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Labour Market Success of Initial Vocational Education and Training Graduates: A Comparative Study of Three Education Systems in Central Europe

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ABSTRACT

This paper compares within-country programmes of initial vocational education and training (IVET) in Austria, the Czech Republic and Germany and their outcomes. Specifically, it aims to analyse and compare the labour market success of graduates of different tracks at the ISCED 3 level in both early and later stages of their careers. The comparison is based on the analysis of PIAAC 2013 OECD study data. A composite multidimensional indicator was constructed to measure labour market success and subsequently used as a dependent variable in regression models. The results indicate that in the systems with dual IVET at the ISCED 3 level (Germany and Austria), graduates are indeed more successful at the labour market than their counterparts with other ISCED 3 tracks. However, their advantage diminishes in later stages of the career. Additionally, in Austria, the success of dual education young graduates is mediated by individual characteristics. In the system with only school-based IVET (the Czech Republic), this track does not guarantee substantively higher labour market success for young graduates compared to other ISCED 3 tracks and also to those with lower education. Czech apprentices in the later stages of career succeed even less than those with below ISCED 3 education.

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KEYWORDS

Initial vocational education and training; apprenticeship; academic education; comparative study; labour market success

Introduction

This paper compares within-country ISCED level 3 programmes of initial vocational education and training (IVET) in Austria, the Czech Republic and Germany by focusing on the labour market success of people aged 15–24 and 25–64. IVET programmes teach vocational skills and aim at preparing students typically between ages 14 and 16 for specific (types of) occupations, mainly for immediate entry into the labour market. Meanwhile, most countries also offer direct

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pathways from vocational programmes to additional levels of education such as professional education and training, and access to tertiary education.¹

Advocates of IVET note that vocational education serves as a ‘safety net’ because it better meets the needs of the labour market as compared to general education, for example, and thus enhances the position of their holders, attenuating the likelihood of IVET graduates becoming unemployed in the future (e.g., Bol and Van De Werfhorst 2013). Results from CEDEFOPS’ latest public opinion survey on VET,² however, suggest that vocational education has a poor image among European residents aged 15 and over and is seen as a second-best choice compared to general education (Salvatore and Villalba-Garcia 2018, 37–41). Advocates of *general education* perceive vocational training more as a ‘diversion’ from tertiary education, arguing that general education diversifies risks by providing broader skill sets and access to a higher education level, which allows for smooth transition to higher education. In the long run, they caution, IVET might restrict an employee’s mobility and become obsolete while at the same time impeding the social equality of educational and occupational opportunities (Hanushek et al. 2017; Shavit and Müller 2000).

Nevertheless, IVET remains one of the key pathways for young people in Europe to enter the labour market, aiming to prepare them not only for existing jobs but also for future employment. On average, 50% of young Europeans aged 15–19 participate in IVET programmes at the upper-secondary level (European Commission 2018). In order to further strengthen IVET by making it more attractive and effective, the European Council (2012, 3) advocates for ‘*increasing substantially the number of apprenticeships and traineeships*’ in the member states; the European Commission promotes high quality vocational education and training to facilitate young people’s transition to the labour market (European Commission 2016, 6), and the European Social Partners in Education are committed to improve the attractiveness and image of IVET (European Federation of Education Employers [EFEE] & the European Trade Union Committee for Education [ETUCE] 2017).³

The above goals are implicitly based on the ‘safety net’ concept of IVET. Indeed, findings on the effect of dual IVET on youth labour market integration (i.e., ([relaxed] unemployment rate, NEET [Neither in employment nor in education or training] rate, long-term employment rate) have consistently been positive (e.g., Bol and Van De Werfhorst 2013; Bolli, Oswald-Egg, and Rageth 2019). Yet in the Czech Republic, for example, Straková (2015) showed that Czech apprenticeship programmes (ISCED 3 C) do not represent a safe way to the labour market and may indeed contribute to educational and labour market inequalities. Moreover, the economic environment and character of the labour market continue to change rapidly due to developments in automation, demography, digitalisation, skill shortage/mismatch and job mobility, for example, with long-term gains in efficiency and productivity on the one hand and with the likelihood of part of the young workforce being replaced by computers (automation) in the near future on

the other hand (e.g., Arntz, Gregory & Zierahn, 2016; World Economic Forum [WEF] 2018). The workforce affected to be replaced is projected to reach 62% in the Czech Republic and 63% in Austria and Germany in 2026 (Elliott 2017).

Considering these developments, the question is whether upper-secondary level IVET training systems (where most vocational education takes place) actually serve as a lasting 'safety net' rather than a 'diversion' when it comes to the labour market success of IVET graduates both initially and throughout their career. In this paper we present the outcomes across ISCED level 3 programmes in three purposefully selected VET systems – Austria, the Czech Republic and Germany. We analysed the PIAAC 2013 data to compare their actual effects on young people's labour market success. We aim to answer the following research questions:

- (1) To what extent is (dual) vocational education associated with higher labour market success among ages 15–24 compared to other types of qualifications at the ISCED 3 level or below in the three countries (after controlling for years of work experience, gender, immigration status, numeracy skills)?
- (2) How does the job market success of vocational ISCED 3 graduates differ over their working life course when comparing young (<25) and older (≥25) cohorts?

Against this background our empirical study can strengthen the discussion on the (long-term) effects of IVET on the labour market success of its graduates by distinguishing between different types of IVET programmes within the three selected countries. Hence, in contrast to only discussing IVET as a whole with a focus on dual IVET, as is usual in the current literature, the paper focuses on one country (CZ) without dual education (only school-based programmes) and two with dual education (AU + DE), with the latter two showing different effects on labour market success. When comparing the three systems, it becomes evident that each country has a unique context and history within which its vocational education system has evolved (see next section).

The following section will outline similarities and differences in the socio-economic environment and IVET features of the selected countries. Subsequently, the data will be presented alongside the analytical approach and measures applied in the empirical study. The subsequent section discusses the study results and leads up to the paper's answers to the two main research questions. Finally, conclusions are drawn based on our empirical findings.

Country selection and socio-economic and educational context

Similarities and reasons for country selection

Some of the educational features of Austria, the Czech Republic and Germany are largely similar: They have a highly stratified education system with a high level of early tracking at the lower-secondary level (between 10 and 12 years of age), and a clear separation between general and vocational education and training on the macro level. The structures and processes underpinning each country's IVET system are standardised and subject to binding regulations.

The three countries have geographical, historical, and other commonalities and are based on the so-called German model, which is characterised by a highly differentiated system of secondary education with vocationally specific apprenticeship programmes (Smith et al. 2016, 340). The Austrian, German and Swiss IVET models especially have grown strongly in international relevance since the financial and fiscal crisis of 2007 to 2009. There is a heightened interest from foreign governments in dual-track vocational education and training programmes stemming mainly from low youth unemployment in these three countries and from the opportunity to have industry involved in funding training, thereby reducing the strain on public budgets (Wolter et al. 2018).

The three selected countries have strong IVET systems which seem to be highly praised. For example, Germany, Austria and the Czech Republic were in the top-ten ranking for IVET graduates' success on the labour market as measured by the KOF Youth Labour Market Index (KOF YLMI) in 2017 (Bolli, Oswald-Egg, and Rageth 2019).⁴ Switzerland reached the highest index score across Europe (5.7 of 6) with Germany ranked fifth (5.46) followed closely by Austria (5.43), and the Czech Republic ranked eighth (5.37) with an EU28 index of 5.07. While the first three countries confirmed their solid position compared to previous years, the Czech Republic – like other Eastern European countries – made large improvements over time. Regarding *transition smoothness to the labour market* (relative unemployment ratio and long-term unemployment rate), Austria came out on top among the three countries, followed by Germany and the Czech Republic (Pusterla and Oswald Egg 2019).

The countries do very well economically – for example, *average unemployment rates* in all three countries dropped significantly between 2014–2019. The Czech Republic had the lowest EU28 unemployment rate (2%) and youth unemployment rate (4.3%) among young people under 25 years of age in December 2019 (although with significant regional differences), followed by Germany (3.2% resp. 5.8%) and Austria (4.2% resp. 8.3%) as compared to the EU average of 6.2% resp. 14.1% (Eurostat, online data). The *youth unemployment rate* of 15- to 24-year-olds with upper-secondary and post-secondary non-tertiary education (ISCED levels 3 and 4) as compared to the overall youth unemployment rate in 2019 was lower in each of the three countries: Austria (6.9% versus 8.5%), the Czech Republic (4.1% versus 5.6%) and Germany (3.9%

versus 5.8%), and far below the EU28 averages of 12.4% versus 14.3% (Eurostat, online data).

The *NEET [Neither in employment nor in education or training]* rate of young people aged 15–24 in the Czech Republic is currently one of the lowest in EU countries with 5.7% in 2019, compared to 5.7% in Germany and 7.1% in Austria – all below the EU 28 average of 10.1%. Lower rates were only found in northern countries (Sweden, Iceland, Norway, the Netherlands) (Eurostat, online data).

Socio-economic environment and IVET Features

Despite the above similarities there are also differences regarding economic environment and labour market structures as well as certain IVET features among the three economies and education systems, briefly discussed below for each country (see [Table 1](#)). One such difference is that, unlike the Czech Republic, Austria and Germany have a so-called ‘dual system’ of vocational education, insofar as skills are taught both at school and in the workplace. Apprentices spend about 60–80% of learning time in the company and 20–40% in vocational school. In contrast, the Czech IVET is mainly ‘school-based’ with much shorter internships in companies. At least 75% of the curriculum is taught at school (OECD 2020).

With this in mind, the next section takes a deeper look comparing the socio-economic environment and selected IVET features of the three countries under study.

Austria

Austria’s economic structure is largely based on small and medium-sized enterprises (SMEs) which have been the core of Austria’s productivity and competitiveness in the past (e.g., tourism, mechanical engineering, automotive suppliers). The employment rate of young adults (aged 25–34) with upper-secondary or post-secondary non-tertiary *vocational* education was 89% in 2019 – three percentage points higher than tertiary education graduates (86%) and 18 points higher than those with a general qualification (71%). However, this employment advantage tends to decrease with age. The employment rate of adults aged 45–54 with upper-secondary or post-secondary non-tertiary education was 88% for adults with vocational and 84% for adults with general education in 2019 (OECD 2020).

Austria currently has 218 legally recognised apprenticeship occupations to choose from (Federal Ministry for Digital and Economic Affairs [BMDW] 2018) with engineering, manufacturing and construction being the most common occupational fields. Austria’s dual IVET system has a duration of 2–4 years, with the 3-year version being the most frequent (OECD 2020).

Table 1. Economic and IVET features of Austria, the Czech Republic and Germany.

	Austria	Czech Republic	Germany	EU 28
Socio-economic environment (2019)				
Population (in thousands)	8901	10,693	83,166	513,471
GDP per capita in PPS ⁵	127	92	121	101
Av. GDP growth (2014–2018) (World Bank)	1.82	1.91	3.56	1.95
Unemployment rate of ages 15–74 (total)	4.5%	2.0%	3.1%	6.3%
Youth unemployment rate (ages 15–24)	8.5%	5.6%	5.8%	14.3%
Youth unemployment rate of ages 15–24 with upper-secondary and post-secondary non-tertiary education (levels 3 and 4)	6.9%	4.1%	3.9%	12.4%
NEET rate of ages 15–24	7.1%	5.7%	5.7%	10.1%
Employment rates of ages 25–34 by educational attainment (OECD 2020)				EU 23
Below upper sec.	58% ^{86%} (71%/89%)			58%
Upper-sec. or post-sec. non-tertiary (general/vocational)	86%	82% (81%/83%)	59% 84% (61%/88%)	80%
Tertiary		78%	88%	(73%/82%) 85%
Employment rates of ages 45–54 by educational attainment (OECD 2020)				EU 23
Below upper sec.	69% ^{87%} (84%/88%)	66%	69%	65%
Upper-sec. or post-sec. non-tertiary (general/vocational)	93%	94% (95%/92%)	88% (79%/89%)	84%
Tertiary		97%	94%	(82%/84%) 92%
Earning difference between adults with upper-secondary or post-secondary non-tertiary vocational education versus general education at this level	–19%	+34%	–15%	–1%
			(–61% compared to tertiary educated adults)	
IVET features (2019)				
Recognised training occupations	218 (BMDW, 2018)	279	327	-
IVET duration	2–4 years (3 years are common)	2–4 years (with matura: 4, apprenticeship certificate: 3, mere completion: 2)	3 years	-
Educational attainment of ages 25–34				EU 23

(Continued)

Table 1. (Continued).

	Austria	Czech Republic	Germany	EU 28
Below upper sec.	11%	7%	13%	13%
Upper-sec. or post-sec. non-tertiary (general/vocational)	8%/40%	36%/24%	8%/46%	14%/30%
Tertiary	42%	33%	33%	44%
Share of upper-sec. students enrolled in VET programmes (2018)	68%	71%	46%	42% (=
Share of women	43%	45%	36%	OECD av.)
Share of upper-sec. VET students enrolled in combined school- and work-based programmes (2018)	45%	n/a	89%	45%
Share of upper-sec. VET students enrolled in programmes providing direct access to tertiary education (2018)	95%	68%	92%	34%
				70%

* AE = Academic education (ISCED 3), DV = dual IVET, SV = School-based IVET
 Data source: Eurostat (online data), OECD (2020)

Austria has a well-established IVET system with 68% of upper-secondary students opting for VET programmes (43% of whom are female) in 2018 compared to the OECD average of 42% (45% of whom are female). Students can choose between two pathways, a vocational training track (vocational colleges, vocational schools and apprenticeship training) and a general education track (secondary academic school). In 2019, 45% of upper-secondary vocational students were enrolled in combined school- and work-based programmes (dual vocational programmes), two fifths opted for a VET school or college, and one fifth continued at secondary academic schools (Bauer & Gessler 2017, 51; OECD 2020).

The vocational matriculation examination (so-called 'Berufsaufnahmeprüfung') can be taken free of charge at the same time as the apprenticeship ensures unrestricted access to higher education and universities. Thereby, upper-secondary vocational students in Austria have better prospects of undertaking tertiary education compared to other OECD countries, with 95% of upper-secondary vocational students enrolled in programmes that offer the chance of direct access to tertiary education compared to the OECD average of 70% (OECD 2020).

Czech Republic

In 2019, *The Guardian* dubbed the Czech Republic 'one of Europe's most flourishing economies' (Tait 2019), representing one of the most successful post-Soviet countries in this respect. The Czech economy demonstrated considerable economic growth between 2014–2018 based on the model of low wages and high reliance on foreign direct investments. At the same time, the Czech labour market continues to shift towards higher-skilled employment (OECD 2018). The employment rate of young adults (aged 25–34) with upper-secondary education was 82% in 2019 and thus higher compared to the employment rate of younger adults with tertiary education (78%). The employment rate of upper-secondary or post-secondary non-tertiary vocational graduates was thus slightly higher compared with those with a general qualification (83% versus 81%). As is the case in most OECD countries, the employment advantage decreases and reverses with age (92% versus 95% among ages 45–54) (OECD 2020).

The Czech Republic has a traditionally strong IVET system. Dual vocational education existed until 1989, when the state took charge of IVET, leading to a shift to a mostly school-based system (with at least 75% of the curriculum taught within the school environment), which also led to a gradual decrease of young people interested in apprenticeships (Průcha 2019). Several types of schools provide IVET and 279 different vocations are officially registered at the upper-secondary level of education (National Institute for Education 2019; see also Straková 2015) with engineering, manufacturing and construction being the

most common fields of study (OECD 2020). Programmes typically last 2–4 years depending on whether they involve the *maturita* exam (4 years), an apprenticeship certificate (3 years) or merely a certificate of completion (2 years).

Nowadays, the majority of students follow the vocational path – about 7 out of 10 upper-secondary graduates obtain a vocational qualification (71%) with 45% of first-time graduates being female (OECD 2020). Czech vocational students' preparation is highly specialised, providing them with skills very specific to certain vocations.

Some vocational tracks present a *terminus* (short VET programmes of three years⁶ or less without *maturita*) and do not allow graduates to continue to tertiary education unless they take a 2-year follow-up course to obtain *maturita* certification. Overall, 68% of upper-secondary vocational students are enrolled in programmes which offer direct access to tertiary education, slightly less than the OECD average (70%) (OECD 2020).

Germany

Micro, small and middle-sized companies with up to 249 employees play a major role in the well-established dual VET system (work- and school-based apprenticeships) in Germany by providing most apprentice placements (Hippach-Schneider and Huismann 2019). Young adults in Germany with a vocational qualification have a particularly strong advantage in the labour market: 88% of 25- to 34-year-olds with upper-secondary or post-secondary non-tertiary vocational qualification are employed compared to 61% of those with a general qualification and 88% of those with tertiary education. The employment advantage of vocational qualifications remains strong over time in Germany for 45- to 54-year-olds (89%) compared to their counterparts with general (79%) or tertiary education (94%) (OECD 2020).

In Germany, about one in two secondary school graduates chooses a vocational path (46% in 2019, with 36% of the enrolled students being female). Some 327 recognised training occupations are offered, with engineering, manufacturing and construction, and business, administration and law being the more common fields of study.⁷ Germany's dual IVET consists of alternating school-based courses with company training and typically has a duration of three years. In Germany, 89% of upper-secondary vocational students are enrolled in combined school- and work-based programmes, which is considerably higher than the OECD average (34%). Full-time school-based IVET accounts for less than 20% compared to dual IVET.

There is a clear and regulated pathway for vocational students to pursue further education. In Germany, 92% of upper secondary vocational students are enrolled in programmes that offer the chance of direct access to tertiary education, higher than the OECD average of 70% (OECD 2020).

Summary of country background

To summarise, the share of upper-secondary students enrolled in *vocational* education programmes is quite high in Austria (68%) and the Czech Republic (71%) and lower in Germany (46%), with an OECD average of 42%. Almost all of the vocational programmes in Austria (95%) and Germany (92%) also offer the chance of direct *access to tertiary education*, while this is the case for 68% in the Czech Republic.

Employment rates of those aged 25–34 with upper-secondary or post-secondary non-tertiary *vocational* education are generally higher than employment rates of their counterparts with *general* education, with large differences in Austria and Germany. Although reduced, this employment advantage remains with age. Additionally, employment rates of graduates in *vocational* education are equally favourable (Germany) or slightly higher (Austria, Czech Republic) compared to young adults with *tertiary* education. The latter employment advantage decreases with age though, with 45- to 54-year-old tertiary-educated adults showing higher employment rates in all three countries (with a difference of five percentage points in each case).

In addition, relative earnings are considerably lower for adults with upper-secondary or post-secondary non-tertiary *vocational* education compared to their *general* education counterparts. The former earn less in Austria (–19%) and Germany (–15%) but much more in the Czech Republic (+34%) (OECD 2020).

Finally, the increasing permeability of VET systems (i.e., the ability to pass from one education track to the other or to continue to higher education) and options for lifelong learning have the potential to mitigate the tensions between general and vocational pathways (e.g., Brunello and Wruuck 2019).

Methods

Data and analytical approach

The study analysed the PIAAC 2013 dataset to answer the research questions. However, the publicly accessible international data files do not contain precise information about the specific track each respondent graduated from, as the coding of education qualifications is standardised to international norms, usually not allowing for more detailed distinctions. Therefore, national scientific PIAAC 2013 data files were used.⁸ These data files do inform of the specific track the respondent graduated from and come with corresponding weight variables (SPFWT0 – final sample weight).

To estimate the relationships between education qualification (regressor) and labour market success (regressand), while also controlling for other influences, multiple OLS regression models were calculated separately for each country and for two groups: aged 15–24 and aged 25–64. The analysis included

only respondents that constitute the country workforce, thus excluding students, retired pensioners, permanently disabled persons, those serving a compulsory military service or community services or those fulfilling domestic tasks or looking after children/family.

First, baseline models (1) containing the educational qualification as predictors of labour market success were estimated; then, extended models (2) with control variables were built for the two cohorts in all three countries separately:

$$y_i = \alpha + \gamma_1 D_{i1} + \dots + \gamma_5 D_{i5} + \varepsilon_i \quad (1)$$

$$y_i = \alpha + \gamma_1 D_{i1} + \dots + \gamma_5 D_{i5} + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon_i \quad (2)$$

where y_i is a predicted value of the labour market success index for individual i , γ_s are estimated coefficients for dummy-coded education level categories D (five in the Czech Republic and four in Austria and Germany, see below for elaboration), β_s are estimated coefficients for control variables (X_1 for gender, X_2 for years of work experience, X_3 for immigration status, and X_4 for numeracy skills) and ε_i is the error term. The applied measures are elaborated further below.

Calculations were performed using IEA's IDB analyser designed for analysing large-scale data with the ability to replicate weights (taking into account the complexity of the sampling methods) and to handle plausible values (used for the estimation of performance in the selected skill) correctly.⁹

Measures

Labour market success

Many previous studies have operationalised labour market success using indicators of unemployment (e.g., Thapa 2004), labour market mismatch (e.g., Støren and Wiers-Jenssen 2010), the pay/salary levels (e.g., Golsteyn and Stenberg 2017), or other one-dimensional indicators. However, this rather simplistic approach does not enable a more nuanced view of a concept of such complexity as labour market success. Thus, to compensate for the disadvantages of one-dimensional concepts, this study uses *multi-dimensional* measures of labour market success developed and validated by Annen (2019) using the Canadian PIAAC dataset to investigate the labour market success of immigrants in the Canadian labour market. The index of labour market success for our study was constructed replicating Annen's (2019) procedure.

First, the relevant variables that each reflect a part of the individual's labour market success were selected for index construction (see Table 2).

Most of the variables used to construct the index were unambiguous and directly included in the dataset. Specific remarks are warranted in the case of the *gross hourly wage* variable. A decile of the hourly wage was used instead of the actual hourly wage because the hourly wage was missing in Austria. Moreover,

Table 2. Variables used to create the index of labour market success.

Variable description (PIAAC dataset variable name)	Scaling	Categories (values)
Employment status (C_Q07)	Ordinal	Full-time employed (1) Part-time employed (2) Unemployed (3)
Gross hourly wage (EARNHRDCL)	Ordinal	deciles (1 lowest decile, 10 highest decile)
Hierarchical status in the company (D_Q08a)	Ordinal	Without managerial responsibility (1) Responsibility for <5 people (2) Responsibility for >5 people (3)
Type of contract (D_Q09)	Ordinal	An indefinite contract (1) A fixed-term contract (2) A temporary employment agency contract (3) An apprenticeship or other training scheme (4) No contract (5)
Weekly working hours (D_Q10_C)	Metric	1–60 hours
Formal qualification level required for the job (D_Q12a)	Ordinal	No formal qualification or below ISCED 1 (1) (...) ISCED 6 (14)
Individual skill match	Ordinal	Under-skilled or over-skilled (1) Well-matched (2)

Source: authors (based on PIAAC 2013 national datasets)

the average wages and price levels in the three countries differ, thus using a decile as a measure is more appropriate as it transforms the actual wages on a scale that is comparable across the three countries.

Skill mismatch was included on the grounds that ‘individuals working in a job matching their skills are interpreted as being more successful than working in a job . . . which underuses their skills or for which they have been under-trained’ (Annen 2019, 226). The variable was calculated as follows: First, in each country separately, the mean numeracy score for each occupation (ISCO 1-digit-level) and 1.5 standard deviations were added as well as subtracted from the mean to define the interval against which an individual’s numeracy skill level (average of the 10 plausible values) is compared. If it falls within the range, the individual is considered ‘well-matched’; if their individual score is lower than the defined occupation range, they are assigned to the category of ‘under-skilled’, while if the opposite is true, they are deemed ‘over-skilled’ (see Annen 2019 for details).

Second, after running the principal component analysis on these variables using the varimax rotation, the Kaiser-Meyer-Olkin (KMO) test of sampling adequacy was performed. Its values were 0.647 for Austria, 0.561 for the Czech Republic and 0.602 for Germany, and the overall value for all three countries was 0.589. All these values achieved an acceptable level, that is, they are higher than 0.5 (Field 2009) – this shows that the chosen variables were appropriate for conducting the factor analysis.

Third, factor scores resulting from the one-factor model (values of index of labour market success) for each respondent were consequently calculated using the full dataset (containing the three countries). Factor loadings can be found in the Appendix.

Factor scores were calculated using the regression method, which adjusts the factor loadings to take account of the initial correlations between variables, thus stabilising the differences in units of measurement and variable variances (Field 2009, 626). These factor scores (values of the index of labour market success) were consequently used in the OLS regression models as dependent variables.

Qualification/track

No comparison was made of the skills of graduates within specific fields of study in vocational education (the subsamples would be too small to draw any conclusions), but specific distinctions were made for tracks at the ISCED 3 level in each country. Thus, apart from the academic track, dual and school-based vocational education graduates were distinguished in Germany and Austria at the ISCED 3 level. In the Czech Republic, tracks with *maturita*, that is, school-leaving exams (academic, technical and vocational) and without *maturita* (apprenticeship track) were distinguished. Other education qualifications were merged into two newly created categories, ‘below ISCED 3’ and ‘ISCED 4 or higher’. The reference category in each of the three regression

models is 'below ISCED 3'. The coding of corresponding education tracks in the three countries in the PIAAC 2013 data can be found in the Appendix.

Control variables

In the regression models, we controlled for four additional variables to fix their effects on the dependent variable (labour market success): Gender, years of work experience, immigration status, and numeracy skills.

Gender. Gender inequalities in the labour market are a well-documented issue in the scholarly literature, with one of the most visible issues being a persistent pay-gap (Bergmann, Scheele, and Sorger 2019). According to Eurostat (Boll and Lagemann 2018), Austria, the Czech Republic and Germany are among the five EU countries with the largest gender pay-gap (from 19.9% in Austria to 21.1% in the Czech Republic). As the pay level in deciles is the constituting variable of labour market success, we control for gender in the regression models. The values are coded male (1) and female (2).

Years of work experience. Much of the previous literature has found a convincing association between the length of work experience and different variables related to labour market success (e.g., Mincer 1974; Dustmann and Meghir 2005). This variable (C_Q09_C) refers to years of paid work in a lifetime in the PIAAC dataset, with integer values between 0–47.

Immigration status. Much previous research has shown that immigrants are disadvantaged in the labour market (e.g., Kogan 2011; Krause and Liebig 2011). To control for this influence, regression models use a simplified binary categorical variable, denoting respondents whose both parents were born outside of the country (1) and respondents with at least one parent born in the country (2).

Numeracy skills. Literacy, numeracy and problem-solving skills, that is, skills measured by PIAAC, are highly correlated (OECD 2016). Therefore, in line with Annen's (2019) study, only numeracy skills were included in calculations of regression models. In the computations, all ten plausible values were used. Skills were measured using the same methodological processes in all three countries and are therefore directly comparable.

Results

In this paper we investigated the labour market success of IVET graduates, analysing the outcomes of different age cohorts at a point in time in Austria, the Czech Republic, and Germany. In this section, the descriptive results are presented, then regression models are shown and commented upon.

Descriptive results

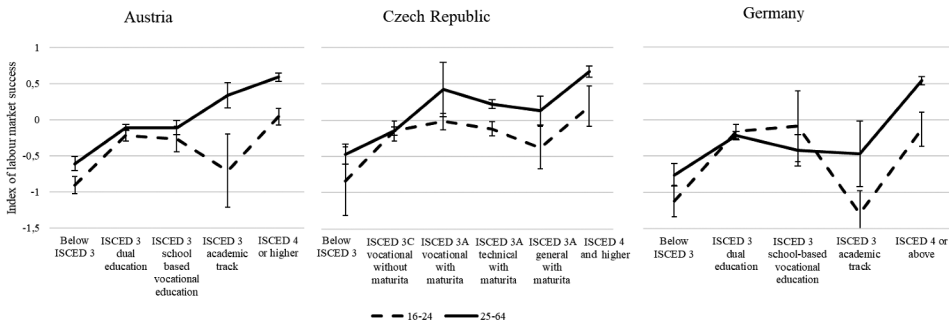


Figure 1. Labour market success index average values of the graduates with corresponding qualification. Source: own calculations from PIAAC 2013 data; error bars show 95% CI.

Figure 1 shows the means of labour market success (LMS) for the two age groups and graduates of different tracks. The patterns in the young generation (aged 15–24) are somewhat similar in the three countries. At the ISCED 3 level of education, IVET graduates demonstrate higher mean values of the LMS index compared to their counterparts with below ISCED 3 education. Compared with the academic track, the LMS index of ISCED 3 graduates is significantly higher only in Germany, where they are even on par with the level of ISCED 4 or higher. Importantly, in all three countries, the mean LMS index does not differ significantly between graduates of different IVET tracks at the ISCED 3 level, thus showing no apparent advantage of dual education graduates in terms of labour market success in the younger cohort compared to school-based IVET in Austria and Germany, and no significant differences between graduates of vocational and technical tracks in the Czech Republic.

In the workforce group aged 25–64, the patterns are similar, except that academic track graduates’ LMS average index values are comparable to those of IVET ISCED 3 graduates (and in Austria even higher).

Regression models

The results of the regression models indicate considerable differences regarding the effects of different IVET ISCED 3 tracks on labour market success in the three countries. The results for each country will be presented separately in this section and discussed in the next section (see Table 3).

Austria

In the baseline model of Austrian youths (aged 15–24), education qualification explains 17% of individual labour market success. Both *dual* and *school-based* education contribute to the higher labour market success of their holders



Table 3. Multiple linear regression models predicting labour market success.

	Aged 15–24				Aged 25–64			
	Baseline model		Extended model		Baseline model		Extended model	
	β	(S.E.)	β	(S.E.)	β	(S.E.)	β	(S.E.)
AUSTRIA								
Qualification (ref: below ISCED 3)								
ISCED 3 – dual education	0.28	(0.05)***	0.02	(0.06)	0.13	(0.03)***	-0.02	(0.03)
ISCED 3 – school-based VET	0.14	(0.05)**	0.12	(0.05)*	0.10	(0.03)***	0.06	(0.03)*
ISCED 3 – academic track	-0.02	(0.12)	-0.06	(0.12)	0.17	(0.02)***	0.08	(0.02)***
ISCED 4 or higher	0.37	(0.05)***	0.30	(0.06)***	0.52	(0.03)***	0.35	(0.03)***
Years of work experience			0.39	(0.07)***			0.18	(0.02)***
Female			-0.14	(0.05)**			-0.35	(0.02)***
Immigrant			0.02	(0.06)			0.04	(0.02)
Numeracy skills			0.25	(0.07)***			0.24	(0.03)***
Adjusted R ²	0.17		0.35		0.18		0.41	
N	308		306		2164		2158	
CZECH REPUBLIC								
Qualification (ref: below ISCED 3)								
ISCED 3 – apprenticeship (without maturita)	0.07	(0.08)	-0.01	(0.1)	0.04	(0.05)	-0.11	(0.05)*
ISCED 3 – vocational track (with maturita)	0.07	(0.03)*	0.05	(0.02)*	0.12	(0.04)**	0.08	(0.04)*
ISCED 3 – technical track (with maturita)	0.11	(0.07)	0.00	(0.07)	0.28	(0.04)***	0.13	(0.05)**
ISCED 3 – academic track	-0.02	(0.06)	-0.08	(0.07)	0.09	(0.03)**	0.04	(0.03)
ISCED 4 or higher	0.21	(0.08)**	0.17	(0.07)*	0.56	(0.04)***	0.37	(0.05)***
Years of work experience			0.29	(0.07)***			0.09	(0.03)**
Female			-0.01	(0.08)			-0.24	(0.03)***
Immigrant			-0.08	(0.04)			-0.04	(0.03)
Numeracy skills			0.17	(0.12)			0.23	(0.03)***
Adjusted R ²	0.05		0.16		0.25		0.37	
N	244		243		2138		2120	
GERMANY								
Qualification (ref: below ISCED 3)								
ISCED 3 – dual education	0.39	(0.06)***	0.32	(0.07)***	0.14	(0.04)***	0.00	(0.04)
ISCED 3 – school-based VET	0.10	(0.06)	0.10	(0.06)	0.02	(0.02)	-0.01	(0.02)
ISCED 3 – academic track	-0.19	(0.07)***	-0.33	(0.07)***	0.03	(0.02)	-0.02	(0.02)
ISCED 4 or higher	0.24	(0.07)***	0.13	(0.07)*	0.54	(0.03)***	0.30	(0.04)***
Years of work experience			0.17	(0.09)			0.08	(0.02)***
Female			0.03	(0.08)			-0.32	(0.02)***
Immigrant			-0.19	(0.08)**			-0.01	(0.02)
Numeracy skills			0.37	(0.08)***			0.27	(0.02)***
Adjusted R ²	0.27		0.47		0.19		0.38	
N	224		222		2670		2656	

*p < .05 **p < .01 ***p < .001; β s are standardised coefficients; data source: PIAAC 2013

compared to those with a 'below ISCED 3' level of education, while the academic track remains on par with the 'below ISCED 3' level.

When control variables (years of work experience, gender, immigrant status, numeracy skills) are included, the explained variance of the extended model rises to 35%. Surprisingly, the effects of *dual* IVET education on labour market success diminish (i.e., the standardised β coefficient decreases from 0.28 in the baseline model to 0.02 in the extended model). Thus, although the descriptive findings indicate that young Austrian *dual* education graduates tend to be more successful in the labour market than their counterparts with other ISCED 3 level qualification, this success is likely to be attributed to other variables than their qualification. *School-based* vocational education is associated with slightly higher labour market success, compared to other ISCED 3 (or lower) qualifications of the young workforce. However, the effect of *school-based* VET ($\beta = 0.12$) is still 2.5 times lower than that of 'ISCED 4 or higher' qualifications ($\beta = 0.30$).

In later stages of life and career (aged 25–64), after the control variables are applied, the extended model indicates that *dual* education graduates' success in the labour market does not differ from those of the 'below ISCED 3' level. In comparison with the latter group, *school-based vocational* and *academic* ISCED 3 qualifications tend to increase labour market success ($\beta = 0.06$ and 0.08 respectively), but their effects are quite small.

Czech Republic

The results of the baseline model suggest that in the young Czech generation, those having graduated from vocational schools with *maturita* ($\beta = 0.07$) and graduates with an ISCED 4 education level ($\beta = 0.21$) are more successful than youths without ISCED 3 qualification. Yet, other ISCED 3 qualifications, that is, apprenticeship without *maturita* or academic track, do not comparatively contribute to higher labour market success.

After introducing the control variables to the extended model for the group aged 15–24, the positive effect of graduating from *vocational* track with *maturita* decreased ($\beta = 0.05$), whereas completing an *apprenticeship without* *maturita* or the *academic* track with *maturita* did not affect the labour market success of young Czechs, compared to young people with 'below ISCED 3' qualifications.

In the Czech Republic, qualification itself explains five times more variance of the LMS index in the group aged 25–64 (baseline model's adjusted $R^2 = 25\%$) compared to those aged 15–24 (baseline model's adjusted $R^2 = 5\%$). These results indicate that in the Czech Republic, formal education credentials are more significant in the later stages of professional life for explaining labour market success.

The associations between qualification and labour market success among those aged 25–64 hold true even after control variables are introduced in the extended model: graduating from either *technical* or *vocational* tracks (both with *maturita*) is associated with higher labour market success (β coefficients are 0.13 and 0.08 respectively), but lower among *apprenticeship* certificate holders

without *maturita* ($\beta = -0.11$). The effects tend to be highest for 'ISCED 4 and higher' graduates ($\beta = 0.37$).

Germany

Patterns in Germany are somewhat different from the other two countries. The baseline model for ages 15–24 shows that the effect of *dual* education on labour market success ($\beta = 0.39$) is 1.5 times higher than the effect of 'ISCED 4 or higher' qualifications ($\beta = 0.24$), when compared to 'below ISCED 3' qualifications. Whilst *school-based* vocational education graduates do not succeed better than unqualified youth, the labour market success of young graduates of the ISCED 3 *academic* track is even worse than if they had no qualification ($\beta = -0.19$), and their situation worsens considerably after introducing the control variables in the extended model ($\beta = -0.33$).

Importantly, among German youth, the positive association between *dual* education and labour market success remains strong even after accounting for years of experience, gender, immigration status and numeracy skills ($\beta = 0.32$). Thus, in Germany we find the largest differences between the influence of *academic* and *dual* ISCED 3 education on the labour market success of the young generation ($\beta = -0.33$ versus $\beta = 0.32$ respectively).

When looking at the baseline model for ages 25–64, we see that compared to the young generation, the positive influence of *dual* education on labour market success decreases (from $\beta = 0.39$ to $\beta = 0.14$), whilst the importance of 'ISCED 4 and higher' qualifications increases (from $\beta = 0.24$ to $\beta = 0.54$). However, after accounting for the control variables, the model shows no statistically significant associations of ISCED 3 level qualifications and labour market success.

This is in line with the fact that education qualification explains 27% of young individual market success, but only 19% when it comes to 25- to 64-year-olds. The results suggest that, unlike in the Czech Republic, educational credentials tend to be more important in predicting labour market success at the beginning of an individual's career and less important later on.

Control variables

The coefficients of the control variables included in the models displayed the expected direction of associations with the dependent variables, although their strength differed across countries and age groups. *Years of work experience* were positively associated with LMS index values in the young generation (aged 15–24), but their importance was generally lower in older generations. *Numeracy skills* were shown to be major predictors of labour market success among young Germans and Austrians, but not Czechs, and play a significant role in predicting LMS among older generations. Elliott (2017) predicts, however, that over the next two decades, computers will increasingly be able to replace workers for tasks that require numeracy skills at a low to medium level of proficiency (levels 1–3), while

high cognitive levels of these skills (levels 4 and 5) are likely to increase in importance since developing these skills is one way for the working population to protect themselves from being replaced by computers and robots (Brunello and Wruuck 2019; OECD 2019). Currently, in the Czech Republic 20% of young people aged 25–34 have proficiency in numeracy at levels 4–5, compared to 18% in both Austria and Germany, while only 11% of working-age adults in OECD countries have proficiency in numeracy at these high levels (Elliott 2017). *Women* in the age category of 25–64 have lower LMS index values. Although women currently have higher levels of formal education than men on average, men enjoy better employment and earning outcomes from education, on average. For example, across OECD countries women have lower employment rates regardless of educational attainment and earn about two-thirds of the earnings of their male peers (OECD 2020). One possible interpretation is that they are more likely to care for children and take on family responsibilities, and thus give up their jobs, work part-time or part-year and hence interrupt their career. Finally, *immigration status* is associated negatively with LMS only in the young German cohort, but not in Austria or the Czech Republic. Overall, three of the four control variables (not immigrant status) show significant effects in each country with gender having the largest effect.

Overall, education qualification (level and track) plays a significant role in predicting the labour market success of youths aged 15–24 in all three countries. With the exception of ISCED 3 dual education in Germany, ‘ISCED 4 or higher’ qualifications – both before and after controlling for years of work experience, gender, immigrant status and numeracy skills – have the largest associations with the labour market success of both the younger (aged 15–24) and the older (aged 25–64) cohorts in the three countries. Considerable differences are also apparent in the impact of qualifications at the ISCED 3 level (see the Appendix for a summary table).

Discussion

In investigating the labour market success of IVET graduates across ISCED level 3 programmes over their lifetime in Austria, the Czech Republic and Germany, this paper contributes to the existing literature on predictors of labour market success and the role of education qualification (level and track) using comparable measures and a multi-dimensional concept of labour market success.

(1) We first looked at how far vocational education is associated with higher labour market success among 15- to 24-year-olds compared to other types of qualifications at ISCED 3 levels or below (after controlling for years of work experience, gender, immigration status, numeracy skills) (research question 1). Overall, young ISCED 3 vocational education graduates in all three countries are more successful than graduates of other ISCED 3 tracks or below ISCED 3 level and (with the exception of Germany) less successful than ISCED 4 or higher

education graduates. However, the LMS of IVET ISCED 3 young graduates (aged 15–24) differ in the three countries in that the success of each specific IVET system and its programmes has evolved in response to each country's unique context and history. Hence, the three systems are similar in some ways but also different, without necessarily implying the superiority of any one of them over the others.

In the *Czech Republic*, which does not offer dual vocational education, the effects of vocational education are negligible and only ISCED 4 education provides a difference. Thus in their early careers, Czech youth do not really benefit from upper-secondary vocational education in terms of overall labour market success measured through the LMS index. These findings extend Straková's (2015) observations that vocational education does not always provide a safe path to the labour market, noting the dire labour market situation of apprenticeship (ISCED 3 C) graduates. While during the communist era, Czech vocational education enjoyed a relatively high status and on-the-job training was provided by state-owned companies, after 1989 the responsibility of employers for apprentice vocational preparation was strongly reduced (partly because they were not able to survive the newly established market environment and many of them went bankrupt) and also the aspirations of youths shifted towards general education tracks or at least tracks that allow enrolling at university. These developments led to a decrease of the quality and interest of the young population in apprenticeships (Průcha 2019, see also Straková 2015). The results of the present study document the outcomes of this evolution.

More importantly, our analysis shows that although dual education in Austria and Germany provides youth with higher labour market success, its 'net' effect differs in the two education systems. In *Germany*, the impact remains almost 2.5 times higher than the effect of ISCED 4 and higher education after introducing controls. These findings are aligned with the longitudinal study of Becker, Tetzner, and Baumert (2020), which found that vocational qualifications seem to be particularly decisive in predicting income and unemployment of young adults. In *Austria*, the higher labour market success of dual education graduates (compared to those with below ISCED 3) is more an indirect effect of other characteristics of the graduates, such as gender or years of experience.

These findings challenge the positive evaluation of dual education on labour market success, which may be mediated through other contextual circumstances, as is the case in Austria. On the other hand, our findings confirm Germany's achievement when it comes to dual education, at least in terms of the LMS of its young graduates. This labour market success of apprenticeship graduates may be partly explained by the fact that Germans trained in the apprenticeship system (like Swiss graduates, for example) are not stigmatised or labelled second class, as is the case in other countries such as the Czech Republic, with vocational education seen as the second or even least desirable choice in terms of educational pathways (e.g., Pilz 2009).

(2) Secondly, we looked at how the job market success of vocational ISCED 3 graduates differs *over their working life course* (i.e., what are the differences between the two age groups?) (research question 2).

Our analysis suggests that IVET facilitates success in the labour market in early stages of one's career, but its effects diminish later on in *Austria and Germany*, where the strength of association between IVET and the LMS index is lower in the 25+ cohort compared to the younger workforce (<25). The *Czech Republic* showed mixed results, indicating that formal education credentials play a more significant role in the later stages of professional life. In line with Straková's (2015), our study confirms that 25- to 64-year-old Czechs who graduated from either technical or vocational tracks with *maturita* enjoy higher labour market success compared to apprenticeship graduates (without *maturita*) and to their younger counterparts (up to 24 years) with the same qualification level/track.

Overall, the results suggest that, except in the Czech Republic, educational credentials tend to be more important in predicting labour market success at the beginning of an individual's career and less important in later stages. Our findings confirm Forster, Bol and Van De Werfhorst (2013), who found that the higher employment probability associated with a vocational qualification, especially in countries where the vocational system provides highly occupation-specific skills, reverses in later life. They are also in line with Hanushek et al.'s (2017) findings that the later-career disadvantage seems most prominent in countries with a strong VET sector.

Finally, some *limitations* apply to this study. While the analysis of PIAAC data using comparable measures and a multi-dimensional concept of labour market success provides valuable insights into the labour market success of younger and older cohorts depending on education qualification and controlling for contextual factors, the PIAAC data used in the paper are nearly a decade old and did not take into account the recent developments related to COVID-19, for example. Future studies would need to collect and draw on newer data sets. Moreover, an even greater focus on country-specific aspects (e.g., Austria's LMS) could provide more information about mechanisms of how dual-education graduates navigate the labour market and seek opportunities to be successful, while taking the local history and context into account.

Conclusion

Do upper-secondary level IVET training systems (where most vocational education takes place) serve as a lasting 'safety net' or as a 'diversion' with regard to labour market success at the start and throughout graduates' working life course? Our data suggest that: (1) young ISCED 3 vocational graduates in all three countries are more successful than graduates of other (below) ISCED 3 tracks; (2) the labour market success of vocational ISCED 3 graduates is

comparatively higher in younger cohorts (aged 16–24) compared to older cohorts (aged 25–64), that is, the advantages of vocational education quickly diminish in older age cohorts ($\geq 25+$) in all three countries, regardless of the specific type of education (e.g., school-based versus dual).

Our detailed analysis shows that there are large differences in how education type and level influence job market success both among young people and throughout careers. Our findings indicate that vocational education helps young graduates succeed in the labour market compared with lower levels of education. However, each country has a favoured ISCED 3 vocational education type when it comes to labour market success. Our study suggests that both school-based and dual IVET can lead to the LMS of its graduates depending on the students themselves and the stages of their career, the country's socio-economic environment and various IVET features of the education system under study. Thereby dual IVET can provide its students with direct exposure to the labour market to acquire the most relevant workplace skills. Hence, comparing IVET as a whole without distinguishing between levels and particularly types can be misleading with regard to the labour market success of graduates. For future studies, similar analyses involving more education levels and more countries would shed further light on IVET graduates' labour market success in both early and later stages of their careers.

Notes

1. In this paper we focus on *initial* VET (IVET), which is usually part of a highly regulated school system. The more heterogeneous continuing VET (CVET) is not the subject of this paper.
2. The survey conducted in June 2016 examined EU citizens' view of VET in their country across a representative sample of European residents aged 15 and over, conducting a total of more than 35,000 interviews across the 28 member states (Salvatore and Villalba-Garcia 2018).
3. European Federation of Education Employers [EFEE] and the European Trade Union Committee for Education [ETUCE].
4. The KOF Youth Labour Market Index (KOF YLMI), published by the KOF Swiss Economic Institute at ETH Zurich, measures the quality of young people's (aged 15 to 24) integration into the labour market using a multi-dimensional approach and comparing data from 193 countries recognised by the United Nations (see Pusterla and Oswald Egg 2019 for details).
5. The official designation of the three-year programme in ISCED 2011 classification is 'Secondary education courses with *apprenticeship* certificate' (UNESCO 2021). These short IVET programmes at the ISCED 3 C level are thus termed 'apprenticeship programmes' in this study (see also Straková 2015), although the share of on-the-job training in their curricula is much lower compared to apprenticeships (dual education programmes) in Germany or Austria.
6. Most apprentices obtain either the intermediate secondary school leaving certificate or the lower-secondary school leaving certificate. However, in 2016, almost one in three apprentices (28.7%) was a high-school graduate (Hippach-Schneider and Huismann 2019).

7. In the case of Austria and the Czech Republic, these files were publicly available. For Germany, the data were provided by the GESIS Leibniz Institute for the Social Sciences (20172017) upon the authors' request.
8. See <http://www.oecd.org/skills/piaac/publicdataandanalysis/> [March 28, 2021].
9. Purchasing Power Standards expressed in relation to the European Union average set to equal 100.

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