Meet the need – The role of vocational education and training for the youth labour market

Author(s):
Bolli, Thomas; Oswald-Egg, Maria Esther; Rageth, Ladina

Publication date:
2017-03

Permanent link:
https://doi.org/10.3929/ethz-a-010869230

Originally published in:
KOF Working Papers 429

ETH zürich

KOF Swiss Economic Institute

Meet the need – The role of vocational education and training for the youth labour market

Thomas Bolli, Maria Esther Egg and Ladina Rageth

KOF Working Papers, No. 429, March 2017

KOF

KOF

ETH Zurich
KOF Swiss Economic Institute
LEE G 116
Leonhardstrasse 21
8092 Zurich, Switzerland

Phone +41 44 632 42 39
Fax +41 44 632 12 18
www.kof.ethz.ch
kof@kof.ethz.ch

Meet the need – The role of vocational education and training for the youth labour market

Thomas Bolli, Maria Esther Egg and Ladina Rageth*
March, 2017

Abstract

To fight negative trends in the youth labour market, policymakers around the world foster vocational education and training programmes (VET). We therefore investigate how the share of three upper secondary education programmes, i.e. general education, school-based VET, and dual VET, affect the labour market of 15- to 24-year-olds. We complement the existing literature by analysing non-linear effects that might arise due to general equilibrium effects. Furthermore, we include ten labour market indicators for integration and job quality. To address unobserved heterogeneity across countries, we run fixed effects regressions on unbalanced panel data of 35 countries from 2004 to 2014. We find that school-based VET hinders youth labour market integration. In contrast, dual VET improves not only labour market integration but also job quality. However, the positive and negative effects of VET programmes diminish with increasing enrolment rates. Thus, policymakers should consider these different effects in their educational reforms.

JEL: I21, E24, J81

Keywords: Education System, Vocational Education and Training, Apprenticeship, Youth Labour Market, Unemployment

* ETH Zurich, KOF Swiss Economic Institute, bolli@kof.ethz.ch, egg@kof.ethz.ch and rageth@kof.ethz.ch. Address for correspondence: KOF Swiss Economic Institute, Leonhardstrasse 21, CH-8092 Zurich. Phone: +41 44 633 87 89. The authors gratefully acknowledge the financial support of the Gebert Ruef Foundation. Additionally, the authors thank Ursula Renold, the members of the Swiss Leading House on the Economics of Education as well as all conferences and workshops participants for helpful comments and suggestions on previous versions of this paper.

1 Introduction

Due to spectacularly high youth unemployment rates in many countries in recent years, the media has drawn great attention to the labour market of young people. However, not all countries experienced a decline in their youth labour market during the last ten years (see, 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 skills that they need on the labour market (human capital function; Klieme et al., 2007).

According to a report by the OECD and the ILO (2014), the youth labour market can be improved by promoting vocational education and training (VET) to better satisfy the needs of the labour market. Indeed, theory states that VET, i.e. education programmes that teach vocational skills and prepare for specific occupations[1], should better meet the requirements of the labour market than purely general education programmes, i.e., programmes teaching general skills. With these VET programmes, students learn occupation-specific skills, which are directly applicable at the workplace (e.g. Mueller and Shavit, 1998; Wolbers, 2007; Bol and Van de Werfhorst, 2013).

In addition, an institutional link has to exist between the education system and the labour market for an education system to best fulfil its human capital function (e.g. Eichmann, 1989; Hannan et al., 1996; Mueller and Shavit, 1998; Mueller and Gangl, 2003). Scholars argue that programmes with a high amount of workplace training enhance such an institutional link. In this regard, we can differentiate VET programmes into school-based VET programmes, where instruction mostly takes place in a school environment, and dual VET programmes, where the skills are taught both at school and in the workplace. Thus, dual VET programmes should provide human capital that better meets the demand of the labour market than school-based

[1] In our paper, the term 'occupation' describes the profession for which a young person receives training. We use a generic approach and do not refer to the 'Berufskonzept' as known from German-speaking countries. Hence, occupation is synonymous to vocation or trade.

VET programmes (e.g. Van de Werfhorst, 2011; Bol and Van de Werfhorst, 2013; Levels et al., 2014).

To analyse the role of the education system in shaping the youth labour market, this paper focuses on the relation between different upper secondary education programmes (general education, school-based VET, and dual VET; OECD, 2004) and the youth labour market of the 15- to 24-year-olds. According to theory, we expect both school-based and dual VET programmes to have a positive impact on the labour market, in comparison to general education, whereat dual VET should 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 programmes.

A large part of the previous literature explores individual labour market outcomes of education (for an overview see, e.g., Wolter and Ryan, 2011, Eichhorst et al., 2012, Cedefop, 2013, or Zimmermann et al., 2013). Some of these studies apply a multilevel approach and thereby consider institutional differences between national education systems (e.g. Van der Velden and Wolbers, 2001; Bol and Van de Werfhorst, 2013; Gangl, 2000; Levels et al., 2014), comparable to studies on the country level (e.g. OECD, 1998; Breen, 2005; Noelke, 2011). In line with our argument in the previous section, a handful of the multilevel studies takes into account a possible nonlinear effect (Gangl, 2000; Wolbers, 2007; Levels et al., 2014; (Hanushek et al., 2017). Although these studies confirm the relevance this nonlinearity, there is only little evidence so far.

The majority of these studies exhibit unexpected findings, as higher enrolment rates in school-based VET and dual VET, respectively, are advantageous for the labour market of young people with a VET degree. This inconsistency could be a result of the limitations of the multilevel regressions applied in these studies and of the different labour market indicators. In this study, we apply fixed effects regressions to investigate possible nonlinear general equilibrium effects of the education programmes on the youth labour market. The use of panel data on the country

level enables us to include a bigger sample of countries and improves the identification strategy by increasing the reliability of our results. We also include indicators for labour market integration and job quality to avoid that the chosen indicator drives our findings. In addition, the previous literature might not sufficiently account for all upper secondary education programmes as they compare the impact of total VET, including both school-based VET and dual VET programmes, or solely dual VET to general education. We therefore differentiate between the impact of school-based VET and dual VET and compare both to general education as well as against each other.

The dataset consists of an unbalanced panel of 35 countries for the years 2004 to 2014. We consider ten different youth labour market indicators, four measure the labour market integration and six the job quality. The ones for labour market integration are the unemployment rate, the relaxed unemployment rate, the not in employment nor education nor training (NEET) rate, and the long-term unemployment rate. The ones indicating job quality are the temporary contract rate, involuntary part-time rate, atypical working hours rate, skills mismatch rate, in-work at-risk of poverty rate, and average hourly earnings. We measure the extent of the different upper secondary education programmes (general education, school-based VET, and dual VET) by their enrolment rates as provided by the OECD. We estimate the impact of VET on the youth labour market with OLS regressions and account for unobserved heterogeneity by controlling for the general labour market and by applying random effects and fixed effects models, whereby the fixed effects models are our preferred specification. In addition, we control for a wide range of observable variables and run a Generalised Methods of Moments (GMM) model as a robustness check.

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

Looking at the nonlinear estimations, we find school-based VET to deteriorate the youth labour market integration significantly but not to influence job quality. In contrast, our results confirm that dual VET significantly improves the youth labour market, i.e. integration and job quality. Most of these effects decrease with higher enrolment rates, which is why it is important to account for their non-linearity. This 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 labour market integration thereby contradicting the theory. For the majority of the indicators, the effects of school-based VET and dual VET are significantly different. Hence, we can conclude that dual VET seems to better meet the needs of the labour market than school-based VET or general education. Importantly, when having low enrolment rates in school-based VET, these programmes might be worse than general education.

This paper proceeds as follows: Section 2 summarizes the theoretical background from which we derive our hypotheses and reviews the existing empirical literature. In section 3 we present our empirical design, including the description of the data and the methodology. Section 4 describes our results and robustness checks. Finally, section 5 concludes and discusses the implications of the empirical findings.

2 Literature Review and Hypotheses

2.1 Theoretical Background

Education has several functions in societies (see, e.g., Fend, 2006). Among others, education needs to prepare young people for employment by providing them the necessary skills and knowledge (Klieme et al., 2007). To be able to fulfil this human capital function and to achieve a favourable skills match, educational programmes need to know and meet the requirements of the labour market.

Interestingly, countries around the world show considerable variation in their education systems, especially on the upper secondary education level (Biavaschi et al., 2012). In most countries, this education level corresponds to the final stage of secondary education and has a typical entry age of 15 or 16. Based on the amount of vocational content and on the education and training locations, the OECD subdivides formal upper secondary education in general education programmes and VET programmes[2]. Whereas general education programmes typically prepare for further academic education, VET programmes prepare for the direct entry into a particular occupation or a range of occupations by combining practical training with occupation-specific theory and some general education. These VET programmes can either happen mainly at school (school-based VET programmes) or they can combine school and workplace education and training (dual VET programmes)[3].

Many authors argue that VET programmes should fulfil the human capital function better than general education programmes. The main reason is that VET programmes entail occupation-specific elements, which align the content more closely to particular occupations and to the demand of the labour market, thereby reducing the problem of education-to-job mismatch and the training costs of employers (Van der Velden and Wolbers, 2003; Wolbers, 2003; Levels et al., 2014). In addition, the workplace training of VET programmes enhances the institutional

[2] We consider VET programmes 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.

[3] In some of the previous literature, dual VET programmes are also called apprenticeship programmes (see, e.g., Wolter and Ryan, 2011). However, apprenticeship does not always refer to dual VET programmes as it can also be purely on-the-job training.

link between the education system and the labour market (e.g. Van de Werfhorst, 2011; Bol and Van de Werfhorst, 2013; Levels et al., 2014). This link is stronger in dual VET programmes which include a significantly higher amount of workplace training. Especially in countries with extensive VET programmes, employers are already involved in the curriculum set up (Van de Werfhorst, 2011). In addition, the workplace training allows students to apply theoretical learning in a practical setting (Wolter and Ryan, 2011), so that the knowledge acquired at school becomes productivity relevant (Mauro and Carmeci, 2003).

According to the theory so far, a national education system would best fulfil the human capital function if it had only dual VET programmes. However, Lazear (1999) argues that firms gain from a varied workforce which brings diverse sets of skills and knowledge. This gain is largest when groups of employees have disjoint skill sets, e.g. general and vocational skills. Accordingly, a workforce diversified regarding academic and VET degrees increases productivity (Backes-Gellner et al., 2015) and innovation performance (Bolli et al., 2015). Furthermore, general equilibrium effects change the valuation of educational degrees on the labour market (Heckman et al., 1999). The value of an educational degree depends on the share of people with the same degree on the labour market. Thus, an educational degree has a higher value if few people attended that programme and a lower value if many people did so. We therefore expect that the advantage of an educational programme diminishes with higher enrolment rates into the programme.

From this theoretical background, we derive our hypotheses on the relationship between VET and the youth labour market. We thereby measure the extent of VET in a country by the enrolment rates in the two upper secondary VET programmes, namely school-based VET and dual VET. In our first two hypotheses, we argue that these VET programmes, which ensure occupation-specific skills demanded by the labour market and an institutional link between the education system and the labour market through workplace training, improve the youth labour market compared to general education programmes. However, as a mixture of educational programmes should serve the labour market best, we can expect a nonlinear relationship between

enrolment rates in educational programmes and youth labour market outcomes, as introduced in the following two hypotheses:

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

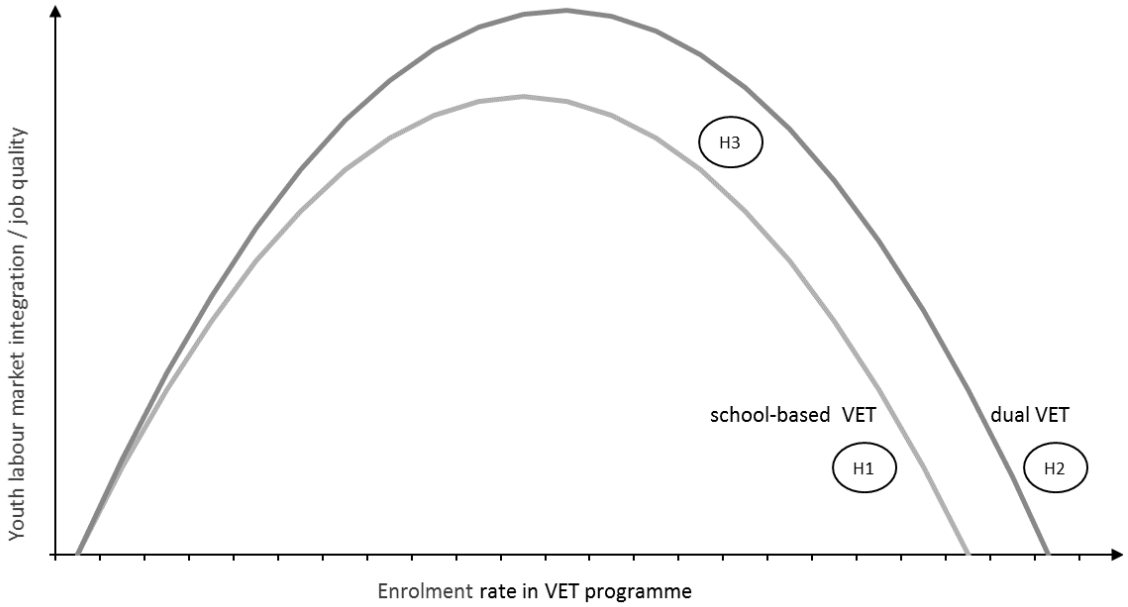
H2: Increasing the enrolment rates of students in dual VET programmes improves the youth labour market but at a decreasing rate.

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

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

The following figure 1 illustrates the effects of VET on the youth labour market as expected in our hypotheses.

Figure 1: Hypotheses on the impact of the education systems on the youth labour markets



2.2 Empirical Evidence

Many previous studies focus on individual labour market outcomes of VET, especially in comparison to general education (for an overview see e.g. Wolter and Ryan, 2011, Eichhorst et al., 2012, Cedefop, 2013, or Zimmermann et al., 2013). These studies, however, do not report consistent results (e.g. Shavit and Mueller, 2000; Ryan, 2001; Mueller and Gangl, 2003; Iannelli and Raffe, 2007). Nevertheless, they provide indication that the effect of VET is more likely positive for young people if the indicator for the labour market outcome is employment rather than income or occupational level (Ryan, 2001; Iannelli and Raffe, 2007). Accordingly, some authors suggest a multidimensional approach for measuring the youth labour market, including indicators for different aspects such as labour market integration or job quality (Freeman and Wise, 1982; OECD, 2000; O'Higgins, 2003; Dewan and Peek, 2007; Renold et al., 2014). Wolter and Ryan (2011) highlight that the challenge of finding convincing methods to determine the effects of VET on individuals, for example due to self-selection into the programme, might be one reason for inconsistent previous findings.

Some scholars suggest that differences between countries in the institutional setting of VET could be another reason for this inconsistency (e.g. Gangl, 2000; Bol and Van de Werfhorst, 2013; Cedefop, 2013). For example, in education systems with strong VET institutions, employers often have a say on the content of the curriculum which leads to a better match between the skills achieved in VET and the skills needed at work (Van de Werfhorst, 2011). To take this institutional effect into account, some studies additionally look at differences in the institutionalisation of VET or in the vocational specificity, mostly measured by the share of students enrolled in VET programmes (e.g. Van der Velden and Wolbers, 2001; Wolbers, 2003; De Lange et al., 2014; see tables 1 and 2).

These studies find that education systems with high enrolment rates in total VET, taking school-based and dual VET together in comparison to general education, come with a better integration of young people into the labour market (Gangl, 2000; Bol and Van de Werfhorst, 2013; Busemeyer, 2015). However, there is mixed evidence for the relationship between total VET and

young people's job quality (Gangl, 2000; Van der Velden and Wolbers, 2001; Levels et al., 2014; Busemeyer, 2015). The one study investigating the impact of school-based VET on the youth labour market just considers job quality and finds a negative effect (Wolbers, 2003). In contrast, the impact of dual VET on job quality points towards a positive relationship (Van der Velden and Wolbers, 2001; De Lange et al., 2014; Levels et al., 2014), though there are also contradicting results (Wolbers, 2007). The findings regarding the effect of dual VET on the youth labour market integration, however, are consistently positive (OECD, 1998; Van der Velden and Wolbers, 2001; Breen and Buchmann, 2002; Breen, 2005; Wolbers, 2007; Noelke, 2011; Bol and Van de Werfhorst, 2013; De Lange et al., 2014; Busemeyer, 2015).

Taken together, even existing studies that consider an institutional effect confirm the findings on the individual level that the effect of VET is positive when looking at youth labour market integration. However, they also find ambiguous results for young peoples' job quality. Wolter and Ryan (2011) argue that differences between countries in the scale of VET, especially of dual VET programmes, might be a third reason for this result heterogeneity. Therefore, some studies include the interaction of an individuals' VET degree with a country's share of students enrolled in VET programmes (Gangl, 2000; Wolbers, 2007; Levels et al., 2014) or investigate individual educational outcomes for country groups that are based on their VET enrolment rates (Hanushek et al., 2017). In doing so, previous authors consider a possible nonlinear effect of VET on youth labour market outcomes, which is in line with the argument that a mixture of educational programmes should serve the labour market best.

Previous evidence agrees 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 peoples' job to the level of their VET degree (vertical education-to-job match). Accordingly, lower skilled employment (including un-/semi-skilled or lower-level occupation) of dual VET students increases with higher enrolment rates in total VET (Gangl, 2000). For youth labour market integration, there is no evidence so far on a nonlinear effect of total VET. The only study investigating a possible nonlinear effect of school-based VET finds that the advan-

tage of a VET degree for initial employment is larger with higher school-based VET enrolment rates in a country (Hanushek et al., 2017).

For dual VET, Wolbers (2007) and Hanushek et al. (2017) find that with higher enrolment rates in dual VET relatively more young people with a VET degree are employed. In contrast, the duration to the first significant job[4] becomes relatively longer (Wolbers, 2007). Looking at job quality, higher enrolment rates in dual VET increase the education-to-job match regarding the field of study (horizontal match) and level of education (vertical match) for young people with a VET degree (Levels et al., 2014) and improve their occupational status[5] (Wolbers, 2007).

The following two tables give an overview on the discussed studies investigating the impact of VET on the labour market of young people in a multilevel or macro perspective. While the first table 1 summarises previous studies investigating a linear effect, the second table 2 shows studies also testing for a nonlinear relationship. The tables thereby contain information on how these studies handle unobserved heterogeneity, their dependent and explanatory variables, the results, and how they relate to our hypotheses.

[4] 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: 194)

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

Table 1: Overview on previous studies investigating the linear impact of VET fractions

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

(+) 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] unclear whether these authors tested for the significance of the effects as they only show the graphs of the linear correlations; [3] index generated with principal factor analysis based on the enrolment in upper secondary education from OECD and UNESCO

Table 2: Overview on previous studies investigating the nonlinear impact of VET fractions

Authors	Unobserved heterogeneity treatment	Dependent variables (youth)		Explanatory variables	Linear effects	Nonlinear effects	Hypotheses	
Gangl (2000)	General labour market Random effects	Unemployment	Integration	VET system dummy	-		✓	H1/H2
				x Dual VET degree		0	?	
				x VET degree		0	?	
	General labour market Random effects	Status attainment	Job quality	VET system dummy	0		?	H1/H2
				x Dual VET degree		0	?	
				x VET degree		0	?	
	General labour 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 labour market Random effects	Access to professional employment positions at labour market entry	Job quality	VET system dummy	+		✓	H1/H2
				x Dual VET degree		0	?	
				x VET degree		0	?	
Wolbers (2007)	General labour market Random effects	Current employment status: unemployed (vs. employed)	Integration	Dual VET fraction	0		?	H2
				x VET degree		0	?	
	General labour market Random effects	Current employment status: inactive (vs. employed)	Integration	Dual VET fraction	-		✓	H2
				x VET degree		-	X	
	General labour market None	Entry speed	Integration	Dual VET fraction	+		✓	H2
				x VET degree		-	✓	
	General labour 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

(+) 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, whereat countries are grouped based on their shares of upper-secondary-school students in VET programmes, school-based VET programmes, and dual VET programmes; [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, 2000).

These tables show that two studies of the previous literature on the effect of VET on the youth labour market do not address unobserved heterogeneity (Noelke, 2011; (Busemeyer, 2015). The other studies use three approaches to account for unobserved heterogeneity between countries. First, one study applies a sample split thereby separately analysing different country clusters (Hanushek et al., 2017). Second, some authors work with multilevel analyses including random effects on the country level (e.g. van2001integration; Bol and Van de Werfhorst, 2013; Gangl, 2000; Levels et al., 2014). Third, most authors control for the general labour market, for example include the adult unemployment rate (e.g. OECD, 1998; Wolbers, 2007; Bol and Van de Werfhorst, 2013; De Lange et al., 2014). The existing empirical literature considers labour market integration and job quality indicators to measure the youth labour market, whereas about half of the literature focuses on the one or other type of indicator.

The tables further show that existing studies mainly investigate the impact of total VET, i.e., both VET programmes together, compared to general education, other however also analyse the impact of dual VET compared to general education, or the impact of dual VET compared to school-based VET. One study even looks at the impact of school-based VET compared to general education (Wolbers, 2003). However, there is only one study that considers the relative effect of dual VET compared to school-based VET by analysing the effect of total VET conditional on the effect of dual VET on young peoples' 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.

Taken together, we find only few evidence for a nonlinear effect of dual VET and school-based VET on youth labour market so far. In addition, the majority of this evidence is not in line with our hypotheses and as we would expect it from theory. According to previous studies, having higher enrolment rates in dual VET and school-based VET is beneficial for the youth labour market integration and quality of jobs of young people with a VET degree, hence they find an increasing rather than decreasing effect. The one exception is the finding of Wolbers (2007) on the entry speed. Only the studies investigating total VET confirm our hypothesis on a decreasing

trend for the job quality. There are two possible reasons for this unexpected evidence. First, the estimation methods of these studies comes 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 that they assume the unobservable variables to be uncorrelated with all observed variables. Second, there might be a substantial difference in the impact of dual VET and school-based VET, which many previous studies do not take into account.

The following section describes our data and methodology that we use to tackle this inconsistency in previous results and to test our hypotheses.

3 Methodology

3.1 Data

Our data set consists of unbalanced panel data for the years 2004 to 2014, covering 35 countries[6] depending on the data availability[7].

As dependent variables, we consider ten labour market indicators for youth, i.e. young people aged 15 to 24[8]. While four of them capture the integration of young people in the labour market, six indicators measure the quality of their jobs. Choosing these dependent variables, we account for the complex situation of young people in the labour market as Freeman and Wise (1982), O'Higgins (2003), Dewan and Peek (2007), and Renold et al. (2014), besides others, suggest.

The indicators to capture the youth labour market integration include the youth unemployment rate, the relaxed youth unemployment rate, the neither in employment, education nor training rate (NEET rate), and the youth long-term unemployment rate. The unemployment rate is the standard labour market indicator to measure unutilized labour supply (ILO, 2016). It considers the proportion of young people in the youth labour force not having a job but actively looking for one. To circumvent this narrow definition of being unemployed, we also include the relaxed unemployment rate. It additionally 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 labour market indicator, we include the NEET rate. This indicator measures the fraction of young people neither being in employment, education, nor training. To capture the difficulty of (re-)entering the labour market after being unemployed, we consider the youth

[6] Those countries are Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, Czech Republic, Denmark, Finland, France, Germany, Hungary, Island, Ireland, Israel, Italy, Japan, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Russia, Slovakia, Slovenia, South Korea, Spain, Sweden, Switzerland, Turkey, Great Britain and the United States of America.

[7] We eliminate countries with unreliable data, like unreasonable jumps, or fractions that are not adding up when they should, like for the enrolment rates. In addition, we have to exclude countries with too few data points and with missing data for our main controls variables. For the remaining dataset we linearly interpolated all variables across time within a country to replace missing values of no more than four consecutive years. This interpolation does not drive the results.

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

Table 3: Description of regression variables

Variable	Description
Dependent variables: Labour market integration	
Unemployment rate[II]	Ratio of unemployed workers on the labour force (ILO standard)[c]
Relaxed unemployment rate[I]	Ratio of unemployed and discouraged workers on the labour force[a]
NEET rate[I,II]	Ratio of young people neither in employment nor education and training; labour force participation rate for adults[a]
Long-term unemployment rate[I,II]	Ratio of workers unemployed longer than one year on total unemployed[c]
Dependent variables: Job quality	
Temporary contract rate[I]	Ratio of workers on a contract less than 18 month on total workers[b]
Involuntary part-time rate[IV,V]	Ratio of involuntary part-time workers on total workers[a]
Atypical working hours rate[I]	Ratio of workers working on Sundays, at night or shifts of 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 on 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 programmes; less than 25 per cent vocational content in curriculum
School-based VET[IV]	Enrolment rate in upper secondary school-based vocational education and training programmes; 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 programmes; more than 25 per cent vocational content in curriculum; students learn at least 25 per cent of the curriculum at the workplace
Control variables	
Youth labour force rate[II]	Ratio of the youth to adult labour force 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 years 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 Globalisation Index[VI]	Index measuring the economic, social, and political dimensions of globalisation

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

long-term unemployment rate.

The indicators to measure young people's job quality are the youth temporary contract rate, the youth involuntary part-time 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 peoples' job and income insecurity, whereas the involuntary part-time rate indicates their dissatisfaction with the workload. The atypical working hours rate captures employees working shifts, on Sundays or at night, which makes the coordination of their personal, social and working life more challenging. The skills mismatch rate[9] captures the mismatch of the workers' qualification to the job. The last two indicators consider job quality in a monetary way, which according to (Jencks et al., 1988) is an important determinant. The first of these indicators captures the average hourly earnings[10], which indicates someone's financial state, while the second one, the in-work at-risk of poverty rate, measures whether the job pays enough to cover the living expenses.

The main explanatory variables capture the enrolment rates in upper secondary education programmes, which belong to either general education, school-based VET, or dual VET (OECD, 2004). Programmes in general education have less than 25 per cent vocational content, thus they do not prepare for a specific occupation but rather teach general knowledge. In contrast, VET programmes contain more than 25 per cent of vocational content and prepare for direct entry into specific occupations. The OECD further divides VET programmes into school-based VET and dual VET programmes. In school-based VET programmes, students learn more than 75 per cent of the curriculum in the school environment, while in dual VET programmes, less than 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[11], which is the average duration of upper secondary education programmes (OECD, 2014).

[9] This indicator is only available for the 15 to 29-year-olds.
[10] This indicator is only available for the 15 to 29-year-olds.
[11] To check the robustness, we lag the explanatory variables also by two and four years, which leads to qualitatively the same findings. The authors provide more details upon request.

As control variables, we additionally include the indicators mentioned in the literature as having an effect on the youth labour market (e.g. OECD, 1998; Bol and Van de Werfhorst, 2013; De Lange et al., 2014; Levels et al., 2014). The main controls are: the adult data of the dependent variables, the youth labour force rate, the gross domestic product (GDP) per capita, the GDP growth, the employment protection legislation (EPL), and the scores of the Programme for International Student Assessment (PISA). The adult variables [12] capture the general circumstances on the labour market. The youth labour force rate accounts for the cohort size of the youth in the labour 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 to terminate a working contract and lastly, the PISA scores[13] consider young peoples' 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 Globalisation Index from our main models as they are not available for the entire data set. However, we control for them in the robustness checks (see subsection 4.5).

3.2 Regression models

The first specification is a pooled ordinary least squares (OLS) regression for each youth labour market indicator, $j = 1, ..., 10$, as dependent variable. To reduce heterogeneity, we include the control variables shown in table 3. Importantly, the adult control variable for each youth labour market indicator accounts for the unobserved heterogeneity in the adult labour market development. The OLS estimation equation looks as follows:

$$y_{j,i,t}^{youth} = \beta_{j,0} + \beta_{j,1} P_{i,\text{t-3}} + \beta_{j,2} y_{j,i,t}^{adult} + \beta_{j,3} X_{i,t} + \gamma_{j,t} + \varepsilon_{j,i,t} \tag{1}$$

[12] The NEET rate is a concept for young people only, hence we instead use the complement, which for adults is the adult labour force participation. The age range for adults varies between 25 to 54, 25 to 64, and 25+.

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

The first term, $y_{j,i,t}^{youth}$, denotes the dependent variable being any of the youth labour market indicators[14]. The indices i and t refer to country and time, respectively. $y_{j,i,t}^{adults}$ stands for the adult variable of the dependent variable, which we include as control. $X_{i,t}$ denotes a matrix of additional time-varying observable control variables, namely the youth labour force rate, 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.

$P_{i,\text{t-3}}$ is a matrix, which stands for our two explanatory variables, i.e. the enrolment rate into school-based VET programmes and the enrolment rate into dual VET programmes, whereas the enrolment rate into general education programmes serves as baseline[15]. As we hypothesise a nonlinear relationship between the enrolment rates and the youth labour market, this matrix additionally includes a quadratic term for each enrolment rate in the nonlinear regressions[16].

To compare the labour market effects of our two explanatory variables, namely the enrolment rates into school-based VET and into dual VET, we test the coefficients of the two VET programmes with Wald tests in the linear regressions. For the nonlinear regressions, we jointly test the two VET coefficients and their quadratic coefficients with joint F-tests (see Baum, 2006, p. 98).

Previous studies often apply multilevel models with random intercepts. We therefore also apply a random effects regression, which focuses on the within country variation over time and eliminates country-specific unobserved heterogeneity by including random intercepts, $\gamma_{j,i}$ with $\text{N}(0, \sigma_j^2)$ into the OLS equation, leading to the following estimation:

[14] Referring to the Mincer equation (Mincer, 1974), we logarithm the dependent variable average hourly earnings and its corresponding adult control.

[15] Including just one programme as explanatory variable does not change our findings. For more information please contact the authors.

[16] Other possible ways to analyse nonlinearity 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 is no theoretical nor empirical suggestions where the cut off should be for the threshold to be used as interaction dummy. Third, the sample split struggles with the same problem and additionally makes the interpretation of the results more circuitously.

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

Another approach to address unobserved heterogeneity is the use of fixed effects regressions. It eliminates time invariant unobserved heterogeneity and does not require the unobserved variables to be independent from all observed variables as the random effects method does (Bruederl and Ludwig, 2015)[17]. 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 method comes at the cost of allowing for time-variant unobserved heterogeneity in the adult labour market development. Nevertheless, we use this method as our main estimation. It reads as follows:

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

3.3 Descriptive statistics

Table A.1 in appendix A.1 presents the summary statistics. Contingent on data availability of the dependent variables, the data set covers between 176 and 272 observations, whereas we have the least observations for the relaxed unemployment rate and the most for the unemployment rate. The mean of all youth labour market indicators are predominantly low compared to the maximum values. Additionally, the youth values are generally higher than the ones of the adults[18].

The enrolment rate into general education programmes varies between 19 and 100 per cent, the one into school-based VET programmes between 0 and 72 per cent, and the one for dual VET programmes between 0 and 61 per cent. Hence, we cannot interpret our results for values outside those ranges.

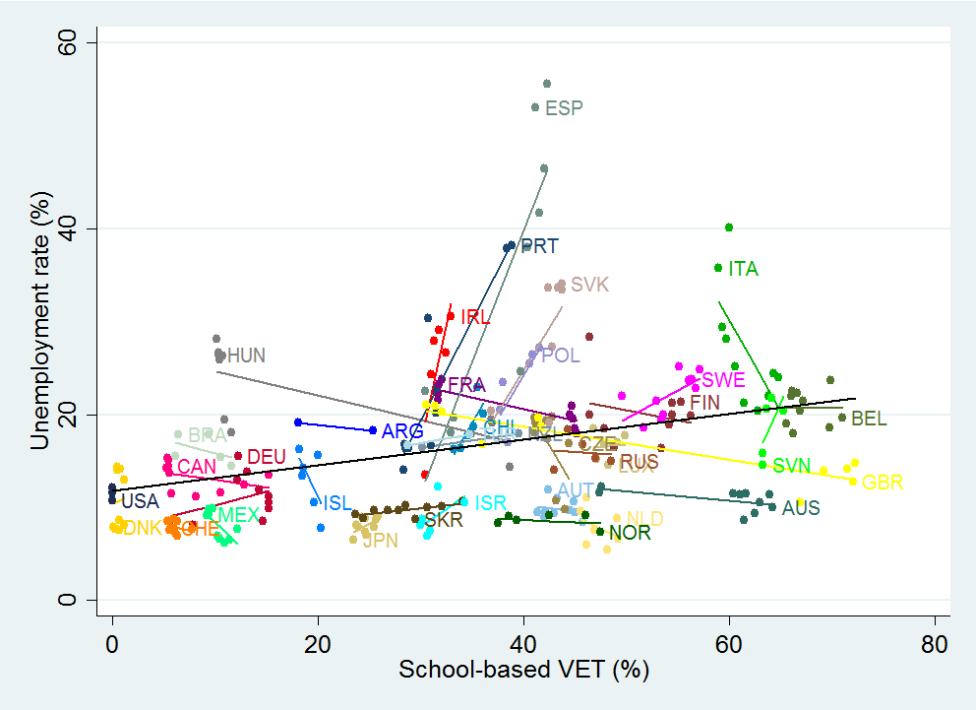
[17] We cannot apply the Hausman test to compare the random effects model with the fixed effects model due to the use of clustered standard errors.

[18] The NEET rate and the long-term unemployment rate are exceptions. The reason for the NEET rate is that we do not have the same indicators for the 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.

The correlation between the ten labour market indicators is generally rather low (see table A.2 in appendix A.1). This observation underlines the need to analyse various labour market indicators to measure the situation of young people on the labour market comprehensively. As expected, the correlation of the youth and adult labour market indicators is high, except for skills mismatch and in-work at-risk of poverty. The correlations between the enrolment rates in educational programmes and the dependent variables do not appear to be systematic. However, most dependent variables correlate positively with the enrolment rates into school-based VET programmes and negatively with the one into dual VET programmes. Hence, these descriptive statistics support our hypothesis regarding dual VET but contradict the one on school-based VET. Finally, there is no strong correlation among the control variables.

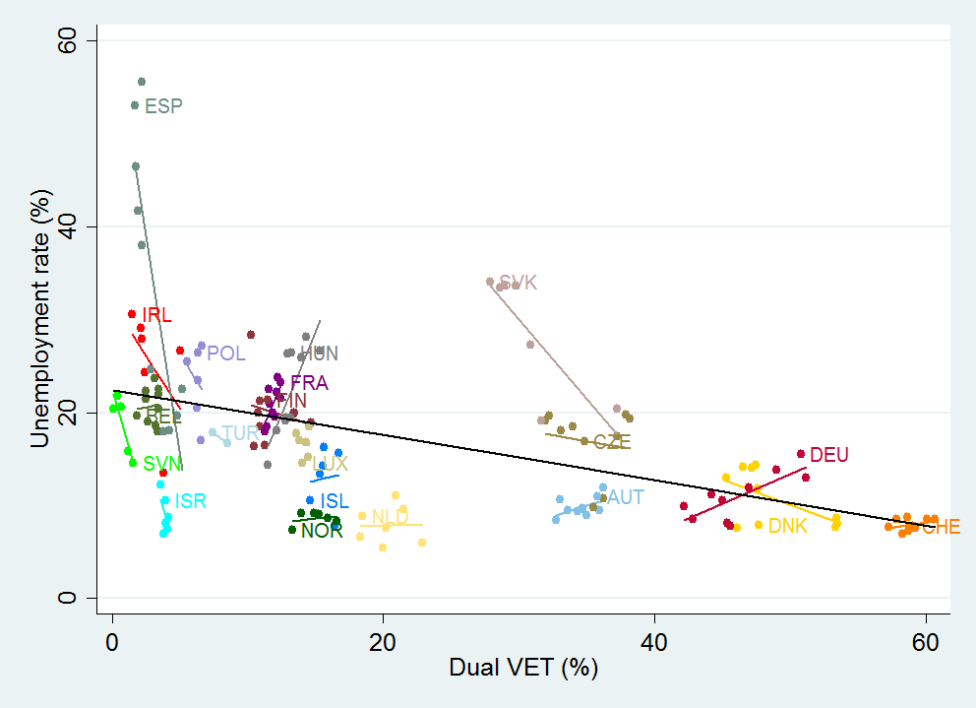
The figures 2 and 3 visualise the variation of our main explanatory variables across and within countries. They display scatter plots with linear predictions for the relation between the youth unemployment rate and the enrolment rates in school-based VET and dual VET, respectively. The black trend line displays the overall relation within and between countries, whereas the smaller coloured lines indicate the within country variation over time, which allows us to see correlations within countries over time.

Figure 2: 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 coloured lines the within country variations over time.

Figure 3: 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 coloured lines the within country variations over time.

Figure 2 shows an overall positive relation between the unemployment rate and the enrolment into school-based VET, i.e. higher enrolment rates into school-based VET correlate positively with youth unemployment. However, while there is also a positive relationship within some countries, e.g. ESP, SVK, PRT, others show a negative one, e.g. AUS, HUN, ITA. In figure 3, the overall relation is negative, i.e. higher dual VET enrolment rates come with lower youth unemployment. Here again, we can see both positive and negative country time relationships. Note that most countries with high enrolment rates in dual VET, e.g. DEU, CHE, AUT, show a positive relation and are therefore not driving the overall negative correlation. These relationships already hint at the existence of nonlinear effects, which is in line with our hypotheses.

The scatter plots for the other dependent variables are shown in appendix A.1, figures A.1 to A.18. The overall relation between the labour 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 just show descriptive correlations without any controls.

4 Results

In the following, we present the main results of our regressions regarding the effect of VET on the youth labour market. We start with describing the results of school-based VET, followed by the ones of dual VET. Thereafter, we compare the results for school-based VET and dual VET for all labour market indicators. Next, as we find nonlinear effects, we examine them more closely. Lastly, we test the robustness of our results.

Table 4 displays the results for the effect of VET on the indicators of the youth labour market integration, while tables 5 and 6 show the results for the quality of young peoples' jobs. In all three tables, the first three columns present the linear estimations for the three models OLS (M1), random effects (M2), and fixed effects (M3). The fourth column contains the results of the GMM model (M4), which we introduce later on as a robustness check and we therefore do not discuss here. In each table, the columns M5 to M7 show the results of the three nonlinear estimation models, which include the squared enrolment rates. Column M8 again contains the results of the GMM model, which we discuss later on in the section with the robustness checks.

4.1 The influence of school-based VET on the youth labour market

In the linear OLS estimations for the youth labour 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 wear off in the more sophisticated models. In contrast, we find significant positive coefficients of school-based VET in the fixed effects estimations for two job quality indicators, namely for the skills mismatch rate and the average hourly earnings. For temporary contract rate, involuntary part-time rate, atypical working hours rate, and in-work at-risk of poverty rate, we find significant coefficients in the OLS or the random effects models, however, they are not consistent over all three models. Hence, we do not find an effect of school-based VET on the labour market integration. However, school-based VET improves the average hourly earnings and worsens skills mismatch, whereby only the latter finding supports Wolbers (2003) results regarding the negative effect of

school-based VET on job quality.

As in the linear models, all significant school-based VET coefficients for the youth labour market integration are positive in the nonlinear models. But only the coefficients for the long-term unemployment rate remain significant over all nonlinear models. The coefficients for the relaxed unemployment rate get significant with higher sophistication of the estimation model. However, the coefficients of the quadratic school-based VET enrolment rates show that the positive relations with relaxed and long-term unemployment diminish with increasing enrolment rates. The coefficients of school-based VET are also significant for the NEET rate in the OLS model and for the unemployment rate in the random effects model, however, they do not persist in our main model. With respect to young people's job quality, we find a significant positive school-based VET coefficient for the involuntary part-time rate together with a significant negative coefficient for the quadratic term in our main model. The coefficients for the other job quality indicators are neither consistent nor significant in the random and fixed effects models. Against H1, the results show that higher enrolment rates in school-based VET significantly increase relaxed unemployment, long-term unemployment, and involuntary part-time but at a decreasing rate. These results contradict the theory, as they imply that higher enrolment rates in school-based VET eventually improve the labour market.

4.2 The influence of dual VET on the youth labour market

In tables 4 to 6, we can also find the results for dual VET. Looking at the linear results (M1-M3), we find negative dual VET coefficients for all labour market integration indicators in the OLS models, though not all of them are significant. The random effects models show significant negative coefficients for the unemployment rate and the relaxed unemployment rate with regard to dual VET. This is in line with many previous studies finding a positive relation between dual VET and the labour market integration (OECD, 1998; Van der Velden and Wolbers, 2001; Breen and Buchmann, 2002; Breen, 2005; Wolbers, 2007; Noelke, 2011; Bol and Van de Werfhorst, 2013; De Lange et al., 2014; Busemeyer, 2015). However, none of these significant results

persist in our main model with the fixed effects. Regarding the quality of young people's jobs, five out of six indicators have the expected negative sign in the fixed effects models. However, only the coefficients for the atypical working hours rate and the in-work at-risk of poverty rate are significant. In addition, the insignificant coefficients are not robust across the three models. Thus, we find evidence that higher dual VET enrolment rates reduce the atypical working hours and the in-work at-risk of poverty, which is in line with the results of Van der Velden and Wolbers (2001), De Lange et al. (2014), and Levels et al. (2014) but contradicts the ones of Wolbers (2007).

Focusing on the nonlinear effect of dual VET on youth labour market integration, we find a significant negative but decreasing relation for all four labour market integration indicators in the fixed effects models (M7). Thus, higher enrolment rates into dual VET improve the youth labour market integration, however, at a decreasing rate. These results are not consistent over all three models, however, we do not find a significant contrary effect in any of them. 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 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 pace. For the remaining indicators, the dual VET coefficient is also negative though not significant in the fixed effects estimations. Therefore, dual VET reduces the involuntary part-time rate, atypical working hours rate, and in-work at-risk of poverty rate at a diminishing rate. These results support H2, however, they contradict the findings of previous studies regarding labour market integration and job quality. They 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), which is surprising from a theoretical perspective.

Table 4: Estimation results on the linear and nonlinear effects of the VET programmes on the youth labour market integration

		Linear				Nonlinear			
		OLS (M1)	**RE** (M2)	**FE** (M3)	**dGMM** (M4)	**OLS** (M5)	**RE** (M6)	**FE** (M7)	**dGMM** (M8)
Dependent variable: Labour market integration									
Unemployment rate	sVET	0.093***	-0.005	0.028	0.043	0.017	0.077*	0.125	0.191***
N = 272 (GMM: 202)		(0.010)	(0.022)	(0.076)	(0.039)	(0.038)	(0.041)	(0.164)	(0.069)
N of C = 35 (GMM: 32)	$sVET^2$					0.001*	-0.001**	-0.001	-0.002**
						(0.001)	(0.000)	(0.002)	(0.001)
	dVET	-0.042***	-0.134***	-0.234	0.057	-0.020	0.047	-1.833**	-0.910**
		(0.011)	(0.051)	(0.275)	(0.122)	(0.037)	(0.082)	(0.795)	(0.437)
	$dVET^2$					-0.001	-0.003*	0.023**	0.013**
						(0.001)	(0.002)	(0.010)	(0.006)
	diff VET	0.000$^+$	0.008$^+$	0.369	0.913	0.000$^+$	0.012$^+$	0.082$^+$	0.029$^+$
Relaxed unemployment rate	sVET	0.104***	-0.010	0.120	0.071*	-0.029	0.175**	0.424***	0.152**
N = 176 (GMM: 130)		(0.028)	(0.036)	(0.071)	(0.039)	(0.081)	(0.070)	(0.150)	(0.075)
N of C = 23 (GMM: 22)	$sVET^2$					0.002	-0.002***	-0.004**	-0.001
						(0.001)	(0.001)	(0.001)	(0.001)
	dVET	-0.112***	-0.197***	-0.254	-0.054	-0.186**	-0.151	-1.578**	-1.121**
		(0.029)	(0.059)	(0.314)	(0.213)	(0.074)	(0.145)	(0.649)	(0.440)
	$dVET^2$					0.001	-0.000	0.020**	0.016***
						(0.001)	(0.002)	(0.009)	(0.006)
	diff VET	0.000$^+$	0.001$^+$	0.229	0.562	0.000$^+$	0.001$^+$	0.022$^+$	0.020$^+$
NEET rate	sVET	0.019	-0.001	-0.003	0.006	0.171***	0.093	0.028	-0.002
N = 245 (GMM: 180)		(0.014)	(0.027)	(0.025)	(0.022)	(0.051)	(0.072)	(0.069)	(0.040)
N of C = 33 (GMM: 29)	$sVET^2$					-0.002***	-0.001	-0.000	0.000
						(0.001)	(0.001)	(0.001)	(0.000)
	dVET	-0.020	0.004	0.027	0.004	-0.158***	-0.137	-0.481*	-0.187
		(0.014)	(0.032)	(0.105)	(0.066)	(0.038)	(0.108)	(0.267)	(0.225)
	$dVET^2$					0.003***	0.003	0.007*	0.003
						(0.001)	(0.002)	(0.004)	(0.003)
	diff VET	0.000$^+$	0.888	0.781	0.969	0.000$^+$	0.221	0.154	0.609
Long-term unemployment	sVET	0.047***	0.007	-0.022	0.034	0.145***	0.209***	0.290***	0.306***
N = 259 (GMM: 195)		(0.016)	(0.034)	(0.067)	(0.048)	(0.053)	(0.061)	(0.103)	(0.097)
N of C = 32 (GMM: 30)	$sVET^2$					-0.001*	-0.003***	-0.004***	-0.003***
						(0.001)	(0.001)	(0.001)	(0.001)
	dVET	-0.029	-0.074	-0.226	-0.346	-0.114**	-0.136	-1.150***	-1.483**
		(0.019)	(0.054)	(0.265)	(0.288)	(0.057)	(0.177)	(0.400)	(0.620)
	$dVET^2$					0.002*	0.002	0.014**	0.018**
						(0.001)	(0.003)	(0.006)	(0.008)
	diff VET	0.000$^+$	0.139	0.473	0.173	0.000$^+$	0.035$^+$	0.002$^+$	0.009$^+$
Controls									
Time FE		YES	YES	YES	YES	YES	YES	YES	YES
Adult control		YES	YES	NO	NO	YES	YES	NO	NO
Standard controls		YES	YES	YES	YES	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, which is the same for all methods except for GMM (number in brackets); N of C stands for the number of countries; Standard controls are the youth labour force rate, GDP per capita, GDP growth, EPL, and PISA scores

Table 5: Estimation results of the linear and nonlinear effect of the VET programmes on the quality of jobs for young people I

		Linear				Nonlinear			
		OLS (M1)	**RE** (M2)	**FE** (M3)	**dGMM** (M4)	**OLS** (M5)	**RE** (M6)	**FE** (M7)	**dGMM** (M8)
Dependent variable: Job quality									
Temporary contract rate	sVET	0.008	0.004	0.006	0.003	0.028	0.097	-0.021	-0.052
N = 192 (GMM: 146)		(0.030)	(0.028)	(0.032)	(0.043)	(0.077)	(0.062)	(0.116)	(0.090)
N of C = 23 (GMM: 22)	$sVET^2$					-0.000	-0.001	0.000	0.001
						(0.001)	(0.001)	(0.001)	(0.001)
	dVET	-0.182***	-0.129*	0.195	0.262*	-0.264***	-0.438**	-0.219	0.472
		(0.029)	(0.068)	(0.185)	(0.152)	(0.084)	(0.203)	(0.291)	(0.447)
	$dVET^2$					0.002	0.006**	0.006	-0.003
						(0.002)	(0.003)	(0.004)	(0.005)
	diff VET	0.000^{+}	0.049^{+}	0.320	0.130	0.000^{+}	0.019^{+}	0.316	0.343
Involuntary part-time rate	sVET	0.055***	0.016	0.049	-0.002	0.055**	0.027	0.237**	0.100***
N = 239 (GMM: 179)		(0.008)	(0.023)	(0.062)	(0.017)	(0.027)	(0.028)	(0.090)	(0.030)
N of C = 30 (GMM: 28)	$sVET^2$					0.000	-0.000	-0.002**	-0.001***
						(0.000)	(0.000)	(0.001)	(0.000)
	dVET	-0.042***	-0.022	-0.025	0.016	-0.124***	-0.180**	-0.787*	-0.215
		(0.009)	(0.018)	(0.156)	(0.090)	(0.029)	(0.090)	(0.401)	(0.152)
	$dVET^2$					0.002***	0.003*	0.011*	0.004**
						(0.001)	(0.002)	(0.006)	(0.002)
	diff VET	0.000^{+}	0.094^{+}	0.603	0.835	0.000^{+}	0.013^{+}	0.072^{+}	0.004^{+}
Atypical working hours rate	sVET	-0.083***	-0.001	0.004	0.000	-0.293***	-0.043	-0.052	-0.011
N = 191 (GMM: 145)		(0.020)	(0.016)	(0.013)	(0.010)	(0.073)	(0.036)	(0.039)	(0.033)
N of C = 23 (GMM: 22)	$sVET^2$					0.003***	0.000	0.001	0.000
						(0.001)	(0.000)	(0.000)	(0.000)
	dVET	-0.181***	-0.097**	-0.154*	-0.162**	-0.028	-0.027	-0.535**	-0.270**
		(0.024)	(0.039)	(0.081)	(0.081)	(0.048)	(0.085)	(0.227)	(0.132)
	$dVET^2$					-0.004***	-0.001	0.005*	0.002
						(0.001)	(0.001)	(0.003)	(0.001)
	diff VET	0.000^{+}	0.003^{+}	0.057^{+}	0.040^{+}	0.000^{+}	0.004^{+}	0.037^{+}	0.092^{+}
Skills mismatch rate	sVET	0.028	0.067	0.104*	0.053**	0.059	-0.018	-0.066	-0.034
N = 192 (GMM: 146)		(0.025)	(0.043)	(0.056)	(0.026)	(0.061)	(0.098)	(0.113)	(0.057)
N of C = 23 (GMM: 22)	$sVET^2$					-0.001	0.001	0.002	0.001
						(0.001)	(0.001)	(0.001)	(0.001)
	dVET	-0.079***	-0.073	-0.327	-0.097	0.324***	0.294	-0.613	-0.411
		(0.029)	(0.065)	(0.251)	(0.131)	(0.066)	(0.191)	(0.591)	(0.394)
	$dVET^2$					-0.008***	-0.007*	0.003	0.003
						(0.001)	(0.004)	(0.008)	(0.005)
	diff VET	0.000^{+}	0.015^{+}	0.090^{+}	0.273	0.552	0.690	0.021^{+}	0.210
Controls									
Time FE		YES	YES	YES	YES	YES	YES	YES	YES
Adult control		YES	YES	NO	NO	YES	YES	NO	NO
Standard controls		YES	YES	YES	YES	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/

Table 6: Estimation results of the linear and nonlinear effect of the VET programmes on the quality of jobs for young people II

		Linear				Nonlinear			
		OLS (M1)	**RE** (M2)	**FE** (M3)	**dGMM** (M4)	**OLS** (M5)	**RE** (M6)	**FE** (M7)	**dGMM** (M8)
Dependent variable: Job quality									
In-work at-risk of poverty rate	sVET	-0.079***	0.018	0.049	0.018	-0.219**	-0.014	0.043	-0.041
N = 185 (GMM: 139)		(0.022)	(0.038)	(0.036)	(0.039)	(0.094)	(0.103)	(0.132)	(0.136)
N of C = 23 (GMM: 22)	$sVET^2$					0.002	0.000	-0.000	0.001
						(0.001)	(0.001)	(0.001)	(0.002)
	dVET	-0.080***	-0.019	-0.367**	-0.277*	-0.208**	-0.220	-0.905**	-0.699
		(0.028)	(0.066)	(0.148)	(0.168)	(0.089)	(0.193)	(0.397)	(0.428)
	$dVET^2$					0.002	0.003	0.008	0.007
						(0.002)	(0.003)	(0.005)	(0.005)
	diff VET	0.988	0.473	0.009^{+}	0.085^{+}	0.000^{+}	0.004^{+}	0.237	0.282
Average hourly earnings (ln)	sVET	0.002***	0.001***	0.002**	0.001	-0.002	-0.001	0.001	0.001
N = 187 (GMM: 133)		(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.002)	(0.003)	(0.001)
N of C = 28 (GMM: 26)	$sVET^2$					0.000***	0.000*	0.000	-0.000
						(0.000)	(0.000)	(0.000)	(0.000)
	dVET	0.001	-0.001	0.002	-0.000	0.008***	0.007***	-0.018	-0.014**
		(0.001)	(0.002)	(0.004)	(0.003)	(0.002)	(0.002)	(0.012)	(0.006)
	$dVET^2$					-0.000***	-0.000***	0.000*	0.000**
						(0.000)	(0.000)	(0.000)	(0.000)
	diff VET	0.038^{+}	0.203	0.896	0.774	0.000^{+}	0.003^{+}	0.185	0.042^{+}
Controls									
Time FE		YES	YES	YES	YES	YES	YES	YES	YES
Adult control		YES	YES	NO	NO	YES	YES	NO	NO
Standard controls		YES	YES	YES	YES	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/

4.3 The difference between school-based VET and dual VET

To test hypothesis H3, we compare the coefficients of school-based VET and dual VET for each youth labour market indicator (labelled diff VET in tables 4 to 6). For all labour market integration indicators, the fixed effects coefficients do not significantly differ in the linear estimations. In the nonlinear estimations, we find significantly different coefficients for three out of four labour market integration indicators (NEET rate is the exception). This is not surprising as the estimations have a different form.

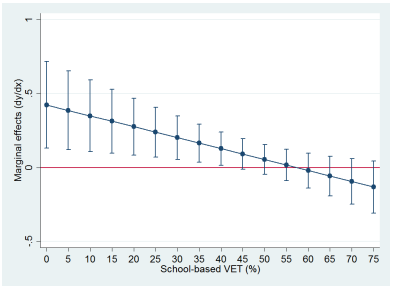
Regarding job quality, the coefficients for the atypical working hours rate, skills mismatch rate, and in-work at-risk of poverty rate are significantly different for dual VET and school-based VET in the linear fixed effects models. We find the same results for the fixed effects coefficients in the nonlinear estimation, except that the ones for in-work at-risk of poverty do not differ significantly anymore, whereas the ones for involuntary part-time do. Thus, these findings support H3 that school-based VET has a significantly different effect than dual VET for labour market integration and job quality, which is in line with previous literature (Bol and Van de Werfhorst, 2013; Van der Velden and Wolbers, 2001; Levels et al., 2014; Van der Velden and Wolbers, 2001).

4.4 In-depth analysis of the nonlinear results

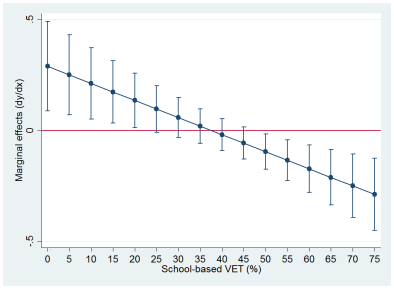
The results show both linear and nonlinear relations between the enrolment rates in VET and the youth labour market. So far, we assumed a quadratic functional form for the estimations of the nonlinear effects. However, we do not know where the turning point of this function is. We therefore have a closer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

Figure 4: Marginal effects of significant regression results

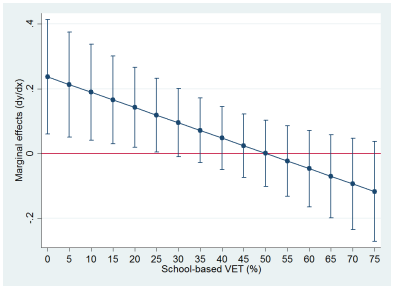
School-based VET on the relaxed unemployment rate



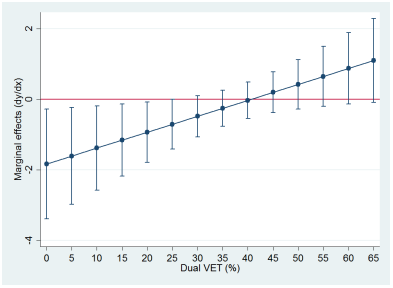
School-based VET on the long-term unemployment rate



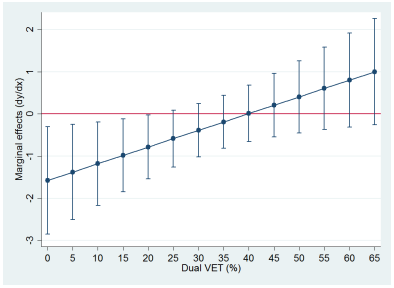
School-based VET on the involuntary part-time rate



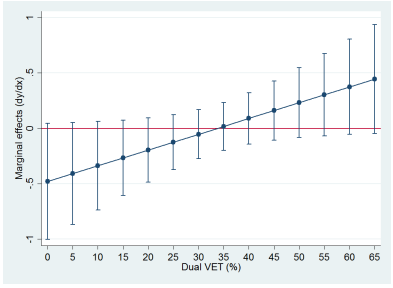
Dual VET on the unemployment rate



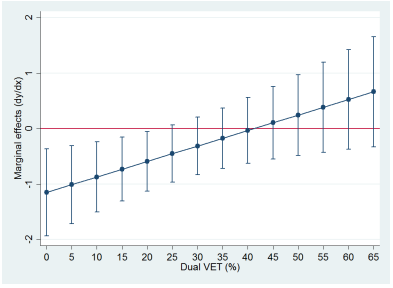
Dual VET on the relaxed unemployment rate



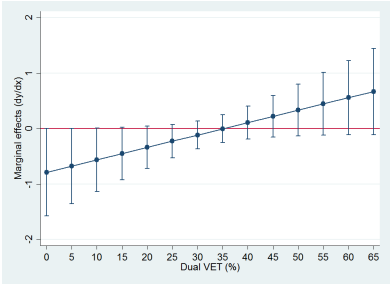
Dual VET on the NEET rate



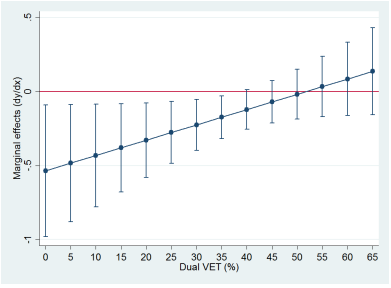
Dual VET on the long-term unemployment rate



Dual VET on the involuntary part-time rate



Dual VET on the atypical working hours rate



Note: Plot shows the marginal effects of school-based VET on the relaxed unemployment rate and where the effect is significant at the 5% level, i.e., the values are significant if their confidence interval does not cross the reference line at 0.

Figure 4 displays the marginal effects of school-based VET on relaxed unemployment. The y-axis indicates the predicted change in the relaxed unemployment rate, 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. Hence, marginal effects are significant when the confidence interval does not cross the horizontal line at zero.

Thus, regarding relaxed unemployment, we see that the effect is significantly positive for low enrolment rates in school-based VET and becomes insignificant with about 40 per cent. Hence, we see no significant turning point as the positive marginal effects get and remain insignificant even though turning negative.

For school-based VET, the nonlinear coefficients of the long-term unemployment rate and involuntary part-time rate were also significant. The marginal effects of the long-term unemployment rate are significantly positive when the enrolment rate into school-based VET is low (below 20 per cent) and significantly negative when the enrolment rate is high (above 50 per cent), indicating that there is a turning point in between. The marginal effects of the involuntary part-time rate follow the same pattern as the ones of 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 nonlinear coefficients for the unemployment rate, relaxed unemployment rate, NEET rate, long-term unemployment rate, involuntary part-time rate, and atypical working hours rate. We do not find any turning point of the marginal effect for these indicators. However, dual VET significantly reduces unemployment, relaxed unemployment, long-term unemployment rate, and atypical working hours initially, but at a decreasing rate until becoming insignificant at more or less 20 per cent dual VET. The marginal effects for the NEET rate and the involuntary part-time rate are not significant, though they show the same pattern.

Taken together, these results support that the effects we found in the precious sections happen at a decreasing rate, except for the quadratic relation between school-based VET and long-term unemployment.

4.5 Robustness checks

In this section, we consider a generalized method of moments (GMM) model and add additional control variables to enhance the causal interpretation and check the robustness of our results.

4.5.1 Generalized method of moments

We first apply the generalized method of moments (GMM), which is suitable for small datasets with few time periods in relation to the number of individuals (Wooldridge, 2001; Roodman, 2009). This model accounts for our dependent variables being dynamic, i.e. depending on their past values ($y^{youth}_{j,i,\text{t-1}}$), and for 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[19]. As instruments we use the by one year lagged dependent variable and the explanatory variables. The equation for the difference GMM reads as follows, whereas the error term, $\nu_{j,i}$, captures the idiosyncratic shocks:

$$\Delta y^{youth}_{j,i,t} = \beta_{j,1}\Delta P_{i,\text{t-3}} + \beta_{j,3}\Delta X_{i,t} + \beta_{j,4}\Delta y^{youth}_{j,i,\text{t-1}} + \Delta\gamma_{j,t} + \Delta\nu_{j,i} \tag{4}$$

The notation is the same as in the previous regressions. However, the difference GMM looks at the changes of the variables between the current and the previous year, which 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 overspecification and thus unreliable coefficient sizes, which is 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. Indeed, we find that GMM yields qualitatively the same results as the fixed effects model in the linear and nonlinear estimations, as the significance and the sign of the coefficients are about the same. We present the results for the GMM estimations in tables 4, 5, and 6 in the fourth (M4) and eight (M8) columns,

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

respectively.

4.5.2 Additional control variables

Beside the control variables that we already included in our main estimations, there are other time-variant variables that might influence the labour market. From previous literature, we know that trade union density, welfare payments, strengths of economic sectors, and the stage of globalisation play an important role (see, e.g., Nickell, 1997; Wolbers, 2007; Felbermayr et al., 2011; Mulligan, 2012). We therefore additionally consider these controls to analyse whether the results stay robust. We account for the trade union density to capture the power of employees on the labour 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 the unemployment insurance as income transfers to unemployed. Additionally, to control for differences between the share of the economic sectors, we include sector dummies, i.e., for industry and services, whereby agriculture serves as baseline. The KOF Globalisation Index further accounts for the stage of globalisation. Unfortunately, the data for these control variables are only available for a subsample, which is why we do not include them in the main analyses. Moreover, we consider that the great recession might have had a stronger impact on youth than on the adults (Choudhry et al., 2012). For that purpose, we include the interactions between the GDP growth and the two VET programmes[20].

We estimate the nonlinear fixed effects models including each of these control variables separately before putting them in altogether. Tables A.3 to A.12 in appendix A.2 display the results. The tables show that including the additional control variables does not change the results qualitatively and that dropping the observable time-variant controls in the baseline estimation do not matter.

[20] As an alternative, we could exclude the recession years from our dataset. However, we would lose too many observations in this case

5 Conclusion

This study explores in how far VET improves the labour market of young people. We thereby investigate not only whether increasing the enrolment rates in dual VET and school-based VET has the same effect but also whether the effects diminish with higher enrolment rates in these programmes. For the analyses, we apply fixed effects estimations on an unbalanced panel of 35 countries in the years 2004 to 2014. As previous studies indicate that the effect of VET also depends on which youth labour market indicator one investigates, we consider a broad set of indicators for the youth labour market integration and the quality of their jobs.

Our linear and non-linear estimations reveal that school-based VET significantly raises the average hourly earnings and significantly increases relaxed unemployment, long-term unemployment, involuntary part-time, and skills mismatch. In contrast, dual VET significantly decreases unemployment, relaxed unemployment, NEET, long-term unemployment, involuntary part-time, atypical working hours, and in-work at-risk of poverty. Thus, school-based VET worsens the youth labour market integration, whereas the influence on the quality of jobs remains unclear. Dual VET, however, improves both. The effects of school-based VET and dual VET are significantly different for six out of ten indicators, i.e., we find no significant difference for NEET, temporary contract, and the two indicators for the financial state (in-work at-risk of poverty and average hourly earnings). The robustness checks thereafter, including an additional estimation model (GMM) and further control variables, do not refute our main results.

/*The question now is whether these statistically significant results are also economically significant, i.e., whether they are large enough to have an important impact. As we mainly find nonlinear effects, we look at their average marginal effects to get an intuition of the economic significance. The largest average marginal effect of the school-based VET coefficients is 0.141 for the relaxed unemployment rate and the smallest one is 0.019 for the long-term unemployment rate. This means that on average an increase of ten percentage points in the school-based VET enrolment rate increases the relaxed unemployment rate from 26.5 percent to 27.9 percent, and the long-term unemployment rate from about 19.1 percent to 19.3 percent. Regarding the

average marginal effect of the school-based VET coefficient for the average hourly earnings separately, due to the different scaling, we find it to change from US$15.4 to US$ 15.7. For dual VET, the average marginal effect of the significant coefficients range from -1.270 for the unemployment rate to -0.284 for the NEET rate. Hence, an increase of ten percentage points in the dual VET enrolment rate leads to a decline in the unemployment rate from 16.5 percent to 3.7 percent and a decline in the NEET rate from 11.3 percent to 8.5 percent. The significant effects of dual VET on the labour market outcomes are substantially large, and so are the ones of the other coefficients lying in-between. This economic significance of the results about dual VET makes them policy relevant. However, the significant effects of school-based VET are negligible in size. */

To improve the situation of young people on the labour market, a large number of countries considers to introduce or expand VET programmes, particularly dual VET (Chatzichristou et al., 2014). We welcome these, however, this study shows that policymakers have to carefully consider which programmes they foster. According to our results, introducing or expanding school-based VET or dual VET will most likely have opposite effects. Despite the fact that both programmes contain a high amount of vocational content, the worsening effects of school-based VET on the youth labour market integration might indicate that such programmes do not meet the needs of the labour market. Van der Velden and Wolbers (2003) thereby argue that dual VET always imparts occupations-specific skills and therefore has a strong vocational specificity, while this does not have to be the case for school-based VET. Additionally, school-based VET programmes do not include much workplace training, where students can apply the skills learned at school in the daily routine, thereby becoming productivity relevant. Furthermore, the institutional link between the education system and the labour market is often weak in school-based VET, which might lead to outdated training standards (Zimmermann et al., 2013). Hence, dual VET programmes prepare young people better for the labour market, thanks to the vocational specificity of the imparted skills and the high amount of workplace training. However, we do not find significant differences between the effects of dual VET and school-based VET for the indicators concerning the financial state. This might indicate that these indicators are

negotiable or that they are relevant at a later stage of the recruitment process. Thus, future policy strategies as well as research should consider the different effects of school-based VET and dual VET on the youth labour market performance.

This study further finds that both effects, the unexpected negative effect of school-based VET and the expected positive effect of dual VET, diminish with increasing enrolment rates. This might suggest that school-based VET has higher quality in programmes with high enrolment rates. Moreover, employers might even become involved in the content setting of the curriculum as they depend on these programmes for their recruitment. With these commitments and stronger vocational institutions, school-based VET assimilates to dual VET and VET certificates might send clearer and 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 educational programmes best meets the demand of the labour market. Thus, policymakers and researchers should hereafter consider these nonlinear effects. Whereas dual VET has a strong advantage over the other education programmes when having low enrolment rates, school-based VET needs high enrolment rates and hence strong VET institutions to be beneficial for the youth labour market.

Even though the robustness checks confirm our findings, the study has some limitations concerning the data and the identification strategy. With respect to the data, there are two main issues unsolved. First, our data set is restricted in the number of countries and periods. Therefore, our data contains limited variation in the enrolment rates of upper secondary education programmes. Thus, the effect sizes as well as the curvatures of the nonlinear effects need cautious interpretation. Second, the data limits the external validity of the results in various ways.

Firstly, the countries considered in this paper have upper bounds in the enrolment rates, which are 80 percent for school-based VET and 60 percent for dual VET. Thus, our results apply only to enrolment rates within these bounds. Secondly, we differentiate the programmes based on a definition that only takes into account the amount of vocational content in the curriculum

and the amount of workplace training. Even the OECD (2010) recognises the need for a more accurate identification of VET programmes in international comparisons. Thirdly, educational programmes exhibit heterogeneity as the enrolment rates neither measure the specificity of the skills inculcated in the education programmes, nor the institutional link between the education system and the labour market or the quality of the education programmes. Fourthly, the study focuses on young people's labour market and does not consider long-lasting effects of different education programmes. Hence, we should keep these data limitations in mind when interpreting the results.

Our identification strategy tries to circumvent the problems of unobserved heterogeneity and reverse causality. To tackle unobserved heterogeneity, we use a fixed effects model, thereby exploiting the variation over time within a country. This restricts our estimations by the underlying assumptions of the model. One is the assumption that there is no relevant time-varying unobserved heterogeneity between countries. Thus, we argue that unobserved time-varying cofounders, which might lead to non-parallel time trends between the countries, are not very likely in this case. Another assumption of our identification strategy is that every graduate faces the same difficulties on the labour market independently of the occupation or industry, i.e. that graduates of general education, school-based VET, and dual VET do not differ regarding employment probabilities and job quality. The fact that the results are stable when including the sectors as additional control variables tackles that problem to a limited extent.

As our identification strategy does not clearly rule out reversed causality, we apply GMM to improve upon identification, which leads to qualitatively the same results. Moreover, lagging the explanatory variables by three years does not only account for the duration of the education programme but also makes it less probable that the business cycle drives our effects as it needs time to implement educational reforms. We further tackle reversed causality by interacting GDP growth with the enrolment rates in each VET programme as an additional robustness check. The coefficients of both interaction terms are positive, thus increasing VET enrolment rates is more favourable in times of economic booms than in recessions, though our main effects remain

stable. Nevertheless, we are not able to completely refute reversed causality.

This study also shows potential for further research. First, one could rule out reverse causality by finding a fitting instrumental variable. Second, it would be interesting to examine the nonlinear trends more in-depth. There is particular interest in identifying the optimal mix of enrolment rates in different education programmes on the upper secondary education level and in investigating whether this mixture is the same for every country or rather depends on different national contexts.

References

Backes-Gellner, U., Rupietta, C., and Tuor Sartore, S. (2015). Educational spillovers at the firmlevel: Who benefits from whom? *Swiss Leading House "Economics of Education" Working Paper*.

Baum, C. F. (2006). *An introduction to modern econometrics using Stata*. Stata press, USA.

Biavaschi, C., Eichhorst, W., Giulietti, C., Kendzia, M. J., Muravyev, A., Pieters, J., Rodriguez-Planas, N., Schmidl, R., and Zimmermann, K. F. (2012). Youth unemployment and vocational training. *IZA Discussion Paper Series*, 6890.

Bol, T. and Van de Werfhorst, H. G. (2013). Educational systems and the trade-off between labor market allocation and equality of educational opportunity. *Comparative Education Review*, 57(2):285–308.

Bolli, T., Renold, U., and Woerter, M. (2015). Vertical educational diversity and innovation performance. *KOF Working Papers*, 395.

Breen, R. (2005). Explaining cross-national variation in youth unemployment: Market and institutional factors. *European Sociological Review*, 21(2):125–134.

Breen, R. and Buchmann, M. (2002). Institutional variation and the position of young people: A comparative perspective. *The Annals of the American Academy of Political and Social Science*, 580(1):288–305.

Bruederl, J. and Ludwig, V. (2015). *Fixed-effects panel regression*. SAGE reference, Los Angeles, London, New Dehli, Singapore, Washington DC.

Busemeyer, M. R. (2015). *Skills and inequality: Partisan politics and the political economy of education reforms in Western welfare states*. CUP, Cambridge.

Cedefop (2013). Labour market outcomes of vocational education in Europe. Report, Publications Office of the European Union.

Chatzichristou, S., Ulicna, D., Murphy, I., and Curth, A. (2014). Dual education: A bridge over troubled waters? Report.

Choudhry, M. T., Marelli, E., and Signorelli, M. (2012). Youth unemployment rate and impact of financial crises. *International journal of Manpower*, 33(1):76–95.

De Lange, M., Gesthuizen, M., and Wolbers, M. (2014). Youth labour market integration across europe: The impact of cyclical, structural, and institutional characteristics. *European Societies*, 16(2):194–212.

Dewan, S. and Peek, P. (2007). Beyond the employment/unemployment dichotomy: Measuring the quality of employment in low income countries. *Working Paper*, 83.

Eichhorst, W., Rodríguez-Planas, N., Schmidl, R., and Zimmermann, K. F. (2012). A roadmap to vocational education and training systems around the world. Report, Institute for the Study of Labor (IZA).

Eichmann, R. (1989). *Diskurs gesellschaftlicher Teilsysteme: Zur Abstimmung von Bildungssystem und Beschaeftigungssystem* . DUV, Wiesbaden.

Felbermayr, G., Prat, J., and Schmerer, H.-J. (2011). Globalization and labor market outcomes: Wage bargaining, search frictions, and firm heterogeneity. *Journal of Economic Theory*, 146(1):39–73.

Fend, H. (2006). *Neue Theorie der Schule. Einfuehrung in das Verstehen von Bildungssystemen*. VS Verlag fuer Sozialwissenschaften, 2 edition.

Freeman, R. B. and Wise, D. A. (1982). *The youth labor market problem: Its nature causes and consequences*, pages 1–16. University of Chicago Press.

Gangl, M. (2000). Education and labour market entry across Europe: The impact of institutional arrangements in training systems and labour markets. *Working Paper Mannheim University*, 25.

Hannan, D. F., Raffe, D., and Smyth, E. (1996). Cross-national research on school to work transitions: An analytical framework. Report.

Hanushek, E. A., Schwerdt, G., Woessmann, L., and Zhang, L. (2017). General education, vocational education, and labor-market outcomes over the life-cycle. *Journal of Human Resources*, 52(1):49–88.

Heckman, J. J., Lochner, L., and Taber, C. (1999). Human capital formation and general equilibrium treatment effects: A study of tax and tuition policy. *Fiscal Studies*, 20(1):25–40.

Iannelli, C. and Raffe, D. (2007). Vocational upper-secondary education and the transition from school. *European Sociological Review*, 23(1):49–63.

ILO (2016). Key indicators of the labour market. Report, International Labour Office.

Jencks, C., Perman, L., and Rainwater, L. (1988). What is a good job? A new measure of labor-market success. *American Journal of Sociology*, 93(6):1322–1357.

Klieme, E., Avenarius, H., Baethge, M., Doebert, H., Hetmeier, H.-W., Meister-Scheufelen, G., Rauschenbach, T., and Wolter, A. (2007). *Grundkonzeption der Bildungsberichterstattung fuer Deutschland*, pages 129–145. VS Verlag fuer Sozialwissenschaften, Wiesbaden.

Lazear, E. P. (1999). Globalisation and the market for team-mates. *The Economic Journal*, 109(454):15–40.

Levels, M., Van der Velden, R., and Di Stasio, V. (2014). From school to fitting work: How education-to-job matching of European school leavers is related to educational system characteristics. *Acta Sociologica*, 57(4):341–361.

Mauro, L. and Carmeci, G. (2003). Long run growth and investment in education: Does unemployment matter? *Journal of Macroeconomics*, 25(1):123–137.

Mincer, J. (1974). *Schooling, experience, and earnings.* , volume 2 of *Human Behavior and Social Institutions*. National Bureau of Economic Research, New York.

Mueller, W. and Gangl, M. (2003). *Transitions from education to work in Europe: The integration of youth into EU labour markets*. Oxford University Press on Demand.

Mueller, W. and Shavit, Y. (1998). *The institutional embeddedness of the stratification process: A comparative study of qualifications and occupations in thirteen countries*, pages 1–48. Clarendon Press, Oxford.

Mulligan, C. B. (2012). *The redistribution recession: How labor market distortions contracted the economy*. Oxford University Press.

Nickell, S. (1981). Biases in dynamic models with fixed effects. *Econometrica: Journal of the Econometric Society*, 49(6):1417–1426.

Nickell, S. (1997). Unemployment and labor market rigidities: Europe versus North America. *The Journal of Economic Perspectives*, 11(3):55–74.

Noelke, C. (2011). The consequences of employment protection legislation for the youth labour market. *Working Paper Mannheim University*, 144.

OECD (1998). *Getting started, settling in: The transition from education to the labour market*, book section 3, pages 81–122. OECD, Paris.

OECD (2000). *From initial education to working life*. OECD Publishing, Paris.

OECD (2004). *OECD Handbook for Internationally Comparative Education Statistics*. OECD Publishing, Paris.

OECD (2010). *Off to a good start? Jobs for youth*. OECD Publishing.

OECD (2014). *Education at a glance 2014: OECD indicators*. OECD Publishing.

OECD/ILO (2014). Promoting better labour market outcomes for youth. Report, OECD/ILO.

O'Higgins, N. (2003). Trends in the youth labour market in developing and transition countries. *World Bank Social Protection Discussion Paper Series*, 321.

Renold, U., Bolli, T., Egg, M. E., and Pusterla, F. (2014). On the multiple dimensions of youth labour markets: A guide to the KOF youth labour market index. *KOF Studies*, 51.

Roodman, D. (2009). How to do xtabond2: An introduction to difference and system GMM in Stata. *Stata Journal*, 9(1):86–136.

Ryan, P. (2001). The school-to-work transition: A cross-national perspective. *Journal of Economic Literature*, 39(1):34–92.

Shavit, Y. and Mueller, W. (2000). *Vocational secondary education, tracking, and social stratification*, pages 437–452. Springer.

Van de Werfhorst, H. G. (2011). Skill and education effects on earnings in 18 countries: The role of national educational institutions. *Social Science Research*, 40(4):1078–1090.

Van der Velden, R. and Wolbers, M. (2003). *The integration of young people into the labour market: The role of training systems and labour market regulation*. Oxford University Press.

Van der Velden, R. and Wolbers, M. H. J. (2001). The integration of young people into the labour market within the European Union: The role of institutional settings. *Research Centre for Education and the Labour Market Working Paper*, 7(E).

Wolbers, M. H. J. (2003). Job mismatches and their labour-market effects among school-leavers in Europe. *European Sociological Review*, 19(3):249–266.

Wolbers, M. H. J. (2007). Patterns of labour market entry: A comparative perspective on school-to-work transitions in 11 European countries. *Acta Sociologica*, 50(3):189–210.

Wolter, S. C. and Ryan, P. (2011). *Apprenticeship*, volume 3, book section 11, pages 521–576. North-Holland, The Netherlands.

Wooldridge, J. M. (2001). Applications of generalized method of moments estimation. *The Journal of Economic Perspectives*, 15(4):87–100.

Zimmermann, K. F., Biavaschi, C., Eichhorst, W., Giulietti, C., Kendzia, M. J., Muravyev, A., Pieters, J., Rodríguez-Planas, N., and Schmidl, R. (2013). Youth unemployment and vocational training. *Foundations and Trends in Microeconomics*, 9(1-2):1–157.

A Appendix

A.1 Descriptive Statistics

Table A.1: Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Dependent variable: Labour 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
Youth 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 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 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 labour force rate (%)	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

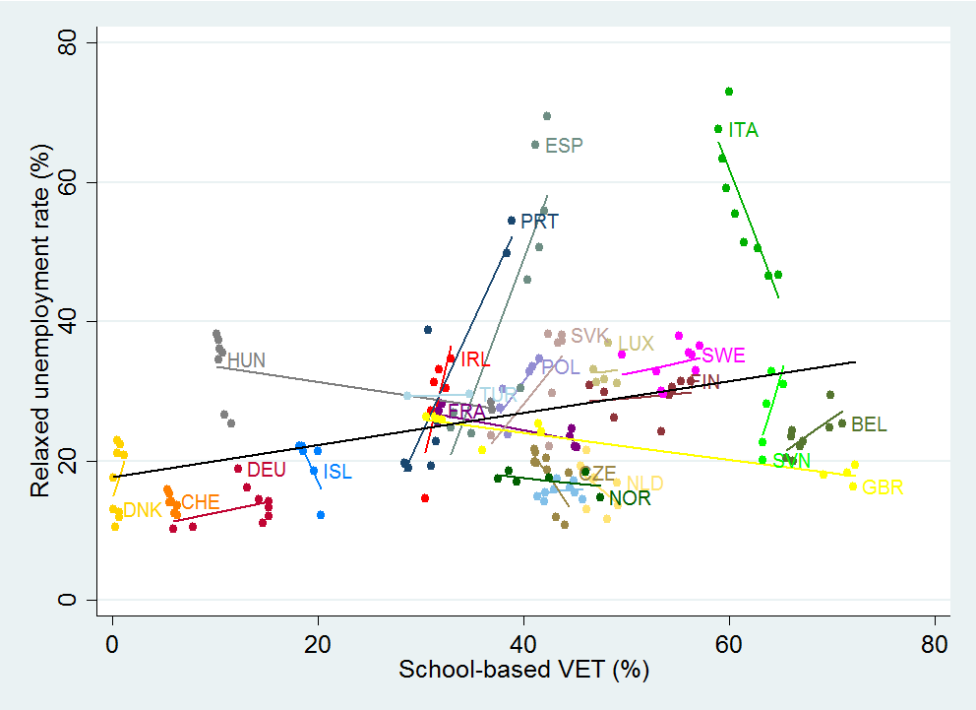
Note: The summary statistics displays the number of observations, mean value, standard deviation, minimum value and maximum value for all variables in the data set.

Table A.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	yolf	gdppc	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										
yolf	-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	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	-0.08	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	0.16	-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	-0.44	-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	-0.31	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	0.15	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	-0.00	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	0.25	-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	0.02	-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	-0.07	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	-0.26	0.46	-0.18	0.20	0.46	0.29	0.18	-0.48	-0.34	0.42	1.00

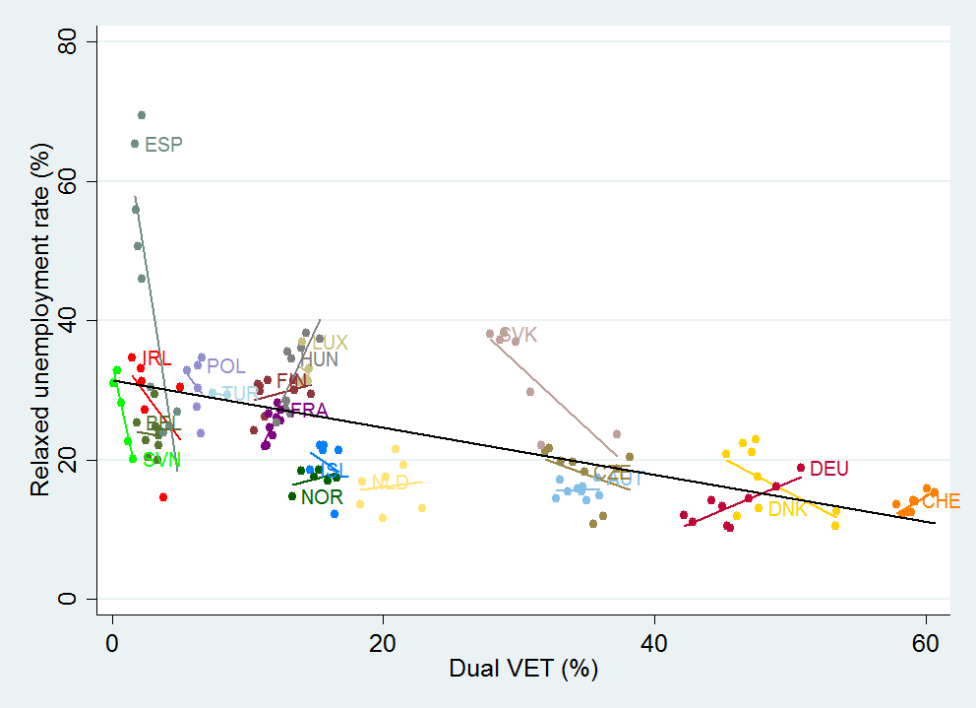
Note: The table displays the correlation among all variables.
The abbreviations stand for: unem = youth unemployment rate; relax = youth relaxed unemployment rate; neet = NEET rate; long = youth long-term unemployment rate; temp = youth temporary contract rate; part = youth involuntary part-time work; atyp = youth atypical working hour; skill = youth skills mismatch; risk = youth in-work at-risk of poverty; learn = average hourly earnings (ln); gened = general education; svet = school-based VET; dvet = dual VET; aunem = adult unemployment; arelax = adult relaxed unemployment; alfp = adult labour force participation rate; along = adult incidence of long-term unemployment; atemp = adult temporary work; apart = adult involuntary part-time 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); yolf = youth labour force rate; 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 A.1: Scatter plot of relaxed unemployment rate and school-based VET



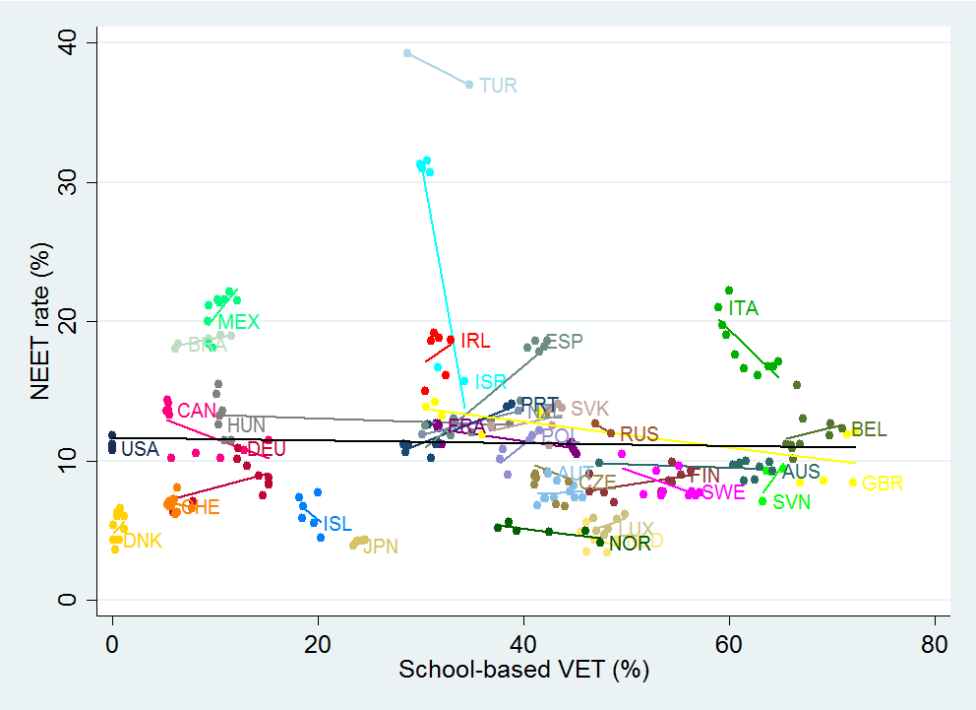
Note: Plot shows correlation between relaxed unemployment rate and school-based VET (lagged three years). The black trend line displays the between countries correlation, the coloured lines the within country correlation over time.

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



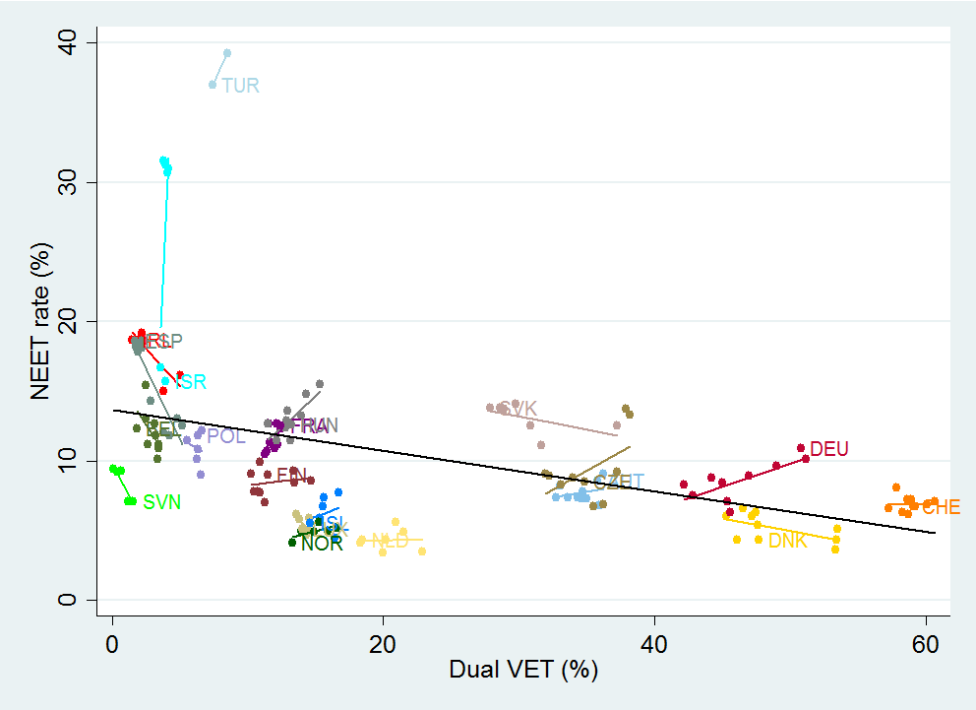
Note: Plot shows correlation between relaxed unemployment rate and dual VET (lagged three years). The black trend line displays the between countries correlation, the coloured lines the within country correlation over time.

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



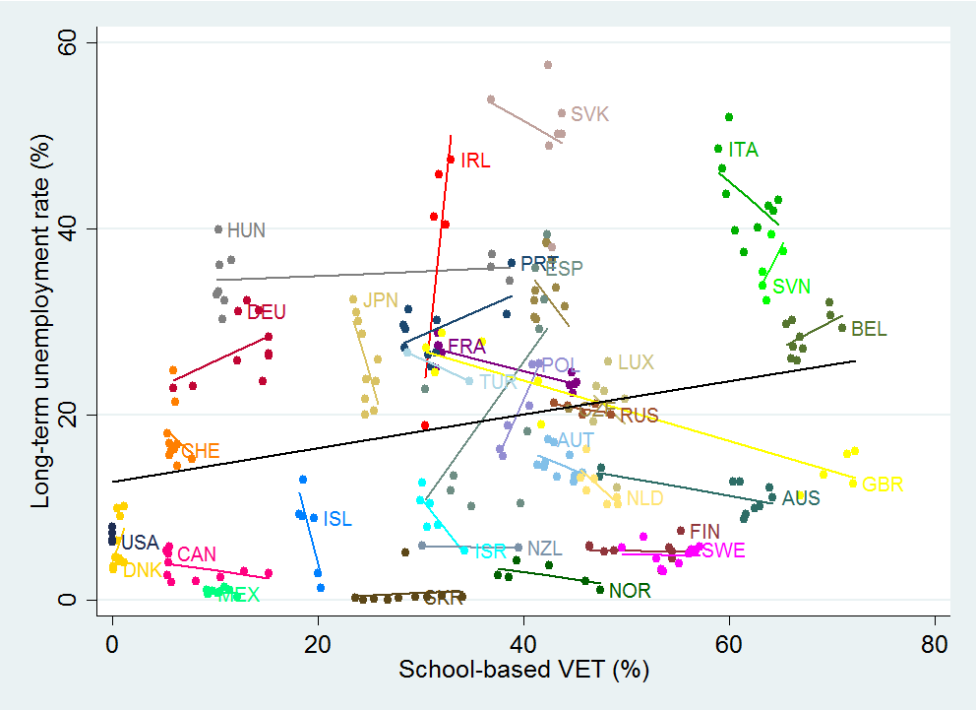
Note: Plot shows correlation between NEET rate and school-based VET (lagged three years). The black trend line displays the between countries correlation, the coloured lines the within country correlation over time.

Figure A.4: Scatter plot of NEET rate and dual VET



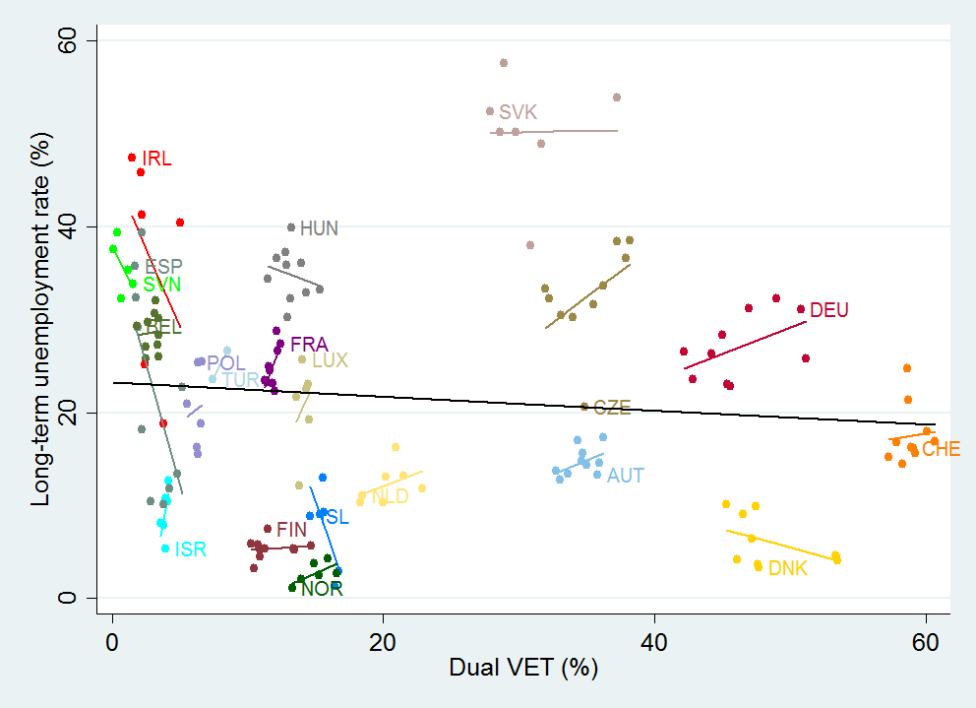
Note: Plot shows correlation between NEET rate and dual VET (lagged three years). The black trend line displays the between countries correlation, the coloured lines the within country correlation over time.

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



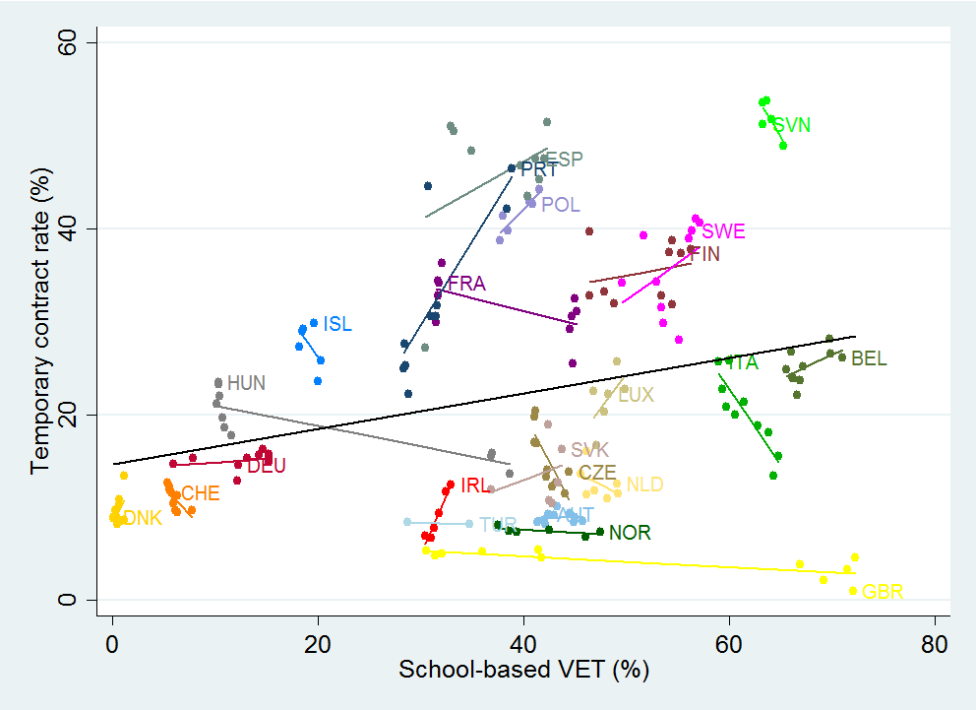
Note: Plot shows correlation between long-term unemployment rate and school-based VET (lagged three years). The black trend line displays the between countries correlation, the coloured lines the within country correlation over time.

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



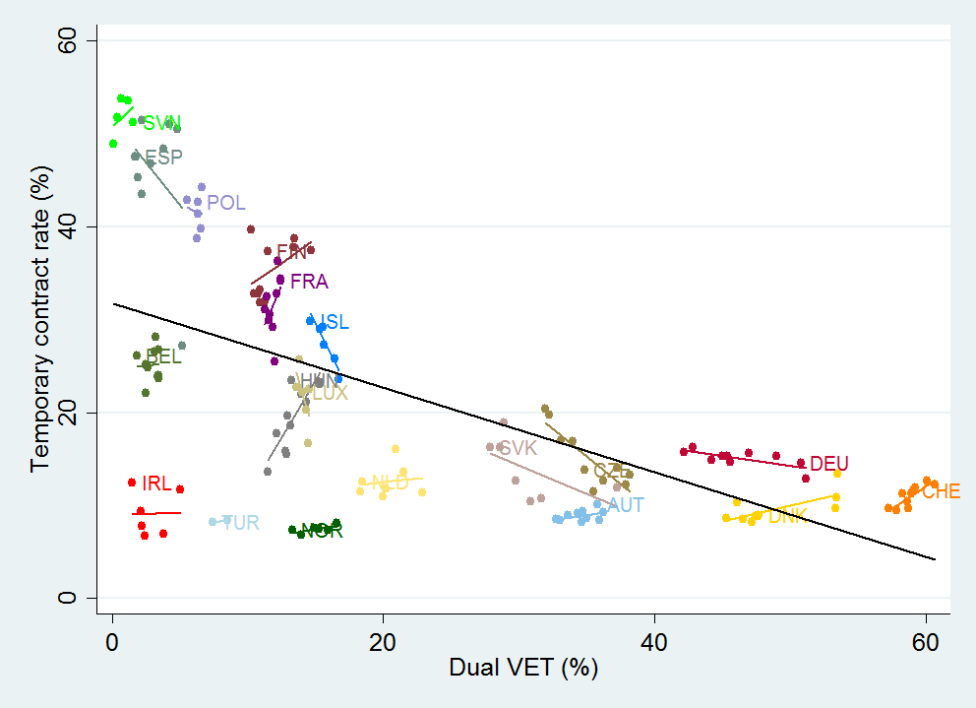
Note: Plot shows correlation between long-term unemployment rate and dual VET (lagged three years). The black trend line displays the between countries correlation, the coloured lines the within country correlation over time.

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



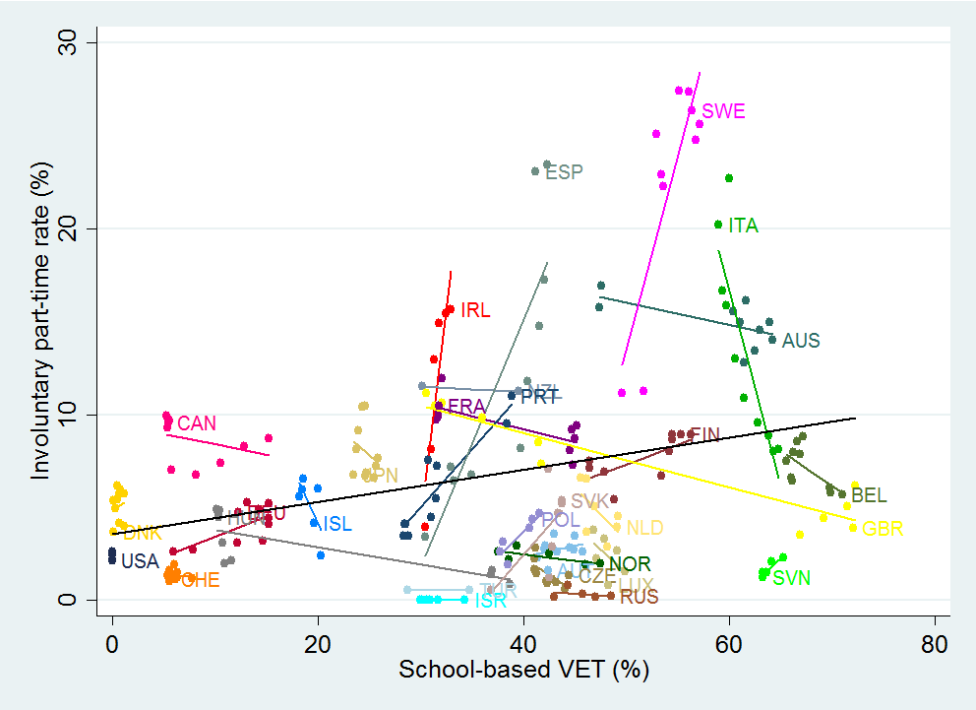
Note: Plot shows correlation between temporary contract rate and school-based VET (lagged three years). The black trend line displays the between countries correlation, the coloured lines the within country correlation over time.

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



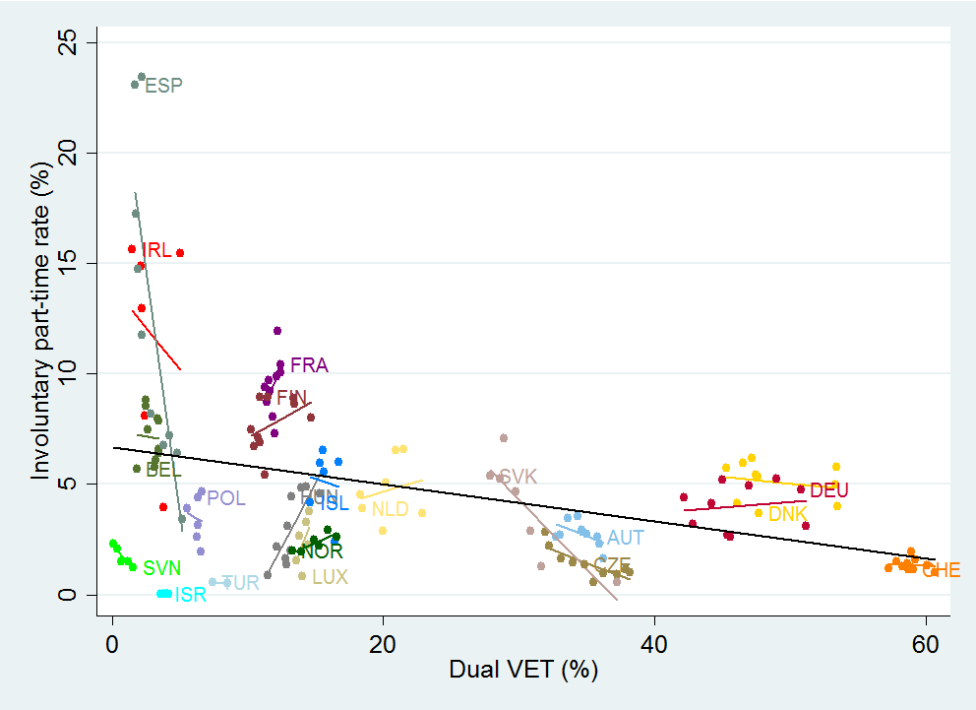
Note: Plot shows correlation between temporary contract rate and dual VET (lagged three years). The black trend line displays the between countries correlation, the coloured lines the within country correlation over time.

Figure A.9: Scatter plot of involuntary part-time rate and school-based VET



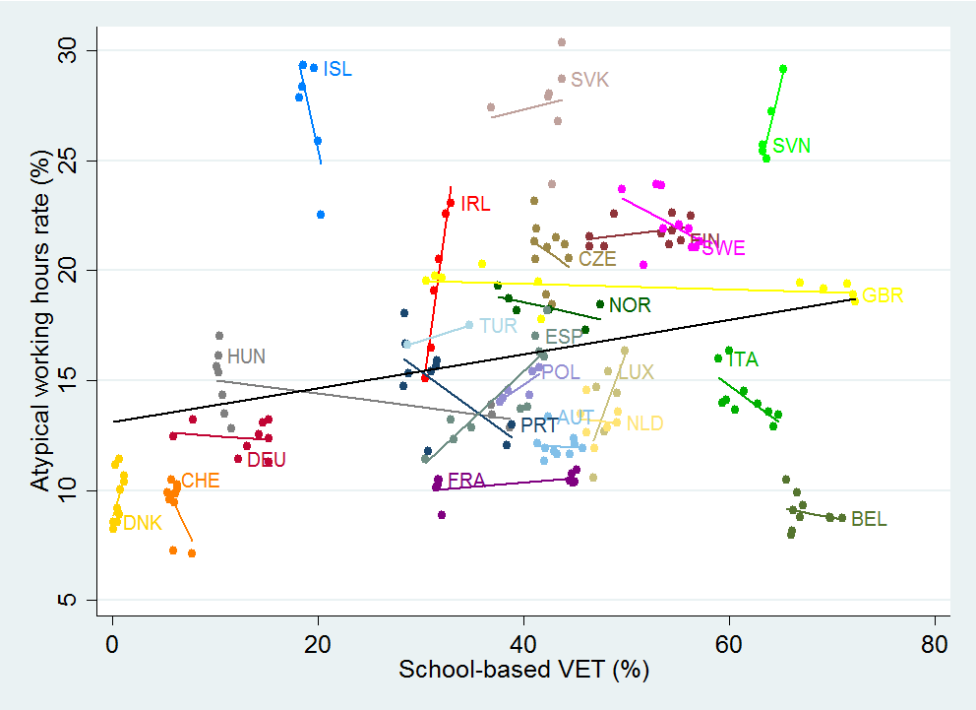
Note: Plot shows correlation between involuntary part-time rate and school-based VET (lagged three years). The black trend line displays the between countries correlation, the coloured lines the within country correlation over time.

Figure A.10: Scatter plot of involuntary part-time rate and dual VET



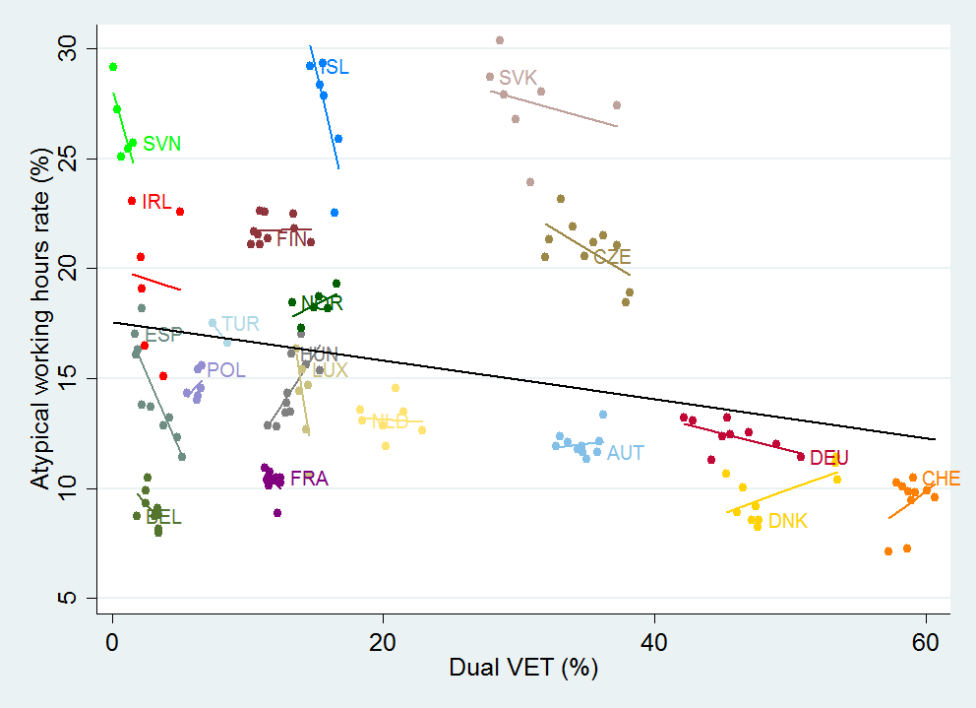
Note: Plot shows correlation between involuntary part-time rate and dual VET (lagged three years). The black trend line displays the between countries correlation, the coloured lines the within country correlation over time.

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



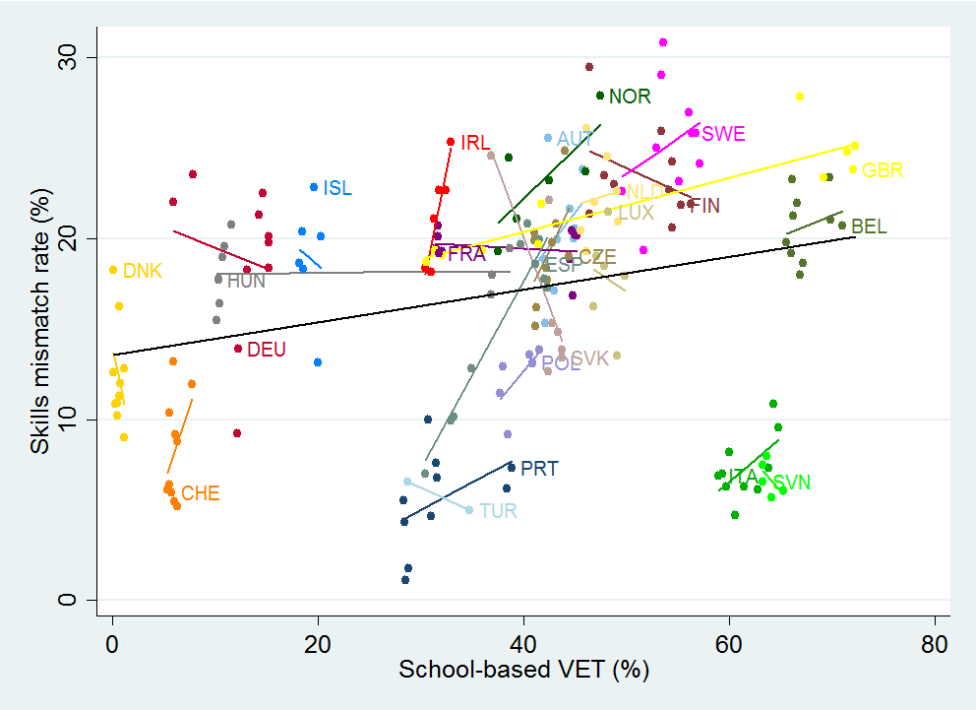
Note: Plot shows correlation between atypical working hours rate and school-based VET (lagged three years). The black trend line displays the between countries correlation, the coloured lines the within country correlation over time.

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



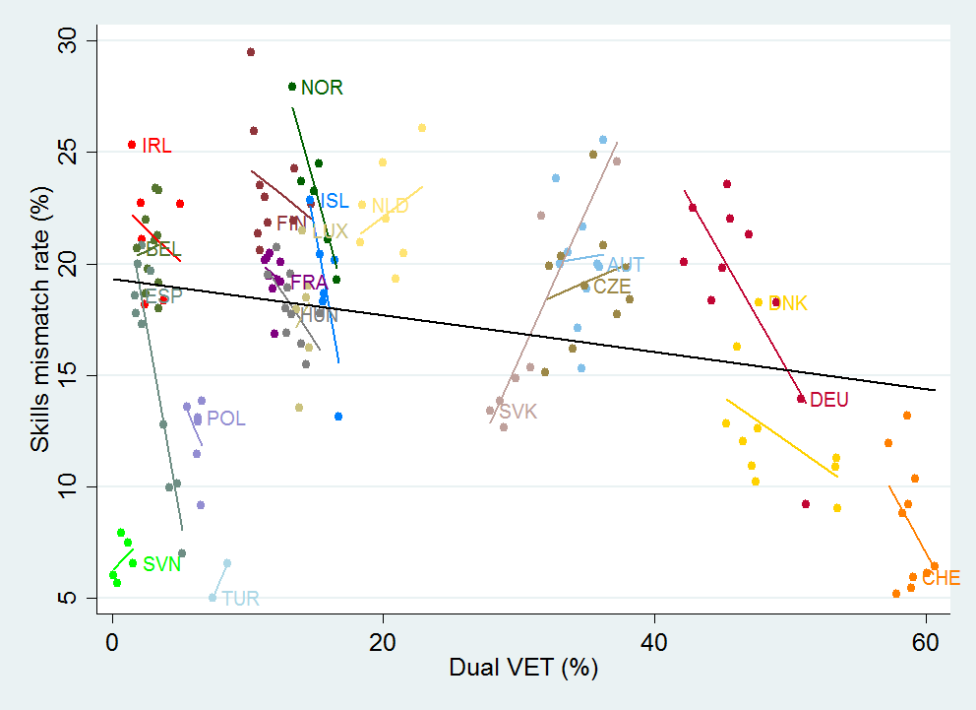
Note: Plot shows correlation between atypical working hours rate and dual VET (lagged three years). The black trend line displays the between countries correlation, the coloured lines the within country correlation over time.

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



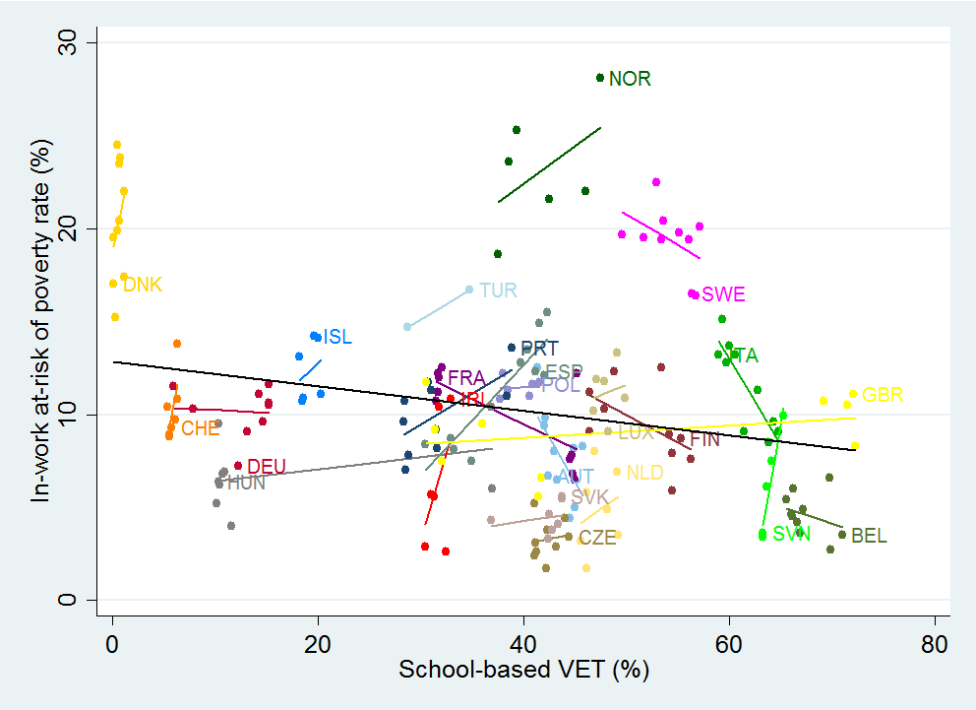
Note: Plot shows correlation between skills mismatch rate and school-based VET (lagged three years). The black trend line displays the between countries correlation, the coloured lines the within country correlation over time.

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



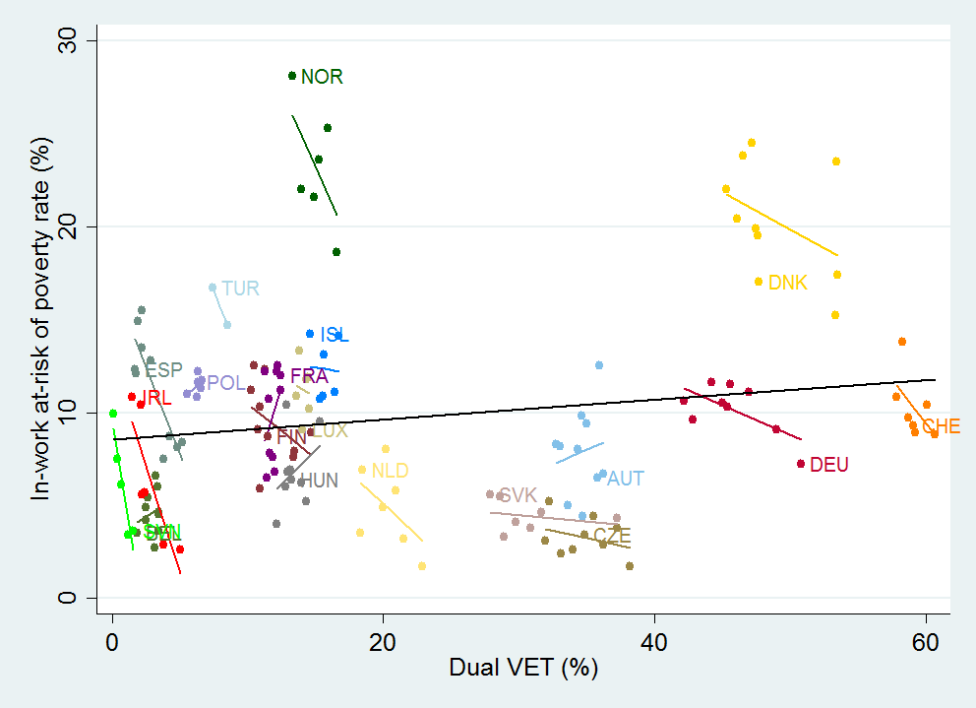
Note: Plot shows correlation between skills mismatch rate and dual VET (lagged three years). The black trend line displays the between countries correlation, the coloured lines the within country correlation over time.

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



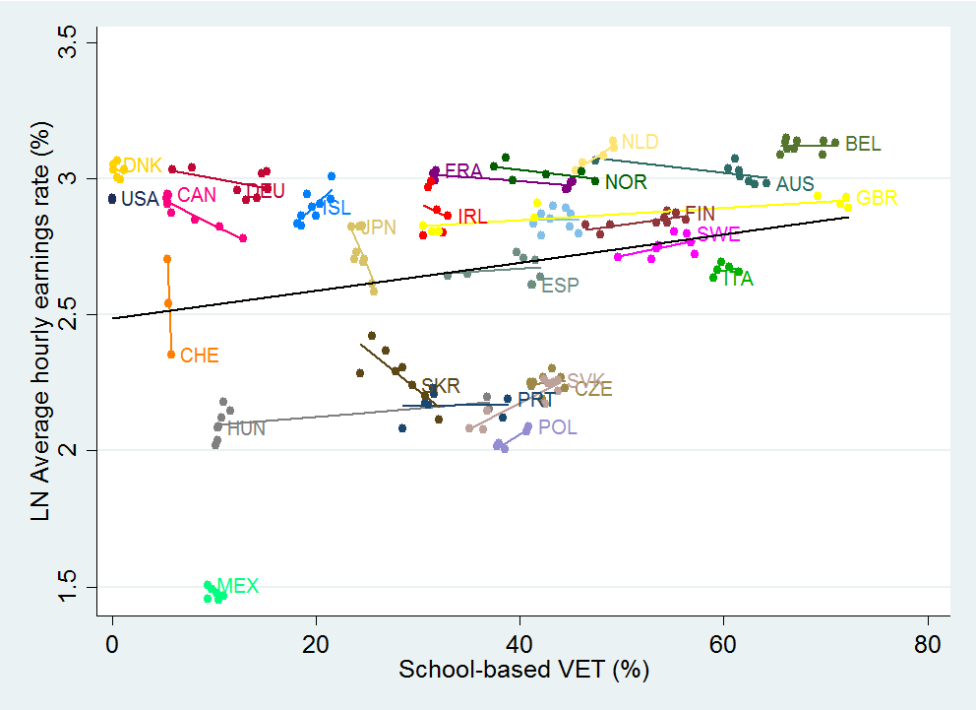
Note: Plot shows correlation between in-work at-risk of poverty rate and school-based VET (lagged three years). The black trend line displays the between countries correlation, the coloured lines the within country correlation over time.

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



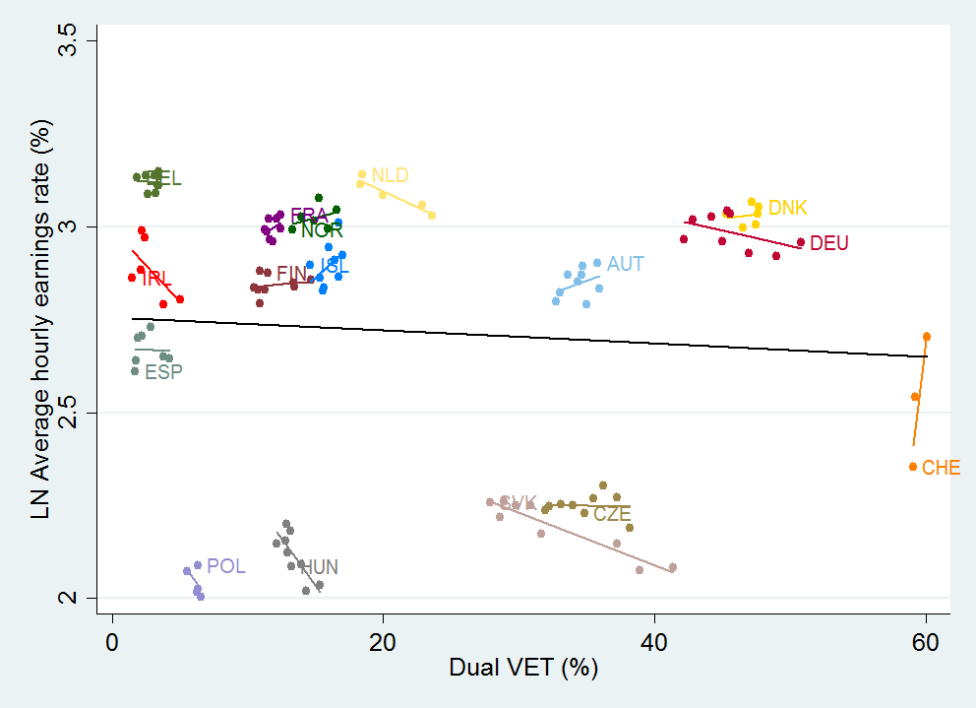
Note: Plot shows correlation between in-work at-risk of poverty rate and dual VET (lagged three years). The black trend line displays the between countries correlation, the coloured lines the within country correlation over time.

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



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

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



Note: Plot shows correlation between average hourly earnings and dual VET (lagged three years). The black trend line displays the between countries correlation, the coloured lines the within country correlation over time.

A.2 Regression results of fixed effects models with additional control variables

Table A.3: Unemployment rate

	FE1	FE2	FE3	FE4	FE5	FE6	FE7	FE8
School-based VET	0.159	0.125	0.171	0.290*	0.047	0.132	0.133	0.252*
	(0.411)	(0.164)	(0.178)	(0.147)	(0.153)	(0.170)	(0.167)	(0.127)
School-based VET^2	-0.002	-0.001	-0.002	-0.003*	-0.001	-0.002	-0.002	-0.003*
	(0.004)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)
Dual VET	-2.640*	-1.833**	-1.776**	-1.493**	-1.967**	-1.773**	-1.898**	-1.576**
	(1.394)	(0.795)	(0.734)	(0.644)	(0.844)	(0.743)	(0.782)	(0.611)
Dual VET^2	0.033*	0.023**	0.022**	0.019**	0.023**	0.022**	0.022**	0.018**
	(0.018)	(0.010)	(0.009)	(0.009)	(0.010)	(0.009)	(0.009)	(0.008)
diff VET	0.215	0.082	0.059	0.053	0.075	0.067	0.069	0.023
Youth labour force rate		-1.036	-1.167	-2.195***	-1.018	-1.128	-0.980	-2.263***
		(0.691)	(0.725)	(0.759)	(0.660)	(0.734)	(0.674)	(0.772)
GDP per capita		-1.500***	-1.530***	-1.941***	-1.354***	-1.497***	-1.465***	-1.895***
		(0.400)	(0.419)	(0.444)	(0.351)	(0.398)	(0.374)	(0.384)
GDP growth		-0.368**	-0.396**	-0.346**	-0.278*	-0.357**	-0.783**	-0.803***
		(0.157)	(0.190)	(0.156)	(0.163)	(0.156)	(0.292)	(0.231)
EPL		-8.122***	-6.240*	-4.474*	-8.101***	-8.228***	-8.030***	-3.970**
		(2.592)	(3.411)	(2.256)	(2.528)	(2.529)	(2.465)	(1.671)
PISA score		-0.016	-0.008	0.035	-0.011	-0.021	-0.021	0.031
		(0.064)	(0.069)	(0.056)	(0.062)	(0.062)	(0.065)	(0.049)
Trade union density			-0.008					-0.108
			(0.336)					(0.271)
Unemployment insurance				-0.046				-0.044
				(0.039)				(0.045)
Sector: Industry					0.556			1.550
					(0.887)			(0.999)
Sector: Services					1.155			1.998*
					(0.874)			(1.051)
KOF Globalisation Index						-0.130		-0.241
						(0.320)		(0.282)
School-based VET x GDP growth							0.007	0.010**
							(0.005)	(0.004)
Dual VET x GDP growth							0.010*	0.012***
							(0.006)	(0.004)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
No. of observations	272	272	254	204	258	269	272	196
No. of countries	35	35	32	28	33	35	35	28
$R\hat{2}$	0.375	0.665	0.658	0.775	0.682	0.666	0.676	0.792

Note: Baseline is nonlinear fixed effects model with clustered standard errors; *** 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 A.4: Relaxed unemployment rate

	FE1	FE2	FE3	FE4	FE5	FE6	FE7	FE8
School-based VET	0.655	0.424***	0.412***	0.407**	0.358***	0.436***	0.464***	0.358***
	(0.649)	(0.150)	(0.144)	(0.146)	(0.116)	(0.149)	(0.128)	(0.114)
School-based VET^2	-0.006	-0.004**	-0.004**	-0.003**	-0.003**	-0.004**	-0.004***	-0.003**
	(0.006)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Dual VET	-2.917**	-1.578**	-1.564**	-1.520**	-1.581**	-1.647**	-1.651***	-1.443**
	(1.394)	(0.649)	(0.640)	(0.661)	(0.645)	(0.645)	(0.550)	(0.564)
Dual VET^2	0.040*	0.020**	0.019**	0.018*	0.019**	0.021**	0.019**	0.015**
	(0.021)	(0.009)	(0.008)	(0.009)	(0.008)	(0.008)	(0.007)	(0.007)
diff VET	0.118	0.022	0.018	0.030	0.026	0.014	0.005	0.013
Youth labour force rate		-2.502***	-2.472***	-2.632***	-2.400***	-2.373**	-2.454***	-2.830***
		(0.870)	(0.852)	(0.903)	(0.762)	(0.987)	(0.699)	(0.816)
GDP per capita		-2.917***	-2.917***	-3.117***	-3.000***	-2.913***	-2.834***	-3.187***
		(0.421)	(0.385)	(0.463)	(0.342)	(0.420)	(0.325)	(0.288)
GDP growth		0.059	0.012	0.038	0.158	0.050	-1.299***	-1.102***
		(0.222)	(0.229)	(0.241)	(0.233)	(0.225)	(0.358)	(0.374)
EPL		-7.935**	-6.350**	-7.685**	-7.705***	-7.784**	-7.524***	-5.130**
		(2.987)	(2.871)	(3.038)	(2.535)	(2.962)	(2.425)	(2.228)
PISA score		0.107	0.099	0.086	0.098	0.112	0.081	0.043
		(0.070)	(0.068)	(0.082)	(0.058)	(0.069)	(0.064)	(0.066)
Trade union			0.056					-0.139
			(0.217)					(0.195)
Unemployment insurance				-0.060				-0.055
				(0.039)				(0.044)
Sector: Industry					2.505**			2.780**
					(0.902)			(0.989)
Sector: Services					2.909***			3.277***
					(0.763)			(0.875)
KOF Globalisation Index						0.167		-0.420
						(0.392)		(0.307)
School-based VET x GDP growth							0.025***	0.022***
							(0.006)	(0.005)
Dual VET x GDP growth							0.020***	0.020***
							(0.006)	(0.006)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
No. of observations	176	176	172	160	176	174	176	157
No. of countries	23	23	23	21	23	23	23	21
$R\hat{2}$	0.525	0.845	0.830	0.855	0.858	0.845	0.867	0.881

Note: Baseline is nonlinear fixed effects model with clustered standard errors; *** 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 A.5: NEET rate

	FE1	FE2	FE3	FE4	FE5	FE6	FE7	FE8
School-based VET	0.043	0.028	-0.013	0.095*	0.090***	0.034	0.028	0.078**
	(0.075)	(0.069)	(0.062)	(0.053)	(0.032)	(0.071)	(0.070)	(0.032)
School-based VET^2	-0.001	-0.000	-0.000	-0.001**	-0.001***	-0.001	-0.000	-0.001***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)
Dual VET	-0.467	-0.481*	-0.427*	-0.406	-0.578**	-0.604**	-0.485*	-0.396*
	(0.424)	(0.267)	(0.242)	(0.239)	(0.242)	(0.251)	(0.268)	(0.203)
Dual VET^2	0.007	0.007*	0.006*	0.006	0.008**	0.009**	0.007*	0.005*
	(0.006)	(0.004)	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)	(0.003)
diff VET	0.366	0.154	0.174	0.130	0.019	0.037	0.180	0.077
Youth labour force rate		0.344	0.453*	-0.194	0.200	0.551	0.349	-0.038
		(0.303)	(0.261)	(0.239)	(0.228)	(0.390)	(0.300)	(0.173)
GDP per capita		-0.679***	-0.459***	-0.689***	-0.524***	-0.665***	-0.669***	-0.621***
		(0.221)	(0.163)	(0.156)	(0.165)	(0.217)	(0.216)	(0.173)
GDP growth		0.033	-0.034	-0.012	-0.017	0.016	-0.025	-0.150
		(0.098)	(0.073)	(0.069)	(0.076)	(0.093)	(0.148)	(0.108)
EPL		-1.492	-2.580	0.475	-0.476	-1.620	-1.488	-0.272
		(1.488)	(1.555)	(0.908)	(0.878)	(1.524)	(1.505)	(0.859)
PISA score		-0.063	-0.066*	0.001	-0.009	-0.059	-0.064	-0.017
		(0.054)	(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)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
No. of observations	245	245	233	191	231	243	245	183
No. of countries	33	33	31	26	31	33	33	26
$R\hat{2}$	0.141	0.306	0.409	0.566	0.478	0.331	0.308	0.614

Note: Baseline is nonlinear fixed effects model with clustered standard errors; *** 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 A.6: Long-term unemployment rate

	FE1	FE2	FE3	FE4	FE5	FE6	FE7	FE8
School-based VET	0.393**	0.290***	0.210	0.403***	0.174*	0.274**	0.293**	0.230*
	(0.162)	(0.103)	(0.133)	(0.109)	(0.099)	(0.101)	(0.108)	(0.117)
School-based VET^2	-0.006***	-0.004***	-0.003*	-0.004***	-0.003***	-0.004***	-0.004***	-0.004***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Dual VET	-1.687*	-1.150***	-1.102***	-1.345***	-1.666***	-1.183**	-1.211***	-2.296***
	(0.908)	(0.400)	(0.336)	(0.481)	(0.457)	(0.447)	(0.363)	(0.513)
Dual VET^2	0.024*	0.014**	0.012**	0.017**	0.019***	0.014**	0.013**	0.025***
	(0.012)	(0.006)	(0.005)	(0.008)	(0.006)	(0.006)	(0.005)	(0.008)
diff VET	0.084	0.002	0.001	0.003	0.001	0.005	0.000	0.000
Youth labour force rate		-1.063	-1.040	-2.356***	-1.432**	-1.061	-1.012	-1.879***
		(0.752)	(0.788)	(0.787)	(0.643)	(0.767)	(0.765)	(0.634)
GDP per capita		-1.281***	-1.130**	-1.690***	-0.650**	-1.292***	-1.206***	-0.865**
		(0.397)	(0.415)	(0.491)	(0.300)	(0.400)	(0.376)	(0.402)
GDP growth		0.453*	0.500*	0.607**	0.597**	0.469*	-0.134	0.068
		(0.260)	(0.277)	(0.243)	(0.246)	(0.256)	(0.365)	(0.248)
EPL		0.476	0.428	2.854	0.767	0.367	0.480	2.506
		(2.876)	(3.752)	(2.829)	(2.126)	(2.941)	(2.873)	(2.438)
PISA score		-0.117*	-0.136**	-0.108	-0.048	-0.118*	-0.126*	-0.088
		(0.066)	(0.061)	(0.075)	(0.052)	(0.067)	(0.066)	(0.061)
Trade union density			0.495*					0.236
			(0.277)					(0.210)
Unemployment insurance				0.029				-0.004
				(0.035)				(0.036)
Sector: Industry					-3.617***			-3.924**
					(1.312)			(1.413)
Sector: Services					-2.361*			-2.605**
					(1.191)			(1.249)
KOF Globalisation Index						0.013		0.368
						(0.336)		(0.264)
School-based VET x GDP growth							0.009	0.012**
							(0.006)	(0.005)
Dual VET x GDP growth							0.016*	0.013*
							(0.009)	(0.007)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
No. of observations	259	259	248	203	245	257	259	195
No. of countries	32	32	31	27	30	32	32	27
$R\hat{2}$	0.341	0.484	0.520	0.632	0.579	0.478	0.508	0.713

Note: Baseline is nonlinear fixed effects model with clustered standard errors; *** 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 A.7: Temporary contract rate

	FE1	FE2	FE3	FE4	FE5	FE6	FE7	FE8
School-based VET	0.082	-0.021	-0.065	-0.086	0.058	-0.045	-0.017	0.028
	(0.296)	(0.116)	(0.141)	(0.121)	(0.134)	(0.110)	(0.110)	(0.151)
School-based VET^2	-0.001	0.000	0.001	0.001	-0.000	0.001	0.000	0.000
	(0.003)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Dual VET	-0.461	-0.219	-0.275	0.410	0.020	-0.355	-0.232	0.574
	(0.285)	(0.291)	(0.260)	(0.468)	(0.335)	(0.382)	(0.295)	(0.430)
Dual VET^2	0.009*	0.006	0.006	-0.002	0.003	0.007	0.006	-0.002
	(0.004)	(0.004)	(0.003)	(0.007)	(0.004)	(0.005)	(0.004)	(0.005)
diff VET	0.187	0.316	0.404	0.361	0.369	0.318	0.239	0.216
Youth labour force rate		-0.472	-0.484	0.193	-0.473	-0.314	-0.466	0.191
		(0.536)	(0.543)	(0.755)	(0.507)	(0.628)	(0.537)	(0.746)
GDP per capita		-0.699***	-0.695***	-0.485	-0.903***	-0.740***	-0.746***	-0.767**
		(0.234)	(0.219)	(0.322)	(0.266)	(0.242)	(0.244)	(0.300)
GDP growth		0.095	0.187	-0.001	0.054	0.131	0.271	0.195
		(0.215)	(0.200)	(0.188)	(0.216)	(0.215)	(0.386)	(0.321)
EPL		-9.530***	-9.240***	-12.817***	-8.962***	-9.726***	-9.513***	-11.268***
		(2.312)	(2.992)	(2.546)	(1.807)	(2.193)	(2.290)	(2.452)
PISA score		0.036	0.022	-0.003	0.018	0.036	0.040	-0.004
		(0.056)	(0.066)	(0.077)	(0.055)	(0.058)	(0.055)	(0.086)
Trade union density			-0.006					-0.167
			(0.200)					(0.238)
Unemployment insurance				-0.016				0.006
				(0.033)				(0.043)
Sector: Industry					1.656*			1.568
					(0.832)			(1.117)
Sector: Services					1.168			0.991
					(0.738)			(1.068)
KOF Globalisation Index						0.243		0.034
						(0.266)		(0.263)
School-based VET x GDP growth							-0.002	-0.002
							(0.006)	(0.005)
Dual VET x GDP growth							-0.005	-0.005
							(0.007)	(0.006)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
No. of observations	192	192	188	161	192	190	192	158
No. of countries	23	23	23	21	23	23	23	21
$R\hat{2}$	0.325	0.510	0.472	0.583	0.526	0.518	0.512	0.572

Note: Baseline is nonlinear fixed effects model with clustered standard errors; *** 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 A.8: Involuntary part-time rate

	FE1	FE2	FE3	FE4	FE5	FE6	FE7	FE8
School-based VET	0.236	0.237**	0.286***	0.219**	0.173*	0.230**	0.234**	0.201*
	(0.179)	(0.090)	(0.093)	(0.082)	(0.092)	(0.091)	(0.092)	(0.099)
School-based VET^2	-0.003	-0.002**	-0.003***	-0.002**	-0.002*	-0.002**	-0.002**	-0.002*
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Dual VET	-1.018*	-0.787*	-0.855**	-0.478	-0.949**	-0.758**	-0.785*	-0.714*
	(0.554)	(0.401)	(0.416)	(0.354)	(0.429)	(0.356)	(0.395)	(0.407)
Dual VET^2	0.015*	0.011*	0.013*	0.007	0.013**	0.011**	0.011*	0.010
	(0.007)	(0.006)	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)	(0.006)
diff VET	0.090	0.072	0.063	0.182	0.053	0.047	0.069	0.105
Youth labour force rate		-0.323	-0.513	-1.102	-0.375	-0.371	-0.327	-1.209**
		(0.782)	(0.643)	(0.704)	(0.767)	(0.732)	(0.777)	(0.567)
GDP per capita		-1.001***	-1.205***	-1.083***	-0.817***	-1.003***	-0.970***	-0.959**
		(0.263)	(0.311)	(0.281)	(0.271)	(0.265)	(0.261)	(0.347)
GDP growth		0.006	0.090	0.043	0.057	0.012	-0.106	0.030
		(0.085)	(0.105)	(0.089)	(0.089)	(0.087)	(0.188)	(0.149)
EPL		0.649	1.989	0.613	0.508	0.543	0.615	0.911
		(1.777)	(1.972)	(1.750)	(1.839)	(1.780)	(1.758)	(1.488)
PISA score		-0.022	0.000	-0.023	-0.010	-0.026	-0.024	-0.002
		(0.050)	(0.043)	(0.061)	(0.051)	(0.051)	(0.051)	(0.050)
Trade union density			-0.382					-0.249
			(0.358)					(0.327)
Unemployment insurance				-0.027				-0.026
				(0.026)				(0.022)
Sector: Industry					-0.818			-0.834
					(0.630)			(0.827)
Sector: Services					-0.419			-0.367
					(0.606)			(0.712)
KOF Globalisation Index						-0.075		-0.080
						(0.206)		(0.200)
School-based VET x GDP growth							0.001	0.002
							(0.003)	(0.002)
Dual VET x GDP growth							0.004	0.003
							(0.003)	(0.002)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
No. of observations	239	239	229	190	225	237	239	182
No. of countries	30	30	29	25	28	30	30	25
$R\hat{2}$	0.402	0.556	0.577	0.626	0.574	0.555	0.558	0.646

Note: Baseline is nonlinear fixed effects model with clustered standard errors; *** 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 A.9: Atypical working hours rate

	FE1	FE2	FE3	FE4	FE5	FE6	FE7	FE8
School-based VET	-0.088	-0.052	-0.031	-0.060	-0.059	-0.048	-0.056	-0.079*
	(0.062)	(0.039)	(0.047)	(0.037)	(0.037)	(0.043)	(0.039)	(0.040)
School-based VET^2	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.001*
	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Dual VET	-0.737***	-0.535**	-0.533**	-0.333	-0.594**	-0.449**	-0.536**	-0.408*
	(0.254)	(0.227)	(0.219)	(0.202)	(0.236)	(0.192)	(0.219)	(0.209)
Dual VET^2	0.009**	0.005*	0.005**	0.002	0.006**	0.004*	0.005**	0.003
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.002)
diff VET	0.063	0.037	0.036	0.059	0.046	0.052	0.060	0.132
Youth labour force rate		-0.764***	-0.781***	-1.014***	-0.827***	-0.886***	-0.761***	-1.022***
		(0.237)	(0.256)	(0.214)	(0.215)	(0.252)	(0.224)	(0.254)
GDP per capita		-0.163	-0.175	-0.287**	-0.108	-0.144	-0.186*	-0.174
		(0.119)	(0.142)	(0.115)	(0.110)	(0.113)	(0.107)	(0.143)
GDP growth		0.144*	0.141	0.194**	0.123*	0.132	0.321**	0.335**
		(0.082)	(0.093)	(0.081)	(0.068)	(0.088)	(0.134)	(0.128)
EPL		5.439***	5.500**	5.140***	5.191***	5.437***	5.375***	4.332***
		(1.582)	(2.112)	(1.465)	(1.362)	(1.564)	(1.490)	(1.493)
PISA score		0.044**	0.051**	0.022	0.052**	0.041*	0.047**	0.029
		(0.020)	(0.021)	(0.019)	(0.019)	(0.020)	(0.019)	(0.020)
Trade union density			-0.046					0.081
			(0.120)					(0.135)
Unemployment insurance				0.041*				0.028
				(0.022)				(0.017)
Sector: Industry					-1.529***			-1.647**
					(0.450)			(0.612)
Sector: Services					-1.555***			-1.642***
					(0.393)			(0.550)
KOF Globalisation Index						-0.184		0.041
						(0.187)		(0.126)
School-based VET x GDP growth							-0.003	-0.004
							(0.002)	(0.003)
Dual VET x GDP growth							-0.003	-0.002
							(0.003)	(0.003)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
No. of observations	191	191	187	161	191	189	191	158
No. of countries	23	23	23	21	23	23	23	21
$R\hat{2}$	0.219	0.420	0.402	0.488	0.485	0.419	0.428	0.557

Note: Baseline is nonlinear fixed effects model with clustered standard errors; *** 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 A.10: Skills mismatch rate

	FE1	FE2	FE3	FE4	FE5	FE6	FE7	FE8
School-based VET	-0.038	-0.066	-0.127	-0.007	-0.061	-0.079	-0.063	-0.057
	(0.105)	(0.113)	(0.144)	(0.092)	(0.126)	(0.112)	(0.102)	(0.116)
School-based VET^2	0.002*	0.002	0.003*	0.001	0.002	0.002*	0.002*	0.002
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Dual VET	-0.571	-0.613	-0.625	-0.159	-0.587	-0.617	-0.587	0.155
	(0.762)	(0.591)	(0.579)	(0.556)	(0.650)	(0.589)	(0.569)	(0.626)
Dual VET^2	0.004	0.003	0.003	0.003	0.003	0.003	0.001	-0.003
	(0.009)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.007)	(0.008)
diff VET	0.556	0.237	0.197	0.958	0.284	0.244	0.085	0.766
Youth labour force rate		-0.619	-0.504	-1.118**	-0.599	-0.639	-0.640	-1.252**
		(0.622)	(0.605)	(0.474)	(0.609)	(0.628)	(0.600)	(0.489)
GDP per capita		-0.190	-0.146	0.164	-0.213	-0.200	-0.037	0.256
		(0.398)	(0.375)	(0.327)	(0.437)	(0.393)	(0.346)	(0.290)
GDP growth		0.461**	0.467**	0.380**	0.466**	0.475**	-0.360	-0.281
		(0.200)	(0.174)	(0.177)	(0.193)	(0.202)	(0.431)	(0.400)
EPL		1.729	0.871	1.893	1.836	1.586	1.845	0.666
		(3.591)	(4.272)	(2.843)	(3.546)	(3.507)	(3.249)	(2.987)
PISA score		0.073	0.052	0.091*	0.071	0.071	0.056	0.023
		(0.078)	(0.078)	(0.051)	(0.080)	(0.078)	(0.075)	(0.053)
Trade union density			0.177					0.374
			(0.350)					(0.243)
Unemployment insurance				-0.000				-0.021
				(0.030)				(0.035)
Sector: Industry					0.533			0.347
					(0.939)			(1.075)
Sector: Services					0.527			0.103
					(1.001)			(0.993)
KOF Globalisation Index						-0.027		-0.326
						(0.169)		(0.287)
School-based VET x GDP growth							0.012*	0.010*
							(0.006)	(0.005)
Dual VET x GDP growth							0.018**	0.011*
							(0.007)	(0.006)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
No. of observations	192	192	188	161	192	190	192	158
No. of countries	23	23	23	21	23	23	23	21
$R\hat{2}$	0.217	0.293	0.301	0.384	0.295	0.291	0.343	0.451

Note: Baseline is nonlinear fixed effects model with clustered standard errors; *** 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 A.11: In-work at-risk of poverty rate

	FE1	FE2	FE3	FE4	FE5	FE6	FE7	FE8
School-based VET	0.094	0.043	-0.015	0.096	0.105	0.065	0.065	0.109
	(0.118)	(0.132)	(0.126)	(0.122)	(0.120)	(0.133)	(0.129)	(0.107)
School-based VET^2	-0.001	-0.000	0.001	-0.001	-0.000	-0.000	-0.000	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
Dual VET	-0.921**	-0.905**	-0.832**	-0.839*	-0.701*	-1.037***	-0.943**	-0.841**
	(0.376)	(0.397)	(0.399)	(0.457)	(0.374)	(0.364)	(0.395)	(0.299)
Dual VET^2	0.009*	0.008	0.006	0.008	0.006	0.009*	0.009*	0.009**
	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)	(0.004)	(0.005)	(0.004)
diff VET	0.027	0.021	0.016	0.094	0.041	0.006	0.020	0.009
Youth labour force rate		-0.258	-0.085	-0.397	-0.298	-0.028	-0.245	0.091
		(0.275)	(0.232)	(0.293)	(0.268)	(0.284)	(0.276)	(0.253)
GDP per capita		-0.430**	-0.256	-0.333	-0.593***	-0.433**	-0.445**	-0.285
		(0.207)	(0.221)	(0.211)	(0.184)	(0.199)	(0.201)	(0.229)
GDP growth		0.303**	0.239	0.324**	0.256*	0.291**	0.110	0.056
		(0.145)	(0.151)	(0.149)	(0.131)	(0.130)	(0.267)	(0.232)
EPL		0.611	0.071	1.051	1.025	0.937	0.815	1.038
		(1.538)	(1.874)	(1.633)	(1.362)	(1.515)	(1.490)	(2.154)
PISA score		0.014	-0.022	0.060	0.001	0.026	0.015	0.026
		(0.049)	(0.049)	(0.052)	(0.052)	(0.048)	(0.050)	(0.056)
Trade union density			0.349**					0.406*
			(0.164)					(0.197)
Unemployment insurance				0.018				0.033
				(0.031)				(0.041)
Sector: Industry					0.887*			-0.114
					(0.466)			(0.718)
Sector: Services					0.442			-0.534
					(0.378)			(0.554)
KOF Globalisation Index						0.341**		0.493***
						(0.130)		(0.164)
School-based VET x GDP growth							0.005	0.005
							(0.004)	(0.004)
Dual VET x GDP growth							-0.001	-0.001
							(0.003)	(0.003)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
No. of observations	185	185	181	161	185	183	185	158
No. of countries	23	23	23	21	23	23	23	21
$R\hat{2}$	0.208	0.271	0.280	0.263	0.298	0.275	0.283	0.352

Note: Baseline is nonlinear fixed effects model with clustered standard errors; *** 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 A.12: Average hourly earnings (ln)

	FE1	FE2	FE3	FE4	FE5	FE6	FE7	FE8
School-based VET	0.001	0.001	0.000	0.001	0.002	0.001	0.001	0.001
	(0.004)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.003)	(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)
Dual VET	-0.016	-0.018	-0.016	-0.020	-0.016	-0.022*	-0.019	-0.021*
	(0.011)	(0.012)	(0.010)	(0.012)	(0.012)	(0.011)	(0.012)	(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)
diff VET	0.436	0.185	0.352	0.207	0.264	0.159	0.237	0.198
Youth labour force rate		-0.007	-0.003	-0.008	-0.007	0.002	-0.007	0.006
		(0.011)	(0.010)	(0.011)	(0.011)	(0.014)	(0.011)	(0.015)
GDP per capita		0.022***	0.023***	0.022***	0.020**	0.021***	0.022***	0.024***
		(0.006)	(0.006)	(0.007)	(0.009)	(0.006)	(0.006)	(0.008)
GDP growth		-0.000	-0.001	0.000	0.000	-0.001	-0.002	-0.002
		(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.003)	(0.004)
EPL		-0.043	-0.063	-0.047	-0.043	-0.043	-0.042	-0.063
		(0.047)	(0.058)	(0.049)	(0.046)	(0.043)	(0.047)	(0.051)
PISA score		0.001	0.001	0.001	0.001	0.001	0.001	0.001
		(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Trade union density			0.009					0.008
			(0.006)					(0.006)
Unemployment insurance				0.000				0.000
				(0.001)				(0.001)
Sector: Industry					0.022			-0.005
					(0.015)			(0.020)
Sector: Services					0.023*			-0.003
					(0.012)			(0.017)
KOF Globalisation Index						0.009*		0.011*
						(0.005)		(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)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
No. of observations	187	187	186	178	182	187	187	172
No. of countries	28	28	28	27	28	28	28	27
$R\hat{2}$	0.197	0.316	0.343	0.317	0.315	0.344	0.318	0.361

Note: Baseline is nonlinear fixed effects model with clustered standard errors; *** 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