.799	0.953	0.298	0.245	0.747	0.269	0.927
DK	0.769	0.796	0.941	0.873	0.419	0.047	0.783
AT	0.744	0.953	0.964	0.953	0.809	0.953	0.986
CH	0.719	0.937	0.963	0.895	0.538	0.841	0.974
EE	0.653	0.702	0.298	0.245	0.322	0.269	0.426
HU (CN)	0.444	0.702	0.298	0.047	0.553	0.583	0.753
NO	0.394	0.702	0.822	0.245	0.737	0.047	0.868
SG	0.386	0.327	0.569	0.313	0.869	0.841	0.953
IS	0.365	0.702	0.298	0.453	0.401	0.047	0.558
FI	0.347	0.453	0.656	0.453	0.622	0.047	0.702
PL	0.205	0.702	0.298	0.245	0.570	0.269	0.906
HK	0.201	0.366	0.594	0.245	0.308	0.583	0.031
KR	0.148	0.245	0.298	0.113	0.625	0.583	0.135
TW	0.018	0.245	0.298	0.245	0.553	0.583	0.823

Data: OECD (2005), UNESCO-IBE (2012), OECD (2014), ILO (2016), Renold et al. (2016, 2017), CIEB (2017), and U.S. Bureau of Labor Statistics (2017).

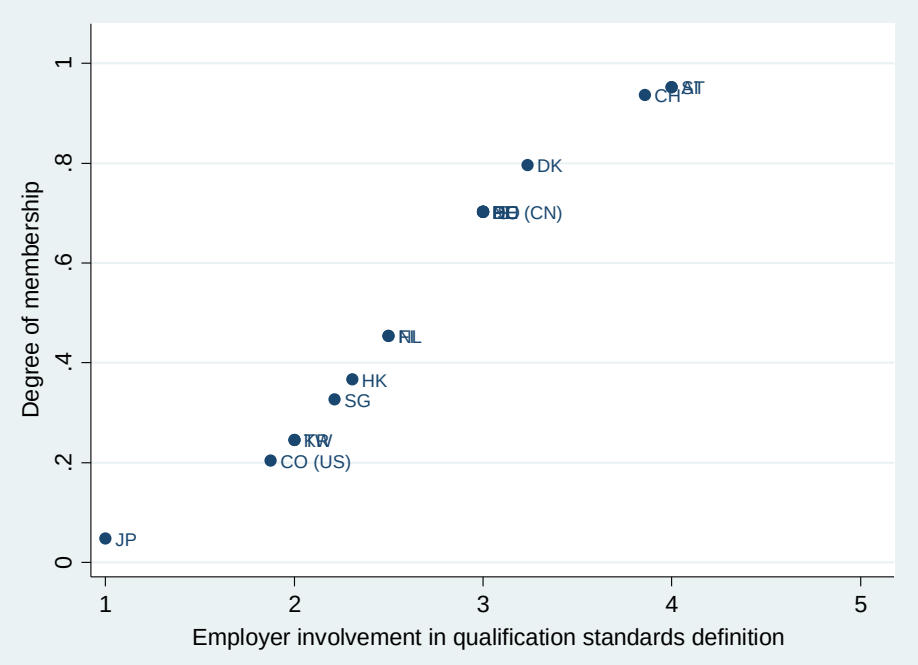
Note: EEL= linkage between actors from the education and employment systems.

Figure A1. Membership degree in the set with high youth labour market integration



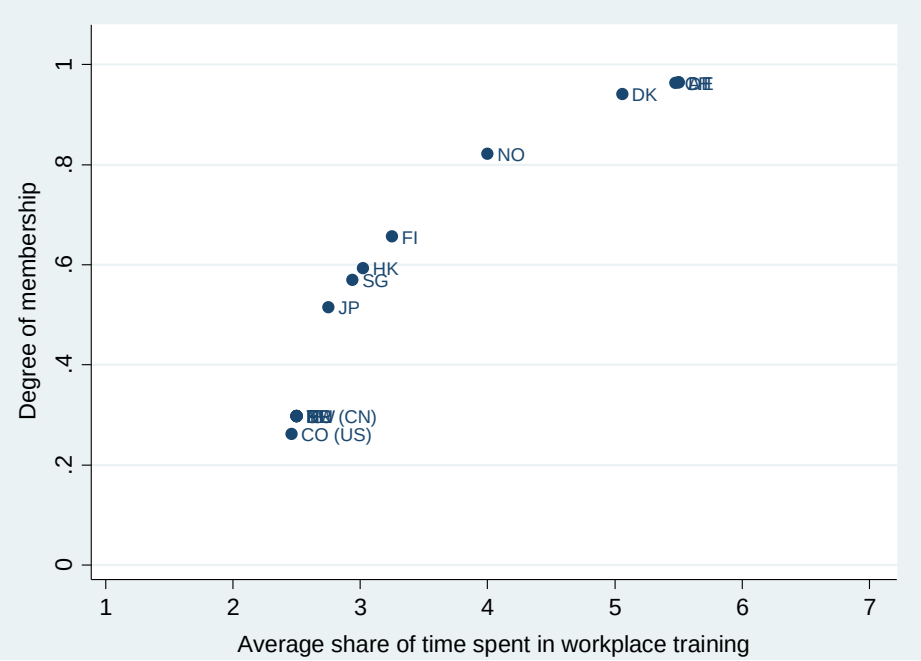
Note: Data from ILO (2016); for Colorado, see U.S. Bureau of Labor Statistics (2017). Plot shows correlation between membership degree in the set of high youth labour market integration and the relative unemployment ratio.

Figure A2. Membership degree in the set with strong linkage in VET curriculum design



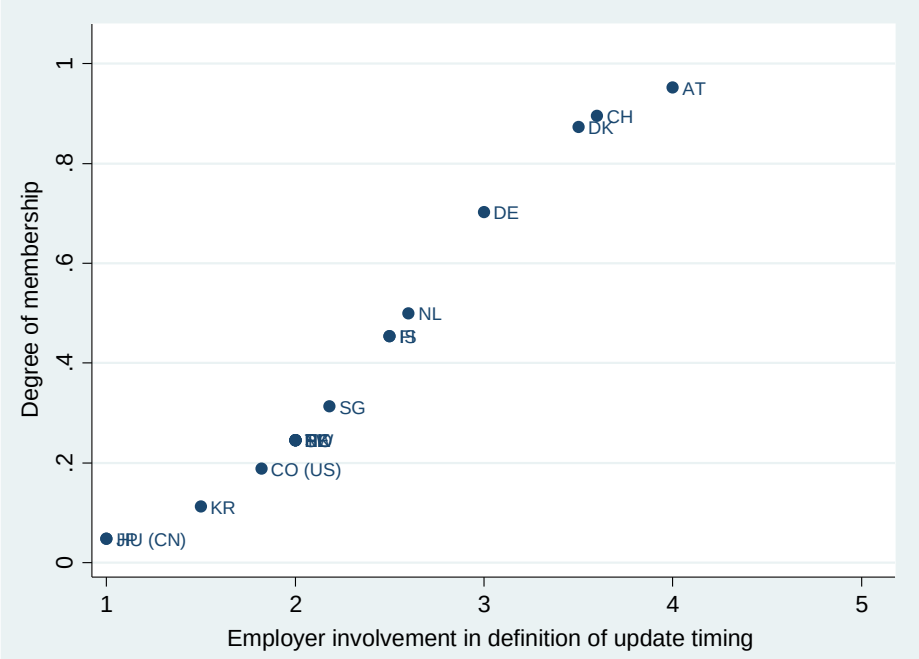
Note: Data from Renold et al. (2016, 2017). Plot shows correlation between membership degree in the set of strong education-employment linkage and employer involvement in qualification standards definition measured on a scale from 1 ‘not involved at all’ to 5 ‘only actors’.

Figure A3. Membership degree in the set with strong education-employment linkage in VET curriculum application



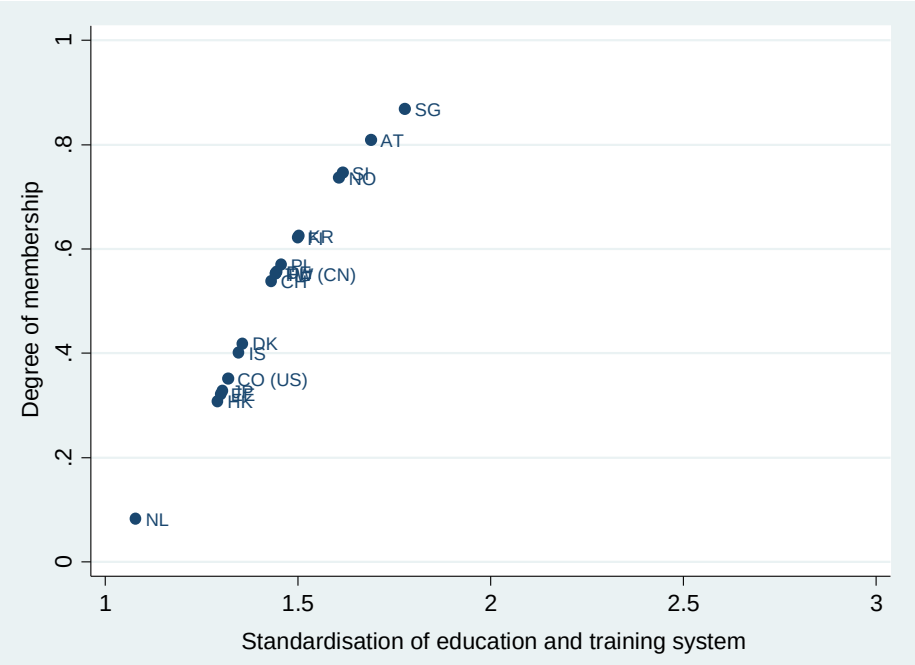
Note: Data from Renold et al. (2016, 2017). Plot shows correlation between membership degree in the set of strong education-employment linkage and average share of time spent at workplace measured on a scale from 1 ‘students spend no time in workplace training’ to 7 ‘students spend all time in workplace training’.

Figure A4. Membership degree in the set with strong education-employment linkage in VET curriculum updating



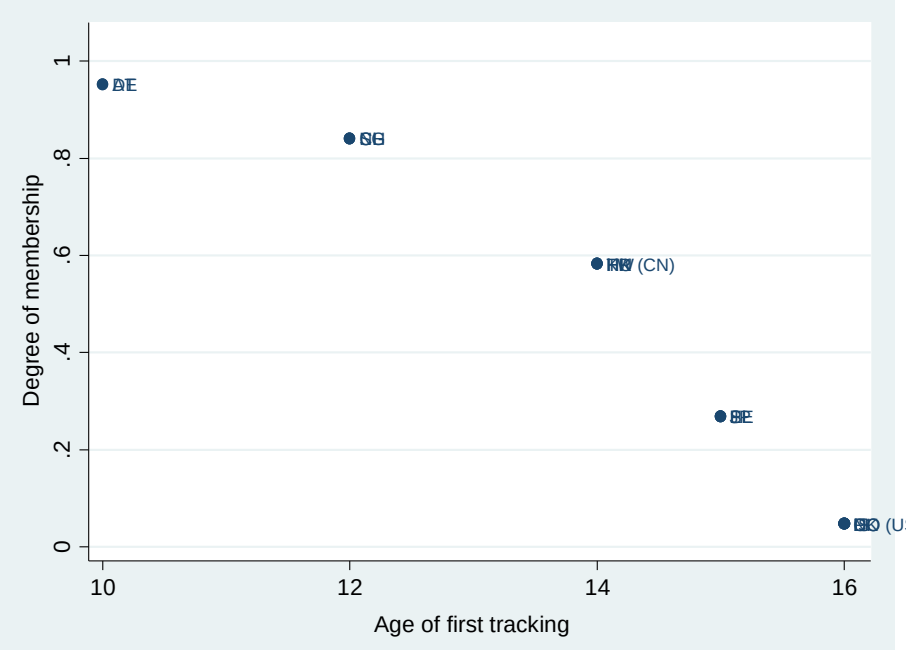
Note: Data from Renold et al. (2016, 2017). Plot shows correlation between membership degree in the set of strong education-employment linkage and employer involvement in definition of update timing measured on a scale from 1 ‘not involved at all’ to 5 ‘only actors’.

Figure A5. Membership degree in the set of standardized education and training systems



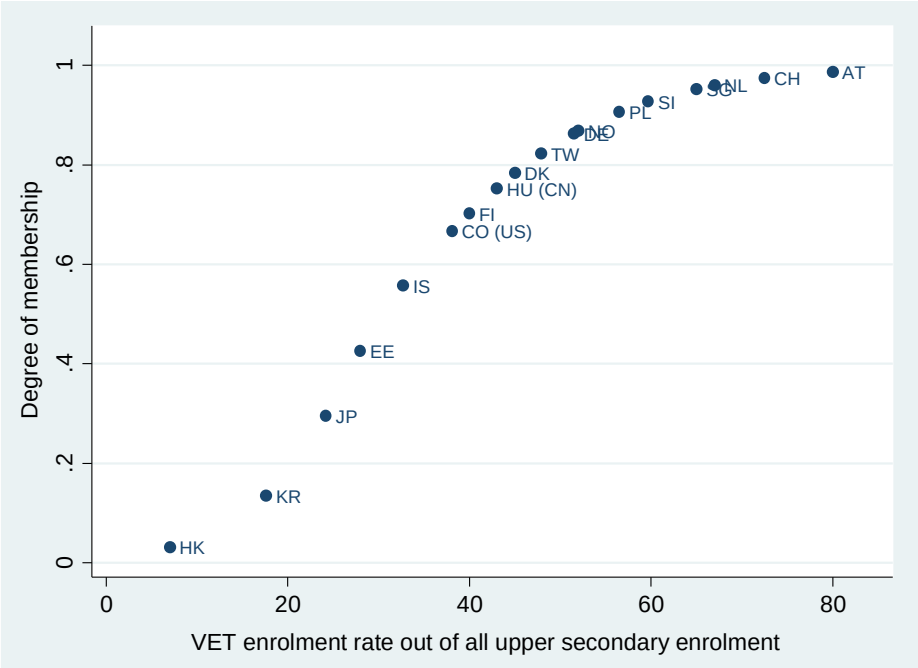
Note: Data from PISA 2012 (OECD 2014). Plot shows correlation between membership degree in the set of standardised education and training systems and school responsibility for a list of tasks measured on a scale from 1 ‘school has all responsibility’ to 3 ‘national education authority has all responsibility’.

Figure A6. Membership degree in the set of stratified education and training systems



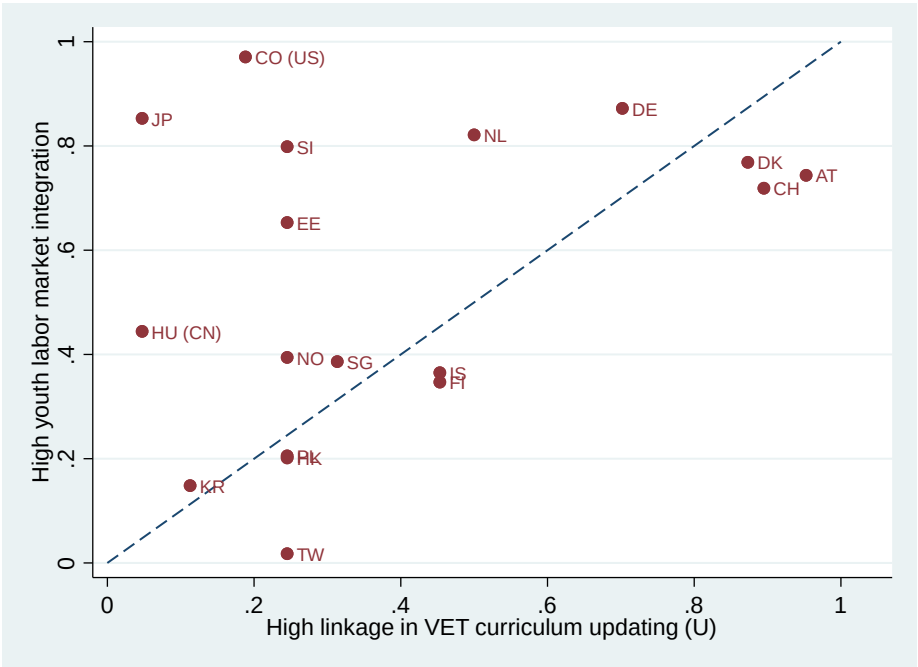
Note: Data from OECD (2005), UNESCO-IBE (2012), Renold et al. (2016), and CIEB (2017). Plot shows correlation between membership degree in the set of stratified education and training systems and age of first tracking.

Figure A7. Membership degree in the set of vocationally specific education and training systems



Note: Data from Renold et al. (2016, 2017). Plot shows correlation between membership degree in the set of vocationally specific education and training system and share of VET enrolment out of all upper-secondary enrolment.

Figure A8. XY plot for education-employment linkage in curriculum updating



Note: Data from Renold et al. (2016, 2017). Plot shows correlation between membership degree in the set with high youth labour market integration and membership degree in the set of strong education-employment linkage in curriculum updating; consistency for necessity=0.619; consistency for sufficiency=0.858.