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Social Status, Typology, and Labor Market Outcomes of Vocational Education and Training

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Diss. ETH No. 25058
KOF Dissertation Series, No. 36, 2018

KOF Swiss Economic Institute

Imprint

Publisher

KOF Swiss Economic Institute, ETH Zurich

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DISS. ETH NO. 25058

SOCIAL STATUS, TYPOLOGY, AND LABOR MARKET OUTCOMES OF VOCATIONAL EDUCATION AND TRAINING

A thesis submitted to attain the degree of DOCTOR OF SCIENCES of ETH ZURICH
(Dr. sc. ETH Zurich)

presented by

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2018

Acknowledgments

I would especially like to thank Dr. Ursula Renold and Prof. Jan-Egbert Sturm for giving me the opportunity to write this PhD thesis while working at the KOF Swiss Economic Institute. Thank you Ursula for all our inspiring discussions, your valuable feedback on my work, and the opportunity to gain insight into many interesting projects. A big thank you goes to Prof. Jan-Egbert Sturm, Prof. Uschi Backes-Gellner and Prof. Andreas Diekmann for their valuable time and precious feedback. I also gratefully acknowledge the financial support of the Hirschmann Foundation and the Gebert Rüf Foundation.

I thank the whole "Education Systems" team for their support and motivating environment that advanced my research by fostering fruitful interactions and thinking across disciplines. A big thank you also to my co-authors, Thomas, Maria Esther, and Ursula for their efforts on behalf of our joint work. And thank you Katharina, Silvia, Dani, and Christian for greatly managing all of the administrative and IT tasks. I also highly appreciate the provision of data by various institutions and the valuable comments that I received at conferences, seminars, and workshops.

Finally, a special thanks goes to my family and friends for always being there for me. I am eternally grateful for my husband's patience and support. Thank you Hans and Hannah for making my days brighter.

Ladina Rageth, Zurich, February 2018

Contents

List of Figures

List of Tables

Abstract

This PhD thesis is a collection of four papers that investigate vocational education and training (VET). On the upper-secondary education level, general education programs typically prepare students for further academic education, while VET programs prepare young people for direct entry to the labor market. To enhance scholarly understanding of unfavorable youth labor market outcomes of VET, the first two papers investigate how scholars can compare VET programs around the world and bring their differences into a meaningful order. The third paper analyzes the relation between different upper-secondary education programs and the situation of young people in the labor market. As the role of VET in shaping the youth labor market also depends on its relative standing compared to other education programs, the fourth paper investigates the social status of VET programs. The following paragraphs shortly summarize the findings of these papers.

The first paper proposes a methodological approach for developing an explanatory typology that is systematic, transparent, and rests on a strong theoretical foundation. Through this typological approach, we construct a VET program typology that builds on the theory of social systems. This theory helps elucidate the significance of the linkage between actors from the education and employment systems in VET to prevent unfavorable youth labor market outcomes. We then heuristically derive three utopian ideal types of VET programs. The first ideal type has an optimal linkage between actors from the education and employment systems in VET. We expect such VET programs with equal power-sharing between the two systems throughout the entire curriculum process to have the most favorable youth labor market outcomes. In the second and third ideal types, only one system has all of the power and we expect them to result in either undesirable outcomes, such as unemployment or skills mismatch, or lack of access to further education.

Moreover, by breaking down the linkage between actors from the education and employment systems into actual communication along the curriculum process, our typological approach guarantees that the education-employment linkage is also empirically measurable. Based on empirical data on the largest upper-secondary VET programs in 18 countries and states, the second paper identifies five real types of VET programs. These real types represent different combinations of the education-employment linkage in any process phase of curriculum design, application, and updating. Importantly, we provide evidence that only VET programs of the real type with an optimal education-employment linkage throughout the entire curriculum process are associated with high youth labor market integration. As this real type is comparable to the first ideal type, the empirical evidence supports the explanatory value of the ideal types developed in the first paper.

The third paper contributes to the literature by providing evidence that enrolment rates in upper-secondary education programs—general education, school-based VET, and dual VET—have a non-linear effect on the youth labor market. We thereby consider ten youth labor market indicators: four measures of labor market integration (e.g., relaxed and long-term unemployment rates); six on job quality (e.g., involuntary part-time work and skills mismatch). By running fixed effects regressions on panel data of 35 countries for 2004 through 2014, we show that increasing the enrolment rates of students in school-based VET programs worsens labor market integration, whereas increasing dual VET enrolment improves both labor market integration and job quality. However, all of these effects decrease with rising enrolment rates. In educational reforms, policymakers should thus consider the non-linear and heterogeneous effects of VET.

The fourth paper proposes a new approach to measuring changes in the social status of education programs, a type of social status that the literature has neglected so far. This measurement approach argues that the social status of an education program affects educational choices. Thus an increase in the relative ability of adolescents choosing an education program compared to the cohort reflects an increase in the social status of that program, when everything else remains constant. For immigrant adolescents, we show that the social status of VET increases with the time spent in Switzerland. We thus argue that differences in the level of knowledge of the Swiss education system and its possibilities might be a reason for differences in the social status of VET. Career guidance and counseling systems should therefore complement VET programs' introduction or reforms from the beginning.

Zusammenfassung

Diese Dissertation besteht aus vier Artikeln, welche sich mit unterschiedlichen Fragestellungen zur Berufsbildung befassen. Während Allgemeinbildungsgänge die Jugendlichen in der Regel auf die akademische Tertiärbildung vorbereiten, hat die berufliche Grundbildung weltweit das Ziel, Jugendliche auf den direkten Einstieg ins Berufsleben vorzubereiten. Trotz dieses gemeinsamen Ziels existieren weltweit grosse Unterschiede zwischen Berufsbildungsgängen. Internationale Vergleiche zeigen, dass verschiedene Typen von Berufsbildungsgängen die Jugendlichen unterschiedlich gut auf den Arbeitsmarkt vorbereiten. Um diese Unterschiede besser zu verstehen, untersuchen wir in den ersten beiden Artikeln, wie Wissenschaftler/innen formale Berufsbildungsgänge international vergleichen können. Im dritten Artikel analysieren wir, ob Bildungssysteme mit einem grösseren Anteil Lernender in der Berufsbildung die Bedürfnisse des Arbeitsmarkts besser abdecken als Bildungssysteme mit mehr Allgemeinbildung. Da dieser Zusammenhang auch von der relativen Wertschätzung der Berufsbildung im Vergleich zu anderen Bildungsgängen abhängt, untersucht der vierte Artikel den sozialen Status von Berufsbildungsgängen. Die Ergebnisse der vier Artikel sind in den folgenden Abschnitten kurz zusammengefasst.

Der erste Artikel präsentiert einen neu entwickelten Ansatz zur systematischen und theoriegestützten Erarbeitung von Typologien von Berufsbildungsgängen. Wir argumentieren dabei, dass jede Typologie einen erklärenden Anspruch hat. Deshalb sollen Typologien nicht nur verschiedene Berufsbildungsgänge gruppieren, sondern auch zum Verständnis eines interessierenden Phänomens beitragen; in unserem Fall ist dies die erfolgreiche Arbeitsmarktintegration von Jugendlichen. Anhand der soziologischen Systemtheorie begründen wir, dass die Koppelung von Akteuren des Bildungssystems und des Beschäftigungssystems eine wichtige Voraussetzung für erfolgreiche Berufsbildungsgänge ist.

Vor der Identifikation empirischer Realtypen umfasst der methodische Ansatz die Herleitung utopischer Idealtypen. Beim ersten Idealtyp kooperieren Akteure des Bildungssystems und des Beschäftigungssystems in allen Phasen des Bildungsprozesses. Beim zweiten und dritten Idealtyp hat jeweils nur ein System die alleinige Gestaltungsmacht. Aus unserem theoretischen Analyserahmen leiten wir ab, dass der erste Idealtyp mit dem besten Jugendarbeitsmarkt einhergeht. Hingegen können allein vom Bildungssystem bzw. Beschäftigungssystem gesteuerte Berufsbildungsgänge die Jugendlichen nicht optimal auf den Arbeitsmarkt vorbereiten beziehungsweise bieten sie ihnen keinen Zugang zu weiterführender Bildung.

Unser methodischer Ansatz garantiert zudem die empirische Messbarkeit der Koppelung des Bildungssystems und des Beschäftigungssystems durch die Kooperation der jeweiligen Akteure entlang des Bildungsprozesses. Anhand der Daten zu 18 Berufsbildungsgängen in verschiedenen Ländern identifizieren wir im zweiten Artikel fünf Realtypen von Berufsbildungsgängen. Diese Realtypen stellen unterschiedliche Kombinationen der Koppelung der beiden Systeme in verschiedenen Phasen des Bildungsprozesses dar. Dabei zeigen wir, dass nur Berufsbildungsgänge mit einer optimalen Koppelung in der Definition, Anwendung und Aktualisierung des Lehrplans mit einer hohen Jugendarbeitsmarktintegration einhergehen. Damit stützt die empirische Evidenz den Erklärungswert der im ersten Artikel entwickelten Idealtypen.

Der dritte Artikel geht anhand von ökonometrischen Analysen den unklaren Ergebnissen bisheriger Forschung zu den Auswirkungen verschiedener Bildungsgänge auf den Jugendarbeitsmarkt nach. Dabei belegen wir, dass der Anteil Lernender in den verschiedenen Arten von Bildungsgängen der Sekundarstufe II – das heisst Allgemeinbildung, schulische Berufsbildung und duale Berufsbildung – einen nichtlinearen Einfluss auf den Jugendarbeitsmarkt hat. So verschlechtert eine Erhöhung des Anteils Lernender in der schulischen Berufsbildung die Arbeitsmarktintegration, während ein zunehmender Anteil Lernender in der dualen Berufsbildung sowohl die Arbeitsmarktintegration als auch die Anstellungsbedingungen von Jugendlichen verbessert. Diese Effekte nehmen jedoch mit steigendem Anteil Lernender im jeweiligen Bildungsgang ab. In Bildungsreformen sollten Entscheidungsträger/innen daher die nichtlinearen und heterogenen Effekte von verschiedenen Berufsbildungsgängen berücksichtigen.

Im vierten Artikel ergänzen wir die bisherige Literatur durch eine neue Messgrösse, welche Veränderungen im sozialen Status von Bildungsgängen misst. Diese relative Messgrösse geht davon aus, dass sich mit höherem sozialem Status eines Bildungsgangs kognitiv leistungsfähigere Jugendliche für diesen Bildungsgang entscheiden. Am Beispiel der Schweiz zeigen wir, dass der soziale Status der Berufsbildung aus der Sicht von immigrierten Jugendlichen mit längerem Aufenthalt in der Schweiz steigt. Wir argumentieren dabei, dass der unterschiedliche Wissensstand zur Schweizer Berufsbildung ein möglicher Grund für unterschiedliche Einschätzungen zum sozialen Status der Berufsbildung ist. Deshalb kommen wir zum Schluss, dass die frühe Integration von Immigranten/innen in das Schweizer Bildungssystem bedeutsam ist und dass Berufsbildungsreformen von Anfang an von Informations- und Beratungsangeboten begleitet werden sollten.

Chapter 1

Introduction

This PhD thesis centers on different perspectives on vocational education and training (VET). On the upper-secondary education level, general education typically prepares students for further academic education, whereas VET equips young people with the knowledge, skills, and competencies required to work in a particular occupation[1] or more broadly on the labor market (Organisation for Economic Co-operation and Development [OECD], 2010a). VET programs refer to the organizational characteristics of education and training and are composed of single or multiple curricula. When speaking of an "education and training system," we are referring to all general education and VET programs in a country. Different VET programs together form the "VET pathway" (Renold et al., 2016), which is again part of the education and training system.

Initial VET programs prepare young people for direct labor market entry by covering not only general but also vocational content and by involving both practical training and learning of relevant theory. These formal programs are usually located at the upper-secondary education level and have a typical entry age of 15 or 16 (OECD, 2004). But despite these commonalities, there is considerable variation in VET across countries (e.g., Zimmermann et al., 2013; Eichhorst, Rodríguez-Planas, Schmidl, & Zimmermann, 2015). For example, dual VET programs[2] combine different learning and training locations, such as the workplace and schools, whereas in school-based VET programs, learning mostly happens in a school environment.

[1] In this thesis, the term "occupation" describes the profession for which a young person receives training. We take a generic approach, in which occupation is synonymous with vocation.

[2] In some of the previous literature, dual VET programs are called "apprenticeship programs" (e.g., Wolter & Ryan, 2011; Eichhorst et al., 2015). However, as apprenticeships can also be purely on-the-job training, they do not always refer to dual VET programs.

In many countries, alarming rates of youth unemployment and deteriorating working conditions followed the 2008 Great Recession (Scarpetta, Sonnet, & Manfredi, 2010; Bell & Blanchflower, 2011; Choudhry, Marelli, & Signorelli, 2012; O'Higgins, 2012; Pusterla, 2016). Southern European countries like Greece and Spain are struggling with severe youth unemployment, with every second adolescent unemployed (Scarpetta et al., 2010; Choudhry et al., 2012; Eichhorst & Neder, 2014; Renold, Bolli, Egg, & Pusterla, 2014). Educational reform leaders are therefore eager to learn from countries that have managed to keep their youth unemployment low and at the same time provide high job quality. For instance, Austria, Denmark, Germany, and Switzerland all have a stable youth labor market performance well above that of the European average (Scarpetta et al., 2010; O'Higgins, 2012; Pusterla, 2017). Those countries' education and training systems include strong VET pathways with high enrolment rates in dual VET programs.

Thus many countries are in the process of reforming or introducing VET programs (e.g., Symonds, Schwartz, & Ferguson, 2011; International Labour Organization [ILO] & OECD, 2014; Caves & Renold, 2016). For educational reform leaders, two main topics arise. First, they are interested in the features that make VET programs successful in terms of integrating young people into the labor market with good working conditions. This question asks for a methodological approach on how we can compare VET programs in a way that helps us understand different youth labor market outcomes. Chapter 2 of this thesis proposes such an approach that builds on a strong theoretical framework and Chapter 3 applies it empirically.

Second, the success of a VET program depends on how far it can attract young people and how employers and society value VET degrees. Different scholars argue that there is a low valuation of VET in many countries and ask for means to improve the relative standing of that educational path (e.g., Koulaidis, Dimopoulos, Tsatsaroni, & Katsis, 2006; Billett, 2014; Mourshed, Patel, & Suder, 2014). When VET has a higher relative standing compared to the other upper-secondary education programs—we call this relative standing the "social status of VET"—more young people are likely to choose a VET program, as we show in Chapter 5. Chapter 4 provides evidence that the extent to which an increase in an education programs' enrolment improves the youth labor market depends in part on the level of that program's enrolment rate.

By adopting different perspectives, the following chapters tackle the two main questions that I just discussed. In a theoretical perspective, Chapter 2 (co-authored with Ursula

Renold) answers the question of how we can compare VET programs around the world and bring its variation into a meaningful order. We argue that to validate a typology's explanatory value (e.g., Doty & Glick, 1994; Elman, 2005), a typological approach must rest on a strong theoretical foundation and follow a systematic, transparent process. We contribute to the existing literature by both proposing such an approach and applying it to construct an explanatory typology of VET programs that enhances our understanding of unfavorable youth labor market outcomes, such as unemployment and skills mismatch. To do so, we build on Luhmann's (1995, 2009, 2013) theory of social systems, which highlights the significance of the linkage between actors from the education and employment systems in VET (Eichmann, 1989).

Based on the theoretical framework, we heuristically derive three utopian "ideal types" (Weber, 1922, 1949, 1968a, 1968b) of VET programs. The first ideal type, with a maximal linkage between actors from the education and employment systems, entails equal power-sharing between the two systems. We expect such a VET program to lead to the most favorable youth labor market. In contrast, the other two ideal types, in which only one system has all of the power, result in either undesirable labor market outcomes, such as unemployment or skill mismatch, or missing access to further education.

By building on the theoretical framework of the preceding chapter, Chapter 3 identifies the "real types" (Weber, 1922, 1949, 1968a, 1968b) of VET programs and analyzes how they relate to a favorable youth labor market. In a comparative approach, this chapter uses existing data on the largest VET programs in 18 countries and states around the world. This data measures the linkage between actors from the education and employment systems along the three process phases of curriculum design, application, and updating (Renold et al., 2016; Renold, Caves, Bolli, & Bürgi, 2017). By using qualitative comparative analysis, this chapter identifies five combinations of the education-employment linkage in any process phase of curriculum design, application, and updating. These configurations represent the real types of VET programs: those with all-linkage, with double-linkage, with application-linkage, with design-linkage, and with no linkage. However, this chapter finds that the only path that leads to high youth labor market integration is one with an optimal linkage in each process phase (all-linkage type) and is thus closest to the first ideal type with equal power-sharing. In addition, by building on existing typologies of education and training systems (Allmendinger, 1989; Hannan, Raffe, & Smyth, 1996; Müller & Shavit, 1998; Lavrijsen, Nicaise, & Poesen-Vandeputte, 2014), Chapter

3 provides evidence that all-linkage VET programs only exist in education and training systems with a high proportion of upper-secondary students enrolled in VET programs.

Chapter 4 (co-authored with Maria E. Oswald-Egg and Thomas Bolli) follows a quantitative approach by investigating how enrolment rates in upper-secondary education programs (general education, school-based VET, and dual VET) affect ten youth labor market indicators on integration and job quality. By running fixed effects regressions on panel data for 35 countries from 2004 through to 2014 and exploring the non-linear argument that VET effects the labor market situation differently depending on the proportion of students enrolled in a VET program, we contribute to the previous literature (e.g., Gangl, 2003; Breen, 2005; Wolbers, 2007; Bol & Van de Werfhorst, 2013a; Levels, Van der Velden, & Di Stasio, 2014). Our findings show that increasing students' enrolment rates in school-based VET programs worsens labor market integration, whereas increasing enrolment in dual VET programs improves both labor market integration and job quality. However, these effects decrease with higher enrolment rates, highlighting the non-linear and heterogeneous effects of VET.

While chapters 2 to 4 of this PhD thesis aims at comparing VET programs and explaining their youth labor market outcomes, Chapter 5 (co-authored with Thomas Bolli) explores the social status of VET programs. As previous literature does not offer a satisfactory measurement for the social status of VET (e.g., Forrer, 1998; Cattaneo & Wolter, 2013; Mourshed et al., 2014; Cedefop, 2014, 2017; Abrassart, Busemeyer, Cattaneo, & Wolter, 2017), we propose a new approach for measuring changes in the social status of an education program. We argue that a change in the average relative abilities of students choosing an education program in relation to the rest of the cohort reflects a change in the social status of that program when everything else remains constant. We apply our measurement approach to dual VET programs in Switzerland and provide evidence that the social status of dual VET increases for immigrant adolescents the longer they live in Switzerland. We argue that this increase reflects adolescents' and their parents' increasing knowledge about the Swiss education system.

In summary, this PhD thesis provides evidence that VET programs have the potential to improve young people's labor market integration and working conditions. Importantly, a mixture of different educational pathways may best serve the labor market. However, the extent to which VET programs ensure both educational and professional career opportunities for VET graduates largely depends on the extent to which these programs

provide a linkage between actors from the education and employment systems. Analyzing this education-employment linkage in different VET programs helps scholars, reform leaders, and policymakers learn from VET programs that are associated with the most favorable youth labor markets. Moreover, to make educational reforms successful, additional measures such as information, advice, and guidance activities should supplement such changes from the beginning.

Chapter 2

The Linkage between Education and Employment Systems: Ideal Types of Vocational Education and Training Programs[3]

2.1 Introduction

After the outbreak of the 2008 financial crisis, politicians and researchers ignited a growing interest in vocational education and training (VET) as a way of combating young people's deteriorating situation in the labor market (e.g., International Labour Organization [ILO] & Organisation for Economic Co-operation and Development [OECD], 2014). In many countries, despite near-universal access to education, the proportion of unemployed young people is extremely high (Symonds et al., 2011; Renold et al., 2014). The post-2008 recession not only led to a dramatic increase in young people's unemployment but also worsened their working conditions (Scarpetta et al., 2010; Choudhry et al., 2012; O'Higgins, 2012; Pusterla, 2016).

In contrast to general education, which is relevant for a wide range of jobs and which particularly prepares students for further academic education, VET directly prepares young people for employment in a specific occupation or type of occupation (OECD 2004). However, despite this clear mission, there is considerable variation across VET in different countries and regions (e.g., Biavaschi et al., 2012). The question therefore arises as to how one can compare VET around the world and bring its variations into a meaningful, systematic order. Such a comparison must entail an explanation of VET outcomes,

[3] co-authored with Ursula Renold

for example the integration of young people into the labor market and the quality of their jobs). The purpose of a typology is to order research entities based on the criteria that one can expect to lead to those outcomes (Doty & Glick, 1994; Elman, 2005).

This chapter develops an explanatory typology of VET by applying the concepts of "ideal types" and "real types" (Weber, 1922, 1949, 1968a, 1968b). Whereas ideal types are heuristically derived pure types, they do not exist empirically but instead serve as benchmarks for the reality described by real types. Determining where real types deviate from ideal types can advance scholarly understanding of unfavorable youth labor market outcomes, such as unemployment and under- or over-qualification.

Much of the recent literature on VET explores its worldwide variation (e.g., Brockmann, Clarke, & Winch, 2008; Dumas, Méhaut, & Olympio, 2013). Classifications and typologies are widely accepted in comparative studies, including those on VET (e.g., Gangl, 2001; Grollmann, 2008; Busemeyer & Schlicht-Schmälzle, 2014), and they vary extensively in their methodological approaches. In addition, previous studies have analyzed different aspects of VET, including pathways, programs, and curricula (Renold et al., 2016; see also the definitions in the first chapter). The most prominent dimensions that scholars use for comparing education and training are the institutional arrangements (e.g., Greinert, 1988; Schelten, 2004; Culpepper & Thelen, 2008; Rauner & Wittig, 2010), the educational providers or learning places (e.g., OECD, 1985; Lauterbach, 1995; Eichhorst et al., 2015), and the organizational structures (e.g., Allmendinger, 1989; Müller & Shavit, 1998; Greinert, 2004).

To date, however, only a few scholars have gone beyond merely classifying VET or have attempted to build typologies that help to explain VET outcomes in the youth labor market. Four explanatory typologies (Allmendinger, 1989; Hannan et al., 1996; Müller & Shavit, 1998; Lavrijsen et al., 2014) exhibit good formal quality in their typological procedures: they are theoretically well founded and empirically applicable. To explain labor market outcomes, these studies compare education and training programs along four dimensions: the existence of nationwide standards (Allmendinger, 1989; Hannan et al., 1996; Müller & Shavit, 1998); stratification (Allmendinger, 1989; Hannan et al., 1996, Müller & Shavit, 1998; Lavrijsen et al., 2014); vocational specificity[4] (Müller & Shavit,

[4] Whereas Müller and Shavit (1998) speak of "occupational specificity", Lavrijsen et al. (2014) call it "vocational specificity". Nevertheless, both papers refer to the argument that VET programs impart more specific skills than general education programs as they prepare for specific (types of) occupations.

1998; Lavrijsen et al., 2014); and the relationship between educational institutions and employers (Hannan et al., 1996). However, the four typologies include both general education and VET programs and therefore do not capture the constituent elements of VET or in-depth differences between VET programs.

We depart from the literature by constructing an explanatory typology of VET programs, a typology that offers a direction for further hypotheses on the causes of unfavorable youth labor market outcomes. This chapter focuses on the development of such a typological approach and the derivation of the ideal types. The criteria for the quality of typologies include a transparent systematic procedure, a strong theoretical foundation, and empirical measurability (e.g., McKinney, 1969; Kluge, 2000; Bailey, 2004; Fleiss, 2010). In meeting these criteria, our typology also answers a call from the Organisation for Economic Co-operation and Development (OECD) for a "comparative policy analysis, undertaken across a range of different countries to identify policy solutions that work" (OECD, 2010a, p. 40).

We restrict our typology to VET programs at the upper-secondary education level, which generally corresponds to the final part of secondary education, and has a typical entry age of 15 or 16 years (OECD 2004). For a complete understanding of how VET programs can result in unfavorable outcomes in the youth labor market, we build on Luhmann's (1995, 2009, 2013) theory of social systems. In brief, he argues that the functional differentiation results in social systems with unique social functions. For example, the function of the education system is to socialize and educate individuals, the function of the employment system is to allocate individuals to different kinds of employment (a later chapter on theory describes Luhmann's idea in much greater detail).

Because VET programs give students both education and employment experience, to understand something demands that we investigate the interface between the two systems (Eichmann, 1989). As the constitutive element of VET programs is their connectivity to not only an educational career but also a professional one, VET programming needs to incorporate the expectations of the employment system and thus the intended effects of a VET program (Kelly, 2009). In essence, Eichmann (1989) argues that if the qualifications

However, more recent literature argues that all skills are general and that their combination and weighting makes skill bundles more or less specific (Lazear, 2009). Eggenberger, Rinawi, and Backes-Gellner (2018), for example, provide evidence that workers' flexibility depends on the overlap of skill bundles across occupations.

of VET graduates do not meet the expectations of the employment system, problems with coordination and control might arise. Such problems are reflected in unfavorable labor market outcomes.

Given this theoretical framework, our typology involves examining the linkage between actors from both the education and employment systems as the main comparative dimension. This linkage measures power-sharing between actors from the two systems—that is the decision competences of each group of actors—along the process phases of curriculum design, application, and updating (Renold et al., 2015, 2016). By taking this linkage to the extreme, we derive our ideal types of VET programs. Building on a curriculum theory (Kelly, 2009) and other theoretical concepts (e.g., Billett, 2011), we then identify the sub-processes (within each process phase), in which the two kinds of actors need to share power to prevent problems with coordination and control. Moreover, identifying the features in each sub-process allows us to empirically measure the power-sharing between actors from the two systems (Renold et al., 2016).

This chapter proceeds as follows: Subchapters 2.2 and 2.3 review the previous literature, and subchapter 2.4 explains our theoretical framework. Subchapter 2.5 proposes a typological approach that combines the theoretical framework and the analytical concepts of ideal types and real types. Subchapter 2.6 applies this approach to develop a typology of VET programs. Subchapter 2.7 concludes and discusses the limitations and opportunities for future research.

2.2 Typological Approaches and their Quality Criteria

The tradition of typologies has a long history in the social sciences, especially in sociology (e.g., McKinney, 1969). In this tradition, scholars have adopted different definitions of typologies, particularly in terms of distinguishing them from classifications. Moreover, discussions about the methodologies and functions of typologies have generated a vast amount of literature (e.g., McKinney, 1969; Nowotny, 1971; Bailey, 2004; Kelle & Kluge, 2010). Overall, scholars use typologies as constructs for reducing the complexity of social reality by putting this reality in a meaningful order.

To present the idea of typologies that we use in this chapter, we first need to define a number of terms with highly specialized meanings in typology theory. First, typologies compare research entities along categories that are called “dimensions” (Bailey, 2004),

for example, a person's socioeconomic status. Second, these dimensions build the axis of the "property space" (Lazarsfeld, 1937). Third, by operationalizing the dimensions with measurable features, such as income and educational degree as features of socioeconomic status, one can locate each research entity in the "property space" (Barton, 1955). Fourth, "types" are special compounds of the values of these features, and, together, these types form a typology.

Bailey (2004) distinguishes typologies by determining whether they embrace heuristic, empirical, quantitative, or qualitative types. Heuristic types have a conceptual or theoretical foundation and are therefore derived deductively, as are ideal types. In contrast, empirical types derive from empirical data, as do real types. For the identification of qualitative and quantitative empirical types, numerous techniques are now available (e.g., cluster analysis, case contrasting, and case comparison). These techniques identify groups of entities, the types, that have high internal homogeneity while maximizing the heterogeneity among them (Bailey, 1994; Kelle & Kluge, 2010; Kuckartz, 2010). The construction of quantitative typologies in particular often suffers from a lack of empirical data.

In this chapter, we rely on a purposely restrictive idea of typologies, defining them not as purely descriptive classifications but rather as explanatory concepts. Whereas classifications order research subjects with specific rules, typologies help scholars understand the outcomes of those subjects. Doty and Glick's (1994) definition highlights two important aspects of such typologies: They "identify multiple ideal types, each of which represents a unique combination of the…[features] that are believed to determine the relevant outcome(s)" (p. 231).

First, according to Doty and Glick (1994), typologies also function as theories. This idea is in accordance with Weber (1922, 1968a, 1968b), who aimed at capturing social reality with the help of theoretical and meaningful concepts, and therefore developed the concepts of ideal types and real types. Ideal types offer guidance for hypotheses about the conditions that created the research subject or the consequences of its creation (Weber, 1968b). However, although resting on dimensions that exist in reality, ideal types occupy such extreme values of these dimensions that scholars rarely find them empirically (Weber, 1968b). These pure types instead serve as benchmarks for identifying similarities and deviations in empirical reality, the reality that real types illustrate:

> In its conceptual purity, this mental construct (Gedankenbild) cannot be found empirically anywhere in reality. It is a utopia.… [R]esearch faces the task of determining in each individual case, the extent to which this ideal-construct approximates to or diverges from reality…. (Weber, 1968b, p. 497)

Second, Doty and Glick (1994) highlight the importance of the features that scholars apply when constructing typologies. Elman (2005) points out that these features are extracted from the variables of existing theories or conceptual frameworks. Importantly, these features need to be relevant for the particular purpose of a typology (McKinney, 1969).

For constructing a typology that offers directions for theorizing an empirical study, Bailey (2004) proposes a simple three-level model: Level A helps the scholar present the mental concept and thus construct the first image of the ideal type. Level B is the documentation level, where a scholar seeks to represent the typology in writing. Level C, the empirical level, includes the identification of the empirical cases of each of the constructed ideal types. According to Bailey (2004), qualitative typological procedures usually start with level A, followed by B and perhaps C, whereas the quantitative ones proceed in reverse. Importantly, Bailey (2004) argues that each typological procedure needs to entail all three levels of his model; otherwise, understanding the underlying typological procedure is difficult.

Drawing on Bailey's model, we propose three formal quality criteria for developing a typology of VET programs. First, the typological procedure needs to be explicit and transparent, as does the reduction of the property space to the final typology (Lazarsfeld, 1937). This argument for comprehensibility finds support from several scholars (e.g., McKinney, 1969; Doty & Glick, 1994).

Second, every explanatory typology needs to have a strong theoretical and conceptual background from which one can derive the comparative dimensions that explain the outcome. Thus the quality of each typology—relative to the form and content—depends largely on a clear definition and rationale for the chosen dimensions (Bailey, 1994; Doty & Glick, 1994). In addition, scholars need to use these dimensions consistently throughout the description of the different types and discuss the theoretical importance of each feature (Doty & Glick, 1994). To identify the features, scholars can either apply the theoretical knowledge they derive from existing theories or carry out an inductive analysis of the empirical material, as in grounded theory (Kluge, 1999).

Third, according to Bailey (2004), building an explanatory typology should include

documentation (level B) and empirical data (level C) in addition to the concept (level A). Thus, to operationalize the dimensions, scholars need to first break down the comparative dimensions into their features. Only then can scholars position real entities in the property space, group them by real types, or compare them to ideal types. As Weber (1922, 1968a) argues that social scientists need to use causal methods to empirically test their understanding of relationships of any kind, the empirical level is particularly important.

In addition, the literature points to specific challenges in developing a VET typology, whether one analyzes VET curricula, programs, or pathways (e.g., Matthes, 1992; Sung, Turbin, & Ashton, 2000; Grollmann, 2008). One major challenge lies in identifying the right dimensionality of VET, that is, finding the balance between too much complexity and too much simplicity (Elman, 2005; Grollmann, 2008). For example, putting too much emphasis on the cultural, historical, and societal contexts of VET programs might lead to an unmanageable (i.e., overly complex) typology (Sung et al., 2000).

A second challenge is what some comparative studies scholars call the problem of "nostrification" (Grollmann, 2008, p. 254), with scholars tending to associate their own culturally determined definitions and concepts with what they observe in other contexts (Matthes, 1992; Grollmann, 2008). According to Grollmann (2008) and Münch (1997), examples of nostrification include those studies that use combined school- and work-based VET programs as a benchmark without taking into consideration "the reconstruction of the respective country-specific cultural and organizational-structural context" (Georg [1997] as quoted in Grollmann [2008, p. 255]). Brockmann et al. (2008) argue that one should use transnational categories so that culturally distinct understandings and meanings of outwardly similar terms, such as skills or competencies, do not lead scholars to compare apples to oranges.

Critics argue that typologies have little explanatory or predictive power (Bailey, 2004). Thus a third challenge lies in constructing typologies that not only have empirical patterns but also feature contextual meanings with implicit—and often hidden—explanations. Scholars therefore need to ensure that they only consider those dimensions that are causally related to the relevant outcome (Doty & Glick, 1994; Kuckartz, 2010).

Scholars need to consider these three challenges in addition to the previously discussed criteria for quality when constructing a VET typology. The later subchapter on our own typological approach explains how we pursue this goal. We also use these criteria in the following subchapter to assess the quality of existing typologies.

2.3 VET Typologies in Previous Research

As Petticrew and Roberts (2006) recommend, we define explicit criteria for the selection of relevant literature while focusing on the issue of how to construct a VET program typology that helps scholars understand and explain different VET-related labor market outcomes. First, we restrict our literature review to studies that investigate the labor market orientation of education and trainings systems, or VET in particular. Although the comparison of entire "VET systems" dominates the scientific debate on VET, most scholars do not refer to the definition of social systems by Luhmann (1995) but instead to all VET programs and pathways in a country. Second, as this chapter examines VET at the upper-secondary education level—usually offered to young people aged 15-19—we exclude studies on higher or continuing education. Third, we exclude studies that apply comparative methods without developing typologies or classifications (e.g., the OECD [2010a] *Learning for Jobs* synthesis report). With these criteria, we take our inspiration from various perspectives and approaches (mainly those in educational science, political science, and sociology). In addition, we consider both theoretical and quantitative or qualitative empirical studies.

Broadly speaking, we group the literature into three perspectives: the transition or labor market perspective, the institutional perspective, and the educational perspective. First, studies from the labor market perspective investigate education and training systems in relation to labor market structures (e.g., Gangl, 2001; Rubery & Grimshaw, 2003) and often overlap with research on the transition from education to employment (e.g., Raffe, 1994). These studies frequently differentiate between occupational labor markets (OLM), in which labor market entry is organized through an extensive VET pathway, and internal labor markets (ILM), in which labor market entry is unregulated (Marsden, 1986).

Societal analysis is another widespread approach. Its pioneers investigate differences in work structures in France and Germany, resulting in the differentiation between qualificational and organizational spaces (Maurice & Sellier, 1979; Maurice, Sellier, & Silvestre, 1986). Whereas qualificational spaces emphasize specific vocational preparation and stratified education and training systems, organizational spaces focus on general education, with low standardization of curricula. Second, studies from the institutional perspective analyze education and training either as part of a broader set of interconnected, complementary institutions, such as the varieties of capitalism approach (e.g.,

Culpepper & Thelen, 2008; Iversen & Stephens, 2008; Busemeyer & Trampusch, 2012), or as part of a focus on the regulation and governance of education and training systems (e.g., Greinert, 1988; Schelten, 2004).

Various studies exploring the regulation or governance of VET use the role of the state as their main comparative dimension (Greinert, 1988; Schelten, 2004). However, they usually do not discuss why this dimension is important when comparing VET. An exception is Busemeyer and Schlicht-Schmälzle (2014), who investigate the variation in VET governance with two dimensions that other studies have shown to be useful for describing different education and training systems: employer involvement and public commitment. Likewise, Rauner and Wittig (2010) identify four ideal models of VET governance based on two dimensions: the integration of the governance measured by the degree of coordination between different actors, and the mode of governance, which is either input- or output-oriented. The scope of studies from the institutional perspective is confined to the institutional setting and regulation of education and training and does not explain labor market outcomes.

Third, studies from the educational perspective analyze the different curricula, programs, and pathways in an education and training system, classifying them as general education or VET. As these studies come closest to our research question, this chapter reviews them according to the formal quality criteria that we defined earlier: the transparency of the typological procedure, its theoretical foundation, and its empirical applicability. A look at the methodology of studies from the educational perspective reveals that major work has been done in developing empirical classifications by comparing selected countries (e.g., Lauterbach, 1984; OECD, 1985; Brockmann et al., 2008). However, the derivation of the comparative dimensions is often not an explicit part of the research process (Biavaschi et al., 2012; Dumas et al., 2013; Eichhorst et al., 2015), and some studies do not even make these dimensions explicit (Green 1991, 1999; Münch, 1997; Greinert, 2004). A few theoretical studies (Deissinger, 1995, 1998; Greinert, 1995, 2000; Clement, 1996) restrict themselves to identifying abstract dimensions and theoretical types.

In studies from the educational perspective, we identify two prominent categories of comparative dimensions: different educational providers and learning places, and the stratification and standardization of education and training (see table A2.1 in the Appendix of Chapter 2). Scholars analyzing educational providers and learning places use them as the only dimension (Lauterbach, 1984, 1995; OECD, 1985; Eichhorst et al., 2015) or

as one of many (ILO, 1998; Greinert, 2004). These scholars generally distinguish between education and training programs that educational institutions or firms provide and between learning in a school environment or in the workplace. Although these empirical studies propose descriptive classifications and make their comparative dimensions transparent, they do not explain theoretically why these dimensions are important.

Drawing on Deissinger (1995, 1998), VET varies not only in one dimension, such as learning places, which is why scholars need to build multidimensional typologies. Deissinger (1995, 1998) proposes ideal types of "qualificational styles" ("Qualifizierungsstile," Deissinger, 1995, p. 367) that describe the unique character of VET along three dimensions: the regulatory framework of the qualification process, the didactic-curricular orientation, and the role of the qualification process in socialization. However, his typology remains fairly abstract and does not show how one could operationalize it for identifying real types.

Many studies emphasize the importance of the organizational structures of education and training systems, specifically stratification and standardization (Allmendinger, 1989; Hannan et al., 1996; Müller & Shavit, 1998; Greinert, 2004; Lavrijsen et al., 2014). Whereas stratification refers to selection procedures (the extent and form of tracking), standardization measures the existence of nationwide standards for education and training. In addition, whereas Allmendinger (1989) develops a separate typology for VET programs, others distinguish between general education and VET based on the specificity of the vocational content (Müller and Shavit 1998; Lavrijsen et al., 2014). To develop a multi-dimensional classification, Pilz (2016) complements the two dimensions of the stratification and standardization with the skill formation approach (Busemeyer & Trampusch, 2012). This approach focuses on the interaction between political and socio-economic institutions and other VET stakeholders, and the pedagogic approach of the practice of learning, which is the specific teaching and learning process.

In addition to these two prominent comparative dimensions—the educational providers or learning places, and organization structures—several studies bring in new perspectives. Two build on Luhmann's (1995) theory of social systems: Greinert (1995, 2000) identifies the governing patterns of system-specific communication in VET, and Clement (1996) explores the different meanings communicated in VET. Although these classifications help scholars understand the diverse cultures and subjective meanings of VET, they remain too abstract for empirical testing and application. Brockmann et al. (2008)

compare the meanings and roles of the key terms of the European Qualifications Framework—qualification, knowledge, skills, competence, and learning outcomes—in different countries. They show that the meanings of these terms largely depend on national and cultural contexts.

Although Greinert (2004) and Green (1999) are particularly interested in the evolution of education and training systems, neither makes their research processes transparent. Focusing on the historical development of VET, Greinert (2004) classifies the guiding principles and learning cultures that underlie education and training systems and that are reflected in educational institutions. Examining how education and training systems respond to globalization, Green (1999) proposes five types based on the modes of articulation among central governments, education and training, labor markets, and firms.

Seven studies (Allmendinger, 1989; Hannan et al., 1996; ILO, 1998; Müller & Shavit, 1998; OECD, 2000; Biavaschi et al., 2012; Lavrijsen et al., 2014) set out to explain the labor market outcomes of education and training. However, the International Labor Organization (ILO, 1998) and Biavaschi et al. (2012) make no attempt at providing the theoretical foundation required for an explanatory typology. Although the OECD (2000) states that it distinguishes between common characteristics in school-to-work transitions, it differentiates only between dominant upper-secondary pathways, leaving the targeted common characteristics unclear. The remaining four studies—Allmendinger (1989); Hannan et al. (1996); Müller and Shavit (1998); Lavrijsen et al. (2014)—derive their comparative dimensions from a theoretical perspective and present empirical examples. They also use their typologies to formulate and empirically test hypotheses on the labor market outcomes of education and training.

Allmendinger (1989) and Müller and Shavit (1998) investigate the relationship between educational attainment and labor market outcomes and the way in which this relationship varies among education and training systems. Allmendinger (1989) compares education and training by differentiating between low or high degrees of standardization and stratification, resulting in a 2x2 typology. For VET, she argues that on-the-job training is less standardized and comes with high stratification (e.g., in the U.S.), whereas training in public schools does not stratify people and is highly standardized (e.g., in Norway, West Germany). In their comparative study of upper-secondary education, Müller and Shavit (1998), using levels of standardization and stratification, identify six types of education and training systems. Although they discuss vocational specificity as a third

dimension, they do not incorporate it into their typology. Building on the idea of qualificational and occupational spaces, both studies show that the association between education and labor market outcomes is strongest in highly standardized and stratified systems. However, they acknowledge that other institutional settings and characteristics (e.g., related to employers) might also affect this association.

Drawing on Allmendinger (1989) and societal analysis, Hannan et al. (1996) propose a conceptual framework for analyzing cross-national variations in school-to-work transitions by adding a third dimension—the relationship between educational institutions and employers—to those of standardization and stratification. After presenting a typology of education and training systems based on these three dimensions, they argue that further research is needed to empirically measure the relationship dimension. Lavrijsen et al. (2014) expect the specificity and stratification dimensions of education and training systems to affect labor market outcomes in the short and long run and propose five types of education and training systems.

In sum, the literature shows that developing a typology that rests upon a strong theoretical framework and that scholars can empirically test and apply in further research is challenging. Moreover, previous studies offer few approaches on which scholars can build to develop a VET typology that explains different labor market outcomes. While some typologies exhibit good formal quality (e.g., Rauner & Wittig, 2010; Busemeyer and Schlicht-Schmälzle 2014), only four explain different labor market outcomes (Allmendinger, 1989; Hannan et al., 1996; Müller & Shavit, 1998; Lavrijsen et al., 2014). These four typologies highlight four comparative dimensions: the standardization, stratification, and vocational specificity of education and training, and the relationship between educational institutions and employers.

Nonetheless, these scholars argue that further dimensions might need consideration. In addition, most of them concentrate on entire education and training systems instead of capturing the specific elements of VET programs. We therefore depart from prior work by constructing a typology of VET programs with an approach that fulfills the formal quality requirements. This approach builds on a systemic perspective, which helps us understand why certain VET programs result in unfavorable youth labor market outcomes.

2.4 Structural Coupling between the Education and Employment Systems in VET

Starting with the conceptual level, we elaborate on our theoretical foundation. Luhmann's (1995, 2009, 2013) theory of social systems offers a framework for examining VET in a perspective of functional differentiation. In this subchapter, we outline this theory and explain how it enhances scholarly understandings of unfavorable youth labor market outcomes.

Luhmann (1995) argues that the functional differentiation of society leads to different social systems. By "function," Luhmann (1995) means the particular contribution a social system offers society, i.e., the specific function gives each system its unique identity. The function of the education system, for example, is to socialize young people and assign them to social positions through selection. According to Luhmann (1995), social systems operate through communication, which he says is composed of a message, information, and understanding. To Luhmann (1995), communication is the origin of all social operations; thus "society is communication" (Lee, 2000, p. 320). Furthermore, in all situations, certain types of communication are expected, and expectations are recursively reproduced through communication. Therefore, communication produces social structures (Lee, 2000).

Luhmann (1995) posits that each social system autonomously structures its operations by using a binary code that follows the function of the system. This binary code helps the system specify its own communication and thus distinguishes the communication within the system from that not belonging to the system. Figure 2.1, for example, shows that Luhmann (2009) defines the binary code of passing or failing as structuring the operations of the education system, thereby serving that system's function, which is selection. Therefore, all communication related to passing or failing is part of the education system. In addition, according to Luhmann (1995), each social system needs programming that guides the assignment of the binary code, such as passing or failing. For example, the programming for the education system is the curriculum, which defines the qualifications that students need to demonstrate on an exam.

Figure 2.1. The self-referential education system (Renold et al. [2015] drawing on Luhmann [2009])

	Encoding ("Kodierung")	Programming ("Programmierung")
Reflection of unit	Career ("Karriere")	Education ("Bildung")
Structuring of operations	Pass/Fail ("positiv/negativ")	Curricula ("Lehr- und Lernpläne")

Luhmann (1995) stresses the importance of the relationship between the system and its environment, as social systems "constitute and maintain themselves by creating and maintaining a difference from their environment" (p. 17). To define its environment, a social system uses its operations. The binary code works by guiding the differences that steer the system's possibilities of processing information from the environment (Luhmann, 1995). In so doing, social systems are sensitive to specific information, whereas other information does not affect them whatsoever. According to Eichmann (1989), this selectivity defines the opportunities and limits for coordination between social systems, and their mutual control. Whereas coordination refers to a system's ability to consider and react to its environment through its operations, control is a system's attempt to stimulate another system's operations.

For Luhmann (2009), a social system is operatively closed insofar as it only understands its own code. In the education system, this code leads to a selection of individuals based on education. This selection ensures that the system fulfills its function and it requires previous selections while at the same time enabling future ones, resulting in an individual's career within the system (Luhmann, 2009).

However, Luhmann (1995) argues that in addition to a closed part, each social system has an open part, the programming. Through the programming, a social system maintains relationships with other systems (Luhmann, 1995). By deciding on what affects system-specific operations, the system's programming allows it to consider external information. According to Luhmann (2013), when a social system structurally relies on certain information in its environment, i.e., from another system, what he calls "structural coupling" occurs. By structural coupling, Luhmann (2013) means that a social system adjusts to another system so that each is aware of—and reacts to—the other system. Nonetheless,

social systems that are structurally coupled remain autonomous. For example, the education system factors external information in its programming through its curricula. These curricula translate the information in such a way that the system can use them to structure its operations.

We conceptualize VET as a part of the education system, as its programming helps assign positions in society through selecting for careers (see figure 2.2). While all communication related to the programming follows the binary code of passing or failing, VET curricula set the standards for how the education system assigns the values of this code. In contrast to VET, workplace learning belongs to the employment system as long as it follows the code of payment or non-payment, which is reflected in trainees' wages. However, we consider the unproductive hours of workplace learning as part of the education system when they teach qualifications that are tested in a practical exam, thereby applying the code of passing or failing.

Figure 2.2. VET in the interface between the education and employment systems (Renold et al. [2015] drawing on Luhmann [2009])

EDUCATION SYSTEM

	Encoding	Programming
Reflection of unit	**Professional** career	Education
Structuring of operations	Pass/Fail	**VET** curricula

Structural Coupling

EMPLOYMENT SYSTEM

	Encoding	Programming
Reflection of unit	Wage	Labor market
Structuring of operations	Payment/ Non-payment	Supply of qualifications and demand for labor

In contrast to general education, the purpose of VET is to prepare its students for both further education and a professional career. Therefore, the connectivity of professional careers to the demand for qualifications in the labor market defines the interface between

the education and employment systems in VET (Eichmann, 1989). Both systems evaluate their operations based on this connectivity, leading to structural coupling between them. Importantly, when this connectivity does not meet the expectations of the two systems, it can lead to problems with coordination and control, such as the occurrence of skills mismatch. On the one hand, this mismatch is the difficulty of having qualifications that are not connected to the expected reward in the labor market (e.g., when graduates have to take jobs that do not match their qualifications). On the other hand, the employment system may observe that the qualifications that the education system produces do not always match the demand of the labor market.

In sum, analyzing VET from the perspective of the theory of social systems points to the importance of clarifying structural coupling between the programming of the education system (VET curriculum) and the employment system (supply of qualifications and demand for labor). This theoretical foundation enables us to identify potential problems with coordination and control, problems that might lead to unfavorable youth labor market outcomes. In the following subchapter, we build on this theoretical framework and propose a methodological approach for developing a typology of the linkage between actors from the two systems in VET.

2.5 Methodological Approach for a VET Typology

2.5.1 Strong Conceptual and Theoretical Framework

We propose a typological approach that deals with the previously discussed challenges with the help of a strong conceptual and theoretical framework. To understand the interface between education and employment systems in VET and to explain unfavorable youth labor market outcomes, we apply Weber's (1968b) concepts of ideal types and real types. Ideal types constitute a mental image for analyzing empirical reality, captured with real types, and for clearly defining the applied terms and concepts (Weber, 1922, 1968b, Doty & Glick, 1994, Gerhardt, 2001). Furthermore, the heuristically derived ideal types guide the formulation of hypotheses on how VET programs affect youth labor market outcomes (Weber, 1968b; Doty & Glick, 1994).

We apply the terms and concepts from Luhmann's (1995, 2009, 2013) theory of social systems, as it provides the necessary vocabulary for analyzing the interface between the

education and employment systems (Eichmann, 1989). As, according to Luhmann (1995), social systems consist of communication, structural coupling between two systems takes place in the communication as well. However, when breaking down this communication into something measurable, one needs to investigate the actors that socially interact by communicating. Through their communication, actors always refer to specific social systems. For example, they refer to the education system when they use the code for passing or failing an exam, whereas they refer to the employment system when they argue about payment or non-payment for specific qualifications.

We assign actors to either the education or employment system according to the codes they use in their communication. Although actors from the employment system might be individual firms, employer associations, labor governance, or even unions, actors from the education system are typically educational institutions, schools, or teachers (Renold et al., 2016). By observing the communication between these two kinds of actors, we can now measure structural coupling between the education and employment systems.

Applying Luhmann's (1995, 2009, 2013) theory of social systems helps us bypass heterogeneous context conditions between or even within countries (Brockmann et al., 2008; Grollmann, 2008). For example, rather than analyzing country-specific qualifications defined in VET curricula, our typology investigates whether actors referring to the communication codes of the education and employment systems engage in defining these qualifications, thereby enabling structural coupling between the two systems. The theory of social systems also sets our analytical unit: VET programs describing different ways in which VET is organized.

As Weber (1968a) argues, understanding is a prerequisite for causal explanation and empirical operationalization in the social sciences. We meet Weber's argument by considering the communication codes of the education and employment systems when constructing our typology of VET programs. However, although Weber assigns meanings to actors, for Luhmann (1995) the codes of social systems constitute specific meanings. Even so, both scholars argue that all social operations refer to subjective meanings that scholars need to take into account.

As our aim is to complete our understanding of different VET programs by achieving an explanation for unfavorable youth labor market outcomes that we can also test empirically, we aim to overcome the often criticized disadvantage of typologies of having little explanatory power (Bailey, 2004). Although the theory of social systems helps scholars

understand a functionally differentiated society, such an all-encompassing theory is not designed to deliver causal explanations (Krieger, 1996; Haller, 2013). Therefore, we have to make the structural coupling between the education and employment systems empirically measurable. To do so, we draw on the concept of the curriculum value chain (CVC; Renold et al., 2015). In brief, the CVC defines the curriculum as a process with three phases that we discuss in a following subchapter. We use the CVC to investigate the structural coupling in VET in each phase of the curriculum process. We then build on further theoretical concepts to explore where actors from the two systems should share power to prevent problems with coordination and control, with what we call the "linkage between actors from the education and employment systems."

2.5.2 Systematic and Transparent Typological Procedure

In addition to having a strong theoretical and conceptual framework, our typology meets the quality criteria of being systematic and transparent. We achieve this aim by applying Bailey's 2004 three-level model. On the conceptual level, we deductively derive the comparative dimensions that serve as the axes of our typology's property space (Lazarsfeld, 1937; Barton, 1955). The theory of social systems (Luhmann, 1995, 2009, 2013) provides our main dimension, specifically the linkage between actors from the education and employment systems in VET. At this level, we already have a mental image of the ideal types by exaggerating our dimension to its logical extremes, which we cannot find empirically (Doty & Glick, 1994; Kelle & Kluge, 2010). We then break down the linkage by identifying the curriculum's process phases and sub-processes along which these actors could interact. Hereafter, we can measure the intensity of the linkage and explore the potential roots of problems with coordination and control.

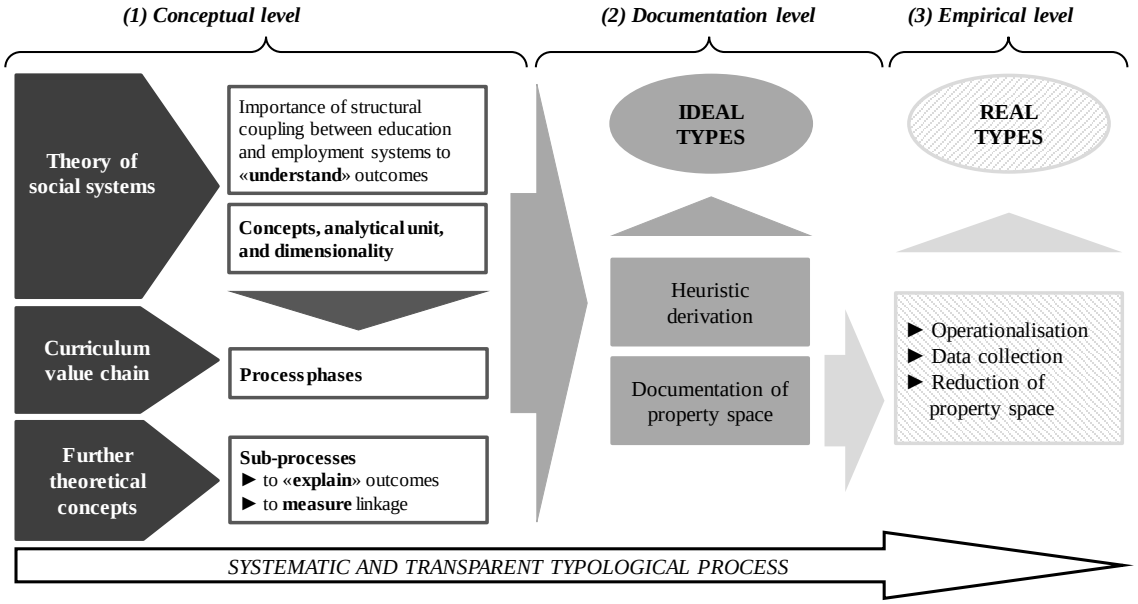
On the documentation level, we first put the property space on paper with the help of the earlier-defined dimension, process phases, and sub-processes. We then elaborate on the designation of each ideal type, where the "goal of the ideal-typical concept-construction is always to make clearly explicit not the class or average character but rather the unique individual character" (Weber, 1968b, p. 505).

At the empirical level, we locate the empirical representations—the real types—in the previously constructed property space. To do so, we first need to operationalize our comparative dimension with measurable features for which we can collect data. To reduce a property space to an empirical typology, Lazarsfeld (1937) proposed three procedures—

a functional, pragmatic, or arbitrary numerical reduction— that scholars still use. Nevertheless, quantitative social scientists today apply various statistical methods to construct empirical types (Doty & Glick, 1994; Bailey, 2004). In addition, in the qualitative social sciences, numerous scholars discuss and develop methodologies for empirical typologies (e.g., Kelle & Kluge, 2010).

Figure 2.3 summarizes our methodological approach for a typology of VET programs, which we apply in the following subchapter to develop a typology of the linkage between actors from the education and employment systems.

Figure 2.3. Overview of methodological approach for VET typology



2.6 Application: Typology of the Linkage between Actors from the Education and Employment Systems

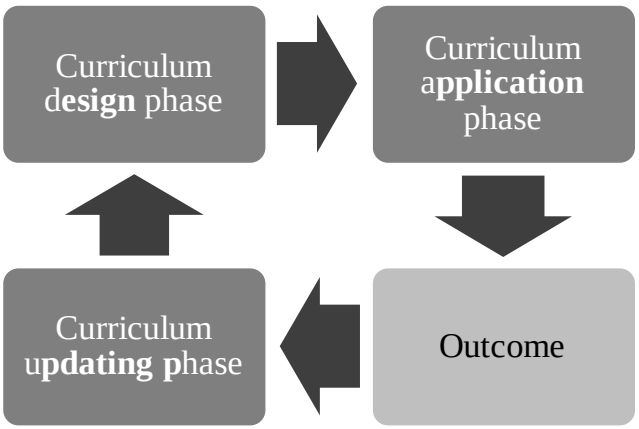
In this subchapter, we identify the property space and ideal types of our typology on the linkage between actors from the education and employment systems in VET. We also propose a theoretical framing of Renold et al.'s (2015, 2016) inductive work on how to operationalize the linkage between actors from the two systems (i.e., they measure the intensity of the power-sharing between those two kinds of actors in the largest VET programs in 18 countries).

2.6.1 Conceptual Level

As the lead theory defines the theoretical framework of the entire typology, identifying this theory represents a crucial step in our methodological approach. We have chosen the theory of social systems (Luhmann, 1995, 2009, 2013), which tells us where to look to better understand the labor market outcomes of VET programs. According to this theory, in all communication related to VET, the education system should refer to the employment system (Eichmann, 1989). As VET programs should not only prepare students for professional careers but also guarantee their eligibility for further education, connectivity to both educational and professional careers defines these programs.

Moreover, the theory of social systems places our focus on VET curricula. These curricula determine the assignment of the communication code's values and thus define the standards for passing or failing an exam. Drawing on Kelly (2009), we conceptualize a curriculum as a process rather than the content that a VET program ought to deliver. The CVC breaks the curriculum process down into three phases: curriculum design, application, and updating (Renold et al., 2015, 2016; see figure 2.4). In the curriculum design phase, actors define the content and qualification standards of the curriculum. In the curriculum application phase, teachers and trainers impart these standards and content to students. These two phases lead to educational outcomes, such as graduates' employment status or conditions. In the curriculum-updating phase, actors evaluate these educational outcomes and use the evaluation results to redesign the curriculum, for example, with the help of an update or a reform.

Figure 2.4. Curriculum value chain (Renold et al., 2016)



Building on the concept of the CVC, we concentrate on VET programs as our analytical unit. These VET programs describe different ways in which VET is organized (Renold et al., 2016). We now identify the sub-processes in which actors from the education and employment systems can engage in VET along the three phases of the CVC—for example, through different forms of social partnerships (e.g., Billett, Ovens, Clemans, & Seddon, 2007). We conceptually derive these sub-processes to elaborate where the communication between the two kinds of actors needs to take place for favorable youth labor market outcomes.

In curriculum design, actors from the education and employment systems need to engage in the definition of a VET program's qualification standards and the form and content of its exams. According to Kelly (2009), a curriculum must go "to an explanation, and indeed a justification, of the purposes of such transmission and an exploration of the effects that exposure to such knowledge and such subjects is likely to have, or is intended to have, on its recipient" (p. 9). In VET programs, curricula can explore these effects by including the needs of the labor market. Consequently, the definition of the qualification standards, content, and forms of exams needs to incorporate the expectations of the employment system by including the actors from that system in the definition. Thus not only actors from the education system but also those from the employment system need to engage in the definition of the skills and competencies that students need to qualify for educational or professional careers.

Müller and Shavit (1998) posit that the vocational specificity of education and training is relevant for explaining its labor market outcomes. They argue that with higher vocational specificity, the association between education and labor market outcomes is stronger. However, as we do not assess qualifications but instead focus on the linkage between actors from the education and employment systems, we can consider this specificity by distinguishing between VET programs for a specific job at a firm (high specificity), for an occupation (medium specificity), or for a professional career (low specificity). As an alternative, we can measure the specificity of a VET program by the number of curricula that the program covers. As with higher specificity, for which each job has its own curriculum, we argue that the more curricula a VET program comprises the more specific it is.

Three of the earlier typologies for explaining the labor market outcomes of education use the standardization of qualification standards as a comparative dimension (Allmendinger, 1989; Hannan et al., 1996; Müller & Shavit, 1998). For our typology, the question is how much such a standardization relates to the linkage of actors between the education and employment systems in VET. We argue that this standardization is related to where the communication between actors from the two systems takes place (e.g., at a regional or national level), and to which proportion of the educational authorities or employers is represented. With a strong standardization of the qualification standards, that is, when VET programs meet the same standards nationwide, employers can rely on standardized and recognized certificates, leading to a smooth transition from education to employment.

Both the vocational specificity and the standardization of a VET program describe the quality of the actors' engagement in the curriculum design. The other two quality criteria in this process phase are whether the engagement of the actors is defined by law—as it is only then guaranteed—and whether each of the different actors only has an advisory role.

Kelly (2009) further differentiates between the planned curriculum and the received curriculum: "By the official or planned curriculum is meant what is laid down in syllabuses, prospectuses and so on; the actual or received curriculum is the reality of the pupils' experience" (p. 11). Consequently, not only does the linkage between both kinds of actors in the establishment of the qualification standards matter, but also the extent to which they engage in the students' experiences.

In the curriculum application phase, when workplace training complements learning in the school environment, VET programs can achieve this mutual engagement of actors from the education and employment systems. The numerous VET classifications focusing on learning places confirm their importance (e.g., Lauterbach, 1984, 1995; OECD, 1985; Eichhorst et al., 2015). As students learn some skills more easily in the school environment, and others more easily in the workplace, some scholars argue that these two learning places are complementary (Aarkrog, 2005; Bolli & Renold, 2017; Baartman, Kilbrink, & de Bruijn, 2018). Others posit that some skills require on-the-job experience with the task itself being for students to develop full competency (Rauner, 2004; Wolter & Ryan, 2011). Like learning in a school environment, workplace learning requires goals that determine the tasks in which students engage. To support the acquisition of prescribed practical skills, workplace learning needs to be structured and regulated (Billett, 2011).

Exams are a crucial part of the qualification process, determining the qualifications with which someone graduates from a VET program, and they must therefore incorporate both learning places. According to the theory of social systems (Luhmann, 1995, 2009, 2013), the education system structures its operations along the code of passing or failing to fulfill the system's selection function. This passing or failing occurs via exams, which in VET programs need to take place both in a school environment and in the workplace. Only then does workplace learning in VET programs become part of the education system. We can assess the quality of the engagement of the two kinds of actors by studying which actors decide on the examination form.

Another possibility for engaging actors from the employment system in the curriculum application is by providing or funding school resources, such as equipment or part-time teachers. In so doing, these actors not only take part in the workplace training of students but also engage in their learning in the school environment. The availability of such resources also influences both how teachers apply the curriculum and how students experience it (Billett, 2011).

In curriculum updating, actors from the two systems can engage in measuring the outcomes of a VET program by, for example, using employer surveys on the professional and educational careers of graduates. The results of these surveys need to enter discussion about the timing and content of an updating or reform of the VET program. Only then can the VET program take the program's effects into account (Kelly, 2009).

Table 2.1 on the following page summarizes the outcome of the conceptual level by differentiating between communication sub-processes (used for measuring which actors are engaged) and quality sub-processes (used for measuring the quality of that engagement).

Table 2.1. Sub-processes in the three process phases of the CVC

PROCESS PHASES	CURRICULUM DESIGN	CURRICULUM APPLICATION	CURRICULUM UPDATING
Communication sub-processes	Definition of qualification standards and content of exams	Learning happens in the school environment and in the workplace	Gathering information on outcomes
	Definition of examination form	Exams take place in the school environment and in the workplace	Using the information for content and timing of update
		Provision of resources (e.g., equipment, teachers, costs)	
Quality of sub-processes	Legal definition of engagement		
	Participation or decision power		
	Vocational specificity	Regulation of workplace learning	
	Standardization of qualification standards		

We now proceed with the documentation level, in which we put our typology in writing with a presentable property space and derive our ideal types of VET programs.

2.6.2 Documentation Level

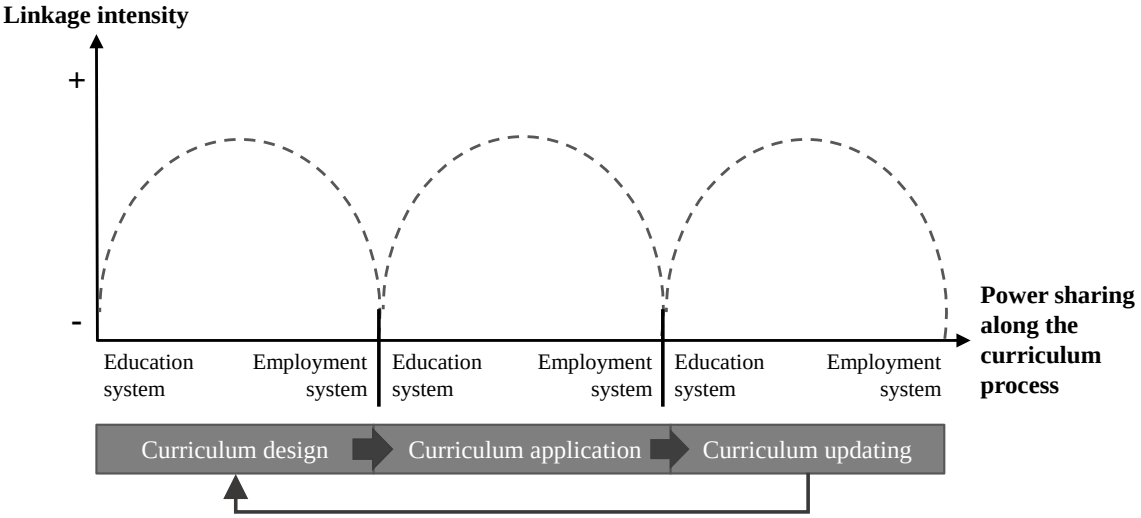
As discussed in the previous subchapter, the linkage between actors from the education and employment systems in VET can take place in different sub-processes in every phase of the CVC. The intensity of the linkage between the two kinds of actors varies depending on how much power, that is, how many decision competencies, each system has. First, the linkage intensity increases with the growing number of process phases in which actors from both systems engage. Second, even within these process phases, the linkage intensity varies with the number of sub-processes in which the two systems are coupled and with the quality of this structural coupling. Third, the intensity of the linkage depends on how much power each system has in every sub-process and on the quality of the linkage. We

thus think of the linkage as the power-sharing between actors from the two systems, representing their attempts to stimulate the other system's coordination (Eichmann, 1989).

However, our theoretical and conceptual framework does not indicate where in the CVC the structural coupling between the two systems needs to take place if it is to prevent problems with coordination and control. Consequently, power-sharing can occur in any of the sub-processes and process phases. This assumption enables us to circumvent the earlier-introduced problem of nostrification (Georg, 1997; Grollmann, 2008), i.e. when scholars apply their own culturally determined concepts (e.g., apprenticeships in German-speaking countries) to their research in other contexts. Moreover, we argue that the combination of different linkage intensities in different process phases—or even sub-processes—can lead to the same outcome.

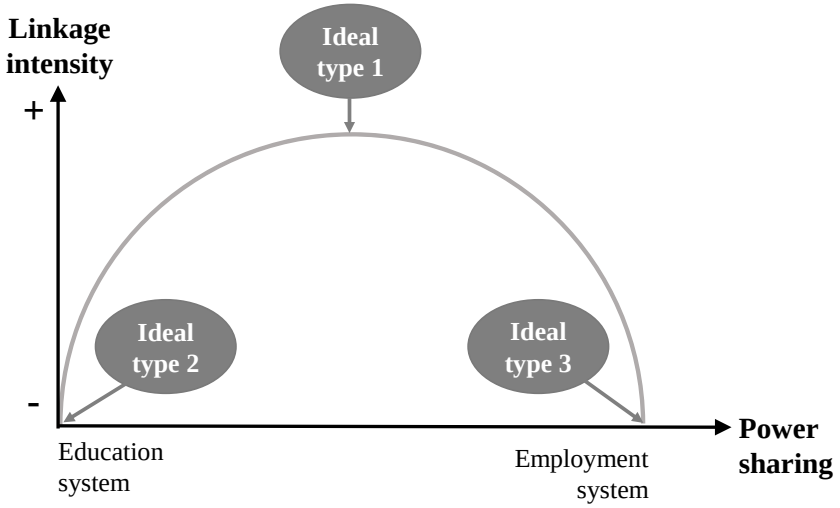
We illustrate our property space via a diagram that includes power-sharing between actors from the two systems (x-axis) and the resulting linkage intensity (y-axis) along the three process phases of the CVC. We reduce this property space to a two-dimensional diagram by splitting the x-axis into the three process phases (see figure 2.5). This diagram shows that the linkage varies not only in intensity but also with the kinds of actors that engage in each process phase. For example, VET programs can have a weak linkage when actors from only one of the systems have all power.

Figure 2.5. Property space with linkage intensity and power-sharing between actors from the education and employment systems along the CVC



Drawing on this diagram, we now derive our ideal types of the linkage between actors from the education and employment systems in VET. Each ideal type highlights an extreme position of our main dimension—instead of an average—even though such pure cases do not exist in reality (Weber, 1922, 1949, 1968b; Schmidt-Hertha & Tippelt, 2011). However, we expect the deviation of a real type from an ideal type to explain the differences in labor market outcomes. Drawing on our property space, we heuristically derive three ideal types of the linkage between the education and employment systems in VET, as Figure 2.6 shows.

Figure 2.6. Three ideal types of VET programs



Ideal type 1 entails VET programs with the maximal linkage. Thus actors from the education and employment systems share power in the curriculum design, application, and updating. From the perspective of the theory of social systems, these VET programs guarantee connectivity to an educational career by providing a formal certificate that educational authorities recognize. At the same time, these VET programs fulfill the expectations of the employment system by providing graduates with both the kind and quantity of qualifications that the labor market demands, thereby also preparing them for professional careers. As with the VET programs, the two systems are structurally coupled, and we expect them to result in the most favorable youth labor market outcomes.

At the level of the sub-processes, actors from the two systems share power when deciding on the qualification standards. The actors' engagement in the definition of qualification standards is legally defined, the qualification standards are nationally standardized,

and VET programs prepare students for both educational and professional careers. Moreover, actors from the employment system represent a high percentage of employers. In VET programs, learning in the school environment is combined with regulated workplace training, and exams occur at both learning places. Actors from the two systems provide a program with the resources (e.g., trainers or equipment) required for carrying out the curriculum. In addition, the law ensures that both kinds of actors engage in the gathering of information on the VET program's outcomes and the collected information flows into decisions on the timing and content of the updating of the VET program.

In contrast, the second and third ideal types have no linkage. Thus actors from only one system have all of the power. Ideal type 2 entails VET programs in which actors from the education system are the only ones engaged in the curriculum design, application, and updating, as in traditional school programs. These programs guarantee only the connectivity within the education system, and thus lack the constitutive element of VET programs (preparing for both professional and educational careers).

In these education-driven programs, only actors from the education system engage in each sub-process; they alone decide on the qualification standards, which ignore occupation-specific skills and impart only general skills. The training and exams therefore take place only in the school environment. Moreover, actors from the education system evaluate the outcome of the program and update it without considering the expectations of the employment system. As these VET programs do not provide graduates with the qualifications in demand among employers, the labor market does not acknowledge the VET certificates. To avoid unemployment and under- or over-qualification, graduates must opt for further education.

Ideal type 3 represents VET programs in which all power is with actors from the employment systems. In these employment-driven VET programs (e.g., labor market integration programs), only actors from the employment system engage in each sub-process. These actors alone define the qualification standards and content of the exams (if any), resulting in unstandardized and highly specific vocational qualifications. The training takes place only in the workplace, where employers provide all the equipment and trainers. In addition, the program information-gathering process and the updating of the program follow the requirements of the labor market. As such ideal-typical VET programs do not offer connectivity within the education system, they also lead to problems with

coordination and control, and they fail to prepare graduates for educational careers. Although graduates might find jobs upon labor market entry, in the long run they will not be eligible for further education for updating or enhancing their skills.

2.7 Conclusion

In this chapter, we propose a methodological approach for developing an explanatory VET typology, one that ensures that we meet the quality criteria of typological procedures, and helps us circumvent the specific challenges of VET comparisons. By following Bailey's (2004) three-level model, we ensure that our typological procedure is systematic and transparent. We contribute to the literature on typological approaches by providing a procedure that scholars can apply in all research fields for developing high-quality explanatory typologies. Moreover, our approach can help scholars construct typologies that build on a strong theoretical foundation and that one can test empirically. By both identifying those features relevant for the particular purpose of a typology and deriving ideal types, explanatory typologies can also guide scholars in the formulation of hypotheses on empirical relationships (Doty & Glick, 1994).

We use the new methodological approach to construct a theoretically well-founded typology of VET programs. By building on Luhmann's (1995, 2009, 2013) theory of social systems, we demonstrate the analytical capacity of this theory to enhance scholarly understandings of the unfavorable youth labor market outcomes of VET programs, such as unemployment or skills mismatch. Such understandings are important because such outcomes can result from coordination and control problems between the education and employment systems in VET (Eichmann, 1989). Thus the linkage between actors from the two systems is the main dimension of our property space. In addition, as the constitutive element of VET programs is their connectivity to both an educational career and a professional one, our theoretical foundation provides a valuable perspective for clearly distinguishing VET programs from general education or labor market integration programs.

The three ideal types of VET programs represent the maximal values of our main dimension—the linkage between the actors from the education and employment systems. The first ideal type entails a power equilibrium between actors from the two systems, a situation that we hypothesize as resulting in the most favorable youth labor market. In

contrast, in both the second and third ideal types, only one system has all of the power, resulting in undesirable outcomes: These programs are either traditional education programs, enabling further careers only in the education system, or labor market integration programs.

For educational reforms, our theoretical framework reveals that, during the curriculum process, successful VET programs ensure a linkage between actors from both the education and employment systems. Thus educational reform leaders need to facilitate and legally define the engagement of both kinds of actors in curriculum design, application, and updating.

By breaking down the linkage between actors from the education and employment systems into actual communication along the CVC, our methodological approach ensures that we can empirically apply our property space, thereby validating the empirical applicability of Weber's (1968b) ideal types and real types. This chapter has concentrated on the conceptual and documentation levels of the typological procedure, with Chapter 3 empirically applying our property space to identify the real types of VET programs. Moreover, by comparing empirical real types to the three ideal types, Chapter 3 benefits from new insights into how countries can learn from those VET programs that are associated with the most favorable youth labor market.

Chapter 3

Real Types of Vocational Education and Training Programs: Configurations of Education-Employment Linkage and Youth Labor Market Integration

3.1 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, Ulicna, Murphy, & Curth, 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 labor market than general education by facilitating young people's labor market entry (e.g., Quintini & Martin, 2006; Wolbers, 2007). Yet despite a clear mission, VET varies considerably across countries, regions, and occupations in terms of its relevance and effectiveness in facilitating the labor market entry of young people (e.g., OECD, 2010b; Wolter & Ryan, 2011; Eichhorst et al., 2015). Therefore, what makes VET programs successful with regard to the youth labor market is a key question for both scholars and policymakers.

This paper compares VET programs worldwide to understand their relationship to the youth labor market. One methodology for organizing complex relationships, such as that between VET programs and labor market outcomes, are typologies, which recently gained popularity for constructing and assessing causal explanations (Doty & Glick, 1994; Elman, 2005; George & 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 & Glick, 1994, p. 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 et al., 2013; Eichhorst et al., 2015). Only Allmendinger (1989), Hannan et al. (1996), Müller and Shavit (1998), and Lavrijsen et al. (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 labor market outcomes of education and training. Even so, these typologies do not capture in-depth differences between VET programs. This paper contributes to this literature by developing an empirical typology of VET programs that is theoretically well-founded.

In addition, this VET typology helps explain how such programs can prevent unfavorable youth labor market outcomes, such as skills mismatch und unemployment. The paper's in-depth analysis of the conditions that differentiate VET programs reveals how these conditions relate to the youth labor market. This chapter draws on the previous chapter that uses 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 favorable youth labor market. Comparing the empirical types of VET programs—which Weber (1949, 1968b) calls "real types"—to the heuristically derived, pure "ideal types" identified in the previous chapter, helped to discover which conditions may be related to unfavorable youth labor market outcomes (Fiss, 2011). Moreover, the ideal types highlight such extreme positions that scholars do not expect to find them in the empirical data (Weber, 1949, 1968b).

In contrast, the real types of VET programs 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, this chapter applies 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 et al. (1996), Müller and Shavit (1998), and Lavrijsen et

al. (2014). This chapter uses data that measures the linkage between actors from the education and employment systems in the largest VET programs in 18 developed countries or states within them (Renold et al. 2015; 2016). This chapter focuses on formal VET programs 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 chapter proceeds as follows: Subchapter 3.2 summarizes the literature, subchapter 3.3 explains the theoretical framework, and subchapter 3.4 discusses the analytical strategy, including the applied method and data. Subchapter 3.5 presents the findings, and subchapter 3.6 discusses them. Subchapter 3.7 concludes and explores the implications.

3.2 Previous Typologies of Education and Training

Although the comparative literature on VET is vast and growing (e.g., Biavaschi et al. 2012; Dumas et al., 2013; Eichhorst et al., 2015), the potential of explanatory typologies remains underexplored. The previous chapter provides the only study that develops an explanatory VET typology for understanding unfavorable youth labor market outcomes. By heuristically deriving ideal types of VET programs, Chapter 2 focuses 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 et al. (1996), Müller and Shavit (1998), and Lavrijsen et al. (2014). These studies cover all three levels—conceptual, documentation, and empirical (Bailey, 2004)—that a typological procedure requires, and derive the dimensions along which they compare education and training from a theoretical argument on the relationship between education and labor 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 labor market outcomes.

While these four explanatory typologies differ in their samples and typological procedures, their applied theoretical arguments and comparative dimensions are similar. They argue that four comparative dimensions are essential for building a typology that helps scholars understand the labor market outcomes of education and training: the exist-

ence of national standards, the stratification of the education and training system, the vocational specificity of the education and training system, and the relationship between educational institutions and employers.

First, Allmendinger (1989), Hannan et al. (1996), and Müller and Shavit (1998) argue that education and training systems—covering all general education and VET programs in a country—vary in their standardization of educational provisions. According to these scholars, this dimension captures the extent to which teacher training, educational curricula, assessment, and certification meet the same standards nationwide. In highly standardized systems, employers can trust the certifications to reliably represent qualifications. Thus standardized education and training systems should improve youth labor market outcomes (e.g., Allmendinger, 1989; Hannan et al., 1996).

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

Third, Müller and Shavit (1998) and Lavrijsen et al. (2014) emphasize that education and training systems differ in their vocational specificity. They define vocational specificity as the extent to which an education and training system provides education programs with a high share of vocational content. As vocational specificity represents a particular aspect of stratification, these two dimensions are highly correlated (Müller & Shavit, 1998). Allmendinger (1989), Hannan et al. (1996), Müller and Shavit (1998), and Lavrijsen et al. (2014) argue that both high stratification and vocational specificity improve young people's labor 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 labor market. By referring mainly to the participation of employers in the provision of education and training, they argue that this institutional relationship ranges from complete isolation to high interconnection. They state that countries with a strong relationship between educational institutions and the labor market facilitate young people's school-to-work transitions. However,

Hannan et al. (1996) acknowledge that their description of that relationship needs further specification and that they do not clearly operationalize it. In contrast, the theoretical typology presented in Chapter 2 focuses on the same actor relationship in VET programs, and it develops a conceptual framework for measuring such a relationship with observable features. Nonetheless, they do not test their framework empirically.

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

3.3 Education-Employment Linkage in VET and the Youth Labor 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 chapter builds on Chapter 2's identification of the VET program conditions that help scholars understand the labor market outcomes of such programs. Building on Luhmann's (1995, 2009, 2013) theory of social systems and the work of Eichmann (1989), Chapter 2 demonstrates the importance of the linkage between actors from the education and employment systems in VET for a favorable youth labor market. They argue that unfavorable labor 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 characterizes society. This functional differentiation organizes 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 socializing 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 practical exams following the code of passing or failing, the unproductive hours of workplace learning belong to the education system.

According to chapter 2, the constitutive element of VET programs is their connectivity to both an educational career and a professional career in the labor market. They argue that VET programs 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 labor 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, labor authorities, or even unions, education-system actors are typically 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, chapter 2 heuristically derives three ideal types of VET programs. 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, p. 43). The first ideal type of VET programs entails equal power-sharing between actors from the two systems throughout the curriculum process, thereby creating an optimal linkage between them, and leads to the most favorable youth labor market. In contrast, the other two ideal types, in which only one system has all the power, result in either undesirable labor market outcomes or lack of access to further education.

According to chapter 2, 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 3.1 shows that the main dimension of the VET program typology consists of the linkage between actors from the education and

employment systems in these three phases. The first two rows show that the ideal types identified in chapter 2 have either an optimal linkage or no linkage throughout the entire CVC. The third column indicates that they expect only the first ideal type to result in favorable youth labor 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 3.1. Property space of VET program typology

DIMENSIONS			OUTCOME	
EEL in curriculum design	**EEL in curriculum application**	**EEL in curriculum updating**	**Favourable youth labor 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; ● = optimal linkage, ○ = no linkage.

In VET programs, 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 program. 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 programs (Renold et al. 2015; 2016).

This theoretical framework makes clear that VET programs similar to the ideal type with equal power-sharing between actors from the education and employment systems are less likely to have unfavorable youth labor 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. This chapter

argues that, on one hand, multiple paths—that is configurations of the education-employment linkage in any of the process phases—to a favorable youth labor market are possible. On the other hand, the interdependencies among the three process phases indicate that what matters for understanding the labor market outcomes of VET programs 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 of the labor market outcomes of education and training (e.g., Müller & Shavit, 1998; Lavrijsen et al., 2014), this paper argues that the relationship between the education-employment linkage in VET and the youth labor 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, we expect the education-employment linkage in VET to have a stronger relationship to the youth labor market.

3.4 Analytical Strategy

3.4.1 Method: Qualitative Comparative Analysis

To identify the real types of VET programs, this paper applies fuzzy-set qualitative comparative analysis (fsQCA) with the software "FSQCA" (Ragin & 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 analyzing small-to-intermediate sample sizes that allow for substantive case knowledge (Mahoney & Goertz, 2006; Schneider & Wagemann, 2006, 2010; Ragin, 2014).

As a configurational approach, fsQCA compares cases as configurations of causally relevant conditions (Doty & 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 & Goertz, 2006; Schneider & Wagemann, 2012).

Associated with set theory, fsQCA conceptualizes the conditions as sets based on predefined concepts and analyzes set relationships (e.g., Mahoney & Goertz, 2006; Schneider & 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[5] (Ragin, 2000, 2008b; Ragin & Pennings, 2005). As the education-employment linkage is the main concept of this paper, the linkages in curriculum design, application, and updating are the conditions, and their calibration is presented in the following data subchapter.

By applying Boolean algebra, fsQCA generates every possible configuration of the conditions (Ragin, 2000, 2008b; Schneider & 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 causations, so that different conditions and their configurations can result in the same outcome (Doty, Glick, & Huber, 1993; George & 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 favorable youth labor 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, Humprecht, Castro-Herrero, Engesser, and Brüggemann (2016). These studies show the analytical capacity of fsQCA to identify empirical real types as configurations of conditions and compare them to ideal types.

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

3.4.2 Data: Sample, Outcome, and Conditions

Sample

My data stems from Renold et al. (2015; 2016), 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.[6] 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 program in each of the chosen countries and states.[7]

Renold et al.'s (2016; 2017) sample covers 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.[8] In all of the examined regions apart from Hong Kong, South Korea, and Japan, VET constitutes a substantial part of the upper-secondary education level[9] with enrolment rates above 20 percent (Renold et al. 2016, 2017). Although VET appears relatively important in most Asian countries, Taiwan and Singapore have VET enrolments of 50 and 65 percent, respectively. In all cases except for Singapore, at least half of upper-secondary VET students are enrolled in the largest VET program in that country or state (Renold et al. 2016, 2017).

The small-to-intermediate sample size of 18 cases is restrictive enough that it allows for in-depth case knowledge that allows me to substantiate the cross-case comparison with qualitative, case-oriented work (Mahoney & Goertz, 2006). However, such a sample

[6] 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.

[7] 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 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).

[8] 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).

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

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 generalization (Thomann & 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).

Outcome

This chapter measures the youth labor market outcome by the relative unemployment ratio, which relates the unemployment rate of 15-24-year-olds to that of those 25 years and over. This unemployment indicator thus reflects the relative disadvantage of young people in the labor market compared to adults and partly controls for cyclical economic conditions (e.g., Breen & Buchmann, 2002). The data, based on national labor 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, p. 16) as unemployed.

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

Table 3.2 on the following page 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 a high youth labor market integration (such as Colorado [US], Germany, and Japan) others have considerable difficulties integrating young people into the labor market (e.g., Poland and Finland, where one in every four adolescents is unemployed). Those countries that exhibit 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.

Table 3.2. Indicators for the youth labor 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 ([N])	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.

This chapter calibrates the fuzzy membership scores in the set of a high youth labor 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.[10] In the Appendix of Chapter 3, Figure A3.1 plots the original values against the calibrated memberships in the set of a high youth labor market integration, and Table A3.2 reports all fuzzy membership scores.

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

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

Causal Conditions

For each process phase of the CVC, Renold et al. (2016, 2017) provide data for different features of the education-employment linkage, as outlined in Table A3.1 in the Appendix of Chapter 3. These features measure the education-employment linkage by observing where actors from the education and employment systems share power. Given that, by definition, the education system is a main actor in every VET program, 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, this chapter relies on the “significance approach” (Amenta & Poulsen, 1994). For each process phase, this chapter chooses the statistically most important feature according to Renold et al.’s (2016, 2017) regression of all features on an overall assessment of the education-employment linkage (as reported in the “weights” column in table A3.1 in the Appendix of Chapter 3).

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 qual-

ification standards, with the two extremes indicating no linkage. For the relationship 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. Thus all cases without employer involvement are full non-members in the set with optimal linkage in VET curriculum design, whereas the ones in which employers are the main actors have full membership in that set.[11] Moreover, the threshold for set membership is set at 2.6 where employers are involved to more than only some extent. To transform the original values into a fuzzy set membership score, the direct calibration procedure applies a logistic function (e.g., Ragin, 2008a; Schneider & 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 programs. 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 program with only workplace training (value of 7).[12]

To define the optimal shares of workplace training and classroom education, that is the shares that ensure an optimal linkage, this chapter draws on Renold et al.'s (2016) empirical finding that in top-performing VET programs, students spend most of their time in the workplace, not in the classroom. Thus in VET curriculum application, full members in the set with optimal education-employment linkage are those programs 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 programs with only minor workplace training are more out of than in that set (value of 2), while programs in which students spend at least some time in workplace training are more in than out of that set (crossover at 2.7).

[11] A configurational analysis in which I tested different calibration cut-offs showed that having employers as main partners is more strongly related to high youth labor market integration than the equal involvement of the two partners. These results are available from the author upon request.

[12] This pattern is in line with the definition of VET programs by the OECD (2004), which states that VET programs 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 to them being the only actors. This chapter applies the same thresholds as it does for the curriculum design phase.

Table 3.3 shows the descriptive statistics of the three causal conditions and their calibration cutoffs. For each process phase, Figures A3.2 to A3.4 in the Appendix of Chapter 3 illustrate the distribution of the original values and the calibrated membership scores.

Table 3.3. Descriptive statistics and calibration cutoffs for causal conditions

Condition	Descriptive Statistics				Set name	Calibration cutoffs[4]		
	Mean	St. Dev.	Min.	Max.		Fully out	Cross-over	Fully in
EEL in curr. design[1]	2.750	0.787	1.000	4.000	Optimal linkage in design (EEL-D)	1	2.6	4
EEL in curr. application[2]	3.331	1.196	2.500	5.500	Optimal linkage in application (EEL-A)	2	2.7	5.25
EEL in curr. updating[1, 3]	2.289	0.822	1.000	4.000	Optimal linkage in updating (EEL-U)	1	2.6	4

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

Note: N=18; EEL=education-employment linkage; curr.=curriculum; [1] 1=not at all involved, 2=involved to some extent, 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] the calibration cutoffs define the points at which a case is fully out of the set, more in than out of the set ('crossover'), and fully in the set.

Domain Conditions

Building on Schneider and Wagemann's (2006) two-step approach, this chapter also analyzes how the real types of VET programs are related to the education and training systems' organizational characteristics (e.g., Allmendinger, 1989; Müller & Shavit, 1998), the "domain conditions". First, to measure the set of highly standardized education and training systems, this chapter uses the 2012 PISA data (OECD, 2014b) on the extent to which schools are responsible for a list of tasks, such as choosing textbooks and course content (Bol & Van de Werfhorst, 2013b). Second, following Lavrijsen et al. (2014) and Bol and Van de Werfhorst (2013b), this chapter measures 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, this chapter follows the literature (Müller & Shavit, 1998; Bol & Van de Werfhorst, 2013b; Lavrijsen et al., 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.

Table 3.4 outlines the descriptive statistics of the three organizational characteristics of education and training systems and their calibration cutoffs. For each domain condition, Figures A3.5 to A3.7 in the Appendix of Chapter 3 illustrate the distribution of the original values and the calibrated membership scores.

Table 3.4. Descriptive statistics and calibration cutoffs for domain conditions

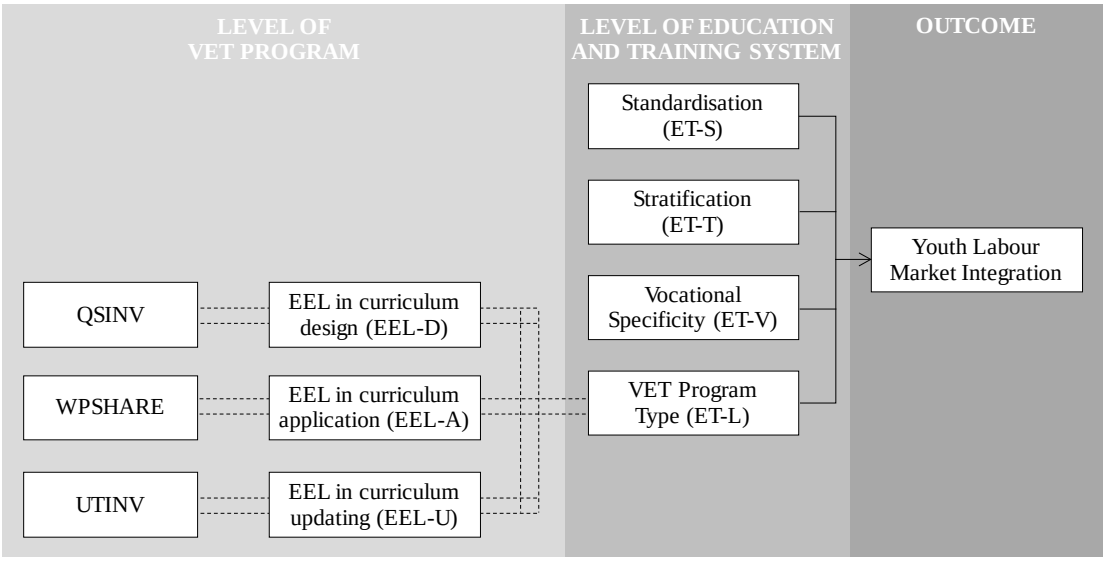
Condition	Descriptive Statistics				Set name	Calibration cutoffs[4]		
	Mean	St. Dev.	Min.	Max.		Fully out	Cross-over	Fully in
Standardisation of ET system[1]	1.439	0.165	1.079	1.778	High standardardisation (ET-S)	1	1.4	2
Stratification of ET system[2]	14.000	2.000	10	16	High stratification (ET-T)	16	14.5	10
Vocational specificity of ET system[3]	45.983	19.464	7	80	High specificity (ET-V)	10	30	65

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

Note: N=18; ET=education and training system; [1] 1=school has all responsibility, 3=national education authority has all responsibility; [2] age of first tracking; [3] proportion of students enrolled in VET out of all upper-secondary students; [4] the calibration cutoffs define the points at which a case is fully out of the set, more in than out of the set ('crossover'), and fully in the set.

Figure 3.1 on the following page summarizes the explanatory model. At the VET program level, the boxes on the left represent the three features that this chapter uses 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 program real types. As these real types are embedded in different education and training systems, this chapter analyzes the extent to which they are connected to the standardization, stratification, and vocational specificity of education and training, and how these configurations relate to youth labor market integration.

Figure 3.1. Two-level structure of the VET typology's explanatory model



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

3.5 Configurations of Education-Employment Linkage and Youth Labor Market Integration

3.5.1 Program Level: Real Types of VET Programs

This subchapter identifies the configurations of the causal conditions and examines their relationship to high youth labor market integration. The rows in the truth table (table 3.5 on the following page) 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 optimal education-employment linkage as one, while those below 0.5 are zeroes. The column OUTCOME indicates whether or not each configuration combines with a high youth labor 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). Column "N" indicates how many cases are in each row and column "Cases" lists them.

Table 3.5. Truth table of the education-employment linkage in curriculum design (EEL-D), application (EEL-A), and updating (EEL-U) for a high youth labor 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 in 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 a high youth labor market integration (low relative unemployment ratio), bold cases are members in this set.

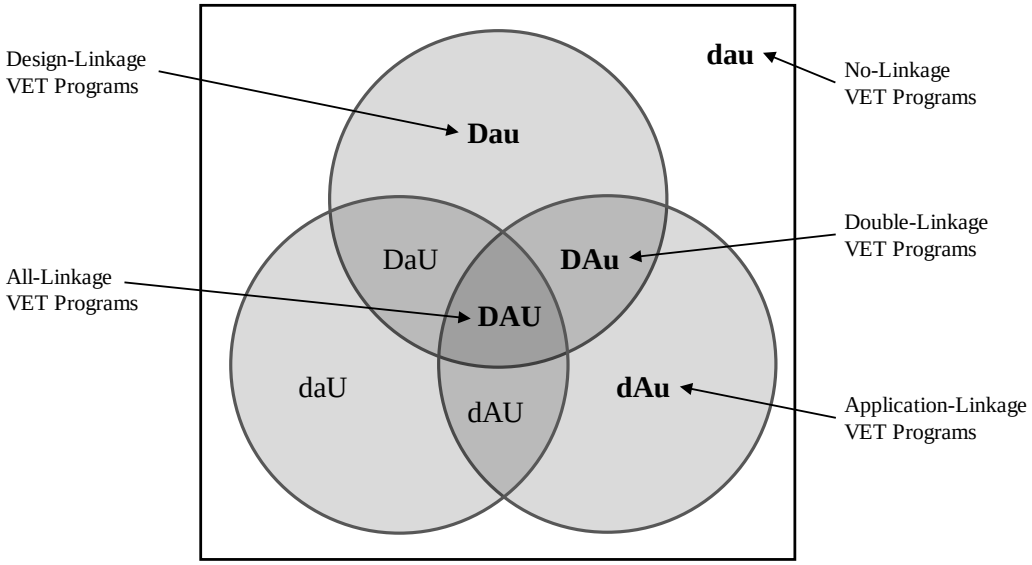
Table 3.5 indicates that the sample covers five configurations of the education-employment linkage in any process phase. Cases with the configuration DAU[13] have the greatest consistency (0.874) for being sufficient for a high youth labor market integration. In the sample, only VET programs with an optimal linkage throughout the entire CVC (configuration DAU) are always related to a favorable youth labor 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 programs and no other domain conditions reinforces this limitation.

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

The other four empirically present configurations show inconsistent outcomes. In the two configurations with an optimal 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 a high youth labor market integration while half do not. Due to limited diversity, the three last rows of the truth table are "remainders" (Ragin & Sonnett, 2005), they are not on the sample.

Applying the logic of typologies, this chapter argues that each empirically present configuration in the truth table stands for a real type of VET programs. Figure 3.2 presents the five VET program types covered by the sample: first, the all-linkage VET programs (DAU); second, the double-linkage ones (DAu); third, the design-linkage ones (Dau); fourth, the application-linkage ones (dAu); and fifth, the no-linkage ones (dau).

Figure 3.2. Real types of VET programs



Note: A=optimal education-employment linkage in curriculum application, D=optimal education-employment linkage in curriculum design, U=optimal 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 programs* in which actors from the education and employment systems optimally cooperate throughout the entire CVC. These countries are well known for their dual VET program, which some scholars also call "apprenticeship programs" (e.g., Wolter & Ryan, 2011; Eichhorst et al., 2015). These programs 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 & Ryan, 2011). In

all-linkage VET programs, 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 programs 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 & Ryan, 2011). 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 & Renold, 2017; Baartman et al., 2018). In addition, the workplace training in Austrian, Danish, German, and Swiss VET programs 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 program has an optimal education-employment linkage in two out of three process phases, thus having a *double-linkage VET program*. 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 is mostly but not completely implemented in that VET program. 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 programs with an education-employment linkage in only one process phase have an optimal linkage either in the design or updating of the curriculum. *Design-linkage VET programs,* in which actors from the two systems optimally cooperate only in the curriculum design phase, appear in Estonia, Iceland, Poland, Shanghai (China), and Slovenia. While in these VET programs, 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 programs 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 an optimal linkage.

Application-linkage VET programs include those that are members in the set with considerable workplace training but without an optimal education-employment linkage in the other two process phases. The VET programs 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 "DVE program", 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). Most DVE students remain in simulated workplace environments within the school. The same applies to the Singaporean "ITE programs" (Renold et al., 2016). The workplace training in Hong Kong's "Earn & Learn" pilot and the VET programs 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 programs in Austria, Denmark, Germany, and Switzerland have more than 50 percent workplace training, the workplace share is less than half in the application-linkage VET programs (Renold et al., 2016). Nonetheless, in these application-linkage VET programs, employers also provide site visits, job shadowing, and information about the world of work.

No-linkage VET programs in Colorado (US), the Netherlands, South Korea, and Taiwan have no optimal 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), employer involvement in the curriculum design is legally defined. Second, in the curriculum application phase, students in no-linkage VET programs 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 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 program" and also legally defined.

3.5.2 System Level: VET Program Types in Different Education and Training Systems

This subchapter outlines the extent to which the real types of VET programs are connected to those organizational characteristics of education and training system mentioned in the literature (e.g., Hannan et al., 1996; Lavrijsen et al., 2014). Given my finding that only all-linkage VET programs are sufficient for high youth labor market integration, this chapter applies the "weakest-link approach" (Dixon & Goertz, 2006) to investigate VET programs in different education and training systems. This chapter therefore measures the membership in the set with optimal 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 3.6 on the following page outlines the truth table with all empirically present configurations of the VET program and the three domain conditions for the organizational structure of the education and training system. The table shows that VET programs with an optimal education-employment linkage exist either in cases with a highly standardized, stratified, and vocationally specific education and training system (LSTV), or in systems that are vocationally specific but not standardized or stratified (LstV). In these two configurations, all cases display a high youth labor market integration. Thus the high share of students enrolled in VET programs 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 programs to substantially affect the labor market integration of young people. Moreover, their highly standardized and stratified education and training systems ensure a clear signaling of the values of the graduates' certificates (Allmendinger, 1989; Hannan et al., 1996; Müller & Shavit, 1998; Lavrijsen et al., 2014).

Table 3.6. Truth table of the education-employment linkage in VET (L) and the education and training system's standardization (S), stratification (T), and vocational specificity (V) for high youth labor 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, 2014b), UNESCO-IBE (2012), Renold et al. (2016, 2017), CIEB (2017).

Note: N=18; outcome measured by the membership in the set of a high youth labor market integration (low relative unemployment ratio); bold cases are members in this set.

VET programs without an optimal education-employment linkage are associated with a favorable outcome. In the Netherlands, the largest VET program is embedded in a highly stratified and vocationally specific education and training system (lsTV). Importantly, although the Dutch "MBO BOL program" belongs to the no-linkage real type, its membership scores in the set with optimal linkage are very close to the crossover—except for the share of workplace training. The VET programs in Japan and Estonia are embedded in education and training systems that are neither standardized, stratified nor vocationally specific (lstv) but are associated with high labor market integration. While the Estonian VET program has only an optimal education-employment linkage in the curriculum design phase, the Japanese one optimally links the two kinds of actors only in the application phase.

Most other VET programs without an optimal education-employment linkage are not members of the set with a high youth labor market integration. The only exceptions are those VET programs in highly stratified and vocationally specific education and training

systems (lStV) with an unclear outcome. In this configuration, Colorado (US) and Slovenia have a high youth labor market integration despite having VET programs of the no-linkage or design-linkage type respectively.

3.6 Comparing the Real Types to the Ideal Types

This subchapter compares the real types identified in the previous subchapter to the VET ideal types presented in Chapter 2. This chapter argues that the similarity of a real type to one of their ideal types helps us explain youth labor 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 programs come closest to the first ideal type, with a power-equilibrium, and thus an optimal education-employment linkage, in all three process phases. However, Germany displays comparably low membership scores in the two sets with an optimal linkage in the curriculum design and updating. Increasing the employer involvement in these two process phases would make Germany's dual VET program more similar to the first ideal type. However, as Germany has the highest youth labor 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 a high youth labor market integration supports the argument that none of the causal conditions alone is sufficient for a favorable outcome. In comparison to the power-sharing ideal type, the double-linkage "Apprenticeship Programme" in Norway—connected to low youth labor 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 relationship reveals that the set in which employers are the main actors in setting the update timing is quasi-sufficient[14] for the outcome (consistency=0.858; see figure A3.8 in the Appendix of Chapter 3). This set relationship may explain Norway's difficulties in integrating young people into the labor market, despite its double-linkage and highly standardized and vocationally specific education and training system.

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

VET programs with an optimal 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 labor market integration. The nonconforming cases for the design-linkage VET programs are Estonia and Slovenia. Despite alternating periods of work- and school-based learning, students in these VET programs spend most of their time in school. While Slovenia's education and training system is standardized and vocationally specific, Estonia's is neither standardized, stratified nor vocationally specific. Moreover, Estonia has weaker employment protection than the OECD average, whereas Slovenia is clearly above that average (despite recent measures to increase labor market flexibility according to Rokicka et al. [2018]).

However, with unemployment rates of 13 percent and 16 percent, respectively, youth unemployment is comparably high in Estonia and Slovenia. In addition, the formal education and training rate in Estonia is relatively low, with many young people receiving 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, & Wehner, 2017; Pusterla, 2017). These descriptions of young people's labor market situations in Estonia and Slovenia are a weakness of this chapter: that is because this chapter measures the outcome by youth labor market integration and thus only considers whether young people are employed or not, not factors such as working conditions or transition smoothness (e.g., Freeman & Wise, 1982; Dewan & Peek, 2007; Renold et al., 2014).

As in three of four cases, the application-linkage real type is not sufficient for a favorable youth labor market, a high amount of workplace training alone does not sufficiently prepare young people for labor 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 program and high youth labor market integration. As in Estonia, Japan's education and training system is neither standardized nor stratified nor vocationally specific. However, Japan's labor market structure may explain its high outcome: Japanese firms hire workers directly out of school for near-lifetime employment (Hannan et al., 1996; Freeman, 2007; Pilz & Alexander, 2011).

As actors from the education system are always main partners in the curriculum design, application, and updating of formal VET programs, programs of the no-linkage real type must lack employer involvement. Thus VET programs 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 labor market integration. While the Colorado "High School Career and Technical Education (CTE) program" scores low for all three process phases, the Netherlands, as mentioned earlier, is a border case. In curriculum design and updating, the Dutch "MBO BOL program" 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 percent enrolment in VET programs, the Dutch education and training system is among the most vocationally specific, with its largest VET program covering over half of upper-secondary enrolments (Renold et al., 2016).

Despite its high relative unemployment ratio, the Netherlands has comparably high youth unemployment (see table 3.2), temporary employment (Eichhorst et al., 2017), and over-qualification (Quintini, 2011; Pusterla, 2017). Although the Dutch labor market has a well-developed "flexicurity" system, with flexible working conditions and strong social security rights (Crowley, Jones, Cominetti, & Gulliford, 2013), this system mostly applies to temporarily or self-employed young workers (De Lange, Gesthuizen, & Wolbers, 2012; Gerritsen & Høj, 2013). In contrast, the labor market for older and better skilled workers is still based on a rigid regulatory framework (Gerritsen & Høj, 2013).

While the "CTE program" 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 favorable youth labor market, Colorado clearly suffers from a middle-skills gap (Skills2Compete-Colorado Campaign 2011; Renold, Bolli, and Caves 2017).

3.7 Conclusion

This paper identifies five real types of VET programs that represent different configurations of the education-employment linkage in any curriculum process phase. The all-linkage type, with an optimal linkage in curriculum design, application, and updating, constitutes the only path to high youth labor market integration. Consequently, educational reform leaders and policymakers should consider that only those VET programs 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 labor market. This finding both shows that the different curriculum process phases are interdependent and supports the previous chapter's theoretical argument that VET programs need to ensure an optimal linkage between actors from the two systems. However, the finding also calls into question the argument that multiple paths towards high youth labor market integration exist. Importantly, providing only enough workplace training in VET programs is not consistently connected to a favorable outcome.

Although the set relationships indicate that an optimal 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 youth labor market integration.

By including the organizational characteristics of education and training systems, this chapter shows that all-linkage VET programs exist only in vocationally specific systems in which the share of students enrolled in upper-secondary VET programs is above 45 percent. Further research should investigate whether all-linkage VET programs with lower enrolment rates exist and, if so, whether they are also connected to high youth labor market integration. In addition, my findings show that three of four cases with all-linkage VET programs have a highly stratified and standardized education and training system, supporting the findings of Allmendinger (1989), Hannan et al. (1996), Müller and Shavit (1998), and Lavrijsen et al. (2014).

The other four real types—the double-, design-, application, und no-linkage VET programs—are in most cases connected to low youth labor market integration. However, each of these real types also includes some nonconforming cases. Although the largest VET programs in those cases do not provide an optimal education-employment linkage

in all three curriculum process phases, they successfully integrate young people into the labor market. However, the previous subchapter shows that especially the different labor 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 labor market to also factor in their working conditions or formal education and training rates.

Importantly, generalizations beyond those from the largest VET programs in the 18 countries and states presented here need to reflect on the "scope conditions" (Schneider & Wagemann, 2010) that delimit the sample analyzed. First, the sample includes only developed countries that are top performers in terms of either the youth labor 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, the highest youth unemployment rate in my sample is 22 percent in Finland, and my sample does not include the countries that were most affected by the 2008 financial crisis, such as Spain and Greece, which have over 50 percent youth unemployment (Scarpetta et al., 2010; Eichhorst & Neder, 2014; Pusterla, 2017).

By analyzing the relationship between the education-employment linkage in VET and the youth labor market, this paper shows how educational reform leaders and policymakers might overcome problems with coordination and control in VET programs. As only all-linkage VET programs are connected to a favorable youth labor market, analyzing those programs 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.

Chapter 4

Meet the Need: The Role of Vocational Education and Training for the Youth Labor Market[15]

4.1 Introduction

Due to spectacularly high youth unemployment rates in many countries since the 2008 financial crisis, the media has drawn great attention to the labor market of young people. However, not all countries have experienced a decline in their youth labor market over the last ten years (e.g., Renold et al., 2014). While some countries (e.g., Germany) managed to lower their youth unemployment rates, others (e.g., France and Switzerland) have kept it relatively constant. One possible explanation for these different trends lies in the variation between national education systems, as they are responsible for providing young people with the skills they need on the labor market (human capital function; Klieme et al., 2007).

According to a report by the Organisation for Economic Co-operation and Development (OECD) and the International Labor Organization (ILO; ILO & OECD, 2014), promoting vocational education and training (VET) can improve the youth labor market by better satisfying its needs. Indeed, studies on the outcome of education theorize that VET programs, which teach vocational skills and prepare students for specific occupations or types of occupation, should meet the requirements of the labor market better than purely general education programs, i.e. programs teaching general skills (e.g., Müller & Shavit, 1998; Wolbers, 2007; Bol & Van de Werfhorst, 2013a). They argue that through these VET programs, students learn occupation-specific skills that are directly applicable in the

[15] co-authored with Maria E. Oswald-Egg and Thomas Bolli

workplace. Critics argue that VET might be an advantage only in the short-run, while in the long run, occupation-specific skills might restrict employees' mobility and become obsolete if they cannot be adapted to new technologies (e.g., Hampf & Woessmann, 2016; Hanushek, Schwerdt, Woessmann, & Zhang, 2017). However, the scant empirical evidence on the long-run effects of VET remains inconclusive (e.g., Oosterbeek & Webbink, 2007; Malamud & Pop-Eleches, 2010; Hall, 2016).

In addition, an institutional link between the education system and the labor market is necessary if an education system is to best fulfill its human capital function (e.g., Eichmann, 1989; Hannan et al., 1996; Müller & Shavit, 1998). Scholars argue that programs with a high amount of workplace training enhance such an institutional link. VET programs fall into one of two categories: school-based VET programs (where instruction mostly takes place in a school environment), and dual VET programs (where the skills are taught both at school and in the workplace). Dual VET programs are most likely to provide human capital that meets the demand of the labor market (e.g., Van de Werfhorst, 2011; Bol & Van de Werfhorst, 2013a; Levels et al., 2014).

To analyze the role of the education system in shaping the youth labor market, this chapter focuses on the relation between different upper-secondary education programs (general education, school-based VET, and dual VET; OECD, 2004) and the youth labor market for the 15- to 24-year-olds. We expect both school-based and dual VET programs to have a positive impact on the labor market in comparison to general education, and for dual VET to outperform school-based VET. However, taking into account the argument that diversity in skills and knowledge is beneficial for the performance of firms (Lazear, 1999), we expect diminishing advantages for both kinds of VET programs.

A great amount of studies explore the individual labor market outcomes of education (for an overview see, e.g., Wolter & Ryan [2011], Cedefop [2013], Zimmermann et al. [2013], or Eichhorst et al. [2015]). Some of these studies apply a multilevel approach, considering institutional differences between national education systems (e.g., Van der Velden & Wolbers, 2001; Gangl, 2003; Bol & Van de Werfhorst, 2013a; Levels et al., 2014), and are comparable to those studies at the country level (e.g., OECD, 1998; Breen, 2005; Noelke, 2011). In line with our argument that VET has a non-linear effect, few multilevel studies take into account a possible non-linear effect (Gangl, 2003; Wolbers, 2007; Levels et al., 2014; Hanushek et al., 2017), i.e. VET effects the labor market situa-

tion differently depending on the proportion of students enrolled in a VET program. Although these studies confirm the importance of this non-linearity, thus far only little evidence supports its existence.

The majority of these studies exhibit unexpected findings, as higher enrolment rates in school-based VET and dual VET, respectively, are advantageous for the labor market of young people with a VET degree. This inconsistency could be the result of limitations in the multilevel regressions applied in these studies and of the different labor market indicators. In this chapter, we apply fixed effects regressions to investigate possible non-linear general equilibrium effects of the education programs on the youth labor market. The use of panel data at the country level enables us to include a bigger sample of countries and improves the identification strategy by increasing the reliability of our results. To ensure that our indicator is not driving our findings, we include indicators for labor market integration and job quality. In addition, as previous studies compare the impact of total VET, including both school-based VET and dual VET programs, or solely dual VET, to general education, the literature might not sufficiently account for all upper-secondary education programs. We therefore differentiate between the impact of school-based VET and dual VET, and compare them both to one another and to general education.

The dataset consists of an unbalanced panel of 35 countries for 2004 through 2014. We consider 10 youth labor market indicators: four measures of labor market integration; six on job quality. The indicators for labor market integration are the unemployment rate, the relaxed unemployment rate, the neither-in-employment-or-education-or-training (NEET) rate, and the long-term unemployment rate. The indicators measuring job quality are the temporary contract rate, the involuntary part-time work rate, the atypical working hours rate, the skills mismatch rate, the in-work at-risk-of-poverty rate, and the average hourly earnings. We measure the extent of the different upper-secondary education programs (general education, school-based VET, and dual VET) by their enrolment rates, provided by the OECD. We estimate the impact of VET on the youth labor market with OLS regressions and consider the temporal structure of the effect by lagging the enrolment rates by three years. We account for unobserved heterogeneity by controlling for the general labor market and the youth labor force participation rate and by applying a fixed effects model. In addition, we control for a wide range of observable variables and run models of seemingly unrelated regression (SUR), random effects and generalized method of moments (GMM) to check for the robustness of our results.

In the linear estimations, we find no clear pattern for the influence of school-based VET or dual VET on the youth labor market. School-based VET increases the skills mismatch rate but slightly raises the average hourly earnings, whereas dual VET improves the atypical working hours rate and the in-work at-risk-of-poverty rate. Therefore, that the coefficients of school-based VET and dual VET are significantly different only for the job quality indicators is not surprising.

Looking at the non-linear estimations, we find that school-based VET significantly worsens youth labor market integration but does not influence job quality. In contrast, our results confirm that dual VET significantly improves the youth labor market, i.e. integration and job quality. Most of these effects decrease with higher enrolment rates, explaining why accounting for their non-linearity is important. This finding is expected for dual VET but unexpected for school-based VET, as it means that higher enrolment in school-based VET might eventually lead to better labor market integration. For most of the indicators, the effects of school-based VET and dual VET are significantly different. Consequently, dual VET appears to better meet the needs of the labor market than school-based VET or general education. Importantly, when enrolment rates in school-based VET are low, these programs might be worse than general education for both labor market integration and job quality. One explanation for this unexpected result could be the heterogeneity of school-based VET programs in terms of quality and labor market orientation, since, for example, the consideration of 21st century skills, such as social skills, critical thinking or problem solving, might differ. If this heterogeneity is correlated with the extent of school-based VET programs, higher enrolment rates could result in a stronger commitment from politicians and employers.

This chapter proceeds as follows: Subchapter 4.2 summarizes the theoretical background from which we derive our hypotheses, and reviews the empirical literature. Subchapter 4.3 presents our empirical design, including the description of the data and the methodology, and subchapter 4.4 describes our results and robustness checks. Subchapter 4.5 concludes and discusses the implications of the empirical findings.

4.2 Literature Review and Hypotheses

4.2.1 Theoretical Background

Education has several functions in societies (e.g., Fend, 2008), including preparing young people for employment by providing them with necessary skills and knowledge (Klieme et al., 2007). To be able to fulfill this human capital function and help students achieve a favorable skills match, education programs need to both know and meet the requirements of the labor market.

Throughout the world, countries show considerable variation in their education systems, particularly at the upper-secondary level (Zimmermann et al., 2013). In most countries, this level corresponds to the final stage of secondary education and has a typical entry age of 15 or 16. Using the amount of vocational content and education and training locations, the OECD divides formal upper-secondary education into general education programs and VET programs.[16] Whereas general education programs typically prepare students for further academic education, VET programs prepare them for direct entry into a particular occupation or a range of occupations by combining practical training with occupation-specific theory and some general education. Either these VET programs take place mainly at school (school-based VET programs) or they can combine school and workplace education and training (dual VET programs).

Many studies argue that VET programs ought to fulfill the human capital function better than general education programs. VET programs entail occupation-specific elements that align content closely to particular occupations and to the labor market demand, thereby reducing the problem of education-to-job mismatch or the training costs of employers (Van der Velden & Wolbers, 2001; Wolbers, 2003; Levels et al., 2014). In addition, workplace training in VET programs enhances the institutional link between the education system and the labor market (e.g., Van de Werfhorst, 2011; Bol & Van de Werfhorst, 2013a; Levels et al., 2014). This link is stronger in dual VET programs, which include a significantly higher amount of workplace training. Especially in countries with extensive VET programs, employers are already involved in the curriculum set-up (Van de Werfhorst, 2011). In addition, workplace training allows students to apply theoretical

[16] We consider VET programs as formal and part of the education system if they are "explicitly deemed to be part of the education system and an education authority has oversight of them" (OECD, 2004: 39).

learning in a practical setting (Wolter & Ryan, 2011) so that the knowledge they acquire at school becomes productivity relevant (Mauro & Carmeci, 2003).

A national education system could thus best fulfill the human capital function if it had only dual VET programs. However, Hong and Page (2004) develop a formal model showing that groups with members of diverse abilities find better solutions than groups with only high ability members. Furthermore, Lazear (1999) argues that firms gain from a varied workforce that brings diverse sets of skills and knowledge. This gain is largest when groups of employees have disparate skill sets, e.g., general and vocational skills. Thus a workforce diversified in terms of academic and VET degrees increases productivity (Backes-Gellner, Rupietta, & Tuor Sartore, 2017). Moreover, general equilibrium effects change the value of educational degrees on the labor market (Heckman, Lochner, & Taber, 1999), a value that depends on the share of people with the same educational degree on the labor market. Thus an educational degree has a higher value if fewer people graduate from the program and a lower value if a larger number of people do. We therefore expect the advantage of an education program to diminish with higher enrolment rates.[17]

Given this theoretical background, we derive our hypotheses on the relation between VET and the youth labor market. We measure the extent of VET in a country by the enrolment rates in school-based VET and dual VET. In our first two hypotheses, we argue that these two VET programs, which ensure both the occupation-specific skills that the labor market demands, and an institutional link between the education system and the labor market through workplace training, should improve the youth labor market more than general education programs. However, as a mixture of education programs is likely to best serve the labor market, we expect a non-linear relation between enrolment rates in education programs and youth labor market outcomes:

H1: Increasing the enrolment rates of students in school-based VET programs improves the youth labor market but at a decreasing rate.

H2: Increasing the enrolment rates of students in dual VET programs improves the youth labor market but at a decreasing rate.

[17] This argument assumes that the heterogeneity within dual VET and school-based VET programs, respectively, remains constant over time within countries.

Moreover, the higher amount of workplace training implies an advantage of dual VET over school-based VET on the youth labor market. We therefore formulate our third hypothesis as follows:

H3: Increasing the enrolment rate of students in dual VET programs improves the youth labor market more than increasing the enrolment rate of students in school-based VET programs.

4.2.2 Empirical Evidence

Many studies focus on the individual labor market outcomes of VET, especially in comparison to general education (for an overview see, e.g., Wolter & Ryan [2011], Cedefop [2013], Zimmermann et al. [2013], or Eichhorst et al. [2015]). These studies, however, do not report consistent results (e.g., Shavit & Müller, 2000; Ryan, 2001; Iannelli & Raffe, 2007). Nevertheless, they indicate that the effect of VET is more likely positive for young people if the indicator for the labor market outcome is employment rather than income or occupational level (Ryan, 2001; Iannelli & Raffe, 2007). Thus, some scholars suggest a multidimensional approach for measuring the youth labor market, including indicators for different factors such as labor market integration or job quality (Freeman & Wise, 1982; OECD, 2000; O'Higgins, 2003; Dewan & Peek, 2007; Renold et al., 2014). Wolter and Ryan (2011) argue that the challenge of finding convincing methods for determining the effects of VET on individuals—for example due to self-selection into the program—might be one reason for the inconsistent findings.

Some scholars suggest that country-level differences in the institutional setting of VET could also explain this inconsistency (e.g., Gangl, 2003; Bol & Van de Werfhorst, 2013a; Cedefop, 2013). For example, in education systems with strong VET institutions, employers often have a say in the content of the curriculum, thereby leading to a better match between the skills achieved in VET and the skills needed at work (Van de Werfhorst, 2011). Taking this institutional effect into account, some studies additionally look at differences in the institutionalization of VET or its vocational specificity, mostly measured by the share of students enrolled in VET programs (e.g., Van der Velden & Wolbers, 2001; Wolbers, 2003; De Lange, Gesthuizen, & Wolbers, 2014; see tables 4.1 and 4.2).

These studies find that education systems with high enrolment rates in total VET (i.e. school-based and dual VET combined) compared to general education result in better integration of young people into the labor market (Gangl, 2003; Bol & Van de Werfhorst, 2013a; Busemeyer & Thelen, 2015). However, the evidence for the relation between total VET and young people's job quality remains mixed (Gangl, 2003; Van der Velden & Wolbers, 2001; Levels et al., 2014; Busemeyer & Thelen, 2015). The one study investigating the impact of school-based VET on the youth labor market, Wolbers (2003) considers only job quality and finds a negative effect. In contrast, the impact of dual VET on job quality points towards a positive relation (Van der Velden & Wolbers, 2001; De Lange et al., 2014; Levels et al., 2014), despite contradictory results (Wolbers, 2007). Nonetheless, findings on the effect of dual VET on youth labor market integration are consistently positive (OECD, 1998; Van der Velden & Wolbers, 2001; Breen & Buchmann, 2002; Breen, 2005; Wolbers, 2007; Noelke, 2011; Bol & Van de Werfhorst, 2013a; De Lange et al., 2014; Busemeyer & Thelen, 2015).

Taken together, even studies that consider an institutional effect support the individual-level findings that the effect of VET is positive when one looks at youth labor market integration. However, they also find ambiguous results for young people's job quality. Wolter and Ryan (2011) argue that differences between countries in the scale of VET, especially of dual VET programs, might be a third explanation for this heterogeneity. Therefore, some studies include the interaction of an individual's VET degree with a country's share of students enrolled in VET programs (Gangl, 2003; Wolbers, 2007; Levels et al., 2014), or investigate individual educational outcomes for country groups based on their VET enrolment rates (Hanushek et al., 2017). In so doing and in line with the argument that a mixture of education programs should best serve the labor market, scholars have considered a possible non-linear effect of VET on youth labor market outcomes.

The scholarly consensus is that higher enrolment rates in total VET increasingly worsen job quality. Levels et al. (2014) show that higher total VET enrolment rates deteriorate the match of young people's job to the level of their VET degree (vertical education-to-job match). Thus lower-skilled employment (including unskilled, semi-skilled or lower-level occupation) of dual VET students increases with higher enrolment rates in total VET (Gangl, 2003). For youth labor market integration, there is no evidence to date that shows a non-linear effect of total VET. The only study investigating a possible non-

linear effect of school-based VET finds that the advantage of a VET degree for initial employment is larger when a country has higher school-based VET enrolment rates (Hanushek et al., 2017).

Wolbers (2007) and Hanushek et al. (2017) find that with higher enrolment rates in dual VET, a higher number of young people with a VET degree are employed. In contrast, the duration to the first significant job[18] becomes relatively longer (Wolbers, 2007). A look at job quality reveals that higher enrolment rates in dual VET increase the education-to-job match for the field of study (horizontal match) and the level of education (vertical match) for young people with a VET degree (Levels et al., 2014), thereby improving their occupational status[19] (Wolbers, 2007).

The two tables on the following pages give an overview of the studies investigating the impact of VET on the youth labor market in a multilevel or macro perspective. While Table 4.1 summarizes studies investigating a linear effect, Table 4.2 shows studies also testing for a non-linear one. The tables contain information on how these studies handle unobserved heterogeneity, their dependent and explanatory variables, the results, and how they relate to our hypotheses.

These tables show that two studies of the literature on the effect of VET on the youth labor market do not address unobserved heterogeneity (Noelke, 2011; Busemeyer & Thelen, 2015). The other studies use three approaches to account for unobserved heterogeneity between countries. First, one study separately analyses different country clusters (Hanushek et al., 2017). Second, some studies use multilevel analyses, including random effects at the country level (e.g., Van der Velden & Wolbers, 2001; Gangl, 2003; Bol & Van de Werfhorst, 2013a; Levels et al., 2014). Third, most studies control for the general labor market, i.e. they include the adult unemployment rate (e.g., OECD, 1998; Wolbers, 2007; Bol & Van de Werfhorst, 2013a; De Lange et al., 2014). While half of the empirical literature uses either labor market integration or job quality indicators to measure the youth labor market, the other half use both.

[18] The first significant job "includes all non-marginal jobs of at least about 20 hours per week that have lasted for at least 6 months" (Wolbers, 2007, p. 194).

[19] The occupational status is determined by the International Socio-Economic Index ISEI (Wolbers, 2007).

Table 4.1. Overview of studies investigating the linear impact of VET fractions

Authors	Unobserved heterogeneity treatment	Dependent variables (youth)		Explanatory variables	Linear effects	Hypotheses	
OECD (1998)	General labor market	Employment probability	Integration	Dual VET system dummy	+	√	H2
Van der Velden and Wolbers (2001)	General labor market Random effects	Unemployment	Integration	Total VET fraction	0	?	H1/H2
				Dual VET system dummy	-	√	H2
	General labor market Random effects	Temporary employment	Job quality	Total VET fraction	0	?	H1/H2
				Dual VET system dummy	-	√	H2
	General labor market Random effects	Part-time employment	Job quality	Total VET fraction	+	X	H1/H2
				Dual VET system dummy	0	?	H2
Breen and Buchmann (2002)	General labor market none	Unemployment	Integration	Dual VET system dummy	-	√	H2
Wolbers (2003)	General labor market Random effects	Vertical mismatch (field of education)	Job quality	School-based VET fraction	+	X	H1
				Dual VET fraction	0	?	H2
Breen (2005)	General labor market none	Unemployment	Integration	Dual VET fraction	-	√	H2
Noelke (2011)[1]	None	Unemployment	Integration	Dual VET fraction	-	√	H2
Bol and Van de Werfhorst (2013a)	General labor market None	Unemployment	Integration	Total VET index[2]	0	?	H1/H2
				Dual VET fraction	-	√	H2
	General labor market None	Average length of job search	Integration	Total VET index[2]	-	√	H1/H2
				Dual VET fraction	0	?	H2
	General labor market None	Average job tenure	Job quality	Total VET index[2]	0	?	H1/H2
				Dual VET fraction	0	?	H2
De Lange et al. (2014)	General labor market Random effects	Permanent employment (vs. unemployment)	Integration	Dual VET fraction	+	√	H2
	General labor market Random effects	Permanent employment (vs. temporary employment)	Job quality	Dual VET fraction	+	√	H2
Busemeyer and Thelen (2015)	None	Unemployment	Integration	Total VET fraction[3]	-	√	H1/H2
	None	Unemployment	Integration	Dual VET fraction[3]	-	√	H2
	None	Incidence of low pay	Job quality	Total VET fraction[3]	-	√	H1/H2
	None	Incidence of low pay	Job quality	Dual VET fraction[3]	0	?	H2

Note: (+) significant positive relationship/impact; (-) significant negative relationship/impact; (0) insignificant results; (√) hypothesis confirmed; (X) hypothesis rejected; (?) hypothesis neither rejected nor confirmed (insignificant); [1]study uses dual VET fraction only as a control variable without interpreting its coefficient; [2]index generated with principal factor analysis based on the enrolment in upper-secondary education from OECD and UNESCO; [3]unclear whether these authors tested for the significance of the effects as they only show the graphs of the linear correlations.

Table 4.2. Overview of studies investigating the non-linear impact of VET fractions

Authors	Unobserved heterogeneity treatment	Dependent variables (youth)		Explanatory variables	Linear effects	Non-linear effects	Hypotheses	
Gangl (2003)	General labor market Random effects	Unemployment	Integration	VET system dummy	-		√	H1/H2
				x Dual VET degree		0	?	
				x VET degree		0	?	
	General labor market Random effects	Status attainment	Job quality	VET system dummy	0		?	H1/H2
				x Dual VET degree		0	?	
				x VET degree		0	?	
	General labor market Random effects	Incidence of lower-skilled employment	Job quality	VET system dummy	0		?	H1/H2
				x Dual VET degree		+	√	
				x VET degree		0	?	
	General labor market Random effects	Access to professional employment positions at labor market entry	Job quality	VET system dummy	+		√	H1/H2
				x Dual VET degree		0	?	
				x VET degree		0	?	
Wolbers (2007)	General labor market Random effects	Current employment status: unemployed (vs. employed)	Integration	Dual VET fraction	0		?	H2
				x VET degree		0	?	
	General labor market Random effects	Current employment status: inactive (vs. employed)	Integration	Dual VET fraction	-		√	H2
				x VET degree		-	X	
	General labor market None	Entry speed	Integration	Dual VET fraction	+		√	H2
				x VET degree		-	√	
	General labor market None	Occupational status of first significant job	Job quality	Dual VET fraction	-		X	H2
				x VET degree		+	X	
Levels et al. (2014)	Random effects	Horizontal match (field of education)	Job quality	Total VET fraction	-		X	H1/H2
				x VET degree		0	?	
				Dual VET fraction	+		√	H2
				x VET degree		+	X	
	Random effects	Vertical match (level of education)	Job quality	Total VET fraction	0		?	H1/H2
				x VET degree		-	√	
				Dual VET fraction	0		?	H2
				x VET degree		+	X	
Hanushek et al. (2017)[1]	Individual controls	Employment	Integration	Total VET fraction	0		?	H1/H2
				Sample split[1]: total VET		+	X	
				Sample split[1]: dual VET		+	X	H2

Note: (+) significant positive relationship/impact; (-) significant negative relationship/impact; (0) insignificant results; (√) hypothesis confirmed; (X) hypothesis rejected; (?) hypothesis neither rejected nor confirmed (insignificant); [1]Hanushek et al. (2017) repeat their analysis for different subsamples, where countries are grouped based on their shares of upper-secondary students in VET programs, school-based VET programs, and dual VET programs; [2]The identification of professional employment positions is based on the International Standard Classification of Occupations (ISCO). These positions require a comparably high skill level and include, for example, teaching and scientific professionals, managers, architects, health professionals, or technicians (Gangl, 2003).

The tables also show that most studies compare the impact of total VET to general education; others, however, also compare the impact of dual VET to general education, or the impact of dual VET to school-based VET. One study even compares the impact of school-based VET to general education (Wolbers, 2003). However, only one study compares the relative effect of dual VET and school-based VET, analyzing the effect of total VET conditional on the effect of dual VET on young people's job quality (Levels et al., 2014). They find that, compared to school-based VET, a higher fraction of dual VET increases young people's job quality, measured by horizontal education-to-job matches.

In sum, there is only limited evidence for a non-linear effect of dual VET and school-based VET on the youth labor market. Moreover, the majority of this evidence is not in line with our hypotheses: that higher enrolment rates in dual VET and school-based VET is beneficial for youth labor market integration and the quality of jobs for young people with a VET degree. The one exception is Wolbers (2007) who analyzes labor entry speed. Only the studies investigating total VET confirm our hypothesis about a decreasing trend for job quality. Two possible reasons for this unexpected evidence are as follows: First, the estimation methods of these studies come with certain limitations. Whereas the multilevel analysis accounts for unobserved heterogeneity between countries, the sample split does so only to a limited extent. However, multilevel analyses have the drawback of assuming the unobservable variables to be uncorrelated with all observed variables. Second, a substantial difference in the impact of dual VET and school-based VET may exist, a difference that many of these studies do not take into account.

The following subchapter describes the data and methodology we use to tackle this inconsistency in earlier results and to test our hypotheses.

4.3 Methodology

4.3.1 Data

Our data set consists of unbalanced panel data from 2004 through to 2014 and covers 35 countries[20] depending on data availability[21]. Table 4.3 on the second next page outlines the variables that we apply in the estimations.

As dependent variables, we consider 10 labor market indicators for young people aged 15 to 24[22]. While four of them capture their integration in the labor market, the other six indicators measure the quality of their jobs. By choosing these dependent variables, we account for the complex situation of young people in the labor market, in line with Freeman and Wise (1982), O'Higgins (2003), Dewan and Peek (2007), Renold et al. (2014), and others.

The indicators for capturing youth labor market integration include the youth unemployment rate, the relaxed youth unemployment rate, the neither-in-employment-or-education-or-training (NEET) rate, and the youth long-term unemployment rate. The unemployment rate is the standard labor market indicator for measuring the unutilized labor supply, i.e. the proportion of those in the youth labor force without a job but actively looking for one (ILO, 2016). To avoid this narrow definition of being unemployed, we also include the relaxed unemployment rate, which accounts for discouraged workers who want to work but are not actively searching due to negative experience. Instead of the employment rate, which is another frequent labor market indicator, we include the

[20] Those countries are Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, Czech Republic, Denmark, Finland, France, Germany, Hungary, Iceland, Ireland, Israel, Italy, Japan, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Russia, Slovakia, Slovenia, South Korea, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States of America. Dropping one country from our sample, as a robustness check, does not qualitatively change our non-linear results. However, the level and significance of the coefficients sometimes changes when we drop countries with either a relatively low or a relatively high enrolment rate or for countries with strong changes over time. More details are available upon request.

[21] We eliminate countries with unreliable data, such as unreasonable jumps or fractions that do not add up properly, as with enrolment rates. In addition, we have to exclude countries with too few data points and with missing data for our main control variables. For the remaining dataset, we linearly interpolated all variables across time within a country to replace missing values for no more than four consecutive years. This interpolation does not drive the results.

[22] As our focus lies with young people entering the labor market, we would ideally use data on the 15- to 30- year-olds. Unfortunately, our indicators are available only for specific age groups, explaining why we chose the closest age range of the 15- to 24-year olds.

NEET rate to take into account that part of the cohort in this age range is still studying. To capture the difficulty of (re-)entering the labor market after being unemployed, we consider the youth long-term unemployment rate.

The indicators for measuring young people's job quality are the youth temporary contract rate, the youth involuntary part-time work rate, the youth atypical working hours rate, the youth skills mismatch rate, the youth in-work at-risk-of-poverty rate, and the youth average hourly earnings. We use the temporary contract rate to measure young people's job and income insecurity, with the involuntary part-time work rate indicating their dissatisfaction with the workload. The atypical working hours rate captures employees working shifts, on Sundays or at night, making the coordination of their personal, social and working life more challenging. The skills mismatch rate[23] captures the mismatch of the worker's qualification for the job. The last two indicators cover job quality in a monetary way, which according to Jencks, Perman, and Rainwater (1988) is an important determinant. The first of these indicators captures the average hourly earnings[24], which indicate someone's financial situation, while the second one, the in-work at-risk-of-poverty rate, measures whether the job pays enough to cover living expenses.

The main explanatory variables capture the enrolment rates in upper-secondary education programs, which belong to either general education, school-based VET, or dual VET (OECD, 2004). As general education programs have less than 25 per cent vocational content, they do not prepare students for a specific occupation, but rather teach them general knowledge. In contrast, VET programs contain more than 25 per cent vocational content and prepare students for direct entry into a specific occupation or type of occupation. The OECD further divides VET programs into school-based VET and dual VET programs. In school-based VET programs, students learn more than 75 per cent of the curriculum in the school environment, while in dual VET programs, between 10 and 75 per cent of the curriculum is presented in the school environment. As the impact of enrolment patterns takes place after students complete their education, we lag the explanatory variables by three years, which is the average duration of upper-secondary education programs (OECD, 2014a).[25]

[23] This indicator is available only for 15- to 29-year-olds.

[24] This indicator is available only for 15- to 29-year-olds.

[25] To test for reverse causality, we also lag the explanatory variables by four years in the non-linear fixed effects model. In addition, lagging the explanatory variables by two and four years also controls

As control variables, we additionally include the indicators mentioned in the literature as having an effect on the youth labor market (e.g., OECD, 1998; Bol & Van de Werfhorst, 2013a; De Lange et al., 2014; Levels et al., 2014). The main controls are the adult data for the dependent variables, the youth labor force participation rate, the youth-to-adult labor force participation ratio, the gross domestic product (GDP) per capita, the GDP growth, the employment protection legislation (EPL), and the "Programme for International Student Assessment" (PISA) scores. The adult variables[26] capture the general circumstances of the labor market.

The youth labor force participation rate measures the share of the cohort being employed or seeking employment, while the youth-to-adult labor force participation ratio accounts for the youth cohort size in the total labor force. The GDP per capita controls for the relative economic strength of a country and the GDP growth for a country's economic cycle. EPL indicates employers' difficulty with terminating a working contract, and the PISA scores[27] consider young people's average skills and knowledge, thereby capturing the quality of primary and lower secondary education levels. We exclude the variables trade union density, unemployment insurance, economic sectors, and KOF Globalization Index from our main model, as they are not available for the entire data set. However, we control for them in the robustness checks (see subchapter 4.4.5).

for different program durations. Both robustness tests lead to the same qualitative findings. More details are available upon request.

[26] As the NEET rate is only for young people, we instead use its adult complement, the adult labor force participation. The age range for adults is variously given as 25 to 54, 25 to 64, and 25+.

[27] We compute the PISA scores as the country's average of the literacy, mathematics, and reading scores for the waves 2000, 2003, 2006, 2009, and 2012. We construct the years in between by interpolating the data. Furthermore, to match the cohort entering the labor market, we lag the PISA scores by four years.

Table 4.3. Description of regression variables

VARIABLE	DESCRIPTION
Dependent variable: labor market integration	
Unemployment rate[II]	Ratio of unemployed workers to the labor force (ILO standard)[c]
Relaxed unemployment rate[I]	Ratio of unemployed and discouraged workers to the labor force[a]
NEET rate[I,II]	Ratio of young people neither in employment nor education and training; labor force participation rate for adults[a]
Long-term unemployment rate[I,II]	Ratio of workers unemployed longer than one year to total unemployed workers[c]
Dependent variable: job quality	
Temporary contract rate[I]	Ratio of workers on a contract of less than 18 months to total workers[b]
Involuntary part-time work rate[IV,V]	Ratio of involuntary part-time workers to total workers[a]
Atypical working hours rate[I]	Ratio of workers working on Sundays, at night or shifts to total workers[b]
Skills mismatch rate[I]	Index of dissimilarities between ratio of employment and ratio of unemployment at a given education level[d]
In-work at-risk-of-poverty rate[I]	Ratio of workers earning less than 60 per cent of the national median equalized disposable income to total workers[a]
Average hourly earnings[IV]	Average hourly wages of employees (US$, constant prices, constant PPP)[d]
Explanatory variables	
General education[IV] (baseline)	Enrolment rate in upper-secondary general education programs; less than 25 per cent vocational content in curriculum
School-based VET[IV]	Enrolment rate in upper-secondary school-based vocational education and training programs; more than 25 per cent vocational content in curriculum; students learn at least 75 per cent of the curriculum in a school environment
Dual VET[IV]	Enrolment rate in upper-secondary combined school- and work-based vocational education and training programs; more than 25 per cent vocational content in curriculum; students learn between 25 and 90 per cent of the curriculum in the workplace
Control variables	
Youth LF participation rate[II]	Ratio of youth in the labor force (LF) to the cohort
Youth-to-adult LF participation ratio[II]	Ratio of youth to adult labor force (LF) participation
GDP per capita[III]	Value of output produced in a country within a year per person
GDP growth[III]	Growth of a country's gross domestic product within a year
EPL[IV]	Regulations on the procedures and costs involved in dismissing and hiring employees
PISA score[IV]	Measurement of 15 year old students' skills and knowledge
Trade union density[IV]	Proportion of employees who take part in a trade union
Unemployment insurance[IV]	Income transfers to unemployed people
Economic sectors[VII]	Three economic sectors agriculture (baseline), industry and services; measured as sector value added in percentage of GDP
KOF Globalization Index[VI]	Index measuring the economic, social, and political dimensions of globalization

Note: The table defines our regression variables including their data source and age range. Adult control variables are equivalent to the youth labor market indicators, i.e. the dependent variables. The exception is the NEET rate, which is defined only for young people. The control variables in italics are included in the robustness checks.

Data source: I Eurostat; II ILO-KILM 9th Edition; III Economic Outlook of the IMF; IV OECD.stat; V SFSO; VI KOF; VII World Development Indicators of the World Bank.

Age range: a Youth: 15 to 24 / Adult: 25 to 54; b Youth: 15 to 24 / Adult: 25 to 64; c Youth: 15 to 24 / Adult: 25+; d Youth: 15 to 29 / Adult: 30+.

4.3.2 Regression Models

The first specification is a pooled ordinary least squares (OLS) regression for each youth labor market indicator, j = 1... 10, as the dependent variable. To reduce heterogeneity, we include the control variables shown in Table 4.3[28]. Importantly, the adult control variable for each youth labor market indicator accounts for the unobserved heterogeneity in the development of the adult labor market. The OLS estimation is as follows:

$$Y_{j,i,t}^{youth} = \beta_{j,0} + \beta_{j,1} P_{i,t-3} + \beta_{j,2} Y_{j,i,t}^{adult} + \beta_{j,3} X_{i,t} + \gamma_{j,t} + \varepsilon_{j,i,t} \quad (1)$$

The first term, $Y_{j,i,t}^{youth}$, denotes the dependent variable being one of the youth labor market indicators.[29] The indices i and t refer to country and time respectively. $Y_{j,i,t}^{adult}$ stands for the adult variable of the dependent variable, which we include as a control. $X_{i,t}$ denotes a matrix of additional time-varying observable control variables: the youth labor force participation rate, youth-to-adult labor force participation ratio, GDP per capita, GDP growth, EPL, and PISA score. $\gamma_{j,t}$ are year fixed effects dummies, and $\varepsilon_{j,i,t}$ is a normally distributed error term clustered at the country level to account for serial correlation within a country.

$P_{i,t-3}$ is a matrix, which stands for our two explanatory variables, the enrolment rate into school-based VET programs and the enrolment rate into dual VET programs, with the enrolment rate into general education programs serving as the baseline.[30] We lag the explanatory variables by three years to consider the average duration of these education programs. As we hypothesize a non-linear relation between the enrolment rates and the youth labor market, this matrix additionally includes a quadratic term for each enrolment rate in the non-linear regressions.[31]

[28] We never include the control variable youth-to-adult-labor force participation ratio when the dependent variable is the NEET rate.

[29] In line with the Mincer equation (Mincer, 1974), we logarithm the average hourly earnings and its corresponding adult control.

[30] Including just one program as explanatory variable does not qualitatively change our findings. More details are available upon request.

[31] Other possible ways of analyzing non-linearity are to logarithm the explanatory variable, to include an interaction term for low and high levels, or to do a sample split. However, these alternatives have major drawbacks. First, our explanatory variables contain zero as values, thus logarithm requires adding a constant. Second, there are no theoretical or empirical suggestions for where the cut-off for the threshold of the interaction dummy should be. Third, the sample split has the same problem and additionally makes the interpretation of the results circuitous.

To compare the labor market effects of our two explanatory variables, the enrolment rates in school-based VET and dual VET, we test the coefficients of the two VET programs with Wald tests in the linear regressions. For the non-linear regressions, we jointly test the two VET coefficients and their quadratic coefficients with joint F-tests (e.g., Baum, 2006).

To account for unobserved heterogeneity, we apply fixed effects regressions. These regressions eliminate time invariant unobserved heterogeneity and do not require the unobserved variables to be independent from all observed variables as the random effects model does (e.g., Brüderl & Ludwig, 2015; see a later subchapter on robustness checks for a comparison of the results of the random effects and fixed effects models). Due to the advanced stage of the model and the high correlation between the youth and adult dependent variable, we need to exclude the adult dependent variables from the fixed effects model to have enough variation left for the estimation. Therefore, the use of the fixed effects model comes at the cost of allowing for time-variant unobserved heterogeneity in the adult labor market development.[32] Nevertheless, we use this model as our main estimation because it exploits the information from the data best. Our fixed effects estimation thus adds the country-specific intercepts $\gamma_{j,i}$ to the previous OLS estimation and drops the adult dependent variables, reading:

$$Y_{j,i,t}^{youth} = \beta_{j,0} + \beta_{j,1} P_{i,t-3} + \beta_{j,3} X_{i,t} + \gamma_{j,t} + \gamma_{j,i} + \varepsilon_{j,i,t} \quad (2)$$

As the residuals of the different dependent variables might be correlated, applying a seemingly unrelated estimation (SUR) model, which treats the different estimations as a system, might yield coefficients that are more efficient. However, a major drawback of the SUR model is that it reduces the number of countries in our sample to 143. We therefore only apply the SUR model as a robustness check of our main specification that is the fixed effects model.[33]

[32] Dropping the adult dependent variables might lead to an omitted variable bias. However, tables A4.3 to A4.12 in the Appendix of Chapter 4 show that the inclusion neither of our main control variables (FE2) nor of all our additional controls (FE8) significantly changes our results.

[33] With the SUR model, the results remain qualitatively the same for school-based VET. For dual VET, the results for the involuntary part-time work rate and atypical working hours rate become insignificant, whereas the ones for average hourly earnings become significant. More details are available upon request.

4.3.3 Descriptive Statistics

Table A4.1 in the Appendix of Chapter 4 presents the summary statistics. Contingent on the data availability for the dependent variables, the data set covers between 176 and 272 observations. We have the least observations for the relaxed unemployment rate and the most for the unemployment rate. Additionally, the youth values are generally higher than those for adults.[34]

The enrolment rate into general education programs varies between 19 and 100 per cent; the one into school-based VET programs, between 0 and 72 per cent; and the one for dual VET programs, between 0 and 61 per cent. We thus require additional assumptions to interpret our results for values outside those ranges.

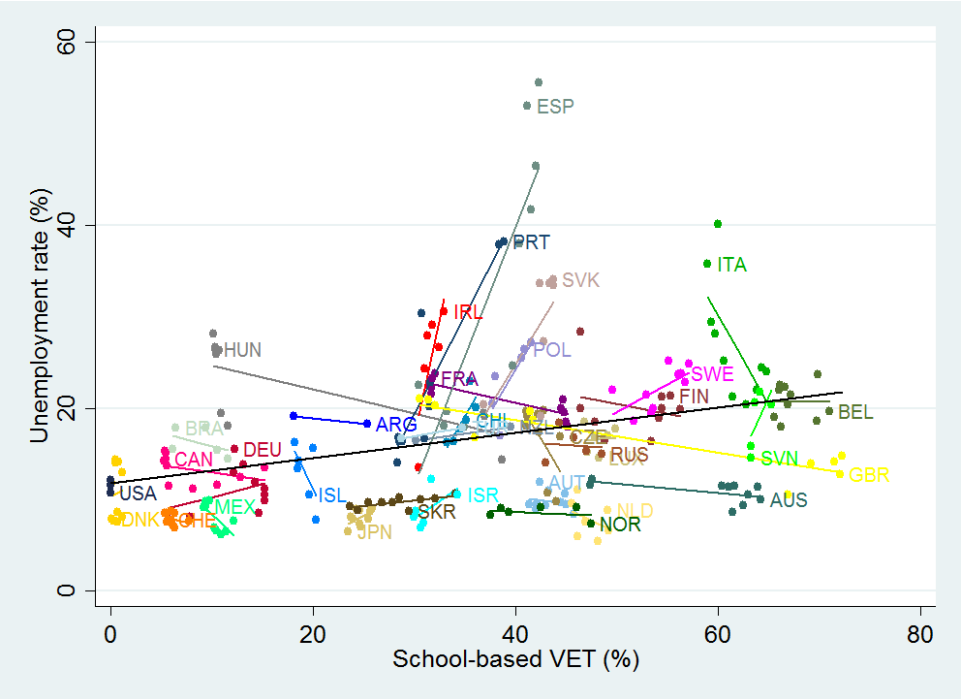
The correlation between the 10 labor market indicators is generally rather low (see Table A4.2 in the Appendix of Chapter 4 for all correlations). This observation underlines the need to analyze various labor market indicators to comprehensively measure the situation of young people in the labor market. As expected, the correlation between the youth and adult labor market indicators is high, except for skills mismatch and in-work at-risk-of-poverty. The correlations between the enrolment rates in education programs and the dependent variables do not appear to be systematic. However, most dependent variables correlate positively with the enrolment rates in school-based VET programs and negatively with enrolments in dual VET programs. These descriptive statistics support our hypothesis about dual VET but contradict the one about school-based VET. Finally, we find no strong correlation among the control variables.

Figures 4.1 and 4.2 on the following pages visualize the variation of our main explanatory variables across and within countries. They display scatter plots with linear predictions for the relation between the youth unemployment rate and the enrolment rates in school-based VET and dual VET, respectively. The black trend line displays the overall relation within and between countries, whereas the smaller colored lines indicate the within-country variation over time, allowing us to see correlations within countries over time.

[34] The NEET rate and the long-term unemployment rate are exceptions. The reason in case of the NEET rate is that we do not have the same indicators for both adults and young people. For the long-term unemployment rate, young people might continue studying instead of staying unemployed if they do not find work.

Figure 4.1 shows an overall positive relation between the unemployment rate and the enrolment in school-based VET, i.e. higher enrolment rates into school-based VET correlate positively with youth unemployment. However, despite a positive relation within some countries (e.g., Portugal, Slovakia, Spain), it is negative in others (e.g., Australia, Hungary, Italy).

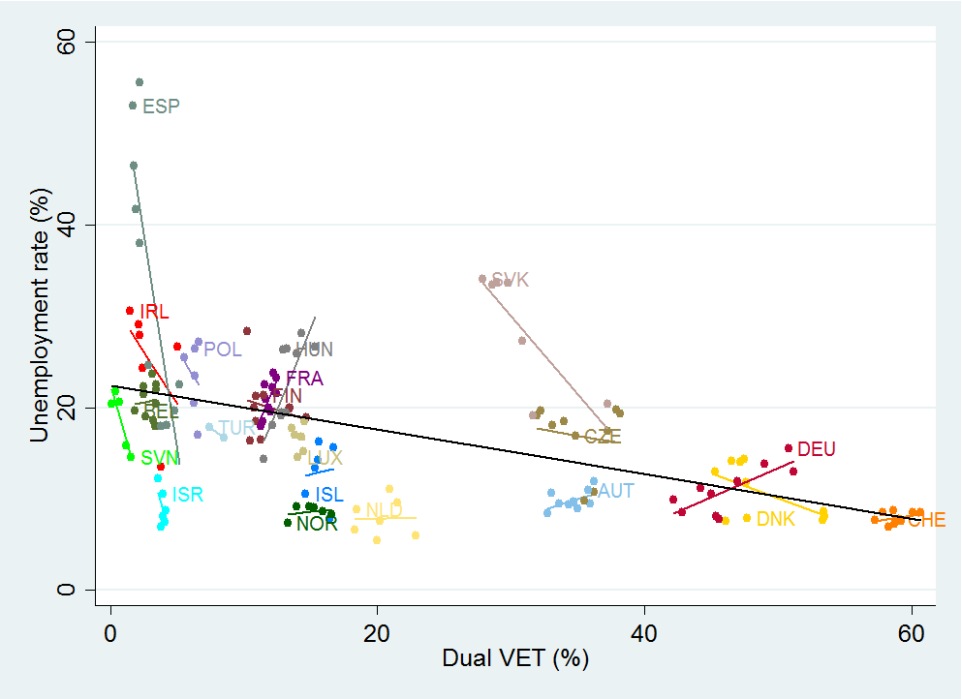
Figure 4.1. Scatter plot of unemployment rate and school-based VET



Note: Plot shows correlation between unemployment rate and school-based VET (lagged by three years); The black trend line displays the overall between and within variation; the colored lines, the within-country variations over time.

In Figure 4.2, the overall relation is negative, i.e. higher dual VET enrolment rates come with lower youth unemployment. Here again, we see both positive and negative country time relations.

Figure 4.2. Scatter plot of unemployment rate and dual VET



Note: Plot shows correlation between unemployment rate and dual VET (lagged three years); The black trend line displays the overall between and within variation; the colored lines, the within-country variations over time.

Most countries with high enrolment rates in dual VET (e.g., Austria, Germany, and Switzerland) show a positive relation and are therefore not driving the overall negative correlation. These relations already hint at the existence of non-linear effects, thereby confirming our hypotheses.

The scatter plots for the other dependent variables appear in figures A4.1 to A4.18 in the Appendix of Chapter 4. The overall relation between the labor market indicators and the enrolment rate into school-based VET is positive for most dependent variables except for the NEET rate and the in-work at-risk-of-poverty rate. For the enrolment into dual VET, the figures show a positive relation for the in-work at-risk-of-poverty rate and a negative relation for the other indicators. Taken together, these descriptive analyses reject our hypotheses concerning school-based VET but support our hypotheses regarding dual VET. However, the analyses show only descriptive correlations without any controls.

4.4 Results

In this subchapter, we present the main results of our regressions on the effect of VET on the youth labor market. We first describe the results of school-based VET, followed by the ones of dual VET. Second, we compare the results for school-based VET and dual VET for all labor market indicators. Third, as we find non-linear effects, we examine them more closely. Fourth, we test the robustness of our results by applying random effects and GMM models and by including additional control variables.

Table 4.4 displays the results for the effect of VET on the indicators of youth labor market integration, while Table 4.5 and Table 4.6 show the results for the quality of young peoples' jobs. All estimations include our main control variables, both for the linear and non-linear models. In all three tables, the first two columns present the linear estimations for the OLS (M1) and fixed effects (M2) models. The third and fourth columns show the results of the non-linear estimation models, which include the squared enrolment rates, for OLS (M3) and fixed effects (M4). For our main specification, the non-linear fixed effects model (M4), we present the detailed estimations results in the Appendix of Chapter 4, Tables A4.3 to A4.12.

Table 4.4. Estimation results on the linear and non-linear effects of the VET programs on youth labor market integration

		LINEAR		NON-LINEAR	
		M1: OLS	**M2: FE**	**M3: OLS**	**M4: FE**
Dependent variable: labor market integration					
Unemployment rate	sVET	0.093***	0.031	0.020	0.086
N = 272		(0.010)	(0.078)	(0.038)	(0.162)
N of C = 35	$sVET^2$			0.001*	-0.001
				(0.001)	(0.002)
	dVET	-0.038***	-0.215	-0.025	-1.980**
		(0.012)	(0.262)	(0.036)	(0.868)
	$dVET^2$			-0.000	0.025**
				(0.001)	(0.011)
	diff VET	0.000^{+}	0.385	0.000^{+}	0.079^{+}
Relaxed unemployment rate	sVET	0.106***	0.115	-0.027	0.385**
N = 176		(0.030)	(0.070)	(0.082)	(0.152)
N of C = 23	$sVET^2$			0.002	-0.003**
				(0.001)	(0.001)
	dVET	-0.114***	-0.231	-0.191**	-1.636**
		(0.030)	(0.288)	(0.077)	(0.650)
	$dVET^2$			0.001	0.021**
				(0.001)	(0.008)
	diff VET	0.000^{+}	0.225	0.000^{+}	0.024^{+}
NEET rate	sVET	0.019	-0.003	0.171***	0.028
N = 245		(0.014)	(0.025)	(0.051)	(0.069)
N of C = 33	$sVET^2$			-0.002***	-0.000
				(0.001)	(0.001)
	dVET	-0.020	0.027	-0.158***	-0.481*
		(0.014)	(0.105)	(0.038)	(0.267)
	$dVET^2$			0.003***	0.007*
				(0.001)	(0.004)
	diff VET	0.000^{+}	0.781	0.000^{+}	0.154
Long-term unemployment	sVET	0.040**	-0.014	0.162***	0.218*
N = 259		(0.016)	(0.065)	(0.053)	(0.126)
N of C = 32	$sVET^2$			-0.002**	-0.003**
				(0.001)	(0.001)
	dVET	-0.020	-0.186	-0.151***	-1.352***
		(0.019)	(0.221)	(0.058)	(0.478)
	$dVET^2$			0.003***	0.017**
				(0.001)	(0.006)
	diff VET	0.002^{+}	0.477	0.000^{+}	0.003^{+}
Controls					
Time FE		YES	YES	YES	YES
Adult control for dependent var.		YES	NO	YES	NO
Main controls		YES	YES	YES	YES

Note: The table displays regression coefficients and clustered standard errors in parentheses (clustered at country level); ***,** and * denote significance at the 1 per cent, 5 per cent and 10 per cent level respectively; diff VET reports the p-values for the null hypothesis that the coefficients of school-based and dual VET are equal; + indicates the significant p-values at the 10% level; N describes the sample size; N of C stands for the number of countries; Main controls are the youth labor force participation rate, youth-to-adult labor force participation ratio, GDP per capita, GDP growth, EPL, and PISA scores; the entire estimation results of M4 are presented in the Appendix of Chapter 4.

Table 4.5. Estimation results of the linear and non-linear effect of the VET programs on the quality of jobs for young people I

		LINEAR		NON-LINEAR	
		M1: OLS	**M2: FE**	**M3: OLS**	**M4: FE**
Dependent variable: job quality					
Temporary contract rate	sVET	-0.002	0.009	0.047	0.055
N = 192		(0.031)	(0.033)	(0.083)	(0.111)
N of C = 23	$sVET^2$			-0.001	-0.001
				(0.001)	(0.001)
	dVET	-0.162***	0.156	-0.327***	-0.042
		(0.031)	(0.107)	(0.087)	(0.307)
	$dVET^2$			0.004**	0.003
				(0.002)	(0.004)
	diff VET	0.000^{+}	0.146	0.000^{+}	0.222
Involuntary part-time work rate	sVET	0.057***	0.049	0.055**	0.228**
N = 239		(0.009)	(0.062)	(0.027)	(0.091)
N of C = 30	$sVET^2$			0.000	-0.002**
				(0.000)	(0.001)
	dVET	-0.044***	-0.019	-0.131***	-0.803*
		(0.009)	(0.161)	(0.031)	(0.411)
	$dVET^2$			0.002***	0.011*
				(0.001)	(0.006)
	diff VET	0.000^{+}	0.640	0.000^{+}	0.077^{+}
Atypical working hours rate	sVET	-0.080***	0.004	-0.300***	-0.048
N = 191		(0.020)	(0.013)	(0.072)	(0.038)
N of C = 23	$sVET^2$			0.003***	0.001
				(0.001)	(0.000)
	dVET	-0.182***	-0.161**	0.007	-0.526**
		(0.025)	(0.076)	(0.051)	(0.225)
	$dVET^2$			-0.005***	0.005*
				(0.001)	(0.003)
	diff VET	0.000^{+}	0.032^{+}	0.000^{+}	0.024^{+}
Skills mismatch rate	sVET	0.022	0.106*	0.046	-0.032
N = 192		(0.025)	(0.053)	(0.059)	(0.112)
N of C = 23	$sVET^2$			-0.000	0.002
				(0.001)	(0.001)
	dVET	-0.074**	-0.346	0.369***	-0.535
		(0.029)	(0.261)	(0.067)	(0.536)
	$dVET^2$			-0.009***	0.002
				(0.001)	(0.007)
	diff VET	0.000^{+}	0.086^{+}	0.000^{+}	0.224
Controls					
Time FE		YES	YES	YES	YES
Adult control for dependent var.		YES	NO	YES	NO
Main controls		YES	YES	YES	YES

Note: The table displays regression coefficients and clustered standard errors in parentheses (clustered at country level); ***,** and * denote significance at the 1 per cent, 5 per cent and 10 per cent level respectively; diff VET reports the p-values for the null hypothesis that the coefficients of school-based and dual VET are equal; $^{+}$ indicates the significant p-values at the 10% level; N describes the sample size; N of C stands for the number of countries; Main controls are the youth labor force participation rate, youth-to-adult labor force participation ratio, GDP per capita, GDP growth, EPL, and PISA scores; the entire estimation results of M4 are presented in the Appendix of Chapter 4.

Table 4.6. Estimation results of the linear and non-linear effect of the VET programs on the quality of jobs for young people II

		LINEAR		NON-LINEAR	
		M1: OLS	**M2: FE**	**M3: OLS**	**M4: FE**
Dependent variable: job quality					
In-work at-risk-of-poverty rate	sVET	-0.063***	0.050	-0.241***	0.049
N = 185		(0.022)	(0.035)	(0.092)	(0.130)
N of C = 23	$sVET^2$			0.002**	-0.000
				(0.001)	(0.001)
	dVET	-0.092***	-0.378**	-0.150	-0.887**
		(0.029)	(0.155)	(0.096)	(0.401)
	$dVET^2$			0.001	0.007
				(0.002)	(0.005)
	diff VET	0.291	0.010^+	0.858	0.023^+
Average hourly earnings (ln)	sVET	0.002***	0.002**	-0.001	0.001
N = 187		(0.000)	(0.001)	(0.001)	(0.003)
N of C = 28	$sVET^2$			0.000**	0.000
				(0.000)	(0.000)
	dVET	0.001	0.002	0.008***	-0.018
		(0.001)	(0.004)	(0.002)	(0.012)
	$dVET^2$			-0.000***	0.000*
				(0.000)	(0.000)
	diff VET	0.083^+	0.925	0.000^+	0.197
Controls					
Time FE		YES	YES	YES	YES
Adult control for dependent var.		YES	NO	YES	NO
Main controls		YES	YES	YES	YES

Note: The table displays regression coefficients and clustered standard errors in parentheses (clustered at country level); ***,** and * denote significance at the 1 per cent, 5 per cent and 10 per cent level respectively; diff VET reports the p-values for the null hypothesis that the coefficients of school-based and dual VET are equal; + indicates the significant p-values at the 10% level; N describes the sample size; N of C stands for the number of countries; Main controls are the youth labor force participation rate, youth-to-adult labor force participation ratio, GDP per capita, GDP growth, EPL, and PISA scores; the entire estimation results of M4 are presented in the Appendix of Chapter 4.

4.4.1 The Influence of School-based VET on the Youth Labor Market

In the linear OLS estimations for youth labor market integration, we find significant positive school-based VET coefficients for the unemployment rate, the relaxed unemployment rate, and the long-term unemployment rate. However, all these effects become insignificant in the fixed effects model. For the job quality indicators involuntary part-time work rate, atypical working hours rate, in-work at-risk-of-poverty rate, and average hourly earnings, we find significant coefficients in the OLS model. In contrast to the labor market integration indicators, we find significant positive coefficients of school-based VET in the fixed effects estimations for two job quality indicators: the skills mismatch

rate and the average hourly earnings. Taken together, we do not find an effect of school-based VET on labor market integration. Nevertheless, school-based VET improves the average hourly earnings and increases skills mismatch, with only the latter finding supporting Wolbers' (2003) results for the negative effect of school-based VET on job quality.

As in the linear models, all significant school-based VET coefficients for youth labor market integration are positive in the non-linear models. However, while the coefficients for the NEET rate and the long-term unemployment rate are significant in the OLS model, only the latter persists in the fixed effects model. In contrast, the relaxed unemployment rate is only significant in our main specification but not in the OLS model. The coefficients of the quadratic school-based VET enrolment rates show that the positive relations for relaxed and long-term unemployment diminish with increasing enrolment rates.

With respect to the relation between school-based VET and young people's job quality, the coefficients for the involuntary part-time work rate, the atypical working hours rate, and the in-work at-risk-of-poverty rate are significant in the OLS model. However, the non-linear effect is significant only for the atypical working hours and in-work at risk-of-poverty. In our main model, we find a significant positive coefficient for the involuntary part-time work rate, together with a significant negative coefficient for the quadratic term.

Against H1, the results show that higher enrolment rates in school-based VET significantly increase relaxed unemployment, long-term unemployment, and involuntary part-time work but at a decreasing rate. These results contradict the theoretical argument that school-based VET improves the labor market but at a decreasing rate. Instead, school-based VET worsens the labor market at a decreasing rate. The only improving effect we find for school-based VET is on average hourly earnings.

4.4.2 The Influence of Dual VET on the Youth Labor Market

In Tables 4.4 to 4.6, we also present the results for dual VET. Looking at the linear estimations, we find negative dual VET coefficients for all labor market integration indicators in the OLS models, although not all of them are significant. These findings are in line with many previous studies finding a positive relation between dual VET and labor market integration (OECD, 1998; Van der Velden & Wolbers, 2001; Breen & Buchmann, 2002; Breen, 2005; Wolbers, 2007; Noelke, 2011; Bol & Van de Werfhorst, 2013a; De

Lange et al., 2014; Busemeyer & Thelen, 2015). However, none of these significant results persists in the non-linear fixed effects model. For the quality of young people's jobs, five out of six indicators in the OLS model and four out of six indicators in the fixed effects model have the expected negative sign. Thereof, all coefficients of the OLS models are significant, but we find only significant coefficients for the atypical working hours rate and the in-work at-risk-of-poverty rate in the fixed effects model. Thus we find evidence that higher dual VET enrolment rates reduce the atypical working hours rate and the in-work at-risk-of-poverty rate, a finding in line with the results of Van der Velden and Wolbers (2001), De Lange et al. (2014), and Levels et al. (2014) but contradicting those of Wolbers (2007).

Focusing on the non-linear effect of dual VET on youth labor market integration, we find a significant negative but decreasing relation for all four indicators in the fixed effects model. Thus higher enrolment rates in dual VET improve youth labor market integration—but at a decreasing rate. These results are not entirely consistent with the OLS model, in which the coefficients are not significant for the unemployment and the relaxed unemployment rate.

The results are similar for the job quality indicators. The dual VET coefficients in the fixed effects models are significantly negative for the involuntary part-time work rate and the atypical working hours rate, and these trends decrease with higher enrolment rates. We further find a significant negative coefficient for the in-work at-risk-of-poverty rate but not at a diminishing rate. For the remaining indicators, the dual VET coefficient is also negative, although not significant in the fixed effects estimations. The results are less consistent in the OLS model. Although the results from the fixed effects model support H2, they contradict the findings of previous studies. These earlier findings show a growing advantage for young people with a VET degree in the case of higher enrolment rates in dual VET (Wolbers, 2007; Levels et al., 2014; Hanushek et al., 2017), a surprising result from a theoretical perspective.

4.4.3 The Difference between the Influences of School-based VET and Dual VET

To test hypothesis H3, we compare the coefficients of school-based VET and dual VET for each youth labor market indicator (labeled diff VET in Tables 4.4 to 4.6). In the linear

estimations, the OLS coefficients are significantly different for all labor market integration indicators, whereas this does not apply to the fixed effects coefficients. In the non-linear estimations, we find significantly different coefficients for all the four indicators in the OLS models and for three out of four labor market integration indicators in the fixed effects models, with the NEET rate being the exception.

For job quality, the coefficients for all indicators except the in-work at-risk-of-poverty rate are significantly different in the linear and non-linear OLS models. In the linear fixed effects model, the atypical working hours rate, the skills mismatch rate, and the in-work at-risk-of-poverty rate are significantly different for dual VET and school-based VET. We find the same results for the fixed effects coefficients in the non-linear estimations, except that those for the skills mismatch rate no longer differ significantly, while those for involuntary part-time work do. Thus these findings support H3 that school-based VET has a significantly different effect than dual VET on labor market integration and job quality, a finding in line with the literature (Van der Velden & Wolbers, 2001; Bol & Van de Werfhorst, 2013a; Levels et al., 2014).

4.4.4 In-depth Analysis of the Non-linear Results

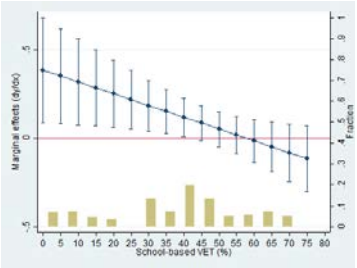
The results show both linear and non-linear relations between the enrolment rates in VET and the youth labor market. Thus far we have assumed a quadratic functional form for the estimations of the non-linear effects. However, we do not know where the turning point of this function is. We therefore take a closer look at the significant non-linear effects identified in the previous subchapter and calculate their marginal effects as a function of the enrolment rates. Doing so shows us how the dependent variables behave depending on the level of the VET enrolment rate and on whether there is a significant turning point or not.

Figure 4.3 displays on the top left the marginal effects of school-based VET on relaxed unemployment together with its data density. The y-axis on the left indicates the predicted change in the relaxed unemployment rate and the y-axis on the right displays the amount of data on which the results are based, whereas the x-axis shows the enrolment rate in school-based VET. The confidence intervals around the marginal effects display whether they are significant or not at the 5 per cent level. Marginal effects are significant when the confidence interval does not cross the horizontal line at zero. Thus, for relaxed unemployment, we see that the effect is significantly positive for low enrolment rates in

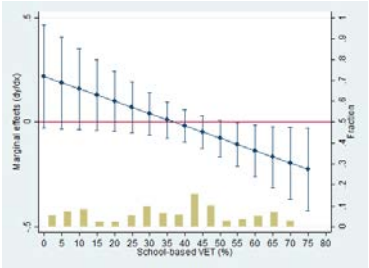
school-based VET, becoming insignificant at about 40 per cent. As the positive marginal effects become and remain insignificant, even though turning negative, we see no significant turning point.

Figure 4.3. Marginal effects of significant regression results

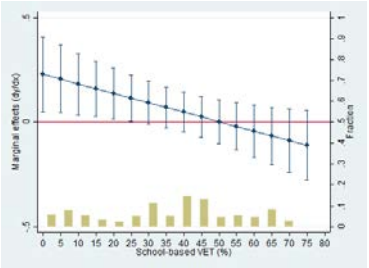
School-based VET on the relaxed unemployment rate



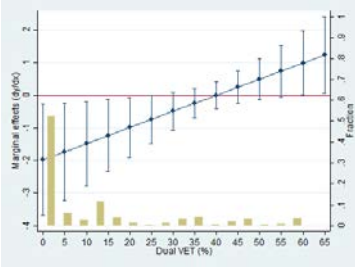
School-based VET on the long-term unemployment rate



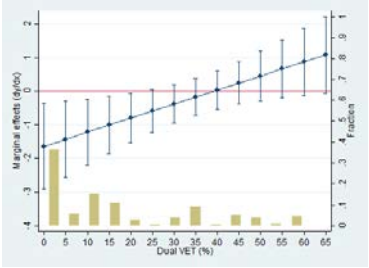
School-based VET on the involuntary part-time work rate



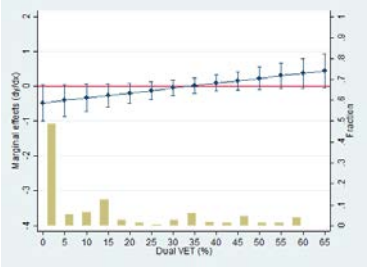
Dual VET on the unemployment rate



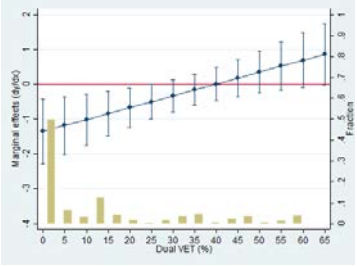
Dual VET on the relaxed unemployment rate



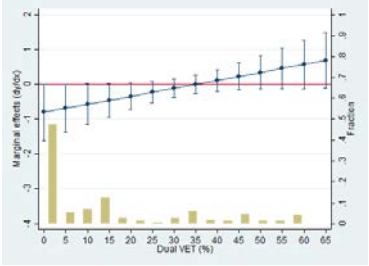
Dual VET on the NEET rate



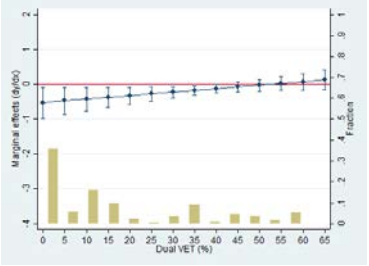
Dual VET on the long-term unemployment rate



Dual VET on the involuntary part-time work rate



Dual VET on the atypical working hours rate



Note: Plots show on the left axis the marginal effects of school-based VET or dual VET for all dependent variables with a significant quadratic relation. The marginal effects are significant at the 5% level if their confidence interval does not cross the reference line at 0. On the right axis, we display the data density for different levels of enrolment.

For school-based VET, the non-linear coefficients of the long-term unemployment rate and involuntary part-time work rate were also significant. The marginal effects for the long-term unemployment rate are significantly negative when the enrolment rate is high (above 50 per cent). The marginal effects for the involuntary part-time work rate follow the same pattern as those for the relaxed unemployment rate. The effects of school-based VET are initially positive (up to 25 per cent) but decrease with higher enrolment rates and remain insignificant.

For dual VET, we find significant non-linear coefficients for the unemployment rate, relaxed unemployment rate, NEET rate, long-term unemployment rate, involuntary part-time work rate, and atypical working hours rate. Initially dual VET significantly reduces unemployment, relaxed unemployment, long-term unemployment, involuntary part-time work and atypical working hours but at a decreasing rate, until becoming insignificant at 25 per cent, 20 per cent, 25 per cent, 5 per cent and 40 per cent respectively. The only indicator with a positive marginal effect is unemployment, when the enrolment rate in dual VET is above 55 per cent. However, we need to interpret this result with caution since there are few observations above this threshold. The marginal effects for the NEET is not significant but shows the same pattern.

Taken together, these results support the conclusion that the effects we found in the previous subchapters occur at a decreasing rate, except for the quadratic relation between school-based VET and long-term unemployment, and between dual VET and unemployment. These exceptions though are based on limited data, which makes them unreliable. Also the unemployment rate, the relaxed unemployment rate, and the NEET rate are very similar measures and the quadratic relation is not consistent across them.

4.4.5 Robustness Checks

To enhance the causal interpretation and check the robustness of our results, in this subchapter we consider a random effects model, a GMM model and add additional control variables. We present the detailed results of these robustness checks in the Tables A4.3 to A4.12 in the Appendix of Chapter 4.

Random Effects Model

Previous studies often apply multilevel models with random intercepts. Thus we additionally apply a random effects model. This estimation focuses on the within-country variation over time and eliminates country-specific unobserved heterogeneity by including random intercepts, $\gamma_{j,i}$ with N $(0, \sigma_j^2)$ into the OLS equation. The estimation equation reads:

$$Y_{j,i,t}^{youth} = \beta_{j,0} + \beta_{j,1} P_{i,t-3} + \beta_{j,2} Y_{j,i,t}^{adult} + \beta_{j,3} X_{i,t} + \gamma_{j,t} + \gamma_{j,i} + \varepsilon_{j,i,t} \quad (3)$$

Comparing our results of the random effects (RE) and the fixed effects (FE2) models (see tables A4.3 to A4.12 in the Appendix of Chapter 4), we find some major differences. To evaluate whether the fixed effects model is more appropriate for our data than the random effects model, we test the two models against one another. As we cluster the standard errors, we apply the Sargan-Hansen test of over-identification to compare the results of the two models. The test results show for every dependent variable that the fixed effects model better fits our data than the random effects model, although the random effects model even controls for the adult dependent variables. These test results support the choice of our main specification[35].

Generalized Method of Moments Model

We apply the generalized method of moments (GMM) as it is suitable for small datasets with few periods in relation to the number of individuals (Wooldridge, 2001; Roodman, 2009). The model accounts for our dependent variables being dynamic, i.e. depending on their past values($Y_{j,i,t-1}^{youth}$), and for the independent variables not being strictly exogenous. Thus GMM allows us to further elaborate on the causality of our results. We decide on the first-difference GMM specification (Roodman, 2009), thereby excluding unobservable time-invariant variables and avoiding the dynamic panel bias.[36] As instruments, we use the dependent variable (lagged by one year) and the explanatory variables. The equation for the difference GMM reads as follows with the error term, $\Delta v_{j,i}$ capturing the idiosyncratic shocks:

[35] More details are available upon request.

[36] Using standard estimation models, such as OLS with autocorrelated panel data and individual fixed effects results in the dynamic panel bias (Nickell, 1981).

$$Y_{j,i,t}^{youth} = \beta_{j,1} P_{i,t-3} + \beta_{j,3} \Delta X_{i,t} + \beta_{j,4} \Delta Y_{j,i,t-1}^{youth} + \Delta \gamma_{j,t} + \Delta \upsilon_{j,i} \quad (4)$$

The notation is the same as in the previous regressions. However, the first-difference GMM looks at the changes of the variables between the current and the previous year, changes we denote by the Δ. For the GMM estimation, our dataset loses entire cross-sections due to the time lagging and further observations due to the unbalanced panel. This reduction leads to a limited dataset with potential for over-specification and thus unreliable coefficient sizes, explaining why we do not use GMM as our main estimation model. Nevertheless, we can use the GMM estimations to test for the robustness of the fixed effects coefficients. The results (see tables A4.3 to A4.12 in the Appendix of Chapter 4) show that GMM yields qualitatively the same results as the fixed effects model in the non-linear estimations, as the coefficients' significance and are about the same.

Additional Control Variables

In addition to the control variables that we have already included in our main estimations, other time-variant variables might also influence the labor market. From the literature, we know that trade union density, welfare payments, strengths of economic sectors, and the stage of globalization all play important roles (e.g., Nickell, 1997; Wolbers, 2007; Felbermayr, Prat, & Schmerer, 2011; Mulligan, 2012). Therefore, to analyze whether the results remain robust, we also consider these controls. We account for the trade union density to capture the power of employees on the labor market, measured as the share of trade union members of all wage and salary earners. Then, to account for variation in welfare payments, we include unemployment insurance as income transfers to the unemployed.

Additionally, to control for differences between the shares of the economic sectors, we include sector dummies, i.e. for industry and services, where agriculture serves as the baseline. The KOF Globalization Index further accounts for the stage of globalization. Unfortunately the data for these control variables are available only for a subsample, and therefore we do not include them in the main analyses. Moreover, the 2008 recession might have had a stronger impact on youth than on adults (Choudhry et al., 2012). For that reason, we include the interactions between the GDP growth and the two VET programs[37].

[37] As an alternative, we could exclude the recession years from our dataset. But if we did so, we would lose too many observations.

We estimate the non-linear fixed effects models, including each of these control variables separately before putting them together. The results (see tables A4.3 to A4.12 in the Appendix of Chapter 4) show that including the additional control variables does not change the results qualitatively (FE3 to FE10) and that dropping the observable time-variant controls in the baseline estimation (FE1) does not change much.

4.5 Conclusion

This chapter explores the extent to which VET improves the labor market for young people. We investigate whether increased enrolment rates in dual VET and school-based VET have the same effect on labor market outcomes, and explore how those effects change with higher enrolment rates in these programs. We analyze these relations using fixed effects estimations on an unbalanced panel of 35 countries from 2004 through 2014. Previous studies indicate that the effect of VET also depends on scholars' choice of youth labor market indicator, so we consider a broad set of indicators for youth labor market integration and job quality.

Our significant linear and non-linear results reveal that school-based VET slightly raises average hourly earnings but increases rates of relaxed unemployment, long-term unemployment, involuntary part-time work, and skills mismatch. Dual VET significantly decreases rates of unemployment, relaxed unemployment, NEET, long-term unemployment, involuntary part-time work, atypical working hours, and in-work at-risk-of-poverty. Thus while school-based VET worsens youth labor market integration, its influence on the job quality indicators is unclear. Dual VET, however, improves both labor market integration and job quality. The effects of school-based VET and dual VET are significantly different for seven of ten indicators; we find no significant difference for NEET, temporary contracts, and average hourly earnings. The robustness checks mostly support our main results.

To improve the situation of young people in the labor market, a large number of countries are introducing or expanding VET programs, particularly dual VET (Chatzichristou et al., 2014). As our results indicate that the introduction or expansion of school-based VET will most likely have very different effects from dual VET, this chapter encourages policymakers to carefully consider which kind of programs they support. Even though both kind of VET programs offer more vocational content than general education does,

the negative effects of school-based VET on youth labor market integration indicate that such programs do not meet the needs of the labor market. Van der Velden and Wolbers (2001) argue that dual VET always imparts occupation-specific skills and therefore has a strong vocational specificity, while school-based VET may not. Moreover, school-based VET programs do not include much workplace training where the curriculum allows students to apply the skills they learned at school, gain valuable experience, and acquire 21st century skills. Furthermore, the institutional link between the education system and the labor market is often weak in school-based VET, possibly leading to outdated training standards (Zimmermann et al., 2013).

Consequently, dual VET programs better prepare young people for the labor market thanks to their skills' occupational specificity and extensive workplace training. However, there is no clear evidence regarding young people's financial situation. On the one hand, dual VET significantly reduces the in-work at-risk-of-poverty rate. On the other hand, school-based VET significantly but slightly increases average hourly earnings. These mixed results might indicate that the earnings are negotiable in a job interview, in contrast to other working conditions. Policy strategies and research in the future should consider the different effects of school-based and dual VET on youth labor market performance.

This chapter also finds that both programs' effects—the unexpected negative effects of school-based VET and the expected positive effects of dual VET—diminish with increasing enrolment rates. One possible explanation for the startling non-linear effects of school-based VET is that such programs might be of better quality in the case of high enrolment rates. Moreover, with a higher proportion of school-based VET graduates, employers might depend on them more for recruiting and might therefore engage more actively in these programs, i.e. in the curriculum development. With employers' and politicians' commitments, school-based VET might become more like dual VET, and thus VET certificates send clearer, more positive signals to employers (Levels et al., 2014). The decreasing effect of dual VET is in line with our argument that a mix of different education programs is the best way to meet labor market demand. Policymakers and researchers will need to consider these non-linear effects. In contrast to dual VET, school-based VET might only be beneficial for the youth labor market when enrolment rates are high.

Even though the robustness checks confirm our findings, this chapter has several limitations in the data and identification strategy, which yield great potential for future research. The first challenge is data availability: the number of countries and periods restricts the data set, leading to limited variation in the enrolment rates of upper-secondary education programs. Thus the effect sizes and curvatures of the non-linear results must be interpreted cautiously.

Second, the data itself limits our results' external validity in various ways. The countries in the data set have upper bounds on VET enrolment rates at 80 percent for school-based VET and 60 percent for dual VET. Thus, to apply our results to enrolment rates outside these bounds, we require stronger assumptions. Next, we differentiate VET programs based on a definition that only accounts for the amounts of vocational content and of workplace training. Therefore, we do not account for heterogeneity between education programs in quality, the occupational specificity of content, the embeddedness in the education system, or the institutional link between the education system and the labor market. Even the OECD (2010b) recognizes the need for a more accurate identification of and differentiation between VET programs in international comparisons. Future research could use more advanced differentiations between VET programs, for example based on education-employment linkage (see chapters 2 and 3; Renold et al., 2015, 2016, 2017). Finally, this chapter focuses on young people's labor market outcomes and does not consider the longer-lasting outcomes of various programs. Despite these data limitations, our data set is the best currently available.

Our identification strategy accounts for unobserved heterogeneity and reverse causality. To tackle unobserved heterogeneity, we use a fixed effects model that exploits variation over time within a country. Two underlying assumptions of this model restrict our estimations. First is the assumption that there is no relevant time-varying unobserved heterogeneity between countries. We argue that unobserved time-varying cofounders, which might lead to non-parallel time trends between countries, are not very likely. The second assumption of our identification strategy is that every graduate faces the same difficulties on the labor market, independent of his or her occupation or industry; that is to say that graduates of general education, school-based VET, and dual VET do not differ in terms of employment probability and job quality. The fact that the results are stable when including the sectors as additional control variables largely tackles this problem.

The major limitation of our identification strategy is that it does not completely rule out reverse causality. One way to avoid the problem of reverse causality is to apply an instrumental variable approach. However, to our knowledge, there is no appropriate instrument available. To improve our identification, we control for the youth labor force participation rate and lag the explanatory variables by three years to account for the average duration of the education programs. As the implementation of educational reforms would take much longer, considering this temporal structure also makes it less probable that the business cycle drives the effects. We further tackle reverse causality by interacting GDP growth with the enrolment rates in each VET program. Although our main effects remain stable, the coefficients of both interaction terms are positive. Increasing VET enrolment rates are more favorable in times of economic boom than in recessions. Moreover, we find qualitatively the same results when applying GMM.

This chapter further provides indication that in-depth analyses of the non-linear effects of VET are necessary for a comprehensive understanding of education programs' labor market outcomes. Future research should particularly explore the optimal mix of enrolment rates in different upper-secondary education programs and whether this mix depends on national context.

Chapter 5

Measuring the Social Status of Education Programs: Applying a New Measurement to Dual Vocational Education and Training in Switzerland[38]

5.1 Introduction

Following the financial crisis of 2008, youth unemployment reached unprecedentedly high rates in various European countries. Due to the comparably low youth unemployment rates in Austria, Germany, and Switzerland, this challenge has ignited increasing political interest in dual vocational education and training (dual VET[39]; e.g., International Labour Organization [ILO] & Organisation for Economic Co-operation and Development [OECD], 2014). By combining practical training in the workplace with learning of occupation-specific theory and some general education (OECD, 2010a), dual VET programs can improve labor market integration (ILO & OECD, 2014). As the successful functioning of dual VET programs[40] depends on their social status (e.g., Lasonen & Manning, 2001; Cedefop, 2014), politicians and scholars search for ways to improve the social status of VET (Caves & Renold, 2016).

Drawing on Podolny (1993) and Devers, Dewett, Mishina, and Belsito (2009), we define the social status of an education program as its relative position compared to other

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[39] VET refers to education and training programs designed for, and typically directly leading to, a particular occupation or type of occupation (OECD, 2004).

[40] We are referring to dual VET as education programs defined and regulated on the national level, rather than to individual school programs or programs for particular occupations.

education programs on the same educational level. While there is a broad literature about the social status of individuals and occupations, little is known about the social status of education programs. Exceptions include studies by Forrer (1998), Cattaneo and Wolter (2013), Cedefop (2014, 2017), Mourshed et al. (2014), and Abrassart et al. (2017), which survey individuals regarding the social status of VET based on specific questions, for example on the expected employment opportunities or the preferred educational path for children. These measurement approaches have three disadvantages. First, the particularity of the questions restricts data availability. Second, social desirability bias, the tendency to respond in a manner that is viewed favorably by others, might cause measurement errors (e.g., Diekmann, 2004). Third, it remains unclear how to aggregate the variety of questions in a single measure of social status.

We expand the existing literature in two directions. First, we present a novel approach to measure changes in the social status of education programs that relies on objective information on educational choices. We follow the theoretical framework of Barone, Schizzerotto, Abbiati, and Argentin (2017), in which educational choices reflect both instrumental considerations and intrinsic preferences, suggesting that the social status of an education program affects educational choices. Therefore, an increase in the relative ability of adolescents choosing an education program compared to the cohort reflects an increase in the social status of that program, assuming everything else remains constant. Likewise, a change in the probability of choosing an education program conditional on ability reflects a change in the social status of that program.

Second, we are the first ones to investigate whether knowledge of the education system increases the social status of dual VET as hypothesized by Depner and Atz (2000), Federal Office for Professional Education and Technology (OPET, 2011), Cedefop (2014, 2017), and Mourshed et al. (2014). Dual VET programs in Switzerland represent an ideal case study thanks to their particularity. This particularity suggests that immigrants are not familiar with the education program at the time of immigration, as most other countries have no comparable education program to serve as a benchmark. Thus their knowledge differs substantially from individuals born in Switzerland.

Using the scores from the “Programme for International Student Assessment” (PISA) as a proxy for cognitive ability and the length of stay of first-generation immigrants in Switzerland as a proxy for the knowledge of the Swiss education system, we analyze the impact of knowledge of the social status of dual VET programs. The results suggest that

the social status of dual VET programs increases as immigrant adolescents live in Switzerland for longer.

Building on the existing literature on the social status of education programs and theoretical concepts explaining educational choices, subchapter 5.2 introduces our approach to measuring changes in the social status of education programs. Subchapter 5.3 develops our hypotheses on the social status of dual VET programs in Switzerland. Subchapter 5.4 describes the data and explains the empirical methodology applied in our results subchapter 5.5. Finally, subchapters 5.6 discusses our results and subchapter 5.7 concludes.

5.2 Literature on Measuring the Social Status of Education Programs

In sociology, social status describes the relative standing of an individual in society, thus referring to a position in a hierarchical order (e.g., Lenski, 1954; Weber, 1968a; Chan & Goldthorpe, 2007). While this definition implies a single vertical social stratification, Max Weber (1968a) conceptualizes social structure as a number of parallel vertical hierarchies. In his view, every individual occupies multiple positions in imperfectly correlated hierarchies (see also Lenski, 1954).

Whereas the term "status" only denotes an individual's relative position, "social status" refers to the standing in a hierarchy that is accepted by society (Weber, 1968a). Importantly, social status reflects the prestige or social honor attached to a certain social position. Weber (1968a) clearly distinguished social status from the concept of classes, which are formed by the social relations of economic life and thus refer to only one aspect of social stratification. Similarly, Chan and Goldthorpe (2007) argue that the concept of socioeconomic status reflects a simplified view of social stratification. Social status is also distinct from concepts like reputation or image, both referring to the signaling of a certain quality rather than to the position in a social structure (Devers et al., 2009). Drawing on Podolny (1993) and Devers et al. (2009) who argue that organizations also occupy socially defined positions, we can apply the concept of social status to a country's education system. We then define the social status of an education program as the relative position of that program in comparison to other education programs.

However, to date, scholars have paid little attention to the social status of education programs. We separate the scant literature to measure the social status of VET into three

approaches. The first approach consists of asking respondents directly about their perception of education programs in terms of image (Cedefop, 2014, 2017), prestige of educational choice (Mourshed et al., 2014; Howard & Rimini, 2016), recommendation for adolescents (Cedefop, 2014), or the preferred education program for children (Cattaneo & Wolter, 2013; Abrassart et al., 2017). This first approach has two disadvantages. First, these questions are very particular, substantially limiting data availability. Second, social desirability, that is the tendency of survey respondents to answer questions in a manner that others will view favorably instead of saying what they really think, might bias the responses (e.g., Diekmann, 2004).

The second approach to measure the social status of education programs asks respondents about their expectations about various labor market outcomes of individuals with a particular education, such as the probability to find work, income prospects, and career perspectives (Cattaneo & Wolter, 2013; Mourshed et al., 2014; Howard & Rimini, 2016; Abrassart et al., 2017; Cedefop, 2017). In addition to the data availability and social desirability drawbacks, it remains unclear in this approach how scholars can aggregate the variety of outcomes into a single measurement of social status. To tackle the aggregation drawback, Forrer (1998) and Haney (2002) combine numerous items about students' perception towards VET, which include both questions on its outcome and valuation, and aggregate them into one measurement.

The third measurement approach, approximates social status by the proportion of students enrolled in different education programs (Cedefop, 2014). While this measurement does not suffer from the previously mentioned disadvantages, it depends on the supply of VET and fails to disentangle the supply and demand for VET.

By arguing that the social status of an education program affects educational choices, we build on this third approach. To constitute our novel measurement approach, we exploit the information on observed education program choices. Drawing on the theoretical framework of educational choices presented by Barone et al. (2017), we argue that adolescents choose an education program based on instrumental considerations and intrinsic preferences. Intrinsic preferences entail adolescents' interests and direct value of an education program, for example by the enjoyment of studying, instrumental considerations include that program's perceived profitability, thus the expected costs, benefits, and chances of success (Breen & Goldthorpe, 1997; Becker & Hecken, 2009; Barone et al.,

2017). Whereas the expected costs and chances of success are related to students' assessment of their own abilities, the benefits also include the expected future earnings and occupational benefits. According to Barone et al. (2017), these instrumental considerations are influenced by the parents' socioeconomic background, that is their economic and cultural capital, and by the adolescents' cognitive ability. In addition, institutional characteristics of the education system, such as the degree to which educational opportunities are differentiated and the selection procedures within the education system, determine an adolescents' educational options (Pfeffer, 2008).

Furthermore, adolescents' and their families' instrumental considerations depend on how well they are informed in terms of costs, benefits, and chances of success (Barone et al., 2017). Barone et al. (2017) posit that adolescents and their parents base their decision-making process on heuristics facilitating educational choices and on easily available information, for example from their friends and relatives, instead of gathering full information. We now argue that the social status of an education program acts as such a heuristic by reducing the uncertainty about its costs and benefits.

Consequently, the theoretical framework suggests that an increase in the social status of an education program enhances the probability of students selecting that program, considering everything else remains constant. We can thus capture the change in the social status of an education program by looking at changes in the probability of selecting that program, conditional on the instrumental considerations and the intrinsic preferences:

$$\Delta \text{ Social Status} = \Delta p \text{ (Educational Choice | Socioeconomic Background, Ability, Intrinsic Preferences, Institutional Context)} \quad (5)$$

Conversely, holding the other factors constant, an increase in the social status of an education program results in a change in the program's composition of adolescents regarding their ability. We can express this approach by the average ability difference between the students of a certain education program and the rest of the cohort, i.e. the students in all other programs on the same level. We can express the change in the social status of dual VET compared to the rest of the cohort that are school-based students on the same educational level as follows:

$$\Delta \text{ Social Status} = \Delta \text{ (Ability of Students in Education Program} - \text{Ability of Rest of the Cohort| Socioeconomic Background, Ability, Intrinsic Preferences, Institutional Context)} \quad (6)$$

As we do not dispose of any reference for interpreting a certain level of the social status of education programs, this approach allows us to analyze differences in this social status across time and groups, but provides no interpretation of the level.

5.3 Hypotheses on the Social Status of Dual VET in Switzerland

Several authors suggest that there is a stigma against VET (Koulaidis et al., 2006; Bilboe, 2011; Billett, 2011; Cedefop, 2014; Mourshed et al., 2014). In many countries, society perceives VET programs as less aspirational options targeted at students from a low socioeconomic background or for those who failed academically (Howard & Rimini, 2016). This stigma against VET even appears to dissuade young people from following pathways that can lead to jobs they want (Mourshed et al., 2014). Such a negative social valuation of VET programs also affects the programs' relative position, that is their social status. Building on the argument that the stigma against VET depends on the level of knowledge of the education system (Depner & Atz, 2000; OPET, 2011; Cedefop, 2014, 2017; Mourshed et al., 2014), we hypothesize that *growing knowledge of the education system leads to an increase in the social status of VET programs*.

We test this hypothesis for the case of dual VET programs in Switzerland. Due to the particularity of its education system (OECD, 2010a), Switzerland presents an ideal case to investigate our hypothesis. In Switzerland, adolescents choose a post-compulsory education program after completing nine years of compulsory education. These post-compulsory education programs prepare youth either for further academic education (general education programs) or for direct labor market entry (VET programs). With about 20 percent, the baccalaureate rate is relatively low due to the restricted access to baccalaureate schools. Correspondingly, VET accounts for about two thirds of upper-secondary qualifications, the majority of which are achieved in dual VET programs (Swiss Coordination Centre for Research in Education SCCRE, 2014). Dual VET students have an apprenticeship contract with companies where they spend three to four days per week receiving on-the-job training and gaining work experience. To learn occupation-specific theory and receive some general education, they spend the remaining one to two days in a vocational school. As Switzerland has evolved VET as its own system by the Federal Act on Vocational and Professional Education and Training, we speak of a "VET system."

VET curricula are thus defined in a national training ordinance and graduates receive a federally recognized degree. VET students have the possibility to obtain a federal vocational baccalaureate, which offers access to professional education and training on the tertiary level. Moreover, the university aptitude test even allows the transition to a university.

As only few countries have education programs that are similar to the dual VET programs in Switzerland, we argue that immigrants are unlikely not know or understand the Swiss VET system and have not experienced this kind of education themselves. In line with this argument, Cattaneo and Wolter (2013) and Abrassart et al. (2017) show that the valuation of VET programs is lower among immigrants living in Switzerland than among Swiss-born individuals. An important exception consists of immigrants from Austria and Germany, who know dual VET systems comparable to Switzerland's.

We now argue that with the time that immigrants spend in Switzerland, their knowledge of the education system increases, and that this increase leads them to a less biased assessment of dual VET programs. We can thus reformulate our hypothesis as follows: *For immigrant adolescents, the social status of dual VET programs increases as they live in Switzerland for longer thanks to their growing knowledge of the Swiss education system.* However, a later subchapter also discusses alternative explanations for changes in the social status of VET programs with the time spent in Switzerland, for example socialization and adaptation of Swiss values.

5.4 Research Design

5.4.1 Data and Variables

Our empirical analysis is based on data from the Program for International Student Assessment (PISA) for Switzerland. Due to missing values in key variables in the wave of 2006, we analyze the PISA waves 2000, 2003, 2009, and 2012 pooled across time (PISA.ch, 2004, 2011, 2012, 2016). The sample of PISA is representative of the 9th grade student cohort in Switzerland, thus adolescents at the end of compulsory education who are in the process of selecting their upper-secondary education program (PISA.ch, 2008). As we analyze whether the social status of dual VET programs increases as immigrant adolescents live in Switzerland for longer, we restrict our sample to students born abroad.

Our DiD approach, which we introduce in the following subchapter, differentiates between adolescents born in a German-speaking country and those born in another foreign country. As the proportion of immigrant adolescents from German-speaking countries is negligible in the French- and Italian-speaking parts of Switzerland, we restrict our sample to the German-speaking part of the country.[41]

For our dependent variable, the Swiss PISA data contain information on the upper-secondary education program that adolescents plan to pursue after compulsory education. The possible activities after compulsory education are grouped into six programs: dual VET (40.5 percent), school-based VET (2.2 percent), general education (23.6 percent), grades 8-9 or gap year (24.2 percent), other education or paid job (3.9 percent) and do not know yet (5.6 percent). Data from the "Transition from Education to Employment" (TREE) survey[42], a longitudinal follow-up survey to PISA 2000, show that the information on the prospective education program in the PISA data has a correlation of more than 0.8 with the chosen education. Although we observe adolescents' educational choices at the end of compulsory education, we speak of "dual VET students" and "students in school-based education programs" in the remaining chapter.

In our analyses, we only include adolescents with a direct transition after compulsory education, thus those who plan to attend dual VET, school-based VET, or general education programs. As these adolescents only account for 66.3 percent of the sample, we exclude a sizeable group of students planning to repeat the 9th grade or doing a gap year (e.g., in school or internship). From the TREE data, we know that these students will mostly choose a dual VET after the bypass. Our preliminary analysis shows that the relative ability of first-immigrant students in grades 8-9 or gap years in comparison to the cohort of students born abroad increases with their time spent in Switzerland. This evidence suggests that omitting these students from our sample biases the effect of time spent in Switzerland downwards. Nevertheless, including the full cohort in our estimations yields qualitatively the same results, which are available from the authors upon request.

[41] A forthcoming paper provides a detailed analysis of the regional differences in the social status of VET in Switzerland.

[42] The Swiss youth panel survey TREE ("Transitions from Education to Employment"; www.tree-ch.ch) has been running since 2000 and has since been funded by the Swiss National Science Foundation, the University of Basel, the Swiss Federal Office of Statistics, the Federal Office of Professional Education and Technology, and the cantons of Berne, Geneva and Ticino. Distribution: Data service, FORS, Lausanne.

For our explanatory variable, we use the time that adolescents have spent in Switzerland as a proxy for their knowledge of the Swiss education system. In addition, we operationalize ability by cognitive abilities measured by the PISA plausible test scores in reading and mathematics (OECD, 2009; Von Davier, Gonzalez, & Mislevy, 2009). Consequently, our ability measure neglects differences in other ability dimensions, such as non-cognitive skills.

PISA offers detailed background information about the tested adolescents and their families, which we use as control variables. In the multivariate analyses, we control for age, gender, and the observable factors mentioned in the theoretical framework on educational choices (Barone et al., 2017). We measure the parents' socioeconomic background by the father's socio-economic status, the mother's educational background, the number of books at home, and the family structure. In addition, having at least one parent born in Switzerland and fixed effects for the adolescent's and parents' birth countries capture the cultural origin. For the institutional context, we use canton, which is a territorial district of the Swiss confederation, and urbanity of the school location. Unfortunately, we are not able to account for the adolescents' intrinsic preferences. However, the robustness checks in tables A5.6 and A5.7 in the Appendix of Chapter 5 show that including the number of applications at firms and schools does not affect our results.

Table 5.1 on the following page provides descriptive statistics for the variables included in our analyses.

Table 5.1. Overview of descriptive statistics

	N	MEAN	STD.	MIN.	MAX.
Main variables					
Educational choice: dual VET	1,126	0.633	-	0	1
Years in Switzerland (CH)	1,126	10.998	4.150	1	18
Control variables					
Reading scores	1,126	488.379	94.186	175.138	753.549
Mathematics scores	1,126	525.151	93.560	274.864	784.943
Year (PISA wave)					
2000	1,126	0.142	-	0	1
2003	1,126	0.448	-	0	1
2009	1,126	0.273	-	0	1
2012	1,126	0.137	-	0	1
Age in months	**1,126**	**186.076**	**10.819**	**157**	**233**
Male	**1,126**	**0.544**	**-**	**0**	**1**
ISEI of father	**1,126**	**44.192**	**18.925**	**16**	**89**
Highest education of mother					
ISCED 2 and lower	1,126	0.440	-	0	1
ISCED 3B, 3C	1,126	0.171	-	0	1
ISCED 3A, 4	1,126	0.107	-	0	1
ISCED 5A, 5B, 6	1,126	0.282	-	0	1
Number of books at home					
0-10 books at home	1,126	0.233	-	0	1
11-100 books at home	1,126	0.456	-	0	1
101-500 books at home	1,126	0.232	-	0	1
>500 books at home	1,126	0.080	-	0	1
CH-born parent	1,126	0.234	-	0	1
Family structure					
Single	1,126	0.083	-	0	1
Nuclear	1,126	0.861	-	0	1
Mixed/Other	1,126	0.055	-	0	1
Urbanity of school location					
Village (<3000)	1,126	0.104	-	0	1
Small town (3000-15000)	1,126	0.582	-	0	1
Town (15000-100000)	1,126	0.204	-	0	1
City (100000-1000000)	1,126	0.110	-	0	1
Canton					
Bern	1,126	0.106	-	0	1
Aargau	1,126	0.135	-	0	1
St.Gallen	1,126	0.211	-	0	1
Valais	1,126	0.075	-	0	1
Other cantons	1,126	0.473	-	0	1
Birth country					
Austria / Germany (AT/DE)	1,126	0.185	-	0	1
Belgium / France (BE/FR)	1,126	0.012	-	0	1
Italy (IT)	1,126	0.032	-	0	1

	N	MEAN	STD.	MIN.	MAX.
Spain (ES)	1,126	0.009	-	0	1
Portugal (PT)	1,126	0.036	-	0	1
Former Yugoslavia (YU)	1,126	0.324	-	0	1
Albania / Kosovo (AL/KO)	1,126	0.091	-	0	1
Turkey (TR)	1,126	0.031	-	0	1
Other countries	1,126	0.282	-	0	1
Birth country of father					
Switzerland (CH)	1,126	0.184	-	0	1
Austria / Germany (AT/DE)	1,126	0.126	-	0	1
Belgium / France (BR/FR)	1,126	0.004	-	0	1
Italy (IT)	1,126	0.043	-	0	1
Spain (ES)	1,126	0.009	-	0	1
Portugal (PT)	1,126	0.035	-	0	1
Former Yugoslavia (YU)	1,126	0.329	-	0	1
Albania / Kosovo (AL/KO)	1,126	0.090	-	0	1
Turkey (TR)	1,126	0.031	-	0	1
Other countries	1,126	0.150	-	0	1
Birth country of mother					
Switzerland (CH)	1,126	0.130	-	0	1
Austria / Germany (AT/DE)	1,126	0.155	-	0	1
Belgium / France (BR/FR)	1,126	0.008	-	0	1
Italy (IT)	1,126	0.026	-	0	1
Spain (ES)	1,126	0.007	-	0	1
Portugal (PT)	1,126	0.033	-	0	1
Former Yugoslavia (YU)	1,126	0.328	-	0	1
Albania / Kosovo (AL/KO)	1,126	0.091	-	0	1
Turkey (TR)	1,126	0.030	-	0	1
Other countries	1,126	0.193	-	0	1

Data source*:* Pooled PISA data 2000, 2003, 2009, and 2012 for German-speaking Switzerland.

5.4.2 Estimation Methods

First, we implement the new approach to measure changes in the social status of dual VET programs by calculating the ability difference between dual VET students and the rest of the upper-secondary education cohort based on formula (6). This approach allows us to explore differences in the social status of dual VET programs descriptively.

To investigate the statistical significance of observed ability differences, we complement the descriptive approach by a multivariate analysis that further allows accounting for potential endogeneity of the estimates due to unobserved heterogeneity. Based on for-

mula (5), we estimate the probability that adolescent i selects a dual VET over the alternative upper-secondary education programs conditional on observed cognitive ability with the following probit model with robust standard errors:

$$Dual_i = \beta_0 + \beta_1 lnPISA_i + \beta_2 lnLength_i + \gamma_1 X_i + \varepsilon_i \quad (7)$$

where $Dual_i$ is a dummy variable indicating whether an adolescent chooses a dual VET program and $lnPISA_i$ refers to the natural logarithm of PISA reading and mathematics scores. We expect a negative sign for β_1 as the relationship between cognitive ability and participation in dual VET programs is supposed to be negative (Bertschy, Cattaneo, & Wolter, 2009). $lnLength_i$ denotes the natural logarithm of the number of years an adolescent has spent in Switzerland, thereby allowing us to test the hypothesis that the longer an adolescent lives in Switzerland, the higher the social status of dual VET programs, and thus the higher the probability of him/her selecting such a program. Thus the most relevant coefficient is β_2, for which we hypothesize a positive sign. Tables A5.3 and A5.4 in the Appendix of Chapter 5 show that using dummies for different time periods instead of the continuous variable $lnLength_i$ yields qualitatively the same results.

X_i is a vector of observable characteristics capturing age, gender, socio-economic status of the father, educational background of the mother, number of books at home, family structure, urbanity, and survey year fixed effects. The main concern regarding the identification of β_2 is that there is unobserved heterogeneity across migration waves, for example in terms of non-cognitive abilities or settlement patterns. The estimation thus further controls for unobserved heterogeneity in settlement patterns and characteristics of migration waves by including school canton fixed effects, fixed effects for the birth country of the adolescent, his/her father, and his/her mother, and birth country trends, i.e. the interaction of time living in Switzerland with the child's country of birth.

We further test our hypothesis with a Difference-in-Difference (DiD) identification strategy (e.g., Legewie, 2012). First, we exploit that we observe educational choices of immigrants born in Germany or Austria, where a dual VET system also exists. We therefore expect that these adolescents are familiar with the dual VET system in Switzerland and the social valuation of dual VET programs. We thus argue that the social status of dual VET programs should increase less for immigrants born in Austria or Germany than for immigrants born in countries without a dual VET system.

Second, we build on the distinction between immigrant adolescents with and without a parent born in Switzerland. We argue that parents who are born in Switzerland have a better knowledge of the Swiss education system at the time of immigration and are therefore better able to guide their children. Consequently, the social status of dual VET programs should increase less with the time spent in Switzerland for immigrants with a parent born in Switzerland compared to the ones without. The following estimation combines both DiD approaches to test our hypothesis:

$$Dual_i = \beta_0 + \beta_1 lnPISA_i + \beta_2 lnLength_i + \beta_3 Similar_i + \beta_4 Similar_i * lnLength_i + \beta_5 Swiss_i + \beta_6 Swiss_i * lnLength_i + \gamma_1 X_i + \varepsilon_i \quad (8)$$

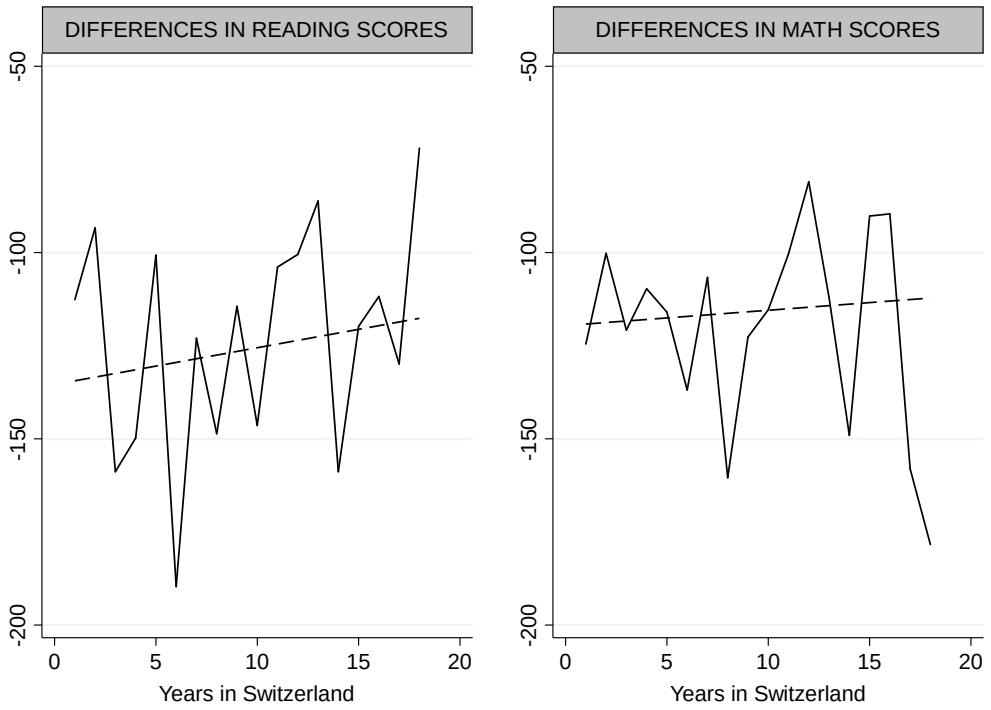
This estimation holds the same variables as (7) plus the two dummy variables $Similar_i$, indicating whether an adolescent is born in Germany or Austria, and $Swiss_i$, denoting if at least one of the adolescent's parents is born in Switzerland. The relevant DiD coefficient is the interaction $Similar_i * lnLength_i$ that captures whether the increase in the relative ability of dual VET students with their time spent in Switzerland is lower for dual VET students born in Austria or Germany than for the ones born in another country. For the second DiD approach, we look at the interaction $Swiss_i * lnLength_i$ that indicates a variation in the probability change of selecting a dual VET, given a certain ability, with the time spent in Switzerland between adolescents with and without at least one parent born in Switzerland.

5.5 Results

5.5.1 Descriptive Analysis

Figure 5.1 shows the average ability differences for reading and mathematics scores as a function of the years an adolescent has lived in Switzerland at the time of the educational choice. In line with our hypothesis, this figure suggests that the average ability differences decrease as they spend more time in Switzerland and thus the social status of dual VET programs increases.

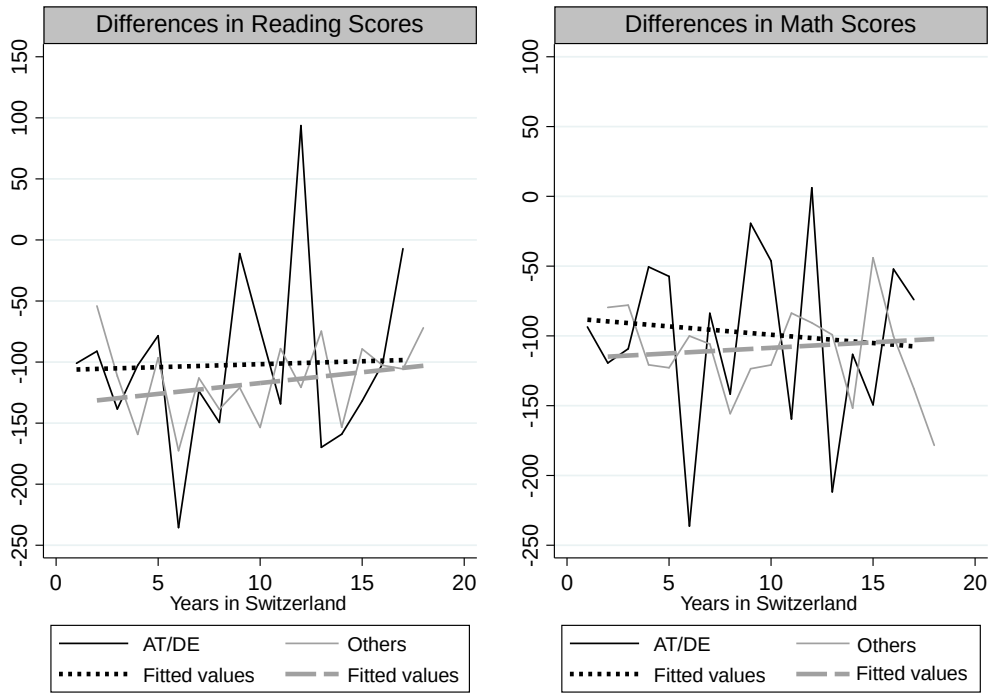
Figure 5.1. Weighted ability differences between immigrant students in dual VET and those in school-based education programs by time spent in Switzerland



Data source*:* Pooled PISA data 2000, 2003, 2009, and 2012 for German-speaking Switzerland, own calculations with sample weighting (N=1,126).

In addition, Figure 5.2 provides descriptive evidence for our first DiD approach that exploits the fact that immigrant adolescents come from countries with different education systems, thereby providing variation in the initial knowledge of dual VET. This figure confirms that the average ability differences increase for immigrants born in a country without a VET system similar to that of Switzerland, but remains roughly constant for immigrants from Germany or Austria.

Figure 5.2. Weighted ability differences between immigrant students in dual VET and those in school-based education programs by time spent in Switzerland and by birth country (AT: Austria, DE: Germany)

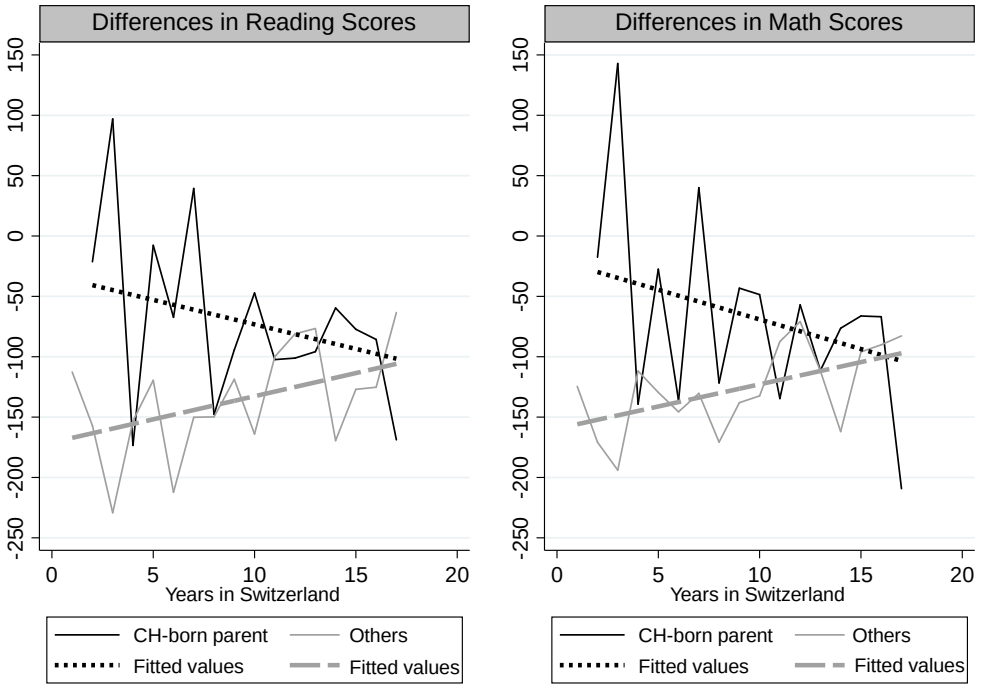


Data source*:* Pooled PISA data 2000, 2003, 2009, and 2012 for German-speaking Switzerland, own calculations with sample weighting (N=1,126).

Lastly, Figure 5.3 illustrates our second DiD approach that distinguishes between immigrant adolescents with at least one parent born in Switzerland[43] and those with both parents born abroad. This figure shows that the average ability differences increase for immigrant adolescents without a parent born in Switzerland, while they decrease for the others.

[43] Also includes parents born in the Principality of Liechtenstein.

Figure 5.3. Weighted ability differences between immigrant dual VET students and those in school-based education programs by time spent in Switzerland and by parent born in Switzerland (CH-born parent)



Data source*:* Pooled PISA data 2000, 2003, 2009, and 2012 for German-speaking Switzerland, own calculations with sample weighting (N=1,126).

5.5.2 Multivariate Regressions

To test whether the descriptive findings hold after controlling for individual characteristics, this subchapter shows multivariate regressions that analyze the effect of living longer in Switzerland on the social status of dual VET programs.

Table 5.2 illustrates the results of the baseline approach, in which the first estimates present the simple correlation of the length of stay in Switzerland on the probability of choosing a dual VET program conditional on PISA reading and mathematics scores (Model 1). Model 2 further controls for observable characteristics. Models 3 to 6 account for unobserved heterogeneity across cantons (Model 3), plus own birth country fixed effects (Model 4), plus birth country of father and mother fixed effects (Model 5), and birth country trends (Model 6).

Table 5.2 indicates that living longer in Switzerland ("Years in CH") increases the probability of selecting a dual VET conditional on cognitive ability measures, thus con-

firming our hypothesis and the descriptive analysis in the precedent subchapter. This finding holds when including control variables and remains remarkably stable when we introduce fixed effects for school canton, birth country, birth country of father and mother, and birth country trends. Furthermore, this table shows that the marginal effects for reading and mathematics scores have the expected negative sign.

Table 5.2. Baseline approach for immigrant adolescents' probability of selecting a dual VET program

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Years in CH (ln)	**0.073*** **	**0.051** **	**0.054*** **	**0.063*** **	**0.060*** **	**0.075***
	(0.021)	**(0.020)**	**(0.020)**	**(0.020)**	**(0.021)**	**(0.040)**
Ability						
Reading scores (ln)	-0.808***	-0.360***	-0.341**	-0.372***	-0.387***	-0.414***
	(0.123)	(0.131)	(0.133)	(0.134)	(0.132)	(0.132)
Math scores (ln)	-0.743***	-0.837***	-0.827***	-0.840***	-0.849***	-0.818***
	(0.129)	(0.135)	(0.137)	(0.136)	(0.131)	(0.130)
Control variables						
Age (months)		-0.127	-0.152	-0.129	-0.114	-0.102
		(0.300)	(0.299)	(0.295)	(0.288)	(0.289)
Male		1.613	1.162	0.694	0.704	0.675
		(1.866)	(1.854)	(1.831)	(1.727)	(1.735)
Age*male		-0.292	-0.207	-0.117	-0.119	-0.114
		(0.357)	(0.355)	(0.351)	(0.331)	(0.332)
ISEI of father (ln)		-0.044	-0.053*	-0.041	-0.049	-0.049
		(0.032)	(0.031)	(0.032)	(0.032)	(0.032)
Mother ISCED 2 and lower		0.052*	0.046	0.057*	0.062**	0.059**
		(0.029)	(0.029)	(0.030)	(0.030)	(0.030)
Mother ISCED 3B, 3C		0.077**	0.075**	0.073**	0.065**	0.063*
		(0.033)	(0.032)	(0.033)	(0.033)	(0.033)
Mother ISCED 3A, 4		0.011	0.015	0.022	0.022	0.024
		(0.037)	(0.037)	(0.037)	(0.037)	(0.037)
Mother ICED 5A, 5B, 6		*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*
Books at home: <11		0.192***	0.195***	0.194***	0.201***	0.199***
		(0.051)	(0.050)	(0.051)	(0.052)	(0.051)
Books at home: 11-100		0.163***	0.163***	0.168***	0.181***	0.178***
		(0.043)	(0.042)	(0.042)	(0.043)	(0.042)
Books at home: 101-500		0.099**	0.096**	0.105**	0.130***	0.127***
		(0.044)	(0.043)	(0.042)	(0.044)	(0.043)
Books at home: >500		*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*
CH-born parent		0.055**	0.052*	0.065**	0.031	0.041
		(0.027)	(0.027)	(0.031)	(0.070)	(0.070)
Family structure: single		-0.021	-0.014	-0.005	-0.015	-0.017
		(0.056)	(0.055)	(0.054)	(0.054)	(0.053)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Family structure: nuclear		-0.007	-0.003	0.005	-0.006	-0.010
		(0.043)	(0.042)	(0.040)	(0.041)	(0.041)
Family structure: mixed/other		*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*
Urbanity: village		*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*
Urbanity: small town		-0.032	-0.041	-0.044	-0.041	-0.044
		(0.038)	(0.038)	(0.038)	(0.039)	(0.038)
Urbanity: town		-0.127***	-0.156***	-0.159***	-0.163***	-0.163***
		(0.043)	(0.044)	(0.044)	(0.044)	(0.045)
Urbanity: city		-0.208***	-0.230***	-0.226***	-0.225***	-0.221***
		(0.049)	(0.050)	(0.050)	(0.051)	(0.051)
Year	Yes	Yes	Yes	Yes	Yes	Yes
School canton	No	No	Yes	Yes	Yes	Yes
Birth country	No	No	No	Yes	Yes	Yes
Birth country father	No	No	No	No	Yes	Yes
Birth country mother	No	No	No	No	Yes	Yes
Birth country trends	No	No	No	No	No	Yes
Observations (N)	1,126	1,126	1,126	1,126	1,126	1,126

Note: The table displays marginal effects of probit estimations and robust standard errors in parentheses. *,** and *** denote significance at the 10 percent, 5 percent and 1 percent level, respectively.

Data source*:* Pooled PISA data 2000, 2003, 2009, and 2012 for German-speaking Switzerland.

Table 5.3 provides the results of the regressions including both DiD approaches. Due to perfect collinearity, the estimations with birth country trends are not included. Table A5.1 in the Appendix of Chapter 5 reports the estimates from the full models.

Our first DiD approach (DiD 1) builds on the differentiation among immigrant adolescents born in countries with different education systems, thereby providing variation in the initial knowledge of dual VET. Table 5.3 shows that the effect of living longer in Switzerland on the probability of choosing a dual VET significantly differs between adolescents born in Austria or Germany and those born in another foreign country (Years in CH * AT/DE). The coefficient has the expected negative sign, thus the effect of time spent in Switzerland is lower for immigrant adolescents coming from a country with a similar VET system compared to the others. Moreover, the effect of living longer in Switzerland on the probability of choosing a dual VET for immigrant adolescents who are born in a country without a dual VET system (Years in CH for others) shows the expected positive sign, whereas there is no effect for immigrant adolescents born in Austria or Germany ("Years in CH for AT/DE").

Table 5.3. DiD approach with birth country and parent born in Switzerland for immigrant adolescents' probability of selecting a dual VET program

	Model 1	Model 2	Model 3	Model 4	Model 5
DiD 1					
Years in CH (ln) * AT/DE	**-0.103****	**-0.103****	**-0.100****	**-0.096****	**-0.093****
	(0.045)	**(0.040)**	**(0.040)**	**(0.040)**	**(0.041)**
Years in CH (ln) for AT/DE	0.011	-0.007	-0.004	-0.002	-0.007
	(0.036)	(0.032)	(0.031)	(0.031)	(0.032)
Years in CH (ln) for others	0.113***	0.096***	0.095***	0.094***	0.086***
	(0.028)	(0.025)	(0.026)	(0.026)	(0.026)
DiD 2					
Years in CH (ln) * CH-born parent	**-0.114***	**-0.129****	**-0.124****	**-0.120****	**-0.143****
	(0.072)	**(0.059)**	**(0.059)**	**(0.059)**	**(0.058)**
Years in CH (ln) for CH-born parent	0.007	-0.022	-0.018	-0.015	-0.041
	(0.065)	(0.054)	(0.053)	(0.053)	(0.053)
Years in CH (ln) for others	0.121***	0.108***	0.106***	0.104***	0.102***
	(0.025)	(0.023)	(0.024)	(0.024)	(0.024)
Ability					
Reading scores (ln)	-0.885***	-0.418***	-0.396***	-0.401***	-0.416***
	(0.121)	(0.129)	(0.130)	(0.131)	(0.129)
Math scores (ln)	-0.747***	-0.811***	-0.796***	-0.809***	-0.818***
	(0.129)	(0.132)	(0.133)	(0.132)	(0.128)
Control variables					
Year	Yes	Yes	Yes	Yes	Yes
Observables	No	Yes	Yes	Yes	Yes
School canton	No	No	Yes	Yes	Yes
Birth country	No	No	No	Yes	Yes
Birth country father	No	No	No	No	Yes
Birth country mother	No	No	No	No	Yes
Observations (N)	1,126	1,126	1,126	1,126	1,126

Note: The table displays marginal effects of probit estimations and robust standard errors in parentheses. *,** and *** denote significance at the 10 percent, 5 percent and 1 percent level respectively.
For the first DiD approach (DiD 1), *Years in CH for AT/DE* and *Years in CH for others* refer to the average marginal effects of time spent in Switzerland for adolescents born in AT/DE and for adolescents born in other countries respectively. *Years in CH * AT/DE* refers to the difference between these two average marginal effects.
For the second DiD approach (DiD 2), *Years in CH for CH-born parent* and *Years in CH for others* refer to the average marginal effects of time spent in Switzerland for adolescents with at least one CH-born parent and for adolescents without a parent born in Switzerland, respectively. *Years in CH * CH-born parent* refers to the difference between these two average marginal effects.
Observable control variables include age, gender, interaction of age and gender, ISEI of father, highest education of mother, number of books at home, family structure, and urbanity.

Data source*:* Pooled PISA data 2000, 2003, 2009, and 2012 for German-speaking Switzerland.

To test the validity of the first DiD approach, we apply a placebo test: instead of looking at the group of adolescents born in Austria or Germany compared to the ones from other countries, we form other groups of immigrants based on their birth country. By

showing that the effect of time spent in Switzerland for immigrants from other countries does not significantly differ among one another, Table A5.2 in the Appendix of Chapter 5 supports the validity of the DiD.

Table 5.3 additionally presents the results of the second DiD approach (DiD 2), which exploits that immigrant adolescents with a parent born in Switzerland know the Swiss education system better than other immigrant adolescents. The difference in the effect of time spent in Switzerland between immigrant adolescents with a parent born in Switzerland and those with foreign born parents ("Years in CH * CH-born parent") is significantly negative, indicating that the effect of living longer in Switzerland is smaller for immigrants with a parent born in Switzerland. Furthermore, the estimated effect of living longer in Switzerland for immigrant adolescents without a parent born in Switzerland ("Years in CH for others") remains significantly positive in all estimations. In contrast, there is no significant effect of the length of stay in Switzerland on the probability that immigrant adolescents with a Swiss-born parent ("Years in CH for CH-born parent") will choose a dual VET .

5.6 Discussion

For immigrant adolescents in Switzerland, the findings of the multivariate regressions indicate that growing knowledge of the education system leads to an increase in the social status of VET programs. This empirical evidence runs parallel with Barone et al.'s (2017) theoretical model of educational choices that incorporates "an information component expressing the perceived profitability of educational options" (p. 85f.). We show that this perceived profitability is not only affected by adolescents' socioeconomic background and cognitive abilities but also by their knowledge of an education program's value.

However, two alternative interpretations of an increase in the social status of dual VET programs as a result of living longer in Switzerland exist. First, our results might reflect that the probability of leaving Switzerland decreases with time spent in Switzerland. As people who intend to leave Switzerland focus on the value of dual VET abroad rather than in Switzerland, such emigration plans also affect adolescents' educational choices. Thus the assumption that the probability of leaving Switzerland decreases with the time spent in Switzerland suggests that the objective value of dual VET at the same time increases. Though this increase would reflect a change in the social status of dual

VET, it would arise due to differences in the probability of going abroad rather than from a knowledge gain. Moreover, individuals who like the Swiss education system more, and thus perceive a higher social status of dual VET programs, might be more likely to stay in Switzerland for longer. This selection problem would also bias our results upwards.

Figure A5.1 in the Appendix of Chapter 5 shows the average marginal effects of time spent in Switzerland on the probability of selecting a dual VET for two groups: immigrants who remain in the TREE data from 2000 until 2010 and immigrants who did not respond in 2010, i.e. who have either emigrated or did not take part in the survey for another reason. The figure shows that the effect is larger in the non-responding sample of immigrants. While the difference between the two groups of immigrants is not statistically significant, this finding has the opposite sign than the previous arguments suggest. This test provides suggestive evidence that our results are not driven by expected emigration patterns or sample selection.

Second, a change in the social status of dual VET programs with the time spent in Switzerland could result from socialization and adaptation to the values held in Swiss society. In Table A5.5 in the Appendix of Chapter 5, we therefore include punctuality as a measure for adaptation to the Swiss values. The inclusion of this additional control variable, which is only available for the PISA waves 2000, 2003, and 2012, yields qualitatively the same results. This robustness check supports our argument that the gain of knowledge about the education system is the reason for changes in immigrants' perception of the social status of dual VET programs.

Lastly, though we exploit information before the actual educational choice takes place, exploiting information on education program choices has the drawback that it might reflect availability of education programs rather than preferences about them. Our results are consistent with alternative explanations that stem from differences in education program availability, such as decreasing discrimination by employers or schools. In the tables A5.6 and A5.7 in the Appendix of Chapter 5, we therefore additionally control for how many times adolescents had to apply for their planned education programs after compulsory schooling, which is available for the PISA 2000 sample. These robustness checks show that the baseline estimates remain unaffected by the inclusion of the number of applications at firms. Including the number of applications at schools reduces the effect of time spent in Switzerland, but the estimates remain significantly positive.

5.7 Conclusion

As existing research does not provide a satisfactory concept for measuring the social status of education programs, we propose a new approach to measure changes in their social status. This approach relies on a theoretical framework suggesting that a change in the probability of choosing a particular education program reflects a change in the social status of that program. Equivalently, we can express the change in the social status of an education program by a change in the average ability-differences between adolescents choosing that program and the rest of the cohort.

Whereas scholars can use this novel measurement approach to analyze the social status of all kinds of education programs in any country, we apply it to the case of Switzerland to test whether immigrant adolescents' growing knowledge of the education system increases the social status of dual VET programs. As we cannot directly measure this knowledge gain, we approximate it by investigating first-generation immigrant adolescents with different lengths of stay in Switzerland. We argue that their knowledge of the education system increases with their time spent in the country.

Our results show that the social status of dual VET programs increases as immigrants live longer in Switzerland: staying an additional year leads to a one percent increase in the probability of choosing a dual VET instead of a school-based VET or general education program when the other variables remain constant. We address unobserved heterogeneity in terms of migration waves and settlement patterns by controlling for school canton and birth country fixed effects, country of birth trends, and two alternative DiD approaches. Still, some concerns regarding endogeneity due to unobserved heterogeneity, for example in terms of non-cognitive skills or intrinsic preferences, remain. Thus future research should exploit quasi-experimental variation to confirm our empirical findings.

As discussed above, this chapter interprets the effect of living longer in Switzerland on the social status of dual VET programs as the result of an increase in education system knowledge. To disentangle the mechanisms behind this change, future research could establish more precise measures of knowledge. In addition, the reasons behind differences in the valuation of dual VET programs, even for people from countries with similar dual VET systems, could be of relevance for further research. For example, how far this valuation is linked to the range of occupations for which dual VET programs prepare or to the income and career perspectives associated with these occupations.

By arguing that the change in the social status of dual VET programs results from immigrants' growing knowledge of the education system with the time they spend in Switzerland, we can conclude that immigrants should receive information on the Swiss education system at an early stage. Adolescents can then learn about the true value of dual VET programs instead of allowing a stigma to distort their educational choices. Such information campaigns are especially important for immigrants in comparison to Swiss natives as they tend to attribute a lower labor market value to VET relative to academic education (Abrassart et al., 2017).

As immigrants' low initial knowledge level is comparable to the situation when introducing new education programs, such reforms should be complemented by the provision of information from the beginning, for example through guidance or counseling systems. The aim is to optimally equip adolescents "to understand and assess their learning and career opportunities to make more informed choices about the pathways to take" (Lasonen & Gordon, 2009, p. 54; see also Howard & Rimini, 2016).

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Appendix

Appendix of Chapter 2

Table A2.1. Summary of VET typologies in previous research

STUDY	RESEARCH QUESTION	METHOD	RESEARCH SUBJECT	COMPARATIVE DIMENSIONS	CLASSIFICATION OR TYPOLOGY (WITH EXAMPLES IN BRACKETS)
Lauterbach (1984) (as quoted in Frommberger & Reinisch, 1999)	*(Unknown)*	Empirical classification (qualitative, 12 mostly European countries)	VET systems	One dimension: – Learning venues	Four models of learning venues: – Firm – School based – Dual (firm based and school based) – Mixed systems
OECD (1985)	Which are the different policies that countries adopt to provide education and training, and what is their impact?	Inductive derivation of dimension Empirical classification (quantitative, 20 countries)	ET systems on post-compulsory level	One dimension: – Educational provision (school sector, apprenticeship, out of school)	As "no country organizes all its education and training within a single setting" (OECD 1985, 44), three ideal models of educational provision patterns : – Schooling (CA, JP, US) – Dual (AT, CH, DE) – Mixed (UK)
Allmendinger (1989)	Do the characteristics of education and training systems matter for occupational outcomes	Deductive derivation of dimensions Empirical typology with explanatory real types	ET systems on different educational levels	Two dimensions of organizational structure of education and training: – Standardization – Stratification	2x2 table separately for VET with two real types: – Low stratification, high standardization (DE, NO) – High stratification, low standardization (US on the job)

STUDY	RESEARCH QUESTION	METHOD	RESEARCH SUBJECT	COMPARATIVE DIMENSIONS	CLASSIFICATION OR TYPOLOGY (WITH EXAMPLES IN BRACKETS)
	upon labor market entry?	(quantitative, three countries)			
Green (1991)	How can scholars use comparative analysis for the development of policy, and what can the UK learn from existing models of VET?	Empirical classification (qualitative)	Post-compulsory VET systems	Unclear	Three models of post-compulsory VET: – Employer led (DE) – Education led, college based with general education and VET – In different institutions (FR, IT, JP) – Within same institution (SE)
Deissinger (1995, 1998)	What are the specific characteristics of VET and their potential for comparative research?	Deductive derivation of dimensions Theoretical classification	VET systems	Three dimensions of qualificational styles: – Role of qualification process in socialization – Regulatory-organizational framework of qualification process – Didactic-curricular orientation	Three ideal models of qualificational styles: – Function oriented (UK, qualification on the job) – Academically oriented (FR) – Occupation oriented (DE)
Greinert (1995, 2000)	How can scholars order VET based on a plausible dimension in a manageable typology?	Deductive derivation of dimension Theoretical classification	VET systems	VET as social action systems, differentiated by the structure of the system's communication → one dimension: Structure of system-specific communication (Luhmann, 1995)	Three models of VET systems, following Max Weber's typology of power: – Legitimized through customary law – Regulated by market (GB, JP, US) – Regulated by government law or bureaucracy (mostly school based) Plus mixed models, such as cooperative systems
Lauterbach (1995)	Unclear	Unclear	VET programs	One dimension: – Leading learning places (vocational schools, firm or work site, vocational training centers)	Five historically grown models of VET: – Apprenticeships – Vocational schools – Firm specific – Compensatory in firm-independent, labor market–oriented institutions – Firm internal
Clement (1996)	Does the category of social meanings help	Deductive derivation of dimension	VET	One dimension: – Communicated	Three models of meanings: Educational (VET in contextual purpose of education

STUDY	RESEARCH QUESTION	METHOD	RESEARCH SUBJECT	COMPARATIVE DIMENSIONS	CLASSIFICATION OR TYPOLOGY (WITH EXAMPLES IN BRACKETS)
	scholars to compare VET?	Theoretical classification		meanings (drawing on Luhmann, 1995)	system) Employment (purpose of matching with qualification profiles in future jobs) Occupational (purpose of occupational status attainment)
Hannan et al. (1996)	Which conceptual framework can help scholars to analyze cross-national variation in school-to-work transitions based on different sources (existing cross-national research, esp. from societal perspective)?	Deductive derivation of dimensions Empirical typology with explanatory real types (quantitative, 11 countries)	ET systems on upper-secondary level	Three dimensions: – Standardization (stand.) – Stratification (strat.) – Relationship between educational institutions and employers (strong, collinear, de-coupled with strong market signals, school placement function, de-coupled with weak market signals)	2x2x5 table with eight real types of ET systems: – High stand. (standard.), high strat., strong relationship (AT, CH, DE, DK) – High stand., high strat., collinear relationship (NL) – High stand., medium strat., de-coupled with strong market signals (GB, FR, FI, IT, IL) – High stand., low strat., de-coupled with strong market signals (IE, SE) – High stand., low strat., school placement function (JP) – Low stand., medium strat., de-coupled with strong market signals (ES) – Low stand., medium strat., de-coupled with weak market signals (CA) – Low stand., low strat., de-coupled with weak market signals (US)
Münch (1997)	How can scholars analyze VET from different perspectives; does no sure formula for a comprehensive comparison exist?	Empirical classification (qualitative)	VET programs	Unclear (phenomenological derivation of essential differences between VET leads to basic models of VET programs)	Three basic models of VET: – Firm where firms have full autonomy (JP, US) – Cooperation, education in schools with practical training (DE) – School (upper-secondary or tertiary)
Müller and Shavit (1998)	Is the strength of the association between educational attainment and labor market outcomes positively related to the institutional context of education and training	Deductive derivation of dimensions and ideal types Empirical typology with explanatory real types (quantitative, 13 countries)	ET systems on upper-secondary level	Three dimensions: – Stratification (strat.) – Standardization (stand.) – Specificity (training for specific areas of activity or occupations)	Two ideal types of school-to-work transitions drawing on societal analysis: – Qualificational spaces with high rate of specific VET – Organizational spaces with mostly academic or general education 2x2x3 table with six real types: – Low strat., low stand. (AU, GB, US) – Low strat., high stand. (IE, JP, SE)

STUDY	RESEARCH QUESTION	METHOD	RESEARCH SUBJECT	COMPARATIVE DIMENSIONS	CLASSIFICATION OR TYPOLOGY (WITH EXAMPLES IN BRACKETS)
	systems?				– Medium strat., low stand. – Medium strat., high stand. (FR, IT, IL, TW) – High strat., low stand. – High strat., high stand.: (DE, CH, NL)
ILO (1998)	How successful are different VET types in preparing young people for employment, and what are their main characteristics in adjusting to the changing demand for skills?	Derivation of dimensions unclear Empirical typology with explanatory types (qualitative)	VET systems	Three dimensions of training: – Organization in the workplace – Supporting incentives – Institutional structures	Three major types of VET: – Cooperative (DE, AT, CH) – Enterprise based - Low labor turnover (JP) - Voluntarist (UK, US) – State driven - Demand led (HK, SK, SG, TW) - Supply led (transition economies)
Green (1999)	Does a process of the convergence of education and training systems on global and regional norms exist (as the globalization theory predicts)?	Empirical classification (qualitative)	ET systems	Unclear (but stresses modes of articulation among central government, education and training systems, labor markets, and firms)	Five primary models of education and training: – Japanese (also SG, TW, SK) – German (also AT, CH, NL) – French (Latin rim states) – Swedish (Nordic states) – England and Wales
OECD (2000)	What are the ways in which various dimensions of transition outcomes relate to the context and processes of transition?	Deductive derivation of dimensions Empirical typology with explanatory real types (quantitative, 10 countries)	ET systems on upper-secondary level	Common characteristics along the process and context of transition, but measured by only one dimension: Dominant upper-secondary pathway (general education, school based vocational, apprenticeship)	Four models of education and training: – Apprenticeship (DE, CH) – Mixed pathway (AT, DK, NL, NO) – School based (AT, DK, NL, NO) – School based vocational (BE, CZ, FI, FR, HU, IT, PL, SW, UK) – General education (AU, CA, GR, IE, JP, SK, PT, ES, US)
Greinert (2004)	What is the historical development of VET based on common principles, organizational forms, and learning concepts that	Empirical classification (qualitative)	VET systems	Description of models along six dimensions that are not explicitly mentioned or used for the classification: – Quantitative relation	Three models of VET (“prototypes”): – Vocational orientation – Academic orientation – Market model

STUDY	RESEARCH QUESTION	METHOD	RESEARCH SUBJECT	COMPARATIVE DIMENSIONS	CLASSIFICATION OR TYPOLOGY (WITH EXAMPLES IN BRACKETS)
	are reflected in educational institutions?			between training demand and supply – Type of occupational qualifications – Standardization of training practices – Financing of training – Tracking of individual training course types – Learning locations	
Brockmann et al. (2008)	What are the debates and policy responses on key terms of the European Qualification Framework in VET in DE, NL, and the UK?	Inductive derivation of dimension Empirical classification (qualitative, three countries)	VET systems	One dimension: – Meanings and rationales of key terms of EQF (which are qualification, knowledge, skills, competence, learning outcomes)	Two models of VET: – Knowledge-based VET in DE and NL – Skill-based VET in UK
Biavaschi et al. (2012)	What are the determinants of the labor market situation of young people (with a special emphasis on the role of VET policies)?	Derivation of dimensions unclear Empirical typology with explanatory types (qualitative)	VET systems	Four dimensions: – Economic development – Youth labor market integration – Labor market institutions – Dominant type of education and training for youth	Eight country clusters: – Continental Europe, mainly German-speaking countries – Anglo-Saxon countries – Transition countries in Central and Eastern Europe – Mediterranean countries, especially ES – Middle East and North Africa – Sub-Sahara and South Africa – Latin American countries – South and East Asia, including CN, IN
Dumas et al. (2013)	Can the idea of a European model of education and training systems be validated, or do structural differences persist?	Derivation of dimensions unclear Empirical typology (quantitative, 25 European countries)	ET systems on post-compulsory level	Three dimensions: – Level of vocational provision in upper-secondary education – Success rates in upper-secondary education – Continuing vocational	Three models in countries with strong VET pathways: – Integrative comprehensive (FI, SE, NO) – Separation type with integrative vocational system (AT, CH, CZ, SK) – Separation type but less integrative (IT, RO, SI) – Stronger heterogeneity in countries with poorly developed VET pathways

STUDY	RESEARCH QUESTION	METHOD	RESEARCH SUBJECT	COMPARATIVE DIMENSIONS	CLASSIFICATION OR TYPOLOGY (WITH EXAMPLES IN BRACKETS)
				training	
Lavrijsen et al. (2014)	How do structural characteristics of education and training systems affect the performance and social distribution of their outcomes?	Deductive derivation of dimensions Empirical typology with explanatory real types (quantitative) Descriptive real types	ET systems	Two dimensions: – Specificity (work based, school based, general) – Stratification (conservative, social democratic, liberal, Mediterranean)	3x4 table with five provisional types: – Dual VET – School-based VET – Comprehensive VET – General – Mediterranean
Eichhorst et al. (2015)	How can scholars better understand VET in industrialized countries and what is the effectiveness of different models of VET?	Derivation of dimensions unclear Empirical classification (qualitative)	VET programs	Two dimensions of VET provision: – Relative importance of institutional learning and workplace training – Training provision within formal school frameworks or at vocational training centers	Three models of VET: – Vocational and technical schools (Southern European Countries) – Formal apprenticeships (UK, US, AU) – Dual apprenticeship systems (AT, CH, DK, DE)
Pilz (2016)	How can we combine existing approaches from a range of disciplines with a multi-perspective typology of VET?	Deductive derivation of dimensions Theoretical classification and categorization of six countries	VET processes in the broadest sense (including all VET activities)	Four dimensions: – Skill formation (macro level) – Stratification (macro level) – Standardization (meso level) – Practice of learning (micro level)	32 potential combinations with the four dimensions, whereof the author provides empirical examples for five types: – Individualized skill formation, low strat., low stand., high practice of learning (US) – Individualized skill formation, high strat., low stand., high practice of learning (IN) – State dominance, high strat., high stand., low practice of learning (FR, CN) – Company dominance, high strat., high stand., high practice of learning (JP) – State and company dominance, high strat., high stand., high practice of learning (DE)

Note: By "education and training system (ET system)", we are referring to all education and training programs in a country; by "VET system," we are referring to the total of all VET programs and pathways in a country.

Appendix of Chapter 3

Table A3.1. Outline of features measuring the education-employment linkage as provided by Renold et al. (2016, 2017)

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	0.1%

FEATURE	QUESTION	EMPIRICAL WEIGHT
	through employer associations (e.g. in a working 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 *If workplace trainer number legally defined*	Are trainers/instructors in employers legally required to receive specific training?	

FEATURE	QUESTION	EMPIRICAL WEIGHT
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%
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%

FEATURE	QUESTION	EMPIRICAL WEIGHT
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 program 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 program 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%

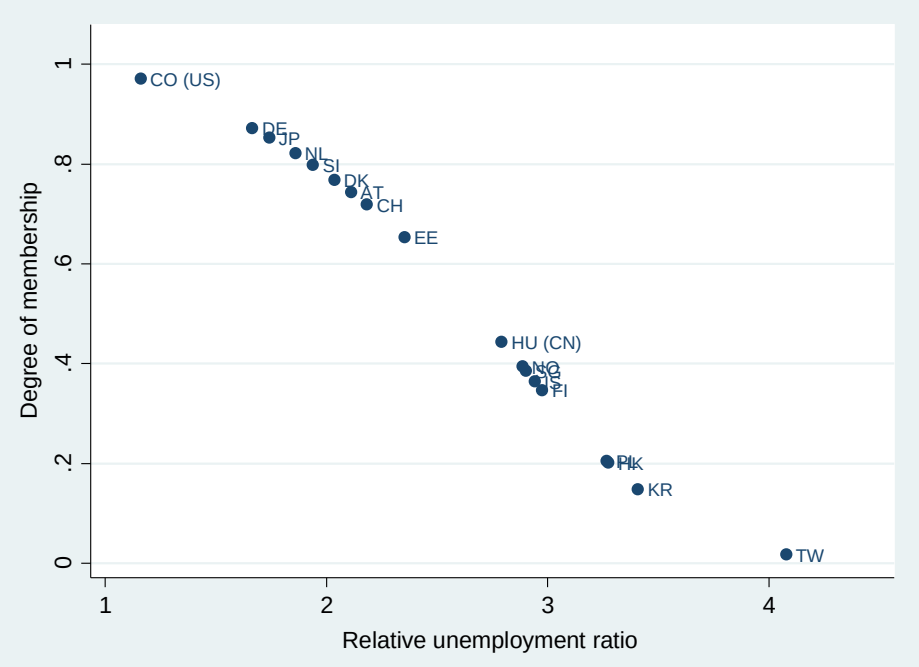
Table A3.2. Fuzzy membership scores for the largest VET programmes in 18 countries and states

CASE	OUTCOME	CAUSAL CONDITIONS			DOMAIN CONDITIONS		
	High youth labour market integration	**Optimal EEL in curriculum design**	**Optimal EEL in curriculum application**	**Optimal 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; 2014b), UNESCO-IBE (2012), 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 A3.1. Membership degree in the set of a high youth labor market integration



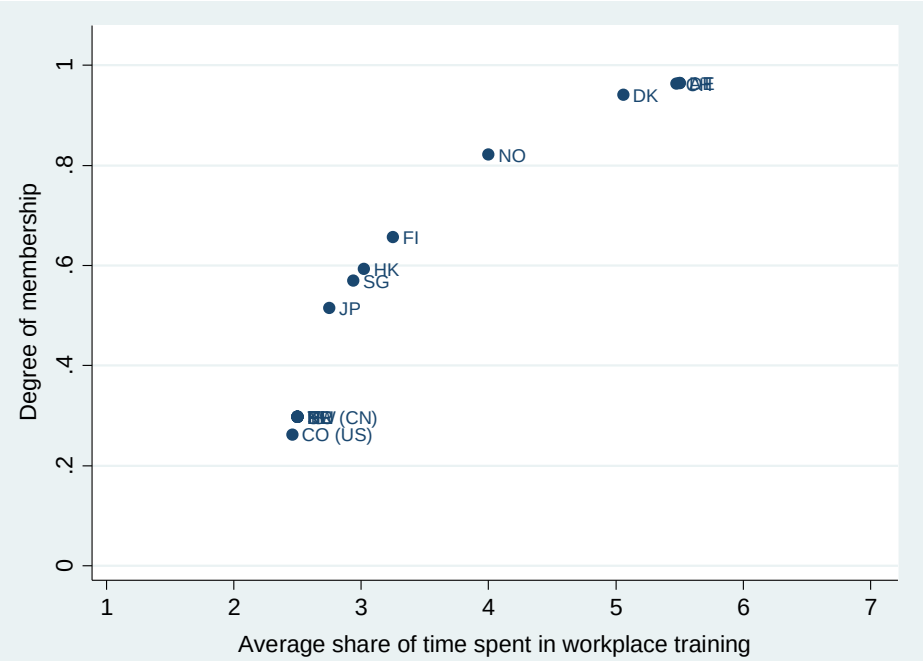
Note: Data from ILO (2016); for Colorado, see U.S. Bureau of Labor Statistics (2017). Plot shows correlation between membership degree in the set of high youth labour market integration and the relative unemployment ratio.

Figure A3.2. Membership degree in the set with an optimal linkage in VET curriculum design

Note: Data from Renold et al. (2016, 2017). Plot shows correlation between membership degree in the set of optimal education-employment linkage in curriculum design and employer involvement in qualification standards definition measured on a scale from 1 ‘not invo

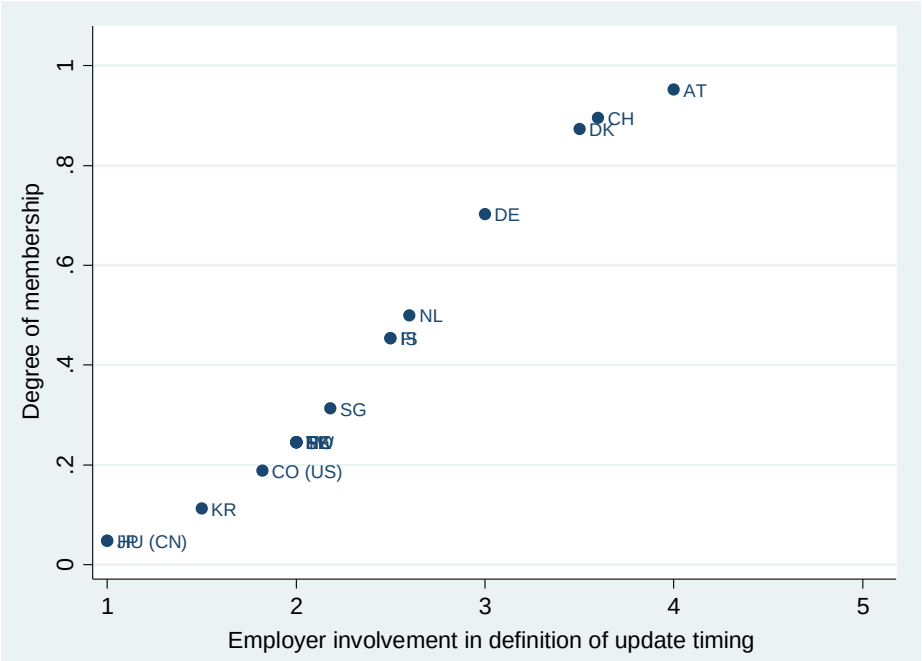
lved at all’ to 5 ‘only actors’.

Figure A3.3. Membership degree in the set with an optimal education-employment linkage in VET curriculum application



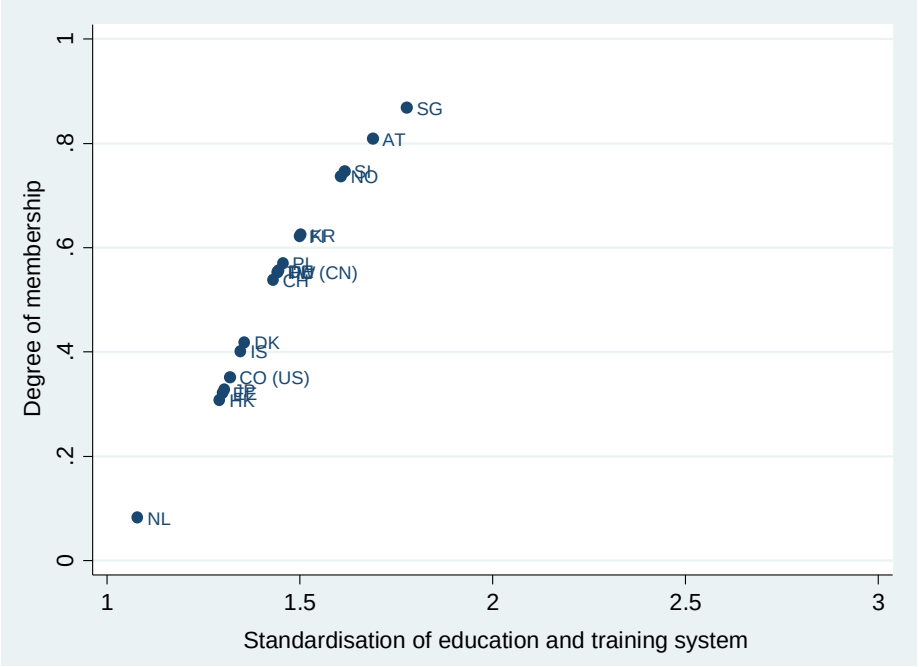
Note: Data from Renold et al. (2016, 2017). Plot shows correlation between membership degree in the set of optimal education-employment linkage and average share of time spent at workplace measured on a scale from 1 ‘students spend no time in workplace training’ to 7 ‘students spend all time in workplace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

Figure A3.4. Membership degree in the set with an optimal education-employment linkage in VET curriculum updating



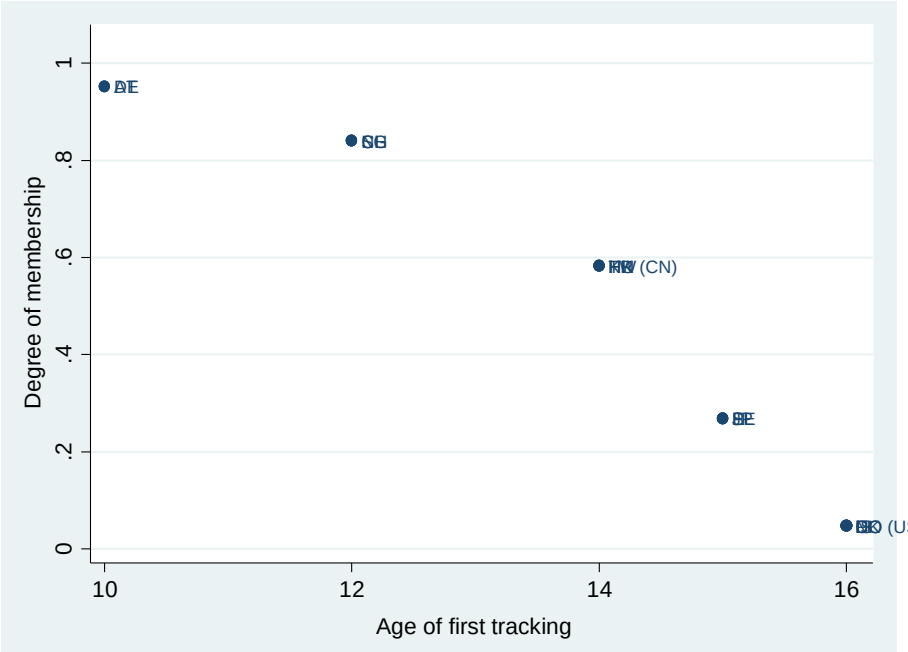
Note: Data from Renold et al. (2016, 2017). Plot shows correlation between membership degree in the set of optimal education-employment linkage in curriculum updating and employer involvement in definition of update timing measured on a scale from 1 ‘not involved at all’ to 5 ‘only actors’.

Figure A3.5. Membership degree in the set of standardized education and training systems



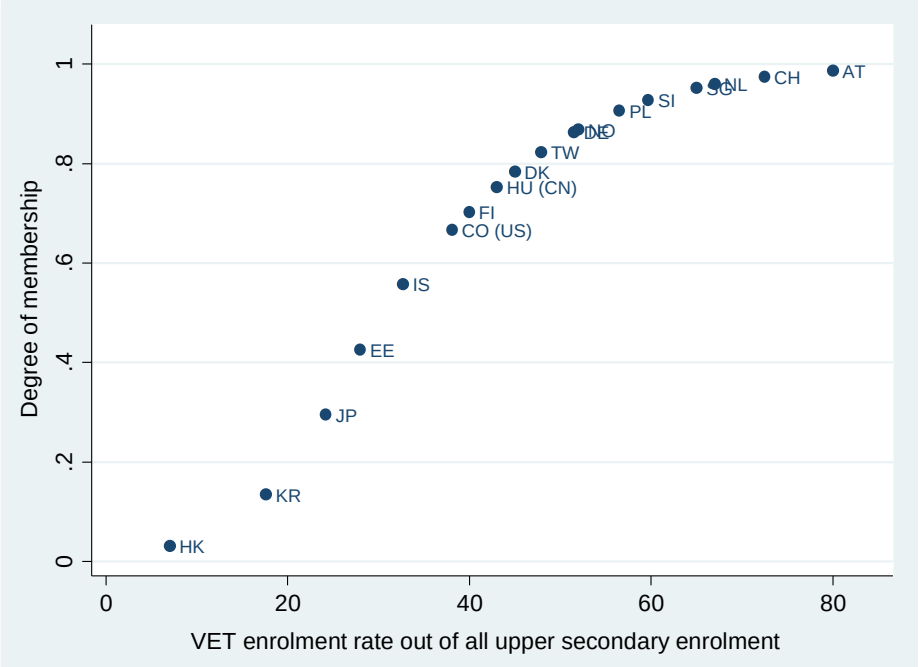
Note: Data from PISA 2012 (OECD, 2014b). Plot shows correlation between membership degree in the set of standardized education and training systems and school responsibility for a list of tasks measured on a scale from 1 ‘school has all responsibility’ to 3 ‘national education authority has all responsibility’.

Figure A3.6. Membership degree in the set of stratified education and training systems



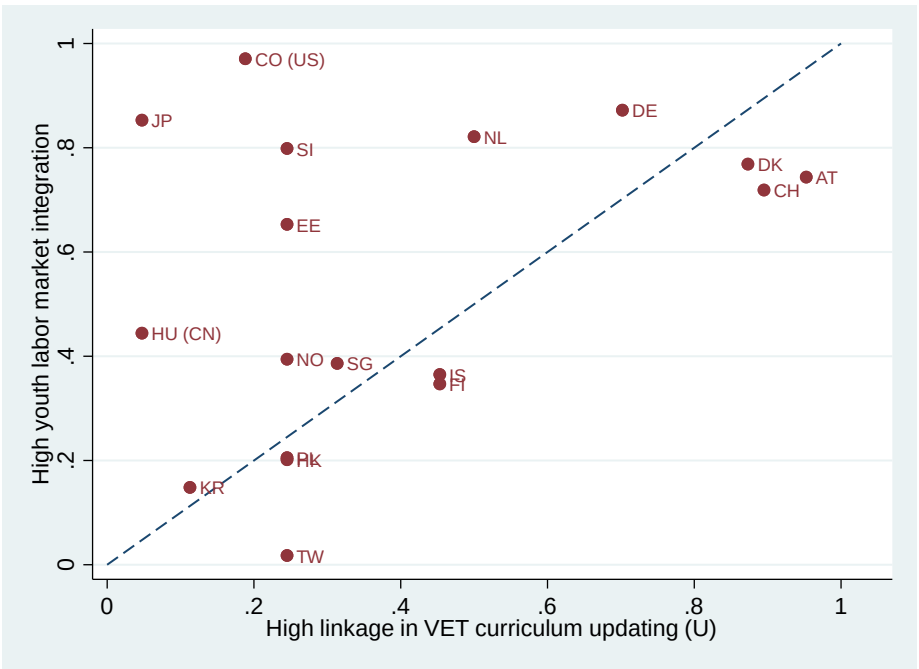
Note: Data from OECD (2005), UNESCO-IBE (2012), Renold et al. (2016), and CIEB (2017). Plot shows correlation between membership degree in the set of stratified education and training systems and age of first tracking.

Figure A3.7. 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 systems and share of VET enrolment out of all upper-secondary enrolment.

Figure A3.8. 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 labor market integration and membership degree in the set of optimal education-employment linkage in curriculum updating; consistency for necessity=0.619; consistency for sufficiency=0.858.

Appendix of Chapter 4

Descriptive Statistics

Table A4.1. Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Dependent variable: labor market integration					
Youth unemployment rate (%)	272	16.53	8.12	5.46	55.60
Youth relaxed unemployment rate (%)	176	26.45	12.31	10.28	72.93
NEET rate (%)	245	11.34	5.64	3.40	39.20
Youth long-term unemployment rate (%)	259	19.11	13.61	0.00	57.60
Dependent variable: job quality					
Youth temporary contract rate (%)	192	21.89	13.22	0.95	53.73
Youth involuntary part-time work rate (%)	239	6.74	5.74	0.00	27.39
Youth atypical working hours rate (%)	191	16.07	5.55	7.10	30.37
Youth skills mismatch rate (%)	192	17.02	6.47	1.09	30.83
Youth in-work at-risk-of-poverty rate (%)	185	10.29	5.37	1.70	28.10
Youth average hourly earnings	187	15.44	5.05	4.26	24.01
Explanatory variable					
Fraction of general education (t-3)	272	52.94	20.89	19.29	100
Fraction of school-based VET (t-3)	272	34.61	19.43	0.00	72.23
Fraction of dual VET (t-3)	272	12.46	17.30	0.00	60.65
Control variable					
Adult unemployment rate (%)	272	5.97	3.05	1.66	23.81
Adult relaxed unemployment rate (%)	177	9.06	4.33	2.88	27.94
Adult LF participation rate (%)	272	84.56	4.95	57.41	90.91
Adult long-term unemployment rate (%)	259	33.92	17.19	0.40	75.10
Adult temporary contract rate (%)	192	5.37	3.43	0.36	19.35
Adult involuntary part-time work rate (%)	239	3.29	2.07	0.00	11.09
Adult atypical working hours rate (%)	191	12.62	3.01	7.07	21.93
Adult skills mismatch rate (%)	192	14.92	4.09	1.04	25.12
Adult in-work at-risk-of-poverty rate (%)	185	7.00	2.65	3.20	18.20
Adult average hourly earnings	187	22.87	8.57	5.32	39.88
Youth labor force participation rate (%)	272	47.67	14.22	24.62	74.51
Youth-to-adult labor force participation ratio (%)	272	12.82	4.20	6.36	23.98
GDP per capita	272	35.42	13.09	12.81	92.93
GDP growth (%)	272	1.61	2.81	-8.27	10.83
EPL	272	2.40	0.54	0.99	3.98
PISA score (t-4)	272	494.51	34.17	383.32	552.67
Trade union density (%)	254	29.58	20.44	7.55	85.46
Unemployment insurance (%)	204	33.51	20.96	0.00	83.27
Sector: Agriculture (%)	258	2.31	1.52	0.28	8.53
Sector: Industry (%)	258	28.53	5.86	11.72	44.80
Sector: Services (%)	258	69.16	6.47	53.94	87.99
KOF Globalisation Index	269	81.20	9.04	57.11	92.62

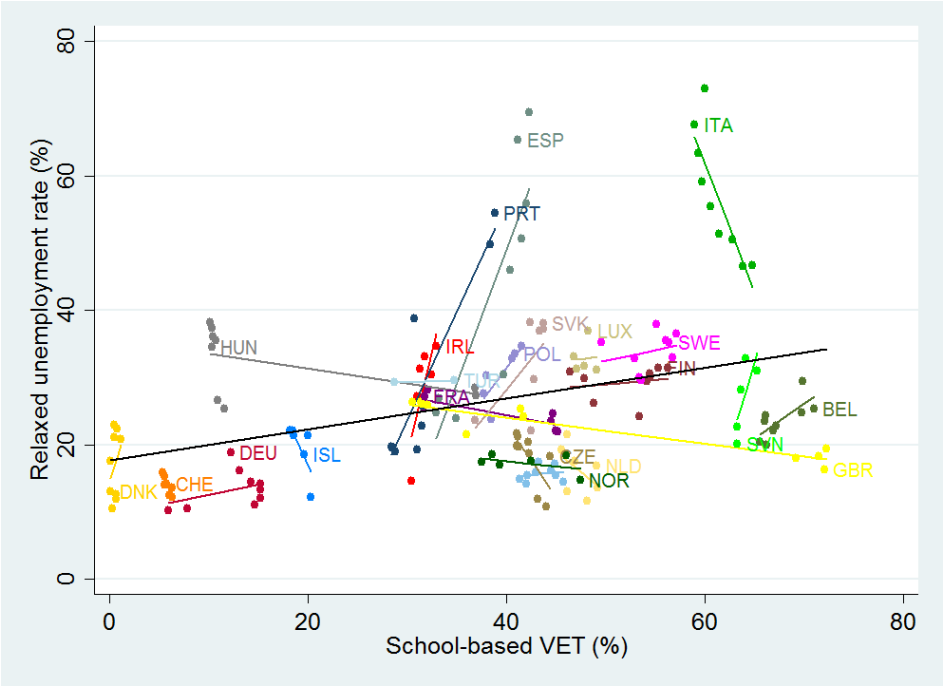
Note: The summary statistics display the number of observations, mean value, standard deviation, minimum and maximum values for all variables in the data set.

Table A4.2. Correlation matrix

	unem	relax	neet	long	temp	part	atyp	skill	risk	learn	gened	svet	dvet	aunem	arelax	alfp	along	atemp	apart	aatyp	askill	arisk	laearn	ylfpr	ytalfr	gdpp	gdpg	epl	pisa	tud	unein	agri	indu	serv	kofgi
unem	1.00																																	
relax	0.87	1.00																																
neet	0.33	0.61	1.00																															
long	0.57	0.46	0.22	1.00																														
temp	0.53	0.46	0.11	0.01	1.00																													
part	0.48	0.62	0.12	-0.03	0.38	1.00																												
atyp	0.24	0.16	0.05	0.09	0.19	0.16	1.00																											
skill	-0.09	-0.22	-0.26	-0.33	-0.13	0.21	0.21	1.00																										
risk	-0.06	0.11	-0.13	-0.51	0.03	0.33	-0.04	0.02	1.00																									
learn	-0.14	-0.30	-0.47	-0.13	-0.22	0.21	-0.29	0.44	0.26	1.00																								
gened	-0.09	0.22	0.38	-0.31	0.24	0.10	0.02	-0.21	0.26	-0.30	1.00																							
svet	0.33	0.35	-0.03	0.26	0.28	0.30	0.27	0.27	-0.23	0.26	-0.63	1.00																						
dvet	-0.26	-0.56	-0.41	0.07	-0.49	-0.44	-0.29	-0.10	0.02	0.09	-0.49	-0.36	1.00																					
aunem	0.87	0.66	0.34	0.59	0.46	0.30	0.16	-0.15	-0.14	-0.13	-0.04	0.11	-0.07	1.00																				
arelax	0.88	0.86	0.72	0.63	0.40	0.42	0.07	-0.33	-0.07	-0.39	0.31	0.10	-0.38	0.89	1.00																			
alfp	0.04	-0.39	-0.74	0.02	0.14	-0.03	0.11	0.23	0.07	0.50	-0.43	0.08	0.42	0.09	-0.44	1.00																		
along	0.48	0.22	0.00	0.90	0.01	-0.09	-0.01	-0.26	-0.59	-0.03	-0.47	0.25	0.27	0.54	0.45	0.28	1.00																	
atemp	0.52	0.46	0.29	0.09	0.83	0.22	-0.02	-0.31	0.03	-0.34	0.36	0.03	-0.33	0.55	0.56	-0.10	0.05	1.00																
apart	0.41	0.60	0.10	0.13	0.24	0.86	-0.03	0.05	0.29	0.29	0.14	0.09	-0.25	0.37	0.56	-0.09	0.07	0.26	1.00															
aatyp	0.10	0.04	0.18	0.25	-0.04	-0.09	0.72	0.02	-0.23	-0.33	-0.29	0.16	0.08	0.16	0.12	-0.06	0.15	-0.04	-0.15	1.00														
askill	0.33	0.17	0.22	0.43	0.05	0.11	0.06	0.33	-0.36	-0.12	-0.15	0.21	-0.09	0.32	0.27	-0.12	0.41	0.05	0.10	0.15	1.00													
arisk	0.28	0.42	0.52	0.22	0.21	0.06	-0.15	-0.51	0.15	-0.31	0.32	-0.01	-0.27	0.24	0.46	-0.52	-0.01	0.43	0.15	0.02	-0.25	1.00												
laearn	-0.16	-0.28	-0.45	-0.19	-0.19	0.21	-0.38	0.33	0.33	0.97	-0.27	0.19	0.13	-0.13	-0.36	0.50	-0.01	-0.28	0.31	-0.38	-0.22	-0.19	1.00											
ylfpr	-0.49	-0.54	-0.29	-0.59	-0.35	0.05	-0.08	0.17	0.35	0.53	0.04	-0.28	0.27	-0.37	-0.53	0.32	-0.40	-0.30	0.06	-0.03	-0.43	-0.24	0.58	1.00										
ytalfr	-0.50	-0.53	0.18	-0.65	-0.41	-0.01	0.01	0.21	0.34	0.15	0.32	-0.32	-0.02	-0.43	-0.52	-0.19	-0.59	-0.36	-0.07	0.06	-0.43	-0.11	0.18	0.77	1.00									
gdppc	-0.17	-0.19	-0.51	-0.17	-0.24	0.04	-0.18	0.22	0.30	0.79	-0.34	0.11	0.28	-0.21	-0.39	0.42	-0.07	-0.39	0.06	-0.31	-0.20	-0.08	0.83	0.28	-0.08	1.00								
gdpg	-0.25	-0.23	0.06	-0.09	-0.06	-0.15	0.06	0.11	-0.06	-0.14	0.05	-0.05	-0.01	-0.23	-0.20	-0.16	-0.06	-0.04	-0.22	0.18	0.04	-0.03	-0.15	0.01	0.16	-0.15	1.00							
epl	0.20	0.13	-0.04	0.38	0.26	-0.07	-0.24	-0.39	-0.12	-0.27	-0.39	0.25	0.18	0.22	0.19	0.10	0.45	0.29	0.04	-0.19	-0.14	0.25	-0.22	-0.41	-0.44	-0.05	-0.14	1.00						
pisa	-0.09	-0.35	-0.61	-0.14	-0.00	0.20	0.07	0.52	-0.16	0.55	-0.34	0.23	0.16	-0.08	-0.45	0.42	0.00	-0.24	0.17	0.03	0.15	-0.67	0.50	0.15	-0.31	0.41	-0.07	-0.16	1.00					
tud	0.02	-0.02	-0.30	-0.31	0.08	0.24	0.25	0.29	0.48	0.42	-0.22	0.17	0.06	-0.13	-0.31	0.36	-0.14	-0.18	0.08	-0.15	-0.18	-0.40	0.41	0.32	0.15	0.35	-0.13	-0.01	0.21	1.00				
unein	-0.32	-0.45	-0.73	-0.22	-0.06	-0.21	-0.10	0.25	0.16	0.37	-0.29	-0.02	0.37	-0.30	-0.58	0.53	0.03	-0.29	-0.29	-0.32	-0.27	-0.48	0.36	0.19	-0.00	0.36	-0.09	0.09	0.34	0.53	1.00			
agri	0.13	-0.18	0.42	0.01	0.23	-0.10	0.43	-0.14	-0.03	-0.44	0.33	-0.14	-0.23	0.09	0.26	-0.37	-0.09	0.33	-0.13	0.32	-0.05	0.24	-0.48	-0.10	0.25	-0.55	0.12	-0.06	-0.46	0.02	-0.08	1.00		
indu	-0.16	-0.18	0.07	-0.15	-0.04	-0.24	0.39	0.13	-0.01	-0.50	0.04	-0.07	0.03	-0.12	-0.09	-0.22	-0.23	0.01	-0.31	0.58	0.31	-0.28	-0.52	-0.18	0.02	-0.47	0.29	-0.02	-0.11	-0.13	-0.23	0.29	1.00	
serv	0.11	0.12	-0.16	0.13	-0.01	0.24	-0.46	-0.08	0.02	0.56	-0.11	0.10	0.03	0.08	0.02	0.29	0.23	-0.09	0.31	-0.61	-0.28	0.20	0.59	0.19	-0.07	0.55	-0.29	0.03	0.20	0.11	0.22	-0.50	-0.97	1.00
kofgi	0.25	-0.17	-0.39	0.21	-0.21	0.13	-0.40	0.25	-0.12	0.46	-0.57	0.29	0.36	0.25	-0.17	0.55	0.42	-0.26	0.04	-0.33	0.07	-0.39	0.48	0.15	-0.26	0.46	-0.18	0.20	0.46	0.29	0.18	-0.48	-0.34	0.42	1.00

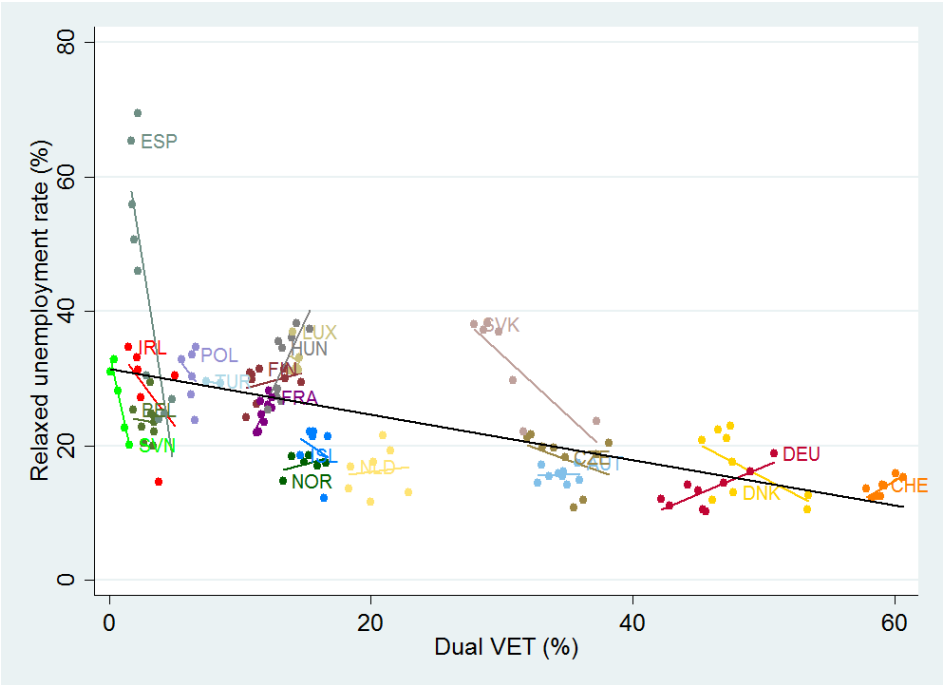
Note: The table displays the correlations among all variables; The abbreviations stand for: unem = youth unemployment rate; relax = youth relaxed unemployment rate; neet = NEET rate; long = youth long-term unemployment rate; temp = youth temporary contract rate; part = youth involuntary part-time work rate; atyp = youth atypical working hour rate; skill = youth skills mismatch rate; risk = youth in-work at-risk-of-poverty rate; learn = average hourly earnings (ln); gened = general education; svet = school-based VET; dvet = dual VET; aunem = adult unemployment rate; arelax = adult relaxed unemployment rate; alfp = adult labor force participation rate; along = adult long-term unemployment rate; atemp = adult temporary contract rate; apart = adult involuntary part-time work rate; aatyp = adult atypical working hour rate; askill = adult skills mismatch rate; arisk = adult in-work at-risk-of-poverty rate; laearn = adult average hourly earnings (ln); ylfpr = youth labor force participation rate; ytalfr = youth-to-adult labor force participation ratio; gdppc = GDP per capita; gdpg = GDP growth; epl = employment protection legislation; pisa = PISA score; tud = trade union density; unein = unemployment insurance; agri = sector: agriculture; indu = sector: industry; serv = sector: services; kofgi = KOF Globalisation Index.

Figure A4.1. Scatter plot of relaxed unemployment rate and school-based VET



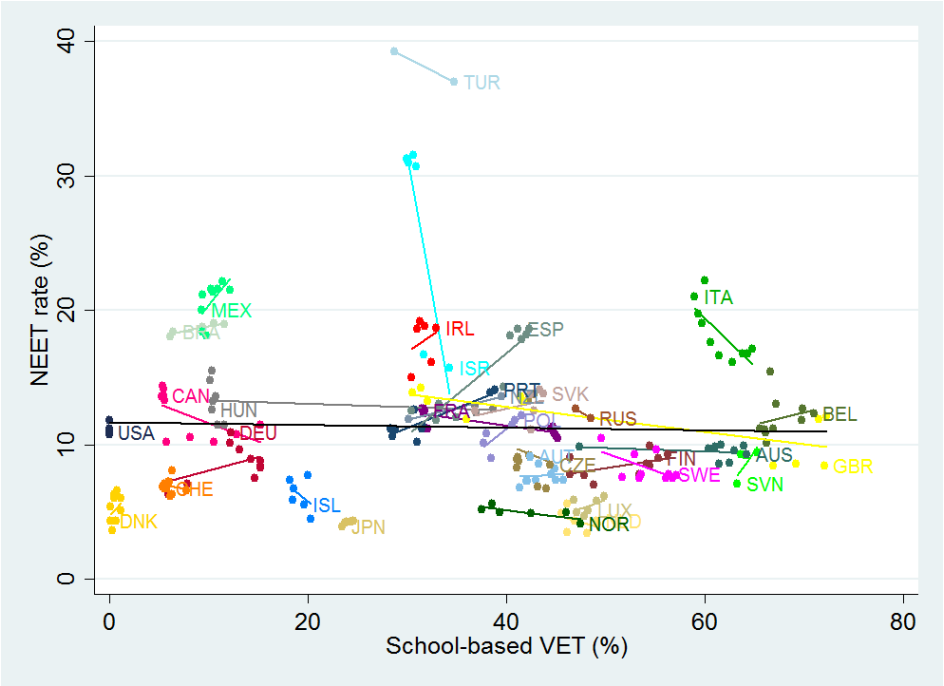
Note: Data from Eurostat and OECD.stat; Plot shows correlation between relaxed unemployment rate and school-based VET (lagged three years); The black trend line displays the between countries correlation; the colored lines, the within-country correlation over time.

Figure A4.2. Scatter plot of relaxed unemployment rate and dual VET



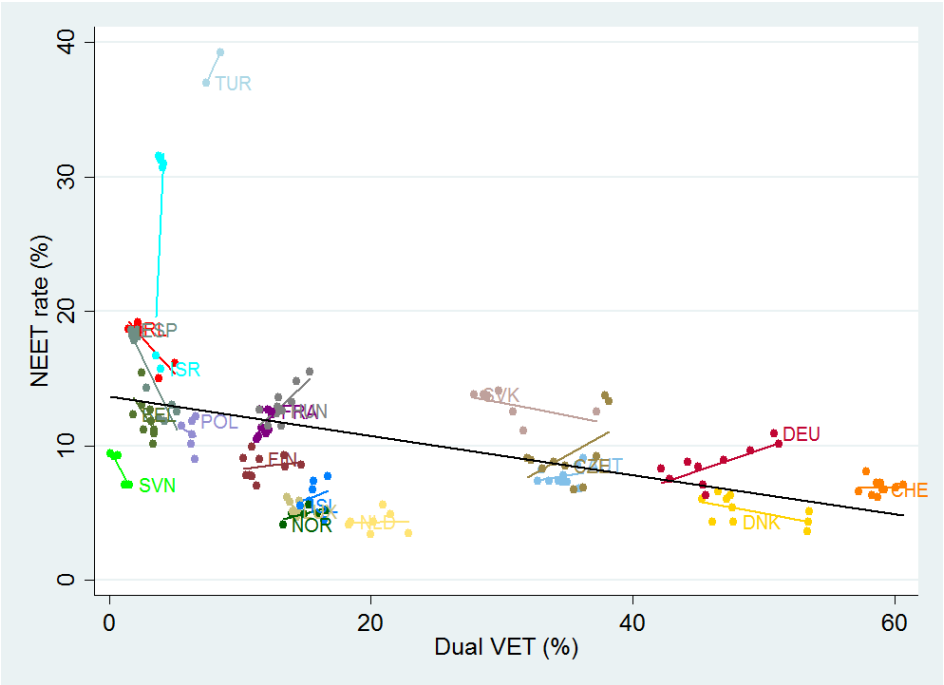
Note: Data from Eurostat and OECD.stat; Plot shows correlation between relaxed unemployment rate and dual VET (lagged three years); The black trend line displays the between countries correlation; the colored lines, the within-country correlation over time.

Figure A4.3. Scatter plot of NEET rate and school-based VET



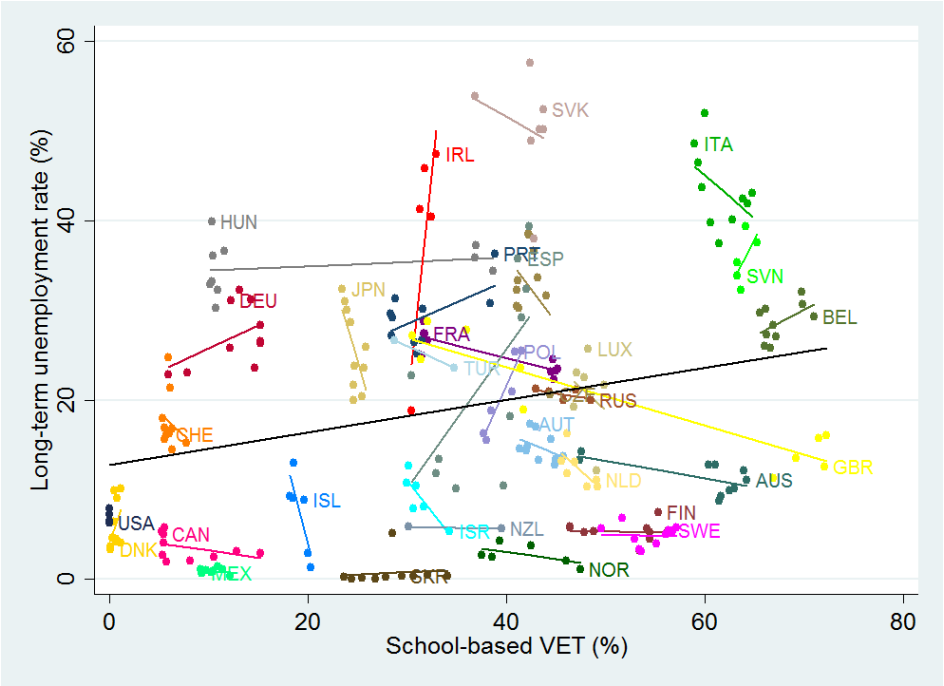
Note: Data from Eurostat, ILO-KILM 9th Edition, and OECD.stat; Plot shows correlation between NEET rate and school-based VET (lagged three years). The black trend line displays the between countries correlation; the colored lines, the within-country correlation over time.

Figure A4.4. Scatter plot of NEET rate and dual VET



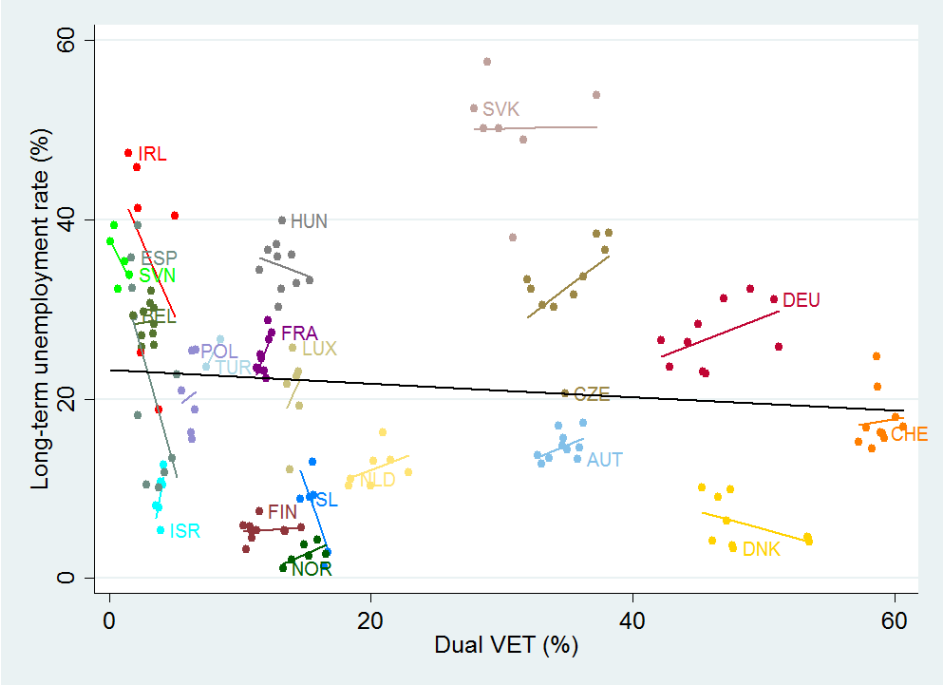
Note: Data from Eurostat, ILO-KILM 9th Edition, and OECD.stat; Plot shows correlation between NEET rate and dual VET (lagged three years); The black trend line displays the between countries correlation; the colored lines, the within-country correlation over time.

Figure A4.5. Scatter plot of long-term unemployment rate and school-based VET



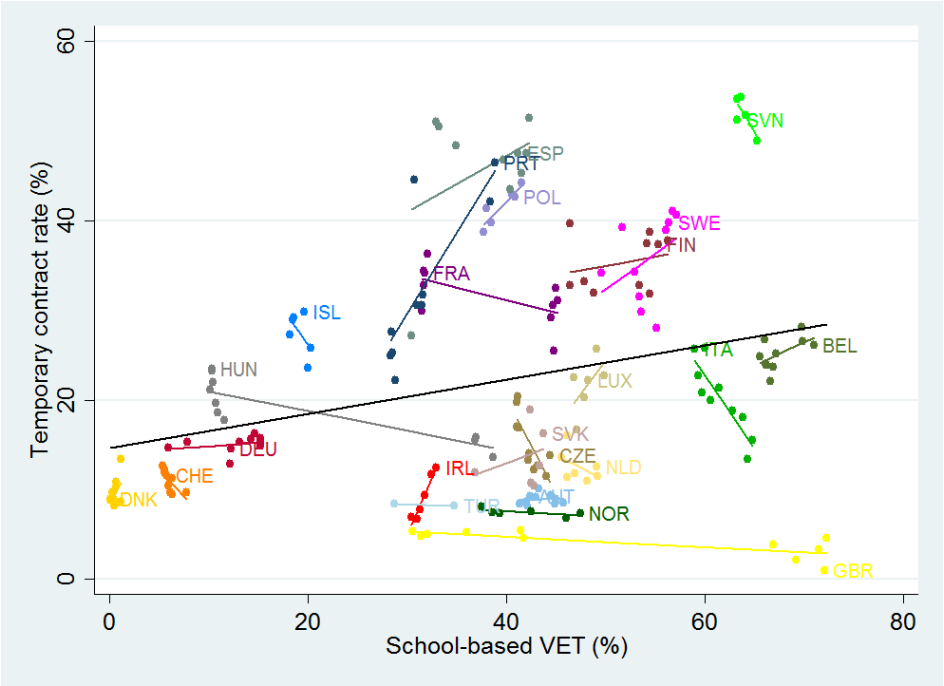
Note: Data from Eurostat, ILO-KILM 9th Edition, and OECD.stat; Plot shows correlation between long-term unemployment rate and school-based VET (lagged three years); The black trend line displays the between countries correlation; the colored lines, the within-country correlation over time.

Figure A4.6. Scatter plot of long-term unemployment rate and dual VET



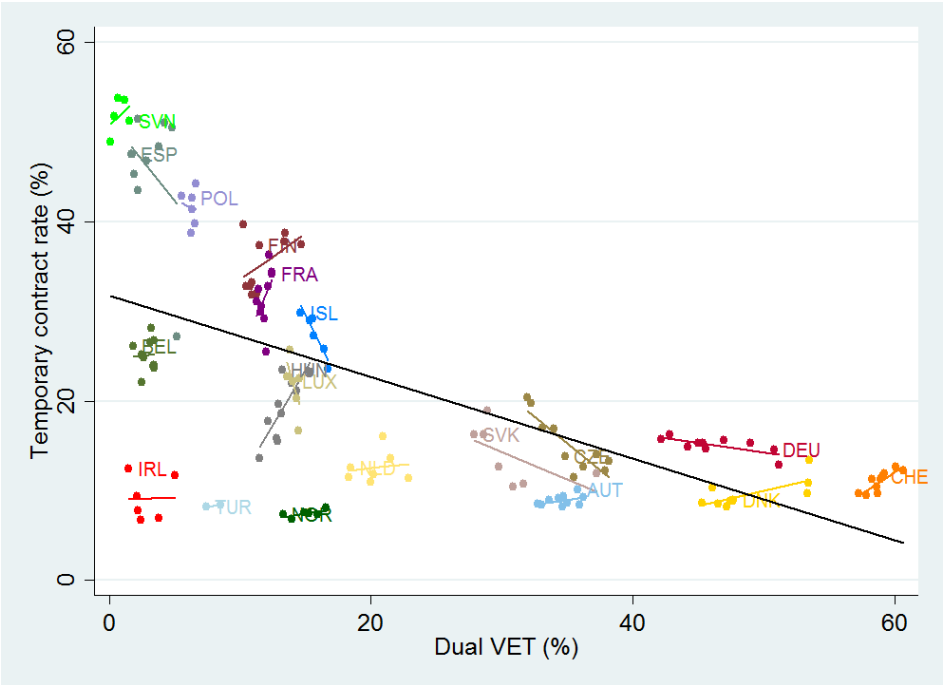
Note: Data from Eurostat, ILO-KILM 9th Edition, and OECD.stat; Plot shows correlation between long-term unemployment rate and dual VET (lagged three years); The black trend line displays the between countries correlation; the colored lines, the within-country correlation over time.

Figure A4.7. Scatter plot of temporary contract rate and school-based VET



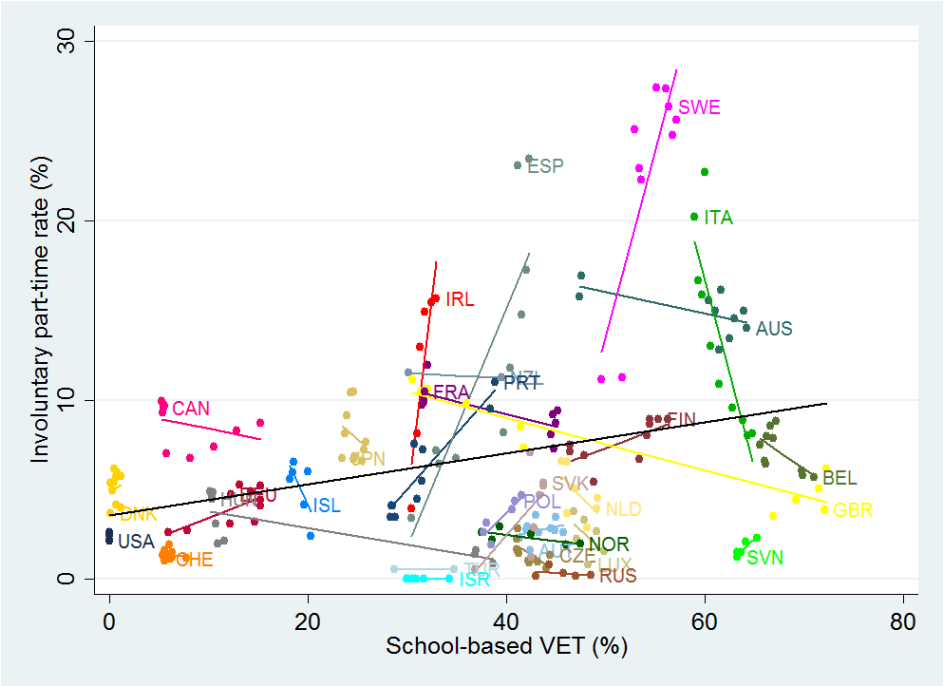
Note: Data from Eurostat and OECD.stat; Plot shows correlation between temporary contract rate and school-based VET (lagged three years); The black trend line displays the between countries correlation; the colored lines, the within-country correlation over time.

Figure A4.8. Scatter plot of temporary contract rate and dual VET



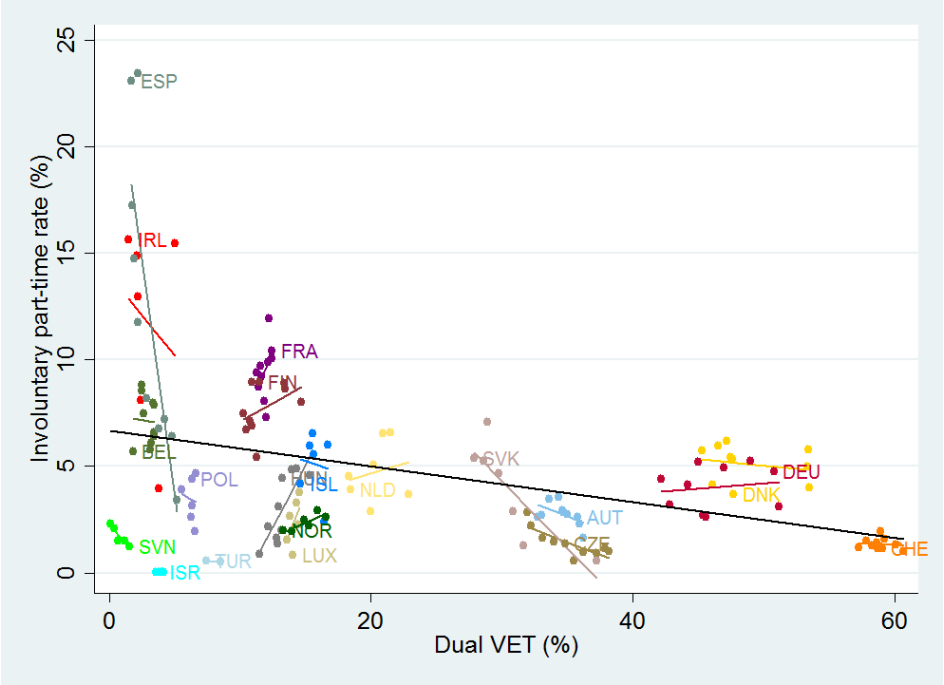
Note: Data from Eurostat and OECD.stat; Plot shows correlation between temporary contract rate and dual VET (lagged three years); The black trend line displays the between countries correlation; the colored lines, the within-country correlation over time.

Figure A4.9. Scatter plot of involuntary part-time work rate and school-based VET



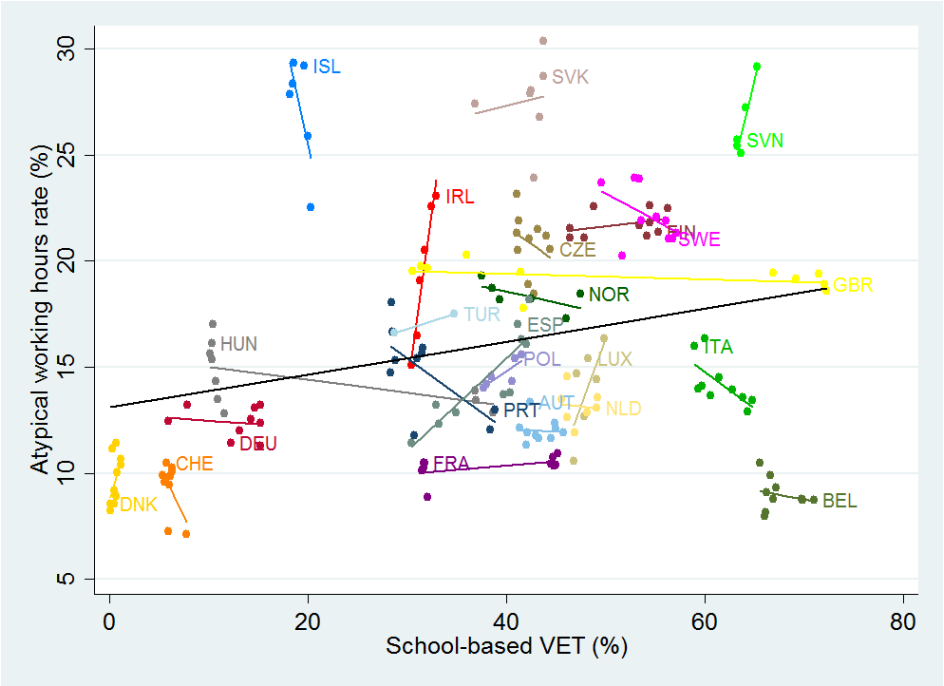
Note: Data from SFSO and OECD.stat; Plot shows correlation between involuntary part-time work rate and school-based VET (lagged three years); The black trend line displays the between countries correlation; the colored lines, the within-country correlation over time.

Figure A4.10. Scatter plot of involuntary part-time work rate and dual VET



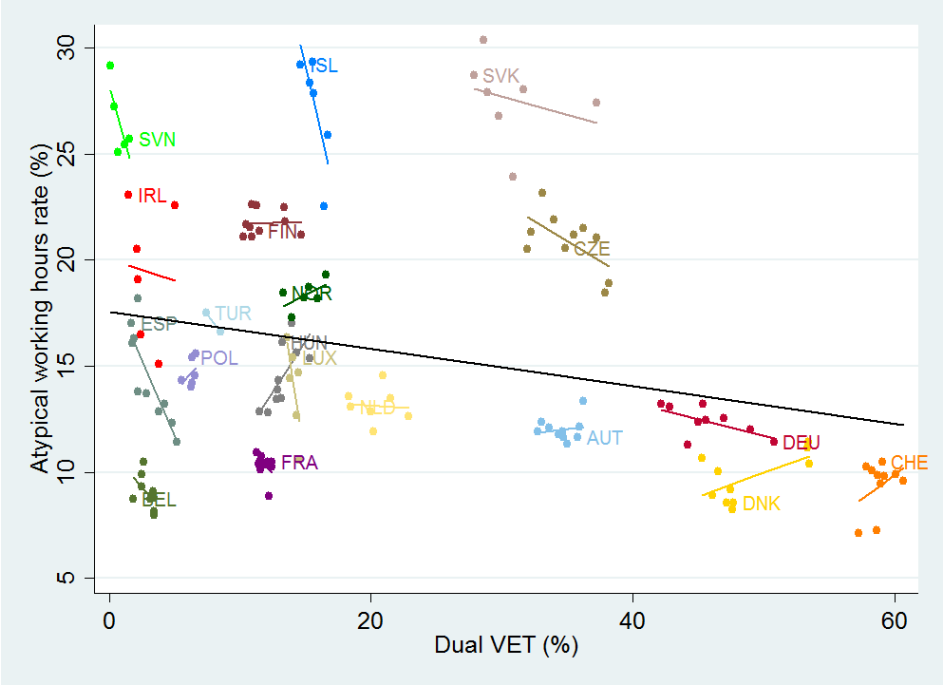
Note: Data from SFSO and OECD.stat; Plot shows correlation between involuntary part-time work rate and dual VET (lagged three years); The black trend line displays the between countries correlation; the colored lines, the within-country correlation over time.

Figure A4.11. Scatter plot of atypical working hours rate and school-based VET



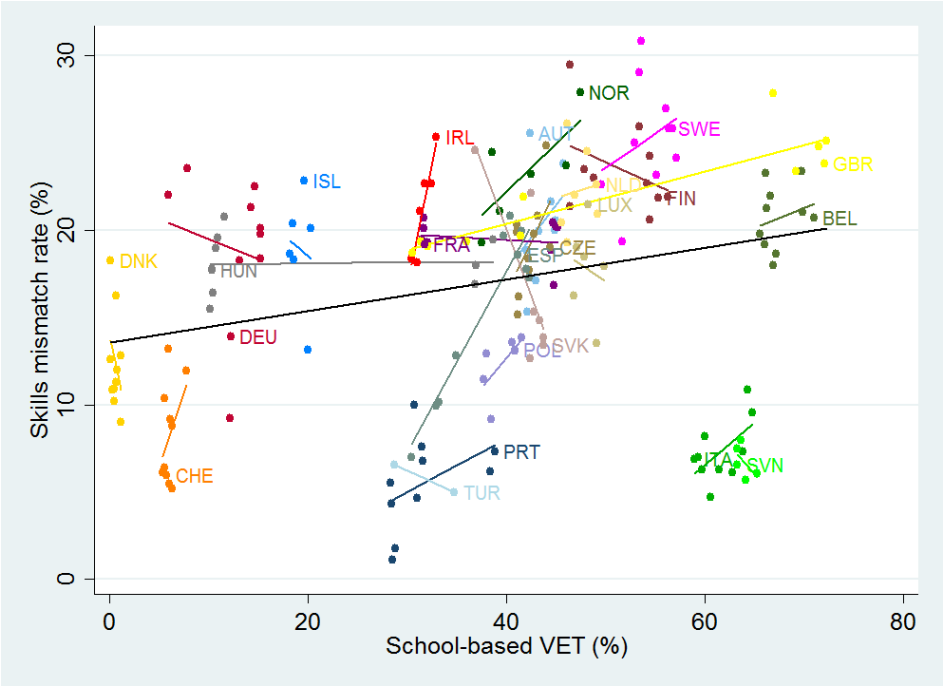
Note: Data from Eurostat and OECD.stat; Plot shows correlation between atypical working hours rate and school-based VET (lagged three years); The black trend line displays the between countries correlation; the colored lines, the within-country correlation over time.

Figure A4.12. Scatter plot of atypical working hours rate and dual VET



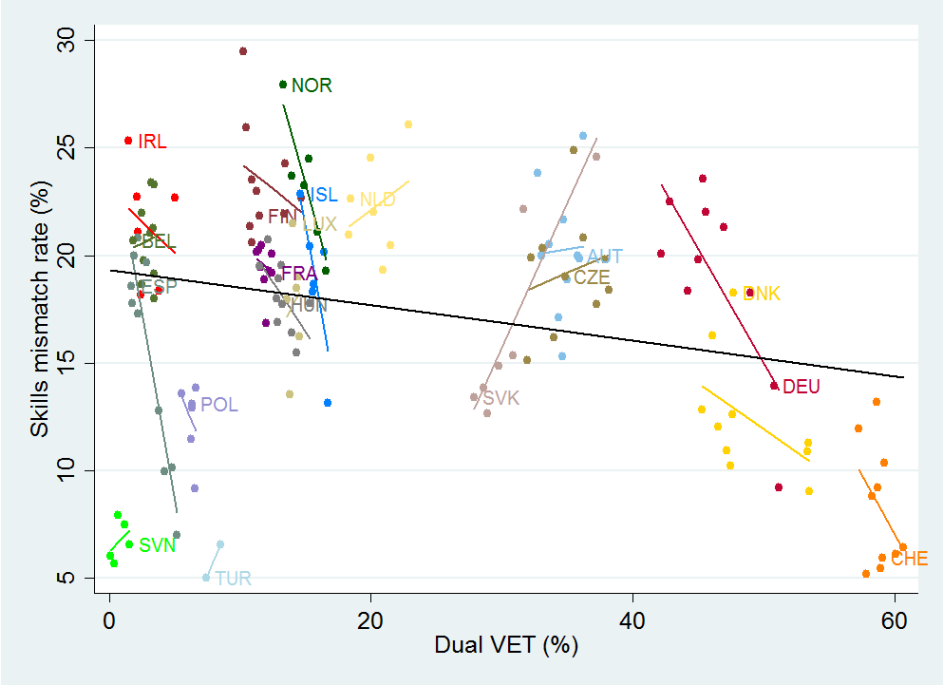
Note: Data from Eurostat and OECD.stat; Plot shows correlation between atypical working hours rate and dual VET (lagged three years); The black trend line displays the between countries correlation; the colored lines, the within-country correlation over time.

Figure A4.13. Scatter plot of skills mismatch rate and school-based VET



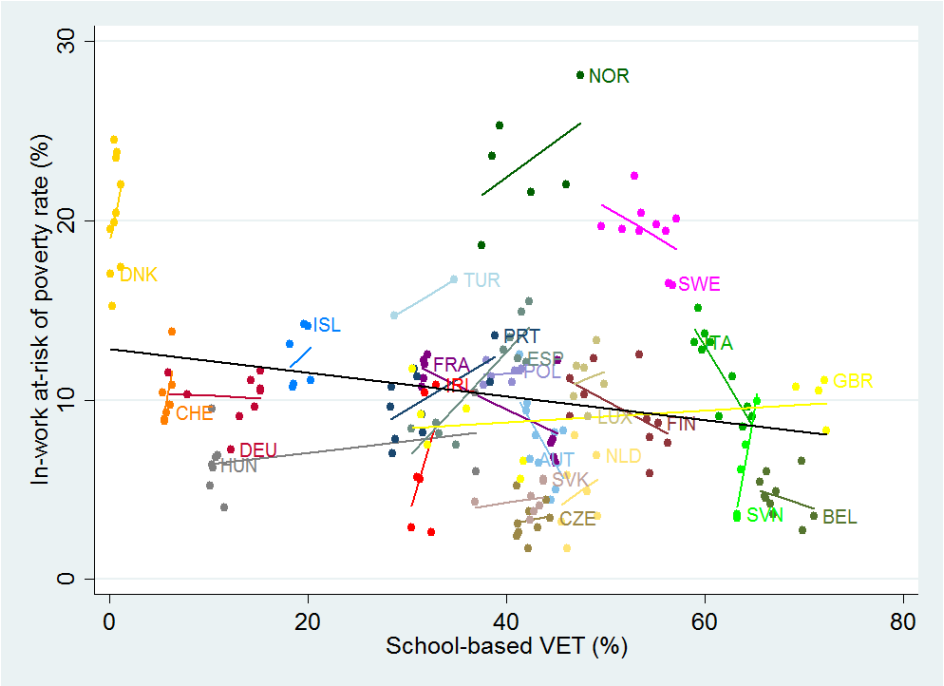
Note: Data from Eurostat and OECD.stat; Plot shows correlation between skills mismatch rate and school-based VET (lagged three years); The black trend line displays the between countries correlation; the colored lines, the within-country correlation over time.

Figure A4.14. Scatter plot of skills mismatch rate and dual VET



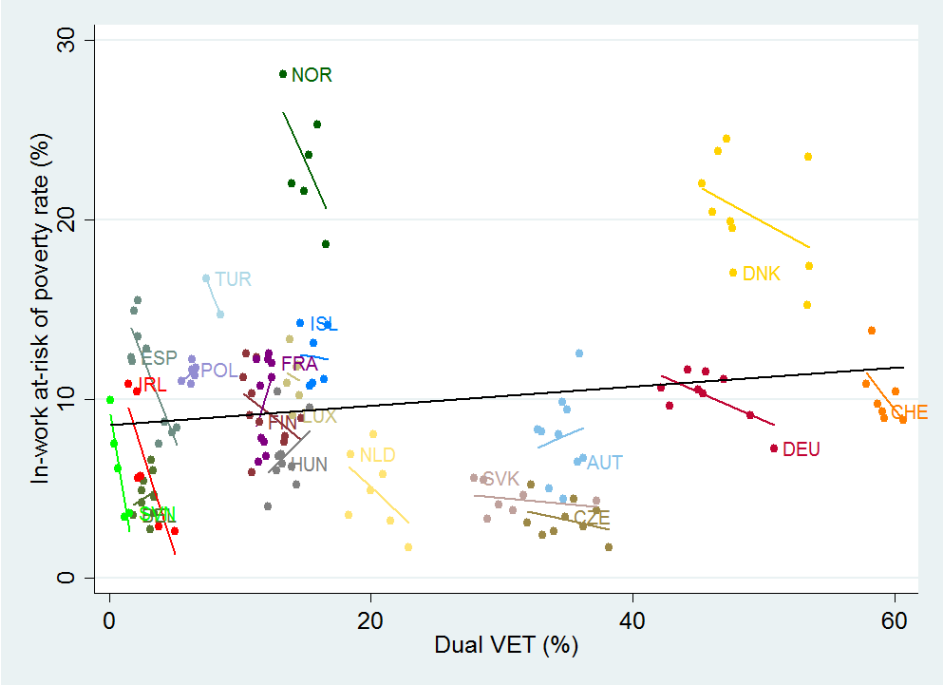
Note: Data from Eurostat and OECD.stat; Plot shows correlation between skills mismatch rate and dual VET (lagged three years); The black trend line displays the between countries correlation; the colored lines, the within-country correlation over time.

Figure A4.15. Scatter plot of in-work at-risk-of-poverty rate and school-based VET



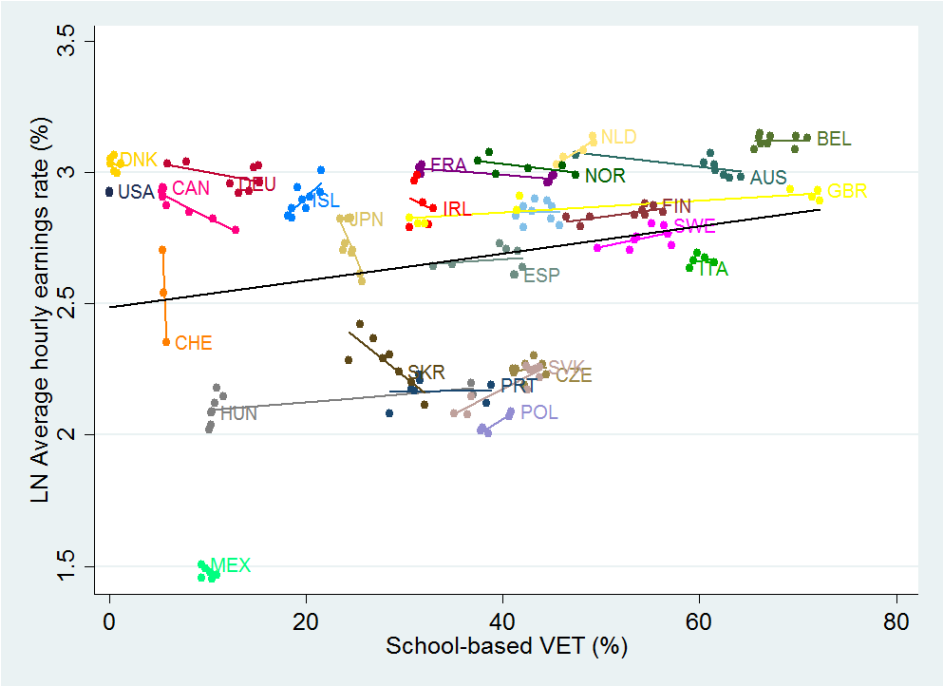
Note: Data from Eurostat and OECD.stat; Plot shows correlation between in-work at-risk-of-poverty rate and school-based VET (lagged three years); The black trend line displays the between countries correlation; the colored lines, the within-country correlation over time.

Figure A4.16. Scatter plot of in-work at-risk-of-poverty rate and dual VET



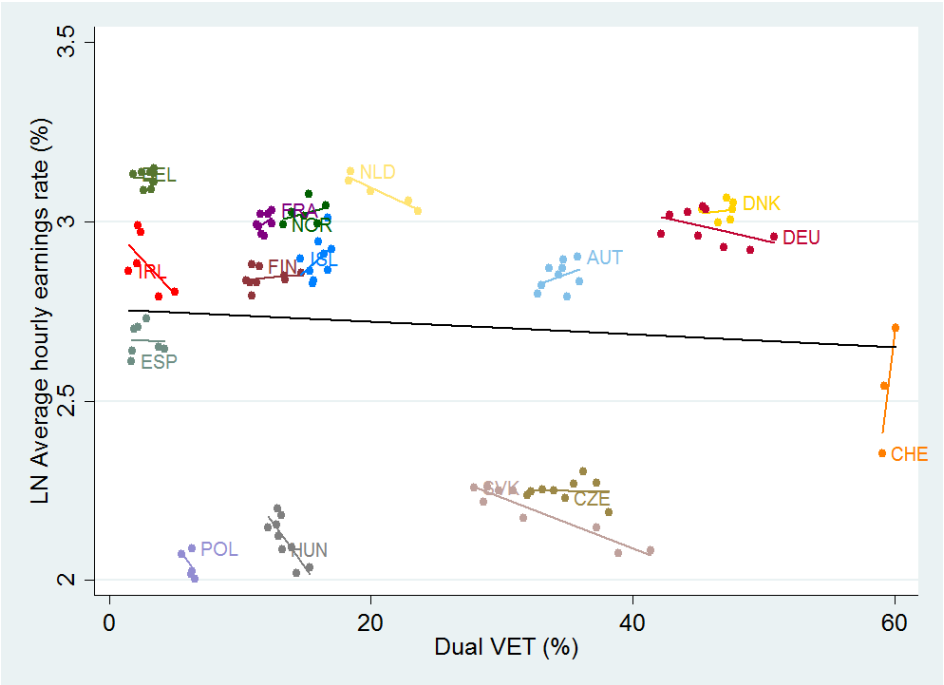
Note: Data from Eurostat and OECD.stat; Plot shows correlation between in-work at-risk-of-poverty rate and dual VET (lagged three years); The black trend line displays the between countries correlation; the colored lines, the within-country correlation over time.

Figure A4.17. Scatter plot of average hourly earnings and school-based VET



Note: Data from OECD.stat; Plot shows correlation between average hourly earnings and school-based VET (lagged three years); The black trend line displays the between countries correlation; the colored lines, the within-country correlation over time.

Figure A4.18. Scatter plot of average hourly earnings and dual VET



Note: Data from OECD.stat; Plot shows correlation between average hourly earnings and dual VET (lagged three years); The black trend line displays the between countries correlation; the colored lines, the within-country correlation over time.

Results of Robustness Checks

Table A4.3. Unemployment rate

	FE1	FE2	RE	dGMM	FE3	FE4	FE5	FE6	FE7	FE8
School-based VET	0.159	0.086	0.078*	0.147**	0.134	0.263*	0.025	0.094	0.096	0.246*
	(0.411)	(0.162)	(0.040)	(0.064)	(0.172)	(0.144)	(0.152)	(0.168)	(0.166)	(0.127)
School-based VET^2	-0.002	-0.001	-0.001***	-0.001*	-0.001	-0.002*	-0.001	-0.001	-0.001	-0.003*
	(0.004)	(0.002)	(0.000)	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)
Dual VET	-2.640*	-1.980**	0.053	-0.958**	-1.962**	-1.521**	-2.059**	-1.955**	-2.033**	-1.579**
	(1.394)	(0.868)	(0.087)	(0.425)	(0.808)	(0.665)	(0.896)	(0.826)	(0.857)	(0.619)
Dual VET^2	0.033*	0.025**	-0.004*	0.014***	0.025**	0.019**	0.025**	0.025**	0.024**	0.018**
	(0.018)	(0.011)	(0.002)	(0.005)	(0.010)	(0.009)	(0.011)	(0.010)	(0.010)	(0.008)
diff VET	0.215	0.079	0.07	0.010	0.044	0.061	0.072	0.063	0.070	0.023
Youth labor force participation		-0.471**	0.033	-0.206*	-0.450**	-0.213	-0.404**	-0.465**	-0.448**	-0.057
		(0.208)	(0.063)	(0.117)	(0.205)	(0.182)	(0.198)	(0.197)	(0.211)	(0.193)
Youth-to-adult labor force participation		-0.161	-0.259	-0.068	-0.309	-1.783**	-0.259	-0.216	-0.152	-2.151**
		(0.658)	(0.219)	(0.370)	(0.714)	(0.830)	(0.677)	(0.666)	(0.663)	(0.971)
GDP per capita		-1.370***	-0.006	-0.503***	-1.426***	-1.840***	-1.283***	-1.370***	-1.344***	-1.874***
		(0.366)	(0.044)	(0.170)	(0.384)	(0.436)	(0.325)	(0.367)	(0.345)	(0.418)
GDP growth		-0.363**	-0.213***	-0.383***	-0.370**	-0.358**	-0.294*	-0.350**	-0.749**	-0.798***
		(0.150)	(0.071)	(0.070)	(0.174)	(0.160)	(0.163)	(0.150)	(0.292)	(0.232)
EPL		-8.076***	-1.643*	-1.953	-6.582**	-4.801**	-8.061***	-8.192***	-7.989***	-4.105**
		(2.342)	(0.985)	(1.534)	(3.123)	(2.207)	(2.324)	(2.299)	(2.221)	(1.857)
PISA score		-0.007	0.000	0.009	0.003	0.034	-0.006	-0.011	-0.012	0.031
		(0.054)	(0.019)	(0.030)	(0.058)	(0.053)	(0.055)	(0.052)	(0.055)	(0.050)
Trade union density					-0.063					-0.106
					(0.307)					(0.275)
Unemployment insurance						-0.049				-0.045
						(0.038)				(0.046)
Sector: Industry							0.704			1.553
							(0.834)			(0.996)
Sector: Services							1.170			1.987*
							(0.864)			(1.069)
KOF Globalisation Index								-0.060		-0.239
								(0.288)		(0.283)
School-based VET x GDP growth									0.007	0.010**
									(0.005)	(0.004)
Dual VET x GDP growth									0.009	0.011**
									(0.006)	(0.004)
Constant	29.384***	117.813***	9.403	-	114.629***	111.840***	15.822	124.967**	119.143***	-47.328
	(10.758)	(36.950)	(10.445)	-	(35.423)	(36.151)	(81.086)	(47.238)	(37.466)	(83.030)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
No. of observations	272	272	272	202	254	204	258	269	272	196
No. of countries	35	35	35	32	32	28	33	35	35	28
R^2	0.375	0.681	-	-	0.673	0.777	0.693	0.682	0.690	0.792

Note: Main specification is non-linear fixed effects model with clustered standard errors (FE2); random effects model includes adult dependent variable as control, but not displayed in table; GMM model with first difference, but not displayed in table; *** $p<0.01$, ** $p<0.05$, * $p<0.1$; school-based VET and dual VET lagged three years; PISA scores lagged four years; diff VET reports the p-values for the null hypothesis that the coefficients of school-based and dual VET are equal.

Table A4.4. Relaxed unemployment rate

	FE1	FE2	RE	dGMM	FE3	FE4	FE5	FE6	FE7	FE8
School-based VET	0.655 (0.649)	0.385** (0.152)	0.179** (0.071)	0.146* (0.077)	0.373** (0.144)	0.362** (0.153)	0.342*** (0.120)	0.395** (0.152)	0.432*** (0.126)	0.344** (0.123)
School-based VET^2	-0.006 (0.006)	-0.003** (0.001)	-0.002*** (0.001)	-0.001 (0.001)	-0.003** (0.001)	-0.003* (0.002)	-0.003** (0.001)	-0.003** (0.002)	-0.004*** (0.001)	-0.003** (0.001)
Dual VET	-2.917** (1.394)	-1.636** (0.650)	-0.144 (0.150)	-1.126*** (0.436)	-1.629** (0.640)	-1.559** (0.661)	-1.589** (0.648)	-1.703** (0.654)	-1.692*** (0.564)	-1.436** (0.561)
Dual VET^2	0.040* (0.021)	0.021** (0.008)	-0.000 (0.002)	0.016*** (0.006)	0.020** (0.008)	0.019** (0.009)	0.019** (0.008)	0.022** (0.008)	0.020*** (0.007)	0.015** (0.007)
diff VET	0.118	0.024	0.002	0.020	0.017	0.036	0.029	0.017	0.006	0.012
Youth labor force participation		-0.334 (0.198)	0.032 (0.098)	-0.046 (0.158)	-0.302 (0.203)	-0.366* (0.208)	-0.252 (0.212)	-0.328 (0.204)	-0.254 (0.179)	-0.136 (0.193)
Youth-to-adult labor force participation		-1.867** (0.719)	-0.568** (0.239)	-0.842 (0.586)	-1.883** (0.704)	-1.953** (0.812)	-1.935** (0.746)	-1.754** (0.821)	-1.972*** (0.625)	-2.580*** (0.838)
GDP per capita		-2.714*** (0.414)	0.023 (0.064)	-1.477*** (0.302)	-2.736*** (0.395)	-2.899*** (0.449)	-2.874*** (0.378)	-2.716*** (0.411)	-2.680*** (0.328)	-3.116*** (0.332)
GDP growth		0.024 (0.219)	-0.135 (0.112)	-0.274 (0.175)	-0.007 (0.228)	0.001 (0.239)	0.120 (0.229)	0.017 (0.224)	-1.289*** (0.376)	-1.097*** (0.379)
EPL		-8.585*** (3.001)	-5.316*** (1.360)	-3.350 (2.309)	-7.250** (3.149)	-8.271** (3.016)	-8.126*** (2.689)	-8.447*** (2.974)	-8.032*** (2.464)	-5.539** (2.604)
PISA score		0.100 (0.066)	0.060** (0.028)	0.087** (0.044)	0.092 (0.068)	0.082 (0.078)	0.091 (0.059)	0.104 (0.066)	0.077 (0.062)	0.040 (0.069)
Trade union					0.057 (0.226)					-0.124 (0.212)
Unemployment insurance						-0.069 (0.041)				-0.059 (0.046)
Sector: Industry							2.555*** (0.870)			2.810*** (0.986)
Sector: Services							2.866*** (0.767)			3.261*** (0.898)
KOF Globalisation Index								0.161 (0.384)		-0.428 (0.299)
School-based VET x GDP									0.024*** (0.005)	0.022*** (0.005)
Dual VET x GDP growth									0.020*** (0.006)	0.020*** (0.006)
Constant	29.384*** (10.758)	117.813*** (36.950)	9.403 (10.445)	- -	114.629*** (35.423)	111.840*** (36.151)	15.822 (81.086)	124.967** (47.238)	119.143*** (37.466)	-47.328 (83.030)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
No. of observations	176	176	176	130	172	160	176	174	176	157
No. of countries	23	23	23	22	23	21	23	23	23	21
R^2	0.525	0.848	-	-	0.833	0.859	0.859	0.848	0.869	0.882

Note: Main specification is non-linear fixed effects model with clustered standard errors (FE2); random effects model includes adult dependent variable as control, but not displayed in table; GMM model with first difference, but not displayed in table; *** $p<0.01$, ** $p<0.05$, * $p<0.1$; school-based VET and dual VET lagged three years; PISA scores lagged four years; diff VET reports the p-values for the null hypothesis that the coefficients of school-based and dual VET are equal.

Table A4.5. NEET rate

	FE1	FE2	RE	dGMM	FE3	FE4	FE5	FE6	FE7	FE8
School-based VET	0.043	0.028	0.093	-0.002	-0.013	0.095*	0.090***	0.034	0.028	0.078**
	(0.075)	(0.069)	(0.072)	(0.040)	(0.062)	(0.053)	(0.032)	(0.071)	(0.070)	(0.032)
School-based VET^2	-0.001	-0.000	-0.001	0.000	-0.000	-0.001**	-0.001***	-0.001	-0.000	-0.001***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)
Dual VET	-0.467	-0.481*	-0.137	-0.187	-0.427*	-0.406	-0.578**	-0.604**	-0.485*	-0.396*
	(0.424)	(0.267)	(0.108)	(0.225)	(0.242)	(0.239)	(0.242)	(0.251)	(0.268)	(0.203)
Dual VET^2	0.007	0.007*	0.003	0.003	0.006*	0.006	0.008**	0.009**	0.007*	0.005*
	(0.006)	(0.004)	(0.002)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)	(0.003)
diff VET	0.366	0.154	0.221	0.609	0.174	0.130	0.019	0.037	0.180	0.077
Youth-to-adult labor force participation		0.344	-0.067	0.287	0.453*	-0.194	0.200	0.551	0.349	-0.038
		(0.303)	(0.150)	(0.300)	(0.261)	(0.239)	(0.228)	(0.390)	(0.300)	(0.173)
GDP per capita		-0.679***	-0.146***	-0.344***	-0.459***	-0.689***	-0.524***	-0.665***	-0.669***	-0.621***
		(0.221)	(0.037)	(0.097)	(0.163)	(0.156)	(0.165)	(0.217)	(0.216)	(0.173)
GDP growth		0.033	-0.104	-0.024	-0.034	-0.012	-0.017	0.016	-0.025	-0.150
		(0.098)	(0.096)	(0.050)	(0.073)	(0.069)	(0.076)	(0.093)	(0.148)	(0.108)
EPL		-1.492	-1.536	-0.801	-2.580	0.475	-0.476	-1.620	-1.488	-0.272
		(1.488)	(1.027)	(0.814)	(1.555)	(0.908)	(0.878)	(1.524)	(1.505)	(0.859)
PISA score		-0.063	-0.057*	-0.035	-0.066*	0.001	-0.009	-0.059	-0.064	-0.017
		(0.054)	(0.033)	(0.031)	(0.038)	(0.029)	(0.027)	(0.049)	(0.054)	(0.026)
Trade union density					0.410**					0.203**
					(0.164)					(0.081)
Unemployment insurance						0.004				-0.003
						(0.014)				(0.014)
Sector: Industry							0.163			0.053
							(0.281)			(0.395)
Sector: Services							0.360			0.093
							(0.335)			(0.401)
KOF Globalisation Index								0.313		0.067
								(0.282)		(0.098)
School-based VET x GDP growth									0.001	0.002
									(0.003)	(0.002)
Dual VET x GDP growth									0.002	0.003*
									(0.003)	(0.002)
Constant	14.108***	65.534**	89.055***	-	49.478**	35.018**	4.219	35.410	65.870**	22.880
	(3.170)	(31.161)	(19.823)	-	(18.544)	(15.952)	(30.450)	(23.692)	(31.154)	(30.345)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
No. of observations	245	245	245	180	233	191	231	243	245	183
No. of countries	33	33	33	29	31	26	31	33	33	26
R^2	0.141	0.306	-	-	0.409	0.566	0.478	0.331	0.308	0.614

Note: Main specification is non-linear fixed effects model with clustered standard errors (FE2); random effects model (RE) includes adult labor force participation as control, but not displayed in table; GMM model with first difference, but not displayed in table; *** $p<0.01$, ** $p<0.05$, * $p<0.1$; school-based VET and dual VET lagged three years; PISA scores lagged four years; diff VET reports the p-values for the null hypothesis that the coefficients of school-based and dual VET are equal.

Table A4.6. Long-term unemployment rate

	FE1	FE2	RE	dGMM	FE3	FE4	FE5	FE6	FE7	FE8
School-based VET	0.393**	0.218*	0.208***	0.187**	0.147	0.325**	0.142	0.198	0.223*	0.189
	(0.162)	(0.126)	(0.066)	(0.078)	(0.143)	(0.133)	(0.118)	(0.126)	(0.129)	(0.136)
School-based VET^2	-0.006***	-0.003**	-0.003***	-0.002**	-0.002	-0.004**	-0.003**	-0.003*	-0.003**	-0.003**
	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Dual VET	-1.687*	-1.352***	-0.173	-1.609***	-1.370***	-1.428***	-1.763***	-1.454***	-1.399***	-2.317***
	(0.908)	(0.478)	(0.182)	(0.593)	(0.413)	(0.493)	(0.466)	(0.506)	(0.449)	(0.515)
Dual VET^2	0.024*	0.017**	0.003	0.020***	0.016***	0.019**	0.021***	0.018***	0.016***	0.026***
	(0.012)	(0.006)	(0.003)	(0.007)	(0.006)	(0.008)	(0.006)	(0.006)	(0.005)	(0.007)
diff VET	0.084	0.003	0.098	0.006	0.002	0.003	0.000	0.003	0.001	0.000
Youth labor force participation		-0.781**	-0.205***	-0.558***	-0.761**	-0.632**	-0.624**	-0.810**	-0.753**	-0.441**
		(0.312)	(0.073)	(0.214)	(0.310)	(0.260)	(0.251)	(0.315)	(0.308)	(0.212)
Youth-to-adult labor force participation		0.347	-0.200	-0.177	0.351	-1.133*	-0.295	0.481	0.343	-1.013
		(0.544)	(0.248)	(0.526)	(0.535)	(0.649)	(0.434)	(0.570)	(0.563)	(0.610)
GDP per capita		-1.064***	-0.026	-0.890***	-0.963***	-1.390***	-0.551**	-1.072***	-1.002***	-0.696*
		(0.313)	(0.046)	(0.206)	(0.325)	(0.426)	(0.232)	(0.316)	(0.288)	(0.379)
GDP growth		0.460*	-0.110	0.303	0.541**	0.570**	0.564**	0.477*	-0.077	0.101
		(0.245)	(0.141)	(0.199)	(0.249)	(0.235)	(0.239)	(0.240)	(0.357)	(0.236)
EPL		0.253	-2.342*	-1.722	-0.155	1.883	0.640	0.156	0.259	1.454
		(2.967)	(1.395)	(2.073)	(3.880)	(3.000)	(2.235)	(3.014)	(2.958)	(2.645)
PISA score		-0.114**	-0.074***	-0.137***	-0.126**	-0.113*	-0.050	-0.112**	-0.122**	-0.092
		(0.055)	(0.026)	(0.045)	(0.049)	(0.064)	(0.045)	(0.055)	(0.055)	(0.057)
Trade union density					0.385*					0.249
					(0.217)					(0.199)
Unemployment insurance						0.021				-0.009
						(0.038)				(0.041)
Sector: Industry							-3.462***			-3.894***
							(1.210)			(1.350)
Sector: Services							-2.445**			-2.687**
							(1.114)			(1.191)
KOF Globalisation Index								0.132		0.380
								(0.288)		(0.254)
School-based VET x GDP growth									0.008	0.011**
									(0.006)	(0.005)
Dual VET x GDP growth									0.014*	0.012
									(0.008)	(0.007)
Constant	24.024***	146.449**	52.899***	-	139.606**	164.437***	373.510***	135.714***	148.692	394.019
	(7.121)	(41.035)	(15.690)	-	(37.635)	(43.857)	(115.470)	(46.056)	(41.086)	(106.514)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
No. of observations	259	259	259	195	248	203	245	257	259	195
No. of countries	32	32	32	30	31	27	30	32	32	27
R^2	0.341	0.532	-	-	0.563	0.654	0.607	0.529	0.552	0.722

Note: Main specification is non-linear fixed effects model with clustered standard errors (FE2); random effects model includes adult dependent variable as control, but not displayed in table; GMM model with first difference, but not displayed in table; *** $p<0.01$, ** $p<0.05$, * $p<0.1$; school-based VET and dual VET lagged three years; PISA scores lagged four years; diffVET reports the p-values for the null hypothesis that the coefficients of school-based and dual VET are equal.

Table A4.7. Temporary contract rate

	FE1	FE2	RE	dGMM	FE3	FE4	FE5	FE6	FE7	FE8
School-based VET	0.082	0.055	0.113*	0.009	0.012	-0.023	0.099	0.035	0.064	0.072
	(0.296)	(0.111)	(0.061)	(0.108)	(0.139)	(0.132)	(0.123)	(0.107)	(0.103)	(0.158)
School-based VET^2	-0.001	-0.001	-0.001*	-0.000	-0.000	0.000	-0.001	-0.000	-0.001	-0.000
	(0.003)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Dual VET	-0.461	-0.042	-0.417**	0.553	-0.072	0.461	0.103	-0.178	-0.061	0.542
	(0.285)	(0.307)	(0.207)	(0.467)	(0.264)	(0.481)	(0.348)	(0.375)	(0.312)	(0.438)
Dual VET^2	0.009*	0.003	0.005*	-0.004	0.003	-0.004	0.001	0.004	0.004	-0.003
	(0.004)	(0.004)	(0.003)	(0.005)	(0.003)	(0.007)	(0.004)	(0.004)	(0.004)	(0.005)
diff VET	0.187	0.222	0.016	0.260	0.400	0.303	0.183	0.237	0.028	0.189
Youth labor force participation		0.742***	0.116	0.460**	0.715***	0.523***	0.710***	0.731***	0.745***	0.435**
		(0.204)	(0.111)	(0.197)	(0.199)	(0.176)	(0.179)	(0.204)	(0.203)	(0.194)
Youth-to-adult labor force participation		-1.827***	-1.004***	-0.325	-1.804***	-0.771	-1.749***	-1.642***	-1.825***	-0.591
		(0.325)	(0.302)	(0.737)	(0.386)	(0.794)	(0.347)	(0.395)	(0.321)	(0.831)
GDP per capita		-1.092***	-0.096	-0.735***	-1.049***	-0.786**	-1.208***	-1.124***	-1.146***	-0.972***
		(0.170)	(0.089)	(0.281)	(0.210)	(0.299)	(0.217)	(0.179)	(0.199)	(0.308)
GDP growth		0.141	-0.151	0.048	0.197	0.047	0.123	0.170	0.257	0.166
		(0.207)	(0.154)	(0.168)	(0.207)	(0.177)	(0.200)	(0.204)	(0.397)	(0.330)
EPL		-8.567***	-1.532	-9.964***	-7.786**	-12.007***	-8.198***	-8.723***	-8.493***	-10.024***
		(2.799)	(1.929)	(2.944)	(3.346)	(2.867)	(2.421)	(2.675)	(2.770)	(2.688)
PISA score		0.044	0.046	0.015	0.029	0.003	0.032	0.045	0.048	0.006
		(0.053)	(0.041)	(0.058)	(0.060)	(0.073)	(0.053)	(0.055)	(0.052)	(0.081)
Trade union density					0.020					-0.203
					(0.172)					(0.227)
Unemployment insurance						-0.003				0.019
						(0.031)				(0.039)
Sector: Industry							1.426*			1.424
							(0.778)			(1.123)
Sector: Services							1.161			0.991
							(0.736)			(1.097)
KOF Globalisation Index								0.251		0.075
								(0.230)		(0.229)
School-based VET x GDP growth									-0.000	-0.001
									(0.006)	(0.006)
Dual VET x GDP growth									-0.005	-0.004
									(0.007)	(0.006)
Constant	18.506*	38.928	2.596	-	43.680	56.918	-75.252	18.253	37.757	-56.036
	(9.680)	(29.147)	(20.230)	-	(29.975)	(37.103)	(64.985)	(39.135)	(28.735)	(99.844)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
No. of observations	192	192	192	146	188	161	192	190	192	158
No. of countries	23	23	23	22	23	21	23	23	23	21
R^2	0.325	0.573	-	-	0.537	0.618	0.582	0.580	0.576	0.597

Note: Main specification is non-linear fixed effects model with clustered standard errors (FE2); random effects model includes adult dependent variable as control, but not displayed in table; GMM model with first difference, but not displayed in table; *** $p<0.01$, ** $p<0.05$, * $p<0.1$; school-based VET and dual VET lagged three years; PISA scores lagged four years; diff VET reports the p-values for the null hypothesis that the coefficients of school-based and dual VET are equal.

Table A4.8. Involuntary part-time work rate

	FE1	FE2	RE	dGMM	FE3	FE4	FE5	FE6	FE7	FE8
School-based VET	0.236	0.228**	0.026	0.086***	0.279***	0.201**	0.169*	0.221**	0.225**	0.194*
	(0.179)	(0.091)	(0.029)	(0.032)	(0.093)	(0.085)	(0.093)	(0.092)	(0.093)	(0.100)
School-based VET^2	-0.003	-0.002**	-0.000	-0.001**	-0.003***	-0.002*	-0.002	-0.002**	-0.002**	-0.002*
	(0.002)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Dual VET	-1.018*	-0.803*	-0.182*	-0.271*	-0.874*	-0.488	-0.953**	-0.777**	-0.800*	-0.713*
	(0.554)	(0.411)	(0.094)	(0.140)	(0.432)	(0.356)	(0.435)	(0.368)	(0.405)	(0.404)
Dual VET^2	0.015*	0.011*	0.003*	0.005***	0.013*	0.008	0.013**	0.011**	0.011*	0.010
	(0.007)	(0.006)	(0.002)	(0.002)	(0.007)	(0.006)	(0.006)	(0.005)	(0.006)	(0.006)
diff VET	0.090	0.077	0.012	0.000	0.067	0.185	0.055	0.052	0.074	0.099
Youth labor force participation		-0.083	-0.005	-0.100	-0.072	-0.135	-0.040	-0.083	-0.081	-0.064
		(0.152)	(0.055)	(0.078)	(0.142)	(0.175)	(0.149)	(0.151)	(0.154)	(0.153)
Youth-to-adult labor force participation		-0.175	0.139	-0.342**	-0.377	-0.850	-0.304	-0.219	-0.183	-1.087
		(0.880)	(0.330)	(0.173)	(0.733)	(0.859)	(0.888)	(0.824)	(0.873)	(0.706)
GDP per capita		-0.959***	0.001	-0.509***	-1.172***	-1.008***	-0.801***	-0.962***	-0.930***	-0.927**
		(0.265)	(0.043)	(0.137)	(0.302)	(0.295)	(0.276)	(0.266)	(0.265)	(0.360)
GDP growth		0.002	-0.040	-0.033	0.089	0.030	0.054	0.009	-0.104	0.028
		(0.085)	(0.050)	(0.047)	(0.104)	(0.091)	(0.089)	(0.087)	(0.185)	(0.146)
EPL		0.528	-1.055*	0.026	1.836	0.370	0.458	0.423	0.493	0.736
		(1.744)	(0.607)	(0.766)	(1.862)	(1.806)	(1.804)	(1.753)	(1.717)	(1.382)
PISA score		-0.023	-0.015	0.001	-0.001	-0.026	-0.011	-0.028	-0.026	-0.003
		(0.051)	(0.020)	(0.022)	(0.043)	(0.062)	(0.052)	(0.052)	(0.051)	(0.051)
Trade union density					-0.384					-0.244
					(0.355)					(0.324)
Unemployment insurance						-0.029				-0.027
						(0.027)				(0.023)
Sector: Industry							-0.807			-0.829
							(0.618)			(0.826)
Sector: Services							-0.419			-0.380
							(0.607)			(0.720)
KOF Globalisation Index								-0.071		-0.080
								(0.203)		(0.198)
School-based VET x GDP growth									0.001	0.001
									(0.003)	(0.002)
Dual VET x GDP growth									0.004	0.002
									(0.003)	(0.002)
Constant	6.388	52.567**	7.856	-	59.289**	68.252**	96.441	61.586*	53.331**	119.521
	(5.449)	(23.452)	(9.350)	-	(27.596)	(30.221)	(70.059)	(30.682)	(23.378)	(77.815)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
No. of observations	239	239	239	179	229	190	225	237	239	182
No. of countries	30	30	30	28	29	25	28	30	30	25
R^2	0.402	0.557	-	-	0.578	0.629	0.574	0.556	0.560	0.647

Note: Main specification is non-linear fixed effects model with clustered standard errors (FE2); random effects model includes adult dependent variable as control, but not displayed in table; GMM model with first difference but not displayed in table; *** $p<0.01$, ** $p<0.05$, * $p<0.1$; school-based VET and dual VET lagged three years; PISA scores lagged four years; diff VET reports the p-values for the null hypothesis that the coefficients of school-based and dual VET are equal.

Table A4.9. Atypical working hours rate

	FE1	FE2	RE	dGMM	FE3	FE4	FE5	FE6	FE7	FE8
School-based VET	-0.088 (0.062)	-0.048 (0.038)	-0.036 (0.035)	-0.007 (0.032)	-0.026 (0.048)	-0.046 (0.035)	-0.056 (0.036)	-0.043 (0.041)	-0.052 (0.037)	-0.070 (0.042)
School-based VET^2	0.001 (0.001)	0.001 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.001)	0.001 (0.000)	0.001 (0.000)	0.000 (0.000)	0.001 (0.000)	0.001 (0.000)
Dual VET	-0.737*** (0.254)	-0.526** (0.225)	-0.016 (0.086)	-0.265** (0.130)	-0.521** (0.216)	-0.322 (0.190)	-0.589** (0.229)	-0.439** (0.189)	-0.528** (0.217)	-0.415* (0.200)
Dual VET^2	0.009** (0.003)	0.005* (0.003)	-0.002 (0.001)	0.002 (0.002)	0.005* (0.002)	0.002 (0.003)	0.006** (0.003)	0.004* (0.002)	0.005** (0.003)	0.003 (0.002)
diff VET	0.063	0.024	0.009	0.079	0.026	0.017	0.034	0.038	0.048	0.082
Youth labor force participation		0.039 (0.082)	0.061 (0.048)	0.036 (0.072)	0.043 (0.079)	0.114 (0.094)	0.040 (0.074)	0.042 (0.086)	0.034 (0.080)	0.095 (0.092)
Youth-to-adult labor force participation		-0.836*** (0.220)	-0.708*** (0.188)	-0.772*** (0.217)	-0.861*** (0.245)	-1.225*** (0.226)	-0.899*** (0.211)	-0.963*** (0.216)	-0.823*** (0.209)	-1.192*** (0.256)
GDP per capita		-0.184 (0.138)	-0.078 (0.062)	-0.228** (0.091)	-0.196 (0.159)	-0.352** (0.143)	-0.124 (0.121)	-0.166 (0.133)	-0.204 (0.120)	-0.219 (0.163)
GDP growth		0.147* (0.083)	0.075 (0.059)	0.190** (0.080)	0.142 (0.093)	0.204** (0.084)	0.128* (0.068)	0.136 (0.089)	0.321** (0.136)	0.329** (0.135)
EPL		5.505*** (1.533)	0.901 (0.858)	4.588*** (0.706)	5.607** (2.085)	5.317*** (1.366)	5.248*** (1.319)	5.512*** (1.514)	5.433*** (1.433)	4.603*** (1.467)
PISA score		0.045** (0.021)	0.017 (0.022)	0.034** (0.015)	0.052** (0.022)	0.023 (0.020)	0.053** (0.020)	0.042* (0.021)	0.048** (0.019)	0.031 (0.021)
Trade union density					-0.045 (0.119)					0.073 (0.134)
Unemployment insurance						0.044* (0.021)				0.030 (0.019)
Sector: Industry							-1.544*** (0.463)			-1.679** (0.626)
Sector: Services							-1.557*** (0.402)			-1.642*** (0.560)
KOF Globalisation Index								-0.183 (0.188)		0.050 (0.125)
School-based VET x GDP growth									-0.003 (0.002)	-0.003 (0.003)
Dual VET x GDP growth									-0.003 (0.003)	-0.002 (0.003)
Constant	24.282*** (3.213)	-1.062 (12.827)	-0.069 (12.780)	- -	-3.021 (13.030)	14.121 (12.971)	146.838*** (41.617)	15.761 (22.984)	-1.548 (12.476)	165.299*** (50.081)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
No. of observations	191	191	191	145	187	161	191	189	191	158
No. of countries	23	23	23	22	23	21	23	23	23	21
R^2	0.219	0.421	-	-	0.403	0.496	0.486	0.421	0.428	0.562

Note: Main specification is non-linear fixed effects model with clustered standard errors (FE2); random effects model includes adult dependent variable as control, but not displayed in table; GMM model with first difference, but not displayed in table; *** $p<0.01$, ** $p<0.05$, * $p<0.1$; school-based VET and dual VET lagged three years; PISA scores lagged four years; diff VET reports the p-values for the null hypothesis that the coefficients of school-based and dual VET are equal.

Table A4.10. Skills mismatch rate

	FE1	FE2	RE	dGMM	FE3	FE4	FE5	FE6	FE7	FE8
School-based VET	-0.038 (0.105)	-0.032 (0.112)	-0.018 (0.089)	-0.032 (0.060)	-0.093 (0.144)	0.005 (0.096)	-0.042 (0.122)	-0.044 (0.110)	-0.025 (0.098)	-0.047 (0.116)
School-based VET^2	0.002* (0.001)	0.002 (0.001)	0.001 (0.001)	0.001 (0.001)	0.002 (0.002)	0.001 (0.001)	0.002 (0.001)	0.002 (0.001)	0.001 (0.001)	0.002 (0.001)
Dual VET	-0.571 (0.762)	-0.535 (0.536)	0.365** (0.173)	-0.407 (0.385)	-0.533 (0.526)	-0.149 (0.537)	-0.547 (0.592)	-0.538 (0.537)	-0.508 (0.504)	0.148 (0.628)
Dual VET^2	0.004 (0.009)	0.002 (0.007)	-0.009*** (0.003)	0.003 (0.005)	0.002 (0.008)	0.003 (0.008)	0.002 (0.007)	0.002 (0.007)	0.000 (0.006)	-0.003 (0.008)
diff VET	0.556	0.224	0.000	0.312	0.180	0.953	0.270	0.236	0.082	0.766
Youth labor force participation		0.329 (0.203)	0.285*** (0.109)	0.022 (0.132)	0.326 (0.197)	0.101 (0.173)	0.342 (0.213)	0.324 (0.203)	0.341* (0.193)	0.097 (0.189)
Youth-to-adult labor force participation		-1.220 (0.750)	-0.796* (0.461)	-0.827** (0.346)	-1.106 (0.741)	-1.304** (0.545)	-1.214 (0.759)	-1.228 (0.747)	-1.263* (0.678)	-1.426** (0.522)
GDP per capita		-0.364 (0.409)	0.067* (0.039)	0.058 (0.188)	-0.308 (0.381)	0.106 (0.334)	-0.360 (0.439)	-0.370 (0.404)	-0.221 (0.351)	0.210 (0.271)
GDP growth		0.481** (0.194)	0.320* (0.169)	0.261*** (0.101)	0.472** (0.173)	0.390** (0.171)	0.500** (0.185)	0.492** (0.196)	-0.367 (0.424)	-0.288 (0.398)
EPL		2.156 (3.583)	-3.189** (1.620)	0.740 (1.434)	1.534 (4.316)	2.050 (2.922)	2.204 (3.555)	2.031 (3.507)	2.312 (3.218)	0.942 (3.066)
PISA score		0.077 (0.073)	0.048 (0.052)	0.063** (0.031)	0.056 (0.070)	0.092* (0.049)	0.077 (0.074)	0.075 (0.073)	0.060 (0.070)	0.025 (0.051)
Trade union density					0.189 (0.372)					0.366 (0.253)
Unemployment insurance						0.002 (0.029)				-0.018 (0.033)
Sector: Industry							0.422 (0.937)			0.315 (1.061)
Sector: Services							0.523 (1.014)			0.103 (0.994)
KOF Globalisation Index								-0.023 (0.173)		-0.317 (0.287)
School-based VET x GDP growth									0.012* (0.006)	0.010* (0.006)
Dual VET x GDP growth									0.018** (0.007)	0.011* (0.006)
Constant	22.597** (8.882)	-11.362 (42.053)	-13.784 (28.396)	- -	-7.171 (41.735)	-31.789 (33.129)	-60.179 (81.969)	-7.082 (41.560)	-6.744 (38.487)	1.034 (82.173)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
No. of observations	192	192	192	146	188	161	192	190	192	158
No. of countries	23	23	23	22	23	21	23	23	23	21
R^2	0.217	0.312	-	-	0.319	0.386	0.314	0.309	0.363	0.452

Note: Main specification is non-linear fixed effects model with clustered standard errors (FE2); random effects model includes adult dependent variable as control, but not displayed in table; GMM model with first difference, but not displayed in table; *** $p<0.01$, ** $p<0.05$, * $p<0.1$; school-based VET and dual VET lagged three years; PISA scores lagged four years; diff VET reports the p-values for the null hypothesis that the coefficients of school-based and dual VET are equal.

Table A4.11. In-work at-risk-of-poverty rate

	FE1	FE2	RE	dGMM	FE3	FE4	FE5	FE6	FE7	FE8
School-based VET	0.094 (0.118)	0.049 (0.130)	-0.006 (0.097)	-0.037 (0.130)	-0.005 (0.125)	0.108 (0.116)	0.105 (0.119)	0.073 (0.131)	0.072 (0.128)	0.116 (0.109)
School-based VET^2	-0.001 (0.001)	-0.000 (0.001)	0.000 (0.001)	0.001 (0.001)	0.000 (0.001)	-0.001 (0.001)	-0.000 (0.001)	-0.000 (0.002)	-0.000 (0.001)	-0.001 (0.001)
Dual VET	-0.921** (0.376)	-0.887** (0.401)	-0.191 (0.182)	-0.694 (0.429)	-0.803* (0.408)	-0.830* (0.463)	-0.701* (0.381)	-1.017** (0.369)	-0.923** (0.400)	-0.846** (0.299)
Dual VET^2	0.009* (0.005)	0.007 (0.005)	0.003 (0.003)	0.006 (0.005)	0.006 (0.005)	0.008 (0.006)	0.006 (0.005)	0.009* (0.004)	0.008 (0.005)	0.009** (0.004)
diff VET	0.027	0.023	0.598	0.202	0.016	0.098	0.035	0.007	0.021	0.006
Youth labor force participation		0.060 (0.158)	0.120 (0.123)	0.029 (0.163)	0.086 (0.163)	0.093 (0.181)	0.002 (0.144)	0.072 (0.152)	0.068 (0.159)	0.070 (0.148)
Youth-to-adult labor force participation		-0.368 (0.391)	-0.507 (0.451)	-0.547 (0.365)	-0.243 (0.333)	-0.568 (0.420)	-0.301 (0.395)	-0.156 (0.385)	-0.368 (0.381)	-0.035 (0.351)
GDP per capita		-0.467** (0.214)	0.003 (0.071)	-0.508** (0.248)	-0.305 (0.229)	-0.387* (0.217)	-0.594*** (0.200)	-0.476** (0.201)	-0.485** (0.213)	-0.318 (0.247)
GDP growth		0.308** (0.148)	0.137 (0.129)	0.244* (0.137)	0.243 (0.153)	0.333** (0.156)	0.256* (0.133)	0.296** (0.131)	0.108 (0.271)	0.052 (0.235)
EPL		0.720 (1.431)	-2.566** (1.112)	0.809 (1.557)	0.296 (1.724)	1.195 (1.532)	1.028 (1.258)	1.073 (1.396)	0.940 (1.367)	1.239 (2.118)
PISA score		0.016 (0.048)	-0.005 (0.040)	0.031 (0.043)	-0.020 (0.048)	0.061 (0.052)	0.001 (0.051)	0.028 (0.046)	0.017 (0.048)	0.027 (0.056)
Trade union den-					0.352** (0.160)					0.400* (0.199)
Unemployment insurance						0.020 (0.033)				0.035 (0.042)
Sector: Industry							0.887* (0.453)			-0.137 (0.726)
Sector: Services							0.442 (0.385)			-0.534 (0.565)
KOF Globalisation Index								0.343** (0.128)		0.499*** (0.167)
School-based VET x GDP growth									0.005 (0.004)	0.005 (0.004)
Dual VET x GDP growth									-0.000 (0.003)	-0.001 (0.003)
Constant	16.622*** (5.415)	24.101 (23.661)	13.789 (20.469)	- -	23.446 (20.556)	-4.733 (26.356)	-23.050 (41.383)	-13.841 (26.765)	22.928 (24.101)	-12.407 (57.723)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
No. of observations	185	185	185	139	181	161	185	183	185	158
No. of countries	23	23	23	22	23	21	23	23	23	21
R^2	0.208	0.272	-	-	0.282	0.265	0.298	0.277	0.285	0.353

Note: Main specification is non-linear fixed effects model with clustered standard errors (FE2); random effects model includes adult dependent variable as control, but not displayed in table; GMM model with first difference, but not displayed in table; *** $p<0.01$, ** $p<0.05$, * $p<0.1$; school-based VET and dual VET lagged three years; PISA scores lagged four years; diff VET reports the p-values for the null hypothesis that the coefficients of school-based and dual VET are equal.

Table A4.12. Average hourly earnings (ln)

	FE1	FE2	RE	dGMM	FE3	FE4	FE5	FE6	FE7	FE8
School-based VET	0.001 (0.004)	0.001 (0.003)	-0.001 (0.002)	0.001 (0.001)	-0.000 (0.002)	0.001 (0.002)	0.002 (0.002)	0.001 (0.003)	0.001 (0.003)	0.001 (0.002)
School-based VET^2	0.000 (0.000)	0.000 (0.000)	0.000* (0.000)	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Dual VET	-0.016 (0.011)	-0.018 (0.012)	0.007*** (0.002)	-0.014** (0.006)	-0.016 (0.010)	-0.020 (0.012)	-0.016 (0.012)	-0.022* (0.011)	-0.019 (0.012)	-0.021* (0.012)
Dual VET^2	0.000 (0.000)	0.000* (0.000)	-0.000*** (0.000)	0.000** (0.000)	0.000 (0.000)	0.000* (0.000)	0.000 (0.000)	0.000** (0.000)	0.000* (0.000)	0.000* (0.000)
diff VET	0.436	0.197	0.001	0.041	0.352	0.206	0.277	0.165	0.239	0.201
Youth labor force participation		-0.002 (0.004)	-0.000 (0.003)	0.001 (0.003)	-0.001 (0.004)	-0.001 (0.004)	-0.002 (0.003)	-0.003 (0.004)	-0.002 (0.004)	-0.001 (0.004)
Youth-to-adult labor force participation		-0.003 (0.011)	-0.006 (0.009)	0.020 (0.013)	-0.001 (0.012)	-0.006 (0.012)	-0.003 (0.011)	0.008 (0.014)	-0.002 (0.012)	0.008 (0.016)
GDP per capita		0.023*** (0.007)	-0.002 (0.001)	0.011*** (0.004)	0.024*** (0.006)	0.022*** (0.007)	0.021** (0.009)	0.022*** (0.006)	0.023*** (0.007)	0.024*** (0.009)
GDP growth		-0.000 (0.003)	0.004 (0.003)	-0.002 (0.002)	-0.001 (0.002)	0.000 (0.003)	-0.000 (0.003)	-0.001 (0.003)	-0.002 (0.003)	-0.002 (0.004)
EPL		-0.046 (0.046)	-0.070* (0.036)	0.020 (0.033)	-0.066 (0.057)	-0.048 (0.046)	-0.045 (0.046)	-0.048 (0.044)	-0.045 (0.047)	-0.065 (0.050)
PISA score		0.001 (0.001)	-0.000 (0.001)	0.002** (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)
Trade union density					0.009 (0.006)					0.008 (0.006)
Unemployment insurance						0.000 (0.001)				0.000 (0.001)
Sector: Industry							0.022 (0.015)			-0.005 (0.020)
Sector: Services							0.023* (0.012)			-0.003 (0.017)
KOF Globalisa-tion Index								0.010* (0.005)		0.011* (0.006)
School-based VET x GDP growth									0.000 (0.000)	0.000 (0.000)
Dual VET x GDP growth									0.000 (0.000)	0.000 (0.000)
Constant	2.677*** (0.080)	1.655** (0.794)	0.390 (0.475)	- -	1.475** (0.685)	1.767** (0.729)	-0.502 (1.418)	0.809 (0.818)	1.648* (0.806)	0.956 (1.617)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
No. of observations	187	187	187	133	186	178	182	187	187	172
No. of countries	28	28	28	26	28	27	28	28	28	27
R^2	0.197	0.317	-	-	0.344	0.317	0.316	0.347	0.319	0.361

Note: Main specification is non-linear fixed effects model with clustered standard errors (FE2); random effects model includes adult dependent variable as control, but not displayed in table; GMM model with first difference, but not displayed in table; *** $p<0.01$, ** $p<0.05$, * $p<0.1$; school-based VET and dual VET lagged three years; PISA scores lagged four years; diff VET reports the p-values for the null hypothesis that the coefficients of school-based and dual VET are equal.

Appendix of Chapter 5

Detailed Regression Results

Table A5.1. Detailed results of the DiD estimation

	Model 1	Model 2	Model 3	Model 4	Model 5
DEPENDENT VARIABLE: SELECTING A DUAL VET PROGRAM					
DiD 1					
Years in CH (ln) * AT/DE	-0.103**	-0.103**	-0.100**	-0.096**	-0.093**
	(0.045)	(0.040)	(0.040)	(0.040)	(0.041)
Years in CH (ln) for AT/DE	0.011	-0.007	-0.004	-0.002	-0.007
	(0.036)	(0.032)	(0.031)	(0.031)	(0.032)
Years in CH (ln) for others	0.113***	0.096***	0.095***	0.094***	0.086***
	(0.028)	(0.025)	(0.026)	(0.026)	(0.026)
AT/DE	0.069***	0.093***	0.082***	-	-
	(0.027)	(0.025)	(0.025)		
DiD 2					
Years in CH (ln) * CH-born parent	-0.114*	-0.129**	-0.124**	-0.120**	-0.143**
	(0.072)	(0.059)	(0.059)	(0.059)	(0.058)
Years in CH (ln) for CH-born parent	0.007	-0.022	-0.018	-0.015	-0.041
	(0.065)	(0.054)	(0.053)	(0.053)	(0.053)
Years in CH (ln) for others	0.121***	0.108***	0.106***	0.104***	0.102***
	(0.025)	(0.023)	(0.024)	(0.024)	(0.024)
CH-born parent	0.060**	0.082***	0.077***	0.079***	0.015***
	(0.026)	(0.025)	(0.026)	(0.029)	(0.070)
Ability					
Reading scores (ln)	-0.885***	-0.418***	-0.396***	-0.401***	-0.416***
	(0.121)	(0.129)	(0.130)	(0.131)	(0.129)
Math scores (ln)	-0.747***	-0.811***	-0.796***	-0.809***	-0.818***
	(0.129)	(0.132)	(0.133)	(0.132)	(0.128)
Control variables					
Age (months)		-0.020	-0.043	-0.063	-0.069
		(0.297)	(0.296)	(0.294)	(0.286)
Male		1.075	0.740	0.679	0.656
		(1.810)	(1.800)	(1.804)	(1.703)
Age*male		-0.190	-0.127	-0.114	-0.110
		(0.346)	(0.345)	(0.345)	(0.326)
ISEI of father (ln)		-0.049	-0.056*	-0.039	-0.050
		(0.032)	(0.031)	(0.032)	(0.032)
Mother ISCED 2 and lower		0.055*	0.048*	0.053*	0.059**
		(0.029)	(0.028)	(0.030)	(0.030)
Mother ISCED 3B, 3C		0.065**	0.064**	0.068**	0.060*
		(0.032)	(0.032)	(0.032)	(0.032)
Mother ISCED 3A, 4		0.012	0.016	0.019	0.018
		(0.037)	(0.037)	(0.037)	(0.037)
Mother ICED 5A, 5B, 6		Ref.	Ref.	Ref.	Ref.
Nb. of books at home: <11		0.215***	0.216***	0.201***	0.204***
		(0.051)	(0.050)	(0.052)	(0.053)

	Model 1	Model 2	Model 3	Model 4	Model 5
Nb. of books at home: 11-100		0.178*** (0.043)	0.176*** (0.042)	0.172*** (0.043)	0.183*** (0.044)
Nb. of books at home: 101-500		0.109** (0.043)	0.104** (0.043)	0.107** (0.043)	0.130*** (0.045)
Nb. of books at home: >500		Ref.	Ref.	Ref.	Ref.
Family structure: single		0.013 (0.054)	0.017 (0.053)	0.013 (0.053)	0.005 (0.053)
Family structure: nuclear		0.026 (0.041)	0.029 (0.040)	0.026 (0.040)	0.018 (0.041)
Family structure: mixed/other		Ref.	Ref.	Ref.	Ref.
Urbanity of school location: village		Ref.	Ref.	Ref.	Ref.
Urbanity of school location: small town		-0.038 (0.037)	-0.045 (0.037)	-0.046 (0.037)	-0.044 (0.038)
Urbanity of school location: town		-0.135*** (0.042)	-0.162*** (0.043)	-0.165*** (0.044)	-0.170*** (0.044)
Urbanity of school location: city		-0.201*** (0.048)	-0.223*** (0.050)	-0.226*** (0.050)	-0.226*** (0.051)
Year	Yes	Yes	Yes	Yes	Yes
School canton	No	No	Yes	Yes	Yes
Birth country	No	No	No	Yes	Yes
Birth country father	No	No	No	No	Yes
Birth country mother	No	No	No	No	Yes
N	1,126	1,126	1,126	1,126	1,126

Note: The table displays marginal effects of probit estimations and robust standard errors in parentheses. *,** and *** denote significance at the 10 percent, 5 percent and 1 percent level, respectively.
For the first DiD approach (DiD 1), *Years in CH for AT/DE* and *Years in CH for others* refer to the average marginal effects of time spent in Switzerland for adolescents born in AT/DE and for adolescents born in other countries, respectively. *Years in CH * AT/DE* refers to the difference between these two average marginal effects. *AT/DE* is the average marginal effect of being born in a country with a similar education system, i.e. in Germany or Austria.
For the second DiD approach (DiD 2), *Years in CH for CH-born parent* and *Years in CH for others* refer to the average marginal effects of time spent in Switzerland for adolescents with at least one CH-born parent and for adolescents without a parent born in Switzerland, respectively. *Years in CH * CH-born parent* refers to the difference between these two average marginal effects. *CH-born parent* is the average marginal effect of having at least one parent born in Switzerland.

Data source*:* Pooled PISA data 2000, 2003, 2009, and 2012 for German-speaking Switzerland.

Table A5.2. Detailed results of the placebo test for the DiD estimation

	Country groups			
	BE / FR	**ES / IT / PT**	**AL / KO / TK / YU**	**Other countries**
DEPENDENT VARIABLE: SELECTING A DUAL VET PROGRAM				
DiD 1				
Years in CH (ln) * country group	0.273	0.145	0.017	0.034
	(0.192)	(0.092)	(0.047)	(0.049)
Years in CH (ln) for country group	0.052**	0.045**	0.041	0.041*
	(0.021)	(0.021)	(-0.028)	(0.023)
Years in CH (ln) for others	0.325*	0.190**	0.058	0.076*
	(0.191)	(0.089)	(-0.039)	(0.044)
DiD 2				
Years in CH (ln) * CH-born parent	-0.119**	-0.117**	-0.116**	-0.132**
	(0.058)	(0.058)	(0.059)	(0.058)
Years in CH (ln) for CH-born parent	0.083***	0.083***	0.076***	0.082***
	(0.022)	(0.022)	(0.025)	(0.022)
Years in CH (ln) for others	-0.037	-0.034	-0.041	-0.050
	(0.053)	(0.054)	(0.054)	(0.053)
CH-born parent	-0.001**	0.010**	0.003**	0.009***
	(0.072)	(0.070)	(0.071)	(0.070)
Ability				
Reading scores (ln)	-0.385***	-0.403***	-0.386***	-0.402***
	(0.131)	(0.131)	(0.131)	0.131)
Math scores (ln)	-0.853***	-0.833***	-0.852***	-0.835***
	(0.129)	(0.130)	(0.129)	(0.129)
Control variables				
Age (months)	-0.111	-0.120	-0.119	-0.100
	(0.287)	(0.287)	(0.290)	(0.284)
Male	0.859	0.643	0.723	0.532
	(1.714)	(1.702)	(1.711)	(1.710)
Age*male	-0.149	-0.108	-0.123	-0.086
	(0.328)	(0.326)	(0.328)	(0.327)
ISEI of father (ln)	-0.051	-0.054*	-0.051	-0.046
	(0.032)	(0.032)	(0.031)	(0.031)
Mother ISCED 2 and lower	0.061**	0.059**	0.062**	0.063**
	(0.030)	(0.030)	(0.030)	(0.029)
Mother ISCED 3B, 3C	0.062*	0.061*	0.063*	0.064**
	(0.032)	(0.032)	(0.033)	(0.032)
Mother ISCED 3A, 4	0.021	0.019	0.020	0.020
	(0.037)	(0.037)	(0.037)	(0.037)
Mother ICED 5A, 5B, 6	*Ref.*	*Ref.*	*Ref.*	*Ref.*
Nb. of books at home: <11	0.201***	0.199***	0.200***	0.202***
	(0.054)	(0.053)	(0.054)	(0.054)
Nb. of books at home: 11-100	0.184***	0.182***	0.184***	0.186***
	(0.045)	(0.044)	(0.045)	(0.045)

	Country groups			
	BE / FR	**ES / IT / PT**	**AL / KO / TK / YU**	**Other countries**
Nb. of books at home: 101-500	0.134***	0.134***	0.133***	0.127***
	(0.045)	(0.045)	(0.045)	(0.045)
Nb. of books at home: >500	*Ref.*	*Ref.*	*Ref.*	*Ref.*
Family structure: single	0.001	0.003	0.002	0.007
	(0.053)	(0.053)	(0.053)	(0.053)
Family structure: nuclear	0.015	0.015	0.018	0.024
	(0.041)	(0.041)	(0.041)	(0.041)
Family structure: mixed/other	*Ref.*	*Ref.*	*Ref.*	*Ref.*
Urbanity of school location: village	*Ref.*	*Ref.*	*Ref.*	*Ref.*
Urbanity of school location: small town	-0.039	-0.040	-0.038	-0.038
	(0.038)	(0.038)	(0.039)	(0.038)
Urbanity of school location: town	-0.166***	-0.165***	-0.165***	-0.166***
	(0.045)	(0.045)	(0.045)	(0.044)
Urbanity of school location: city	-0.226***	-0.224***	-0.225***	-0.222***
	(0.051)	(0.051)	(0.051)	(0.050)
Year	Yes	Yes	Yes	Yes
School canton	Yes	Yes	Yes	Yes
Birth country	Yes	Yes	Yes	Yes
Birth country father	Yes	Yes	Yes	Yes
Birth country mother	Yes	Yes	Yes	Yes
N	1,126	1,126	1,126	1,126

Note: The table displays marginal effects of probit estimations and robust standard errors in parentheses. *,** and *** denote significance at the 10 percent, 5 percent and 1 percent level, respectively.
FR: France, BE: Belgium, ES: Spain, IT: Italy, PT: Portugal, AL: Albania, KO: Kosovo, TK: Turkey, YU: Former Yugoslavia.

For the first DiD approach (DiD 1), *Years in CH for country group* and *Years in CH for others* refer to the average marginal effects of time spent in Switzerland for adolescents born in the respective country group and for adolescents born in other countries, respectively. *Years in CH * country group* refers to the difference between these two average marginal effects. *Country group* is the average marginal effect of being born in the respective country group.
For the second DiD approach (DiD 2), *Years in CH for CH-born parent* and *Years in CH for others* refer to the average marginal effects of time spent in Switzerland for adolescents with at least one CH-born parent and for adolescents without a parent born in Switzerland, respectively. *Years in CH * CH-born parent* refers to the difference between these two average marginal effects. *CH-born parent* is the average marginal effect of having at least one parent born in Switzerland.

Data source*:* Pooled PISA data 2000, 2003, 2009, and 2012 for German-speaking Switzerland.

Results of Robustness Checks

Table A5.3. Baseline estimation with time-period dummy for immigrant adolescents who spent more than ten years in Switzerland

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
DEPENDENT VARIABLE: SELECTING A DUAL VET PROGRAM						
Time spent in Switzerland						
More than 10 years	0.057**	0.040*	0.045**	0.051**	0.046**	0.067
	(0.023)	(0.022)	(0.022)	(0.022)	(0.022)	(0.041)
Ability						
Reading scores (ln)	-0.832***	-0.367***	-0.348**	-0.376***	-0.389***	-0.410***
	(0.125)	(0.132)	(0.135)	(0.137)	(0.135)	(0.135)
Math scores (ln)	-0.734***	-0.829***	-0.819***	-0.830***	-0.841***	-0.828***
	(0.131)	(0.136)	(0.138)	(0.137)	(0.133)	(0.133)
Control Variables						
Year	Yes	Yes	Yes	Yes	Yes	Yes
Observables	No	Yes	Yes	Yes	Yes	Yes
School canton	No	No	Yes	Yes	Yes	Yes
Birth country	No	No	No	Yes	Yes	Yes
Birth country father	No	No	No	No	Yes	Yes
Birth country mother	No	No	No	No	Yes	Yes
Birth country trends	No	No	No	No	No	Yes
N	1,126	1,126	1,126	1,126	1,126	1,126

Note: The table displays marginal effects of probit estimations and robust standard errors in parentheses. *,** and *** denote significance at the 10 percent, 5 percent and 1 percent level, respectively.

Observable control variables include age, gender, interaction of age and gender, ISEI of father, highest education of mother, number of books at home, family structure, and urbanity.

Data source*:* Pooled PISA data 2000, 2003, 2009, and 2012 for German-speaking Switzerland.

Table A5.4. Baseline estimation with time dummies of five year periods for immigrant adolescents' length of stay in Switzerland

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
DEPENDENT VARIABLE: SELECTING A DUAL VET PROGRAM						
Time spent in Switzerland						
Less than 5 years	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*
5-9.9 years	0.060	0.032	0.030	0.043	0.032	0.007
	(0.043)	(0.039)	(0.039)	(0.040)	(0.041)	(0.068)
10-14.9 years	0.086**	0.056	0.056	0.075*	0.065*	0.023
	(0.039)	(0.037)	(0.037)	(0.038)	(0.039)	(0.064)
15 years or more	0.171***	0.125***	0.126***	0.138***	0.127***	0.137*
	(0.044)	(0.041)	(0.041)	(0.041)	(0.043)	(0.072)
Ability						
Reading scores (ln)	-0.797***	-0.355***	-0.339**	-0.366***	-0.383***	-0.414***
	(0.124)	(0.131)	(0.134)	(0.135)	(0.134)	(0.135)
Math scores (ln)	-0.745***	-0.827***	-0.814***	-0.829***	-0.837***	-0.821***
	(0.130)	(0.134)	(0.136)	(0.135)	(0.131)	(0.133)
Control Variables						
Year	Yes	Yes	Yes	Yes	Yes	Yes
Observables	No	Yes	Yes	Yes	Yes	Yes
School canton	No	No	Yes	Yes	Yes	Yes
Birth country	No	No	No	Yes	Yes	Yes
Birth country father	No	No	No	No	Yes	Yes
Birth country mother	No	No	No	No	Yes	Yes
Birth country trends	No	No	No	No	No	Yes
N	1,126	1,126	1,126	1,126	1,126	1,111

Note: The table displays marginal effects of probit estimations and robust standard errors in parentheses. *,** and *** denote significance at the 10 percent, 5 percent and 1 percent level, respectively.

Observable control variables include age, gender, interaction of age and gender, ISEI of father, highest education of mother, number of books at home, family structure, and urbanity.

Data source*:* Pooled PISA data 2000, 2003, 2009, and 2012 for German-speaking Switzerland. Differences in sample size stem from perfect collinearity.

Table A5.5. Robustness check to controlling for immigrant adolescents' punctuality

	Model 1	Model 1	Model 2	Model 3	Model 4
DEPENDENT VARIABLE: SELECTING A DUAL VET PROGRAM					
Years in CH (ln)	0.049**	0.049**	0.049**	0.062***	0.056**
	(0.023)	(0.023)	(0.023)	(0.023)	(0.024)
Reading scores (ln)	-0.322**	-0.319**	-0.285*	-0.341**	-0.415**
	(0.158)	(0.159)	(0.162)	(0.165)	(0.159)
Math scores (ln)	-0.956***	-0.957***	-0.948***	-0.942***	-0.902***
	(0.163)	(0.163)	(0.165)	(0.165)	(0.153)
Control variables					
Late for school		-0.022	-0.023	-0.014	-0.015
		(0.027)	(0.027)	(0.027)	(0.026)
Age (months)	-0.204	-0.222	-0.278	-0.252	-0.273
	(0.354)	(0.354)	(0.352)	(0.344)	(0.326)
Male	1.132	0.962	0.395	-0.211	0.871
	(2.294)	(2.291)	(2.250)	(2.192)	(2.057)
Age*male	-0.195	-0.163	-0.056	0.060	-0.150
	(0.441)	(0.440)	(0.432)	(0.421)	(0.395)
ISEI of father (ln)	-0.051	-0.050	-0.057	-0.046	-0.054
	(0.036)	(0.036)	(0.035)	(0.037)	(0.036)
Mother ISCED 2 and lower	0.040	0.040	0.032	0.042	0.045
	(0.033)	(0.033)	(0.032)	(0.033)	(0.033)
Mother ISCED 3B, 3C	0.088**	0.086**	0.080**	0.077**	0.059
	(0.037)	(0.037)	(0.036)	(0.037)	(0.036)
Mother ISCED 3A, 4	0.042	0.041	0.046	0.053	0.049
	(0.043)	(0.043)	(0.042)	(0.042)	(0.042)
Mother ICED 5A, 5B, 6	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*
Nb. of books at home: <11	0.226***	0.227***	0.231***	0.237***	0.260***
	(0.058)	(0.058)	(0.058)	(0.060)	(0.063)
Nb. of books at home: 11-100	0.206***	0.205***	0.204***	0.222***	0.241***
	(0.050)	(0.050)	(0.050)	(0.051)	(0.054)
Nb. of books at home: 101-500	0.156***	0.157***	0.150***	0.165***	0.194***
	(0.051)	(0.050)	(0.050)	(0.051)	(0.054)
Nb. of books at home: >500	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*
CH-born parent	0.063*	0.063*	0.059*	0.070*	0.070
	(0.034)	(0.034)	(0.033)	(0.039)	(0.086)
Family structure: single	-0.043	-0.039	-0.024	-0.017	-0.022
	(0.061)	(0.061)	(0.059)	(0.058)	(0.059)
Family structure: nuclear	-0.000	-0.002	0.002	0.010	0.016
	(0.043)	(0.043)	(0.042)	(0.041)	(0.042)
Family structure: mixed/other	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*
Urbanity of school location: village	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*

	Model 1	Model 1	Model 2	Model 3	Model 4
Urbanity of school location: small town	-0.023 (0.044)	-0.022 (0.044)	-0.039 (0.044)	-0.039 (0.043)	-0.016 (0.044)
Urbanity of school location: town	-0.108** (0.051)	-0.107** (0.051)	-0.138*** (0.052)	-0.134** (0.052)	-0.129** (0.053)
Urbanity of school location: city	-0.186*** (0.057)	-0.183*** (0.057)	-0.203*** (0.059)	-0.190*** (0.059)	-0.169*** (0.059)
Years	Yes	Yes	Yes	Yes	Yes
School canton	No	No	Yes	Yes	Yes
Birth country	No	No	No	Yes	Yes
Birth country father	No	No	No	No	Yes
Birth country mother	No	No	No	No	Yes
N	819	819	819	819	819

Note: The table displays marginal effects of probit estimations and robust standard errors in parentheses. *,** and *** denote significance at the 10 percent, 5 percent and 1 percent level, respectively.

Data source*:* Pooled PISA data 2000, 2003, and 2012 for German-speaking Switzerland.

Table A5.6. Robustness check to controlling for immigrant adolescents' number of applications at schools

	Model 1	Model 1	Model 2	Model 3
DEPENDENT VARIABLE: SELECTING A DUAL VET PROGRAM				
Years in CH (ln)	0.116* (0.058)	0.097 (0.061)	0.128* (0.067)	0.084* (0.052)
Reading scores (ln)	-0.989*** (0.169)	-1.107*** (0.201)	-1.249*** (0.199)	-1.183*** (0.165)
Control variables				
Applications at schools		-0.029*** (0.011)	-0.039*** (0.011)	-0.037*** (0.009)
Age (months)	-0.817 (0.767)	-0.905 (0.761)	-0.281 (0.583)	-0.317 (0.445)
Male	0.070 (5.012)	0.029 (5.002)	0.641 (3.948)	-1.808 (3.402)
Age*male	0.010 (0.950)	0.018 (0.948)	-0.095 (0.748)	0.378 (0.645)
ISEI of father (ln)	-0.171** (0.072)	-0.164** (0.074)	-0.123* (0.066)	-0.082 (0.070)
Mother ISCED 2 and lower	0.049 (0.068)	0.071 (0.070)	0.056 (0.070)	0.028 (0.051)
Mother ISCED 3B, 3C	0.039 (0.063)	0.036 (0.063)	-0.014 (0.058)	0.019 (0.039)
Mother ISCED 3A, 4	-0.214* (0.124)	-0.264** (0.131)	-0.211* (0.120)	-0.193** (0.070)
Mother ICED 5A, 5B, 6	*Ref.*	*Ref.*	*Ref.*	*Ref.*
Nb. of books at home: <11	0.181* (0.095)	0.139 (0.101)	0.073 (0.102)	-0.075 (0.087)

	Model 1	**Model 1**	**Model 2**	**Model 3**
Nb. of books at home: 11-100	-0.004	-0.032	-0.052	-0.077
	(0.088)	(0.091)	(0.100)	(0.071)
Nb. of books at home: 101-500	0.100	0.089	0.058	0.025
	(0.084)	(0.083)	(0.089)	(0.069)
Nb. of books at home: >500	*Ref.*	*Ref.*	*Ref.*	*Ref.*
CH-born parent	0.071	0.059	0.165	0.029
	(0.165)	(0.157)	(0.098)	(0.086)
Family structure: single	-0.011	-0.037	-0.037	-0.176***
	(0.081)	(0.078)	(0.064)	(0.063)
Family structure: nuclear	*Ref.*	*Ref.*	*Ref.*	*Ref.*
Family structure: mixed/other	*Ref.*	*Ref.*	*Ref.*	*Ref.*
Urbanity of school location: village	-0.310***	-0.291***	-0.336***	-0.438***
	(0.088)	(0.085)	(0.076)	(0.052)
Urbanity of school location: small	-0.236***	-0.219**	-0.229**	-0.293***
	(0.085)	(0.085)	(0.089)	(0.054)
Urbanity of school location: town	-0.345***	-0.333***	-0.377***	-0.460***
	(0.098)	(0.094)	(0.097)	(0.069)
Urbanity of school location: city	0.065	0.076	0.097**	0.066
	(0.057)	(0.060)	(0.053)	(0.048)
School canton	No	No	Yes	Yes
Birth country	No	No	No	Yes
N	134	134	133	133

Note: The table displays marginal effects of probit estimations and robust standard errors in parentheses. *,** and *** denote significance at the 10 percent, 5 percent and 1 percent level, respectively.
We drop the mathematics scores for this robustness check to have a large enough sample. We can show that the results of our baseline and DiD estimations also hold if we exclude the mathematics scores for the pooled PISA sample 2000, 2003, 2009, and 2012 but also for the sample of 2000; these results are available from the authors upon request.

Data source*:* Pooled PISA data 2000 for German-speaking Switzerland. Differences in sample size stem from perfect collinearity.

Table A5.7. Robustness check to controlling for immigrant adolescents' number of applications at firms

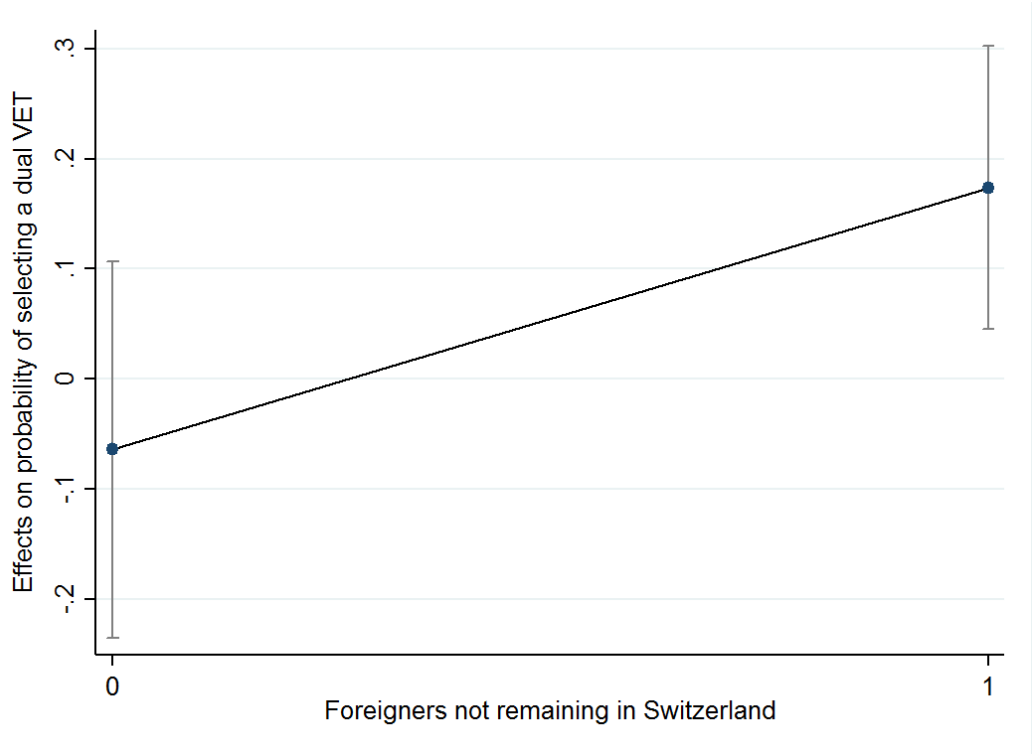
	Model 1	Model 1	Model 2	Model 3
DEPENDENT VARIABLE: SELECTING A DUAL VET PROGRAM				
Years in CH (ln)	0.031	0.028	0.021	0.035
	(0.032)	(0.031)	(0.035)	(0.035)
Reading scores (ln)	-0.797***	-0.699***	-0.764***	-0.941***
	(0.121)	(0.126)	(0.136)	(0.123)
Control variables				
Applications at firms		0.004	0.003	0.003
		(0.002)	(0.002)	(0.002)
Age (months)	-0.570	-0.419	-0.356	-0.341
	(0.622)	(0.606)	(0.664)	(0.800)
Male	3.793	3.217	4.204	7.819
	(4.481)	(4.506)	(4.715)	(5.877)
Age*male	-0.714	-0.605	-0.790	-1.479
	(0.851)	(0.855)	(0.894)	(1.116)
ISEI of father (ln)	-0.092	-0.067	-0.048	-0.119*
	(0.060)	(0.057)	(0.057)	(0.066)
Mother ISCED 2 and lower	0.077	0.064	0.082	0.033
	(0.051)	(0.049)	(0.052)	(0.059)
Mother ISCED 3B, 3C	0.189***	0.177***	0.172***	0.203***
	(0.045)	(0.048)	(0.051)	(0.055)
Mother ISCED 3A, 4	-0.011	-0.015	-0.031	-0.024
	(0.071)	(0.071)	(0.076)	(0.080)
Mother ICED 5A, 5B, 6	*Ref.*	*Ref.*	*Ref.*	*Ref.*
Nb. of books at home: <11	0.177*	0.145	0.164	0.180
	(0.095)	(0.091)	(0.101)	(0.125)
Nb. of books at home: 11-100	0.024	0.013	0.016	0.005
	(0.083)	(0.079)	(0.087)	(0.113)
Nb. of books at home: 101-500	0.159*	0.134	0.136	0.167
	(0.083)	(0.080)	(0.084)	(0.103)
Nb. of books at home: >500	*Ref.*	*Ref.*	*Ref.*	*Ref.*
CH-born parent	0.096	0.101	0.102	0.153*
	(0.076)	(0.078)	(0.075)	(0.082)
Family structure: single	0.046	0.043	0.043	0.135**
	(0.057)	(0.055)	(0.055)	(0.064)
Family structure: nuclear	*Ref.*	*Ref.*	*Ref.*	*Ref.*
Family structure: mixed/other	*Ref.*	*Ref.*	*Ref.*	*Ref.*
Urbanity of school location: village	-0.083**	-0.086**	-0.107***	-0.095**
	(0.033)	(0.030)	(0.031)	(0.031)
Urbanity of school location: small town	-0.150***	-0.164***	-0.168***	-0.183***
	(0.044)	(0.045)	(0.046)	(0.047)

	Model 1	Model 1	Model 2	Model 3
Urbanity of school location: town	-0.124** (0.053)	-0.130** (0.056)	-0.130** (0.057)	-0.095* (0.059)
Urbanity of school location: city	-0.030 (0.040)	-0.023 (0.039)	-0.016 (0.042)	0.009 (0.065)
School canton	No	No	Yes	Yes
Birth country	No	No	No	Yes
N	197	197	195	182

Note: The table displays marginal effects of probit estimations and robust standard errors in parentheses. *,** and *** denote significance at the 10 percent, 5 percent and 1 percent level, respectively.
We drop the mathematics scores for this robustness check to have a large enough sample. We can show that the results of our baseline and DiD estimations also hold if we exclude the mathematics scores for the pooled PISA sample 2000, 2003, 2009, and 2012 but also for the sample of 2000; these results are available from the authors upon request.

Data source*:* Pooled PISA data 2000 for German-speaking Switzerland. Differences in sample size stem from perfect collinearity.

Figure A5.1. Average marginal effects of time spent in Switzerland on the probability of selecting a dual VET for immigrants remaining and not remaining in Switzerland for a prolonged period, with 95% confidence intervals



Note: N=76; Figure shows the average marginal effects of time spent in Switzerland on the probability of selecting dual VET for two groups, namely for immigrants who remain in Switzerland, identified as remaining in the TREE data from 2000 until 2010, and for immigrants who do not remain, therefore the ones that do not respond in 2010. The figure shows that the effect size is larger in the non-responding sample. While the difference is not statistically significant, this finding has the opposite sign than the previous argument suggests. This test thus provides suggestive evidence that our results are not driven by expected emigration patterns.

Data source*:* TREE data 2000 (longitudinal follow-up survey to PISA 2000) for immigrant adolescents in German-speaking Switzerland.

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