Research in Social Stratification and Mobility 67 (2020) 100495

Contents lists available at ScienceDirect

Research in Social Stratification and Mobility

journal homepage: www.elsevier.com/locate/rssm

Income during the early career: Do institutional characteristics of training occupations matter?

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ARTICLE INFO

Keywords:
Institutional characteristics
Income
Standardization
Specificity
Vertical differentiation
Labour market entry
Vocational education and training
Multilevel regressions

ABSTRACT

This paper addresses the mechanisms leading to income differences during the early career, both between individuals and between occupations. It compares the level of standardization, vocational specificity, and vertical differentiation of vocational education and training (VET) programmes and examines how these differences affect VET diploma holders' incomes in their early careers. We go beyond previous research by developing refined theoretical concepts of vocational specificity, standardization, and differentiation and by measuring them with novel curriculum-based data. Theoretically, the paper assumes that training programmes' institutional characteristics determine income by influencing diploma holders' productivity as well as the signalling power of the degree. We test our hypotheses by combining institutional data from VET curricula with individual-level data from the Swiss Labour Force Survey and by applying multilevel regression analyses. The results show that the institutional dimensions, in particular vocational specificity, are multifaceted and consist of several subdimensions, which impact young workers' incomes to different degrees at various time points during their early careers.

1. Introduction

Income differences remain a source of social inequality, even between individuals with the same level of education. In Switzerland, the pronounced differences in average entry-level wages between vocational education and training (VET) occupations with similar training durations are particularly striking (Pfister, Tuor Sartore, & Backes-Gellner, 2017). Even though VET is known to facilitate a smooth school-to-work transition (Gangl, 2001; Müller & Shavit, 1998), it still produces considerable inequality in the returns to education (Swiss Federal Statistical Office, 2018). The reasons for these inequalities among young people with similar education qualifications and the same training durations are still not fully explored even though differences in income levels between occupations have been a recurring topic in stratification research. Explanations includes differences in employment relations (Goldthorpe, 2000; Wright, 1997), mechanisms of closure, such as licensing and unionization (Bol & Weeden, 2014; Weeden, 2002), gender composition (Leuze & Strauß, 2016; Murphy & Oesch, 2016), risk level in occupations (Rosen, 1986; Viscusi, 1993), and a task-based approach (Autor & Handel, 2013; Williams & Bol, 2018). A further strand of theory focuses on skill requirements within occupations to explain wage inequality (Le Grand & Tåhlin, 2013). We aim at extending this strand of research by arguing that income inequalities in the early careers of people holding VET diplomas are partly due to institutionalized differences in training characteristics, which affect the VET diplomas' signalling value as well as the average skill level of the diploma holders. This argument draws on comparative research on education systems that implies that the institutional characteristics of education systems, such as the levels of standardization, differentiation, and vocational specificity, impact individual skill formation and productivity and thereby affect labour market outcomes (Breen, 2005; Müller & Shavit, 1998; van de Werfhorst, 2011; Wolbers, 2007). These findings suggest that highly standardized and vocationally oriented education systems with a high degree of differentiation give young workers a favourable start in the labour market, and that general education increases in importance over the career (de Lange, Gesthuizen, & Wolbers, 2014; Hanushek, Schwerdt, Wössmann, & Zhang, 2017; Wolbers, 2007).

However, the mechanisms that explain the relationship between institutional characteristics and income are situated at the level of educational programmes rather than national education systems. Within VET, individuals are allocated to occupational fields or training

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https://doi.org/10.1016/j.rssm.2020.100495
Received 17 April 2019; Received in revised form 11 February 2020; Accepted 22 March 2020
Available online 03 April 2020

occupations. We argue that this context directly influences their skill development and quantity, quality, and type of human capital endowment, which in turn impacts productivity and income levels. We therefore compare training occupations and investigate whether income differences between VET diploma holders are related to the institutional characteristics of their training programmes. In particular, we analyse how the standardization, differentiation, and vocational specificity of occupation-specific upper secondary training programmes impact the income level of VET diploma holders. We focus on the early career: the first 15 years of labour market experience. In this period, institutional characteristics of the training programme should be particularly important for career outcomes because their effects are not yet moderated by work experience or further training.

The Swiss VET context is ideally suited to studying this question. Two thirds of all compulsory school leavers start vocational education and training in one of approximately 230 different training occupations. The majority pursue a dual apprenticeship, with training in three locations: the training firm, inter-company courses, and vocational school. A minority of 10 % attend a fully school-based type of VET. Dual programmes combine a large share of practical training with some theoretical education, and they impart occupation-specific skills as well as some general knowledge and skills. Most programmes last three or four years. All are highly standardized, with apprentices following the same curricula and earning nationwide-recognized federal diplomas of VET. Due to the extensive involvement of labour market organizations in the development and implementation of VET, the diploma clearly signals labour-market-relevant skills to employers (Gangl et al., 2003; Iannelli & Raffe, 2007). However, despite the high standardization within the programmes, the training occupations differ significantly in their levels of exam standardization, differentiation, and specificity (Grønning, Kriesi, & Sacchi, 2018). We exploit these differences to gain a closer understanding of how the institutional characteristics of vocational education and training programmes shape income levels.

We contribute to previous research in several ways. First, we focus on the training programmes, because these determine the skill and knowledge development of students. Second, we go beyond the use of simple proxies, such as type or level of education (Korber & Oesch, 2019; Lavrijsen & Nicaise, 2017; Piopiunik, Schwerdt, & Wössmann, 2014), by making use of detailed curriculum-based data. This allows us to distinguish between subdimensions of institutional characteristics within VET and to analyse the dimensions simultaneously. Third, by controlling for two possible occupational-level confounders, labour market opportunities and intellectual requirement level (Buchs, Müller, & Buchmann, 2015; Stalder, 2011), we reduce the likelihood of estimating spurious effects of the institutional characteristics, thus avoiding a problem that hampers many existing studies.

2. Theory and hypotheses

We focus on theoretical arguments that explain how skill requirements and the signalling power of education programmes lead to income inequalities. First, differences in income arise because of differences in productivity levels based on individuals' human capital (Becker, 1975; Mincer, 1974). Second, wages may also depend on anticipated rather than actual productivity and trainability. When hiring employees and setting their starting wages, employers derive information on the applicants' productivity levels from available information sources, so-called signs (Spence, 1973; Stiglitz, 1975). For young labour market entrants, education is the main source and signal of labour-market-relevant skills and knowledge (Iannelli & Raffe, 2007; Mincer, 1974; Müller & Shavit, 1998). Our central assumption, depicted in Fig. 1, is that differences between vocational education and training programmes in their institutional characteristics, vocational specificity, vertical differentiation, and standardization influence 1) human capital development (quantity and quality of skills) and 2) the signalling power of the diploma (Allmendinger, 1989; Müller & Shavit, 1998). This in turn impacts the income levels of VET diploma holders shortly after labour market entry.

2.1. Vocational specificity

Vocational specificity refers to the extent to which an education provides students with specific vocational rather than general skills (Bol & van de Werfhorst, 2016, p. 74). The concept is based on human capital theory, which distinguishes between general and specific skills and knowledge (Becker, 1962, 1975). In Becker's original work, specific skills were conceptualized as skills that can be utilized only within the firm. Later contributions have differentiated between firm-specific and occupation-specific skills (Müller & Shavit, 1998; Shaw, 1987).[1] General skills such as literacy, communication skills, problem solving, and analytical skills are useful regardless of context and transferable between occupations (Borghans & Heijke, 2005).

A handful of studies has analysed the relationship between vocational specificity and income after labour market entry. However, the results are not clear-cut. Whereas Eggenberger, Rinawi, and Backes-Gellner (2018) find positive effects for Switzerland, Coenen, Heijke, and Meng (2015) find negative effects, and Busemeyer (2015) finds no relationship between specificity and income. The few analyses taking long-term outcomes into account imply that high vocational specificity may be less advantageous for income development than general education (Hanushek et al., 2017; Korber & Oesch, 2019; Lavrijsen & Nicaise, 2017) and may increase wage losses after displacement (Nawakitphaitoon & Ormiston, 2015). These ambiguous findings are unsurprising and are likely due to the use of diverse concepts of specificity, which are often based on the crude distinction between general and vocational education (for an exception see Eggenberger et al., 2018). However, fully grasping the vocational vs. general orientation of the curricula requires a more profound theoretical understanding of the concept of specificity that considers how the learning objectives are taught and how broadly training programmes are defined. We therefore develop a multidimensional concept of specificity. It distinguishes between the type of the imparted skills, the *manner of skill acquisition,* and the *broadness* of the taught skills.

The dimension of skill type refers to the classical distinction between occupation-specific and general skills. General skills are transferable between occupations but not immediately convertible into productivity (Hanushek et al., 2017). However, general skills facilitate further formal and informal learning (Lavrijsen & Nicaise, 2017) as well as occupational mobility (Menze, 2017). For this reason, they are likely to increase productivity and income later in careers. We therefore hypothesize that there is no significant difference in income between those with high levels of general education and those with low levels at labour market entry (H1a). However, the effect of general education becomes positive with increasing labour market experience (H1b). Occupation-specific skills are only useful in the training occupation or in very closely related occupations. They are thus less transferable between occupations than general skills, but they ensure instant productivity at labour market entry and reduce the need for on-the-job training (Hanushek et al., 2017; Iannelli & Raffe, 2007; Müller & Shavit, 1998).

Within the Swiss VET system, occupation-specific and general skills differ in their manner of acquisition. While general education is only taught in school, occupation-specific skills are imparted by practical training in a workplace setting and, to a lesser degree, by theoretical education in vocational school. Workplace-based learning is learning by doing in an authentic and up-to-date work environment. It provides

[1] Müller and Schweri (2009) find that the firm-specific element of upper secondary VET in Switzerland is marginal, and that most skills imparted are transferable between firms. Therefore we do not discuss the influence of firm-specific skills any further.

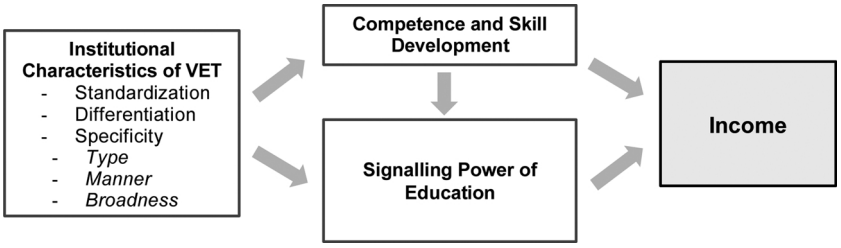

Fig. 1. Conceptual model of the relationship between institutional characteristics of training programmes and income.

highly occupation-specific and well-developed skills for labour market participation. However, the value of these skills are prone to depreciate over the career due to technological change (Hanushek et al., 2017). Classroom-based education is less close to 'real-life' work environments and more theoretical, and thus not as immediately applicable to the job (OECD, 2010). However, it should promote analytical thinking and problem solving, which makes individuals able to adjust to new situations and requirements (Jonker, van Ophem, & Hartog, 2006). Previous findings suggest that workplace-based training is associated with a higher-paid first job (Müller & Schweri, 2009; Polidano & Tabasso, 2014), whereas individuals with fully school-based vocational education do better in the long run (Jonker et al., 2006). Accordingly, we hypothesize that practical occupation-specific training has a positive impact on income at labour market entry (H2a), which subsequently weakens over the career (H2b). Theoretical occupation-specific education has no immediate effect at labour market entry (H3a). However, the effect of theoretical occupation-specific training becomes positive with growing work experience (H3b).

The third aspect of specificity is how broad or narrow the taught skill set is. The narrower the training and education curriculum is, the more specific to a certain subject or occupational subfield the knowledge and skills taught are. These very specific skills are likely to increase the initial productivity of individuals working in their training occupation after labour market entry. Because we focus on individuals in their early careers, we hypothesize that individuals training in programmes that teach narrow skill sets will have higher incomes than individuals training in programmes teaching a broader range of skills (H4). However, Coenen et al. (2015) found that Dutch VET diploma holders who attended narrow training programmes earned less than those who attended broad training programmes. They assume that narrowly defined training content makes workers less able to undertake diverse tasks and thus hampers their productivity within the occupation at the workplace.

2.2. Vertical differentiation

Vertical differentiation is the degree to which apprentices are sorted into different tracks according to their intellectual abilities (Kerckhoff, 1995, p. 328). For some occupational fields, the Swiss VER system provides three- or four-year programme leading to a federal diploma as well as an intellectually less demanding two-year training programme leading to a federal certificate. The lower track has a lower share of lessons in vocational school and focusses strongly on practical training in the apprenticeship firm. Generally speaking, lower tracks impart less theoretical knowledge and analytical skills but similar practical occupation-specific skills (Wettstein, Schmid, & Gonon, 2017).

A number of studies have shown that tracking leads to more homogenous student composition regarding academic performance and ability (Hallinan, 1988; Huang, 2009; van de Werfhorst & Mijs, 2010; Zimmer & Toma, 2000). Within vertically differentiated training fields, allocation to the lower-track two-year programme is based on negative signalling due to low performance in lower-secondary school, irregular school trajectories, and/or lower intellectual abilities. In untracked training fields, all apprentices enter the same track regardless of their intellectual level or school background. Consequently, apprentices who train in vertically differentiated programmes are more homogenous within their track in terms of school backgrounds, skills and productivity. Education tracks with a more homogenous ability group, i.e., vertically differentiated training occupations, are thus likely to have higher signalling value than education tracks with a more heterogeneous ability composition, i.e., undifferentiated training occupations (Allmendinger, 1989; Müller & Shavit, 1998). This also implies that apprentices who train in more demanding tracks on average perform better than apprentices in untracked occupations. Because of their higher average productivity and the signalling power of their diploma, they may receive higher wages. Therefore, we hypothesize that those who trained in the more challenging tracks of vertically differentiated training fields have higher wages than those who trained in untracked occupations (H5a). Furthermore, we assume that, as a result of their positive selection and more extensive training, individuals in vertically differentiated training occupations increase their average productivity faster after labour market entry than their counterparts who trained in untracked fields. The positive income effect of having trained in the more demanding track of a vertical differentiation field should therefore become stronger with growing labour market experience (H5b).

2.3. Standardization

Standardization is the "degree to which the quality of education meets the same standards nationwide" (Allmendinger, 1989, p. 233). The literature differentiates between input and output standardization. The former refers to the curricula, whereas the latter taps the standardization of the exams (Bol & van de Werfhorst, 2016). In Switzerland, the VET curricula are highly standardized. However, the standards set for educational achievement in the final exams differ between training occupations. The empirical evidence available on the effect of exam standardization on labour market outcomes yields unclear results. A comparative study of the adult population in 23 countries finds a positive relationship between centralized exams and average earnings (Leschnig, Schwerdt, & Zigova, 2017). In contrast, two German studies find positive and significant effects on income only for the minority of pupils who completed the lowest nonacademic track of lower-secondary school (Backes-Gellner & Veen, 2008; Piopiunik et al., 2014).

We argue that final exam standardization in VET affects the performance of apprentices, their human capital, and the signalling power of a diploma. Highly standardized exams are centrally organized, curriculum-based, and defined and graded by an external regional or national authority (Klein, Kruger, Kuhn, & van Ackeren, 2014). In these settings, schools can influence neither the exam questions nor the grading. Standardized final exams are thus assumed to set incentives for teachers and schools to improve the quality of teaching and for pupils and parents to raise their investments in schooling (Bishop & Mane, 2001; Wössmann, 2002). This leads to increased performance, as a number of comparative and single-country studies have shown (Bishop, 1997; Jürges, Schneider, & Büchel, 2005; Wössmann, 2010). Further, exam standardization forces teachers to teach the curricula and

improves the comparability of final grades (Müller & Shavit, 1998). The tested skills, including the test standards, are apparent to employers. Therefore, diplomas of training occupations with standardized final exams should send clear-cut, reliable signals to employers about apprentices' productivity levels and skill profiles. Accordingly, we hypothesize that individuals who trained in occupations with standardized final exams have higher incomes than individuals who trained in occupations with less standardized final exams (H6).

2.4. Other occupation specific, firm specific, and individual determinants of income

Returns to human capital depend on the skill demand in the labour market (Lazear, 2009; Thurow, 1975). The demand for occupation-specific skills depends to some degree on the average skills of workers holding occupation-specific diplomas. However, skill demand is also determined by exogenous factors, such as technological change, size of birth cohorts, globalization, general economic conditions, and outsourcing. To avoid spurious relationships between institutional characteristics of educational programmes and labour market outcomes, most previous research acknowledged these factors by controlling for the general economic situation (e.g. local unemployment rate, year dummies, or region dummies) in their analyses (Coenen et al., 2015; Eggenberger et al., 2018; Forster & Bol, 2018; Menze, 2017; Vogtenhuber, 2014). However, as Sacchi, Kriesi, and Buchmann (2016) have shown, the general economic situation is an inadequate indicator for individual employment opportunities in occupationally segmented labour markets. Such markets are subdivided into numerous occupation-specific subsegments that are only accessible to those holding a narrow range of occupation-specific training credentials. Due to mobility barriers, occupational subsegments differ in their working conditions, average firm size and structure, opportunities for mobility, and labour demand and supply (Salvisberg & Sacchi, 2014). These differences are also mostly independent of the institutional dimensions of the segment-specific training programmes. Thus, the occupation-specific employment situation is substantially more important for job quality than the overall employment situation (Buchs et al., 2015; Sacchi et al., 2016). When demand for a particular diploma is high, applicants have higher bargaining power than when demand is low. For employers, hiring skilled workers will come at a higher cost in times of labour shortage (Brunner & Kuhn, 2014; Buchs, Murphy, & Buchmann, 2017). Furthermore, training occupations differ in their intellectual requirements and therefore attract school leavers with different intellectual abilities (Stalder, 2011). This is likely to impact the productivity signals sent by the diplomas and thus affect income at labour market entry. To avoid estimating a spurious effect of the institutional dimensions Due to correlation with these occupation-level explanatory variables, we consider both job opportunities and intellectual requirement levels in the analysis.

Region and firm size impact the resources available to employers and thus also the incomes of the employed (Kalleberg, Wallace, & Althauser, 1981). Regional differences are especially important in Switzerland, because language barriers often prevent workers from moving between language regions. Occupational training programmes are distributed unevenly across regions and firms of different size. To test the effect of the institutional characteristics net of these compositional effects, we control for these potentially wage-relevant variables in our analysis. Further, income levels depend on gender, migration background, work experience, and tenure. These attributes can be used by employers as signals of productivity and of other job-relevant attributes, such as motivation and communication skills (Spence, 1973; Stevens, 2004). Finally, individuals changing their occupation at labour market entry can apply fewer of their learned skills on the job. This impacts income levels negatively (Müller & Schweri, 2009).

3. Data and measures

3.1. Data

The empirical analyses are based on the Swiss Labour Force Survey (SLFS) from 2003 to 2015. The SLFS is a representative survey of the permanently resident adult Swiss population. Interviews with participants were repeated up to five consecutive years. We combined this data with register data on the yearly income of the respondents from the Social protection on the labour market statistical project (SESAM). Our sample is based on employed individuals who trained in Switzerland in a three- or four-year upper-secondary training programme leading to a federal diploma. These federal diploma holders completed their workplace-based training between 2000 and 2015, when they were between 17 and 25 years old. Individuals who completed higher education subsequently had to be excluded due to missing information about their vocational education and training programmes.[2] Because the SLFS changed their rotation scheme in 2010, most of the respondents are only included once in our sample. To avoid using an unbalanced panel and adding unnecessary complexity to the analysis, we restricted the sample to the first observation after VET for each individual.[3]

Our measures of the institutional characteristics of training programmes stem from training occupation ordinances and curricula in force between 2000 and 2015. These documents are legally binding in all Swiss cantons. The documents provide detailed and comparable information on the number of lessons in the various training locations, the organization of the final exams and exam grades, and subject differentiation within the training programme (for an overview on the collected data see Grønning et al., 2018). This data makes it possible to compare training characteristics across occupations.

We linked the individual-level data with occupation-level data on institutional characteristics based on the 8-digit codes of the Swiss Standard Classification of Occupations (SSCO2000) (Swiss Federal Statistical Office, 2003). This yielded an accurate match of the individual training occupation with one of the 550 current or former training occupations or subject specializations for which we had collected institutional data. We excluded both individuals with unidentifiable occupational titles and individuals who had graduated at a time for which curriculum and ordinances were not traceable. After excluding observations with missing data and the top and bottom percentiles of the income distribution, our sample consists of 6 123 individuals who completed training in one of 211 training occupations. Whereas some of them have work experience up to 16 years, allowing us to examine whether the relationship between institutional characteristics and income changes with growing experience, about two thirds of our sample are at the beginning of their career, with a maximum of 58 months of work experience and a maximum age of 25 years.

3.2. Measures

3.2.1. Dependent variable and institutional characteristics

The dependent variable is the gross logged yearly income in the year of interview. For individuals with part-time employment, which is frequent in Switzerland, we calculated the fulltime equivalent.[4]

[2] Missing information on the training occupation or the duration since training completion was imputed from previous or consecutive waves as long as the respondents had not finished any further education between the waves.

[3] Using the full data with several observations per individual does not change the results. For testing purposes, we also reduced our sample to individuals who did not change their occupation after completion of training. This resulted in somewhat larger effect sizes for our institutional variables. However, the pattern of results remains the same (results available from authors on request).

[4] Because the consumer price index varies with only 7.7% between 2003 and 2015, we used an uncorrected indicator for earnings. However, the results are robust to adjusting for the rate of inflation (results available upon request).

Table 1
Dimensions of specificity and measures.

		Skill type: General	Skill type: Occupation-Specific
Manner of skill acquisition	Theoretical	General education in vocational school in days per week	Occupation-specific education in vocational school in days per week
	Practical		Training in intercompany courses & apprenticeship training in firm in days per week
Narrowness of skill set	Broad		Training occupations without specializations
	Narrow		Training occupations with field or subject specialization.

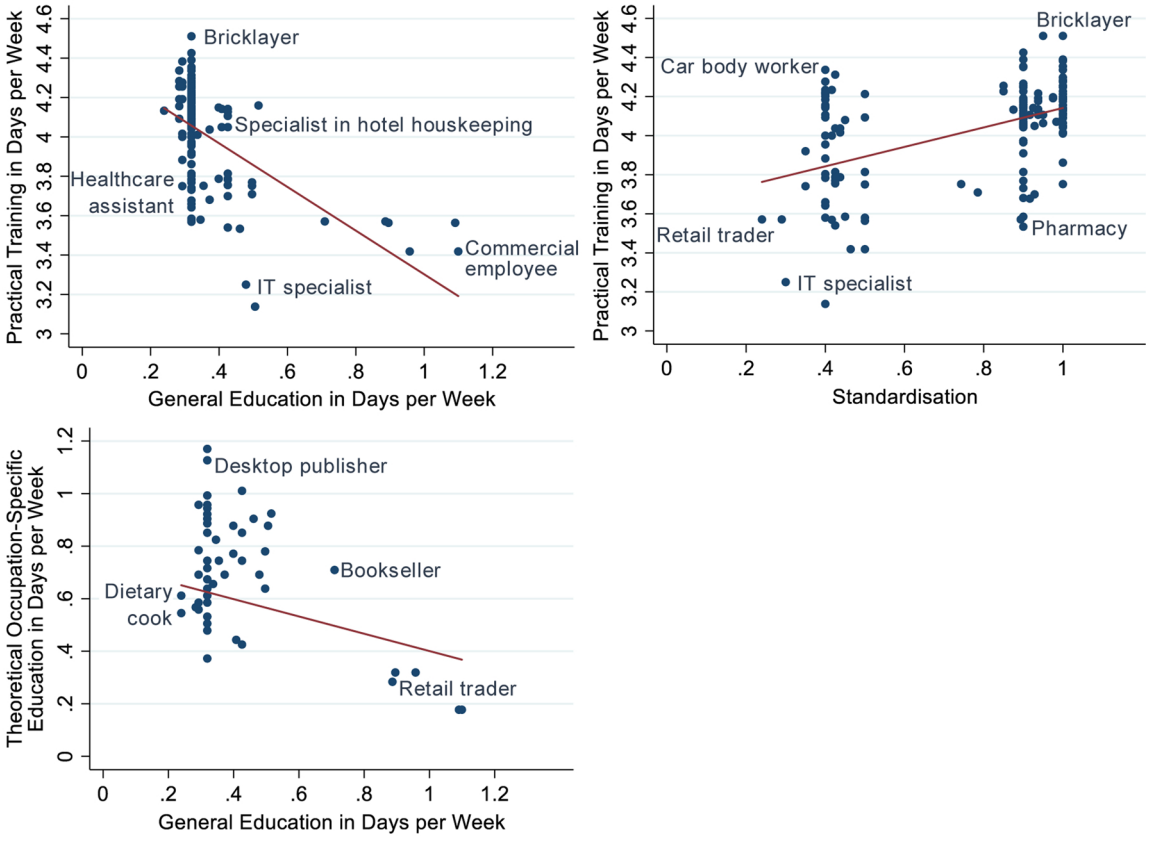

Fig. 2. Scatter plots of the significant and substantial correlations between the institutional characteristics.
Note: The red lines are the estimated correlations at the occupational level.

To capture the three proposed theoretical dimensions of specificity – skill type, manner of skill acquisition, and broadness of skills – we construct four variables (see Table 1). The first one refers to the skill type and measures the average days of *general education* in vocational school per week. This includes lessons in language, history, ethics, society, politics, law, and economy, and the time devoted to it ranges from 0.24 (dietary cook) to 1.10 (commercial employees) days a week (see also Fig. 2).

Depending on the training location, occupation-specific skills are either taught theoretically in vocational school or through practical training in the firm or in intercompany courses. The manner of skill acquisition thus represents the second dimension of specificity. We capture this with two variables: *Theoretical occupation-specific education* is captured by the occupation-specific lessons in vocational school measured in days per week. Examples of occupations with high levels of theoretical occupation-specific education are desktop publishers (1.13 days a week) and electronic technicians (1.01 days a week); commercial employees and retail traders have far less theoretical occupation-

specific education (0.32 and 0.28 days a week respectively). *Practical occupation-specific training* is based on the number of days per week apprentices spend in the training firm and in inter-company courses.[5] The indicator ranges from 3.14 to 4.51 days a week. Occupations in construction have high levels of practical training, while IT specialists receive little practical training (see Fig. 2). To capture the third dimension of specificity, broadness of skill sets, we constructed a dummy, *narrow skill set,* that distinguishes between training occupations with subject or field specializations within the occupation and occupations without any specialization.[6] For example, social care workers specialize in childcare, elderly care, or care for disabled people and thus have a narrower skill set than healthcare assistants, who do not specialize during training.

The second institutional characteristic is based on a dummy variable, *vertical differentiation,* which indicates whether a less demanding two-year track existed within the training field at the time of training. Because our sample does not include certificate holders from the two-year track, the indicator measures whether the respondent trained in the more challenging track of a vertically differentiated training field or in an untracked training occupation.[7]

The variable representing our third institutional characteristic, *exam standardization,* is measured with an index based on two indicators of standardization: degree of centralization and relevance of previous performance grades (for a detailed description of the final examinations in Swiss VET see Wettstein et al., 2017). The indicator of centralization captures whether the final practical exam is set and assessed by a central cantonal authority (1) or by the vocational trainer within the training firm (0). Coursework is marked by teachers and trainers during the school year. Higher proportions given to the coursework marks in the final assessment indicate lower exam standardization. We computed the index based on the mean of the two indicators and reversed the scale so that higher levels indicate higher standardization. The highest level of exam standardization (1) is found in several ordinances where coursework is not taken into consideration in the final assessment and the practical exam is defined by the central authority (e.g. tiler and pharmacy assistant). Retail traders have the least standardized exams (0.24).

3.2.2. Correlations between the institutional characteristics

Fig. 2 depicts scatter plots of the institutional characteristics and significant and substantial correlations at the occupational level. The measures of general and specific education and training correlate to some degree. The highest correlation can be found between general education and practical occupation-specific training ($r = -0.51$, $p < 0.000$). Furthermore, there is a negative association between practical and theoretical occupation-specific training ($r = -0.46$, $p < 0.000$). The standardization level is positively associated with practical occupation-specific training ($r = 0.49$, $p < 0.000$). Vertical and horizontal differentiation are not systematically associated with other occupation-level variables. In sum, the scatterplots show that there is considerable variation between training occupations in their levels of specificity and exam standardization. Thus, the simple distinction between general and specific, workplace-based and school-based, or standardized and nonstandardized education programmes masks the heterogeneity in institutional characteristics that can be found within Swiss VET.

3.2.3. Occupational level control variables

To avoid observing a spurious relationship because our institutional characteristics covary with other occupational context factors affecting income, we include the *intellectual requirement level* of the upper-secondary training occupations. The indicator ranges from 1 (lowest level) to 6 (highest level) (see Stalder, 2011)[8] and captures the sorting of individuals into training occupations according to their abilities.[9]

Furthermore, we include an indicator of occupation-specific individual *labour market opportunities*. It is based on the annual number of vacancies within each occupational field (two-digit level of SSCO2000) open to labour market entrants with a federal diploma relative to the annual number of unemployed with a VET diploma. Higher values indicate more job opportunities. The estimation of the demand side is based on Swiss Job Monitor data (SJM). The SJM is a representative sample of job ads published in newspapers and online job platforms in the German-speaking part of Switzerland. It provides an accurate yearly picture of skill demand in the Swiss labour market (Sacchi, 2014). The supply side is measured with register data on unemployment provided by the job placement and labour market statistics information system. To account for spillovers between occupations, the numbers of both unemployed and open positions were weighted by the transition probability between occupations (see Buchs et al., 2015 for details). We matched the indicator with the individual SLFS data by training occupation and the year in which the respondents started to work in their current workplace.

3.2.4. Individual level variables

We rely on the *time since graduation*, measured in months, to capture the respondents' labour market experience. The fact that the SLFS data does not report inactive times since graduation is mitigated by the low Swiss youth unemployment rate. Gomensoro et al. (2017) find that at the age of 30, 3% of the 2010 school-leaver cohort who had completed VET were unemployed (see also Fazekas & Field, 2013). Furthermore, young VET diploma holders rarely experience long-term unemployment or recurrent unemployment episodes (Sacchi & Salvisberg, 2012). Thus, the majority of our sample is likely to have experienced a smooth transition into the labour market.[10]

Control variables at the individual level include *gender* (0: male 1: female), *migration background* (0: Swiss by birth 1: born with a foreign nationality), and participation in *further training* or education at tertiary level. The *number of education diplomas* distinguishes between individuals with one federal diploma, with several diplomas or an additional baccalaureate, and individuals with a federal certificate additional to the federal diploma. Furthermore, we measured *tenure* in months after completion of training. *Changes in the occupational field* are captured by comparing the training occupation with the current occupation at the two-digit level.[11] Diploma holders are considered to have *changed firm* if their work experience in their current firm is shorter than the time since graduation. *Labour market region* of the workplace distinguishes seven regions and a missing category. *Firm size* differentiates between firms with less than 10 employees, firms with 10–19

[5] Intercompany courses provide practical occupation-specific skills that cannot be developed during training within the firm due to the firm's small size or specialization (Wettstein et al., 2017).

[6] Ideally, a measure of broad and narrow general skill sets would be included. However, the available data limits this measure to occupation-specific skills.

[7] The 50 training occupations with vertical differentiation include both three- and four-year programmes in various industry sectors (e.g. metal work, retail trade, social and health care, and farming).

[8] The indicator is based on the evaluations of career counsellors, ratings of trainers in firms, and statistical data on transition rates between lower-secondary school tracks and VET. We assume that the requirement levels did not change during the time period considered. In cases where occupations were not classified, we imputed the rating of similar training occupations in the same field with the same training duration.

[9] In highly practical occupations, the intellectual requirements tend to be lower ($r = -0.68$, $p < 0.000$). Somewhat surprisingly, high intellectual requirements do not coincide with high levels of general training.

[10] The VET diploma holders in the sample are between 17 and 39 years old at the time of the survey. However, 93% of the sample are 30 or younger.

[11] We controlled whether these changes were spurious due to inconsistencies in the classification scheme. If necessary, corrections were made. A list of the corrections can be provided by the authors.

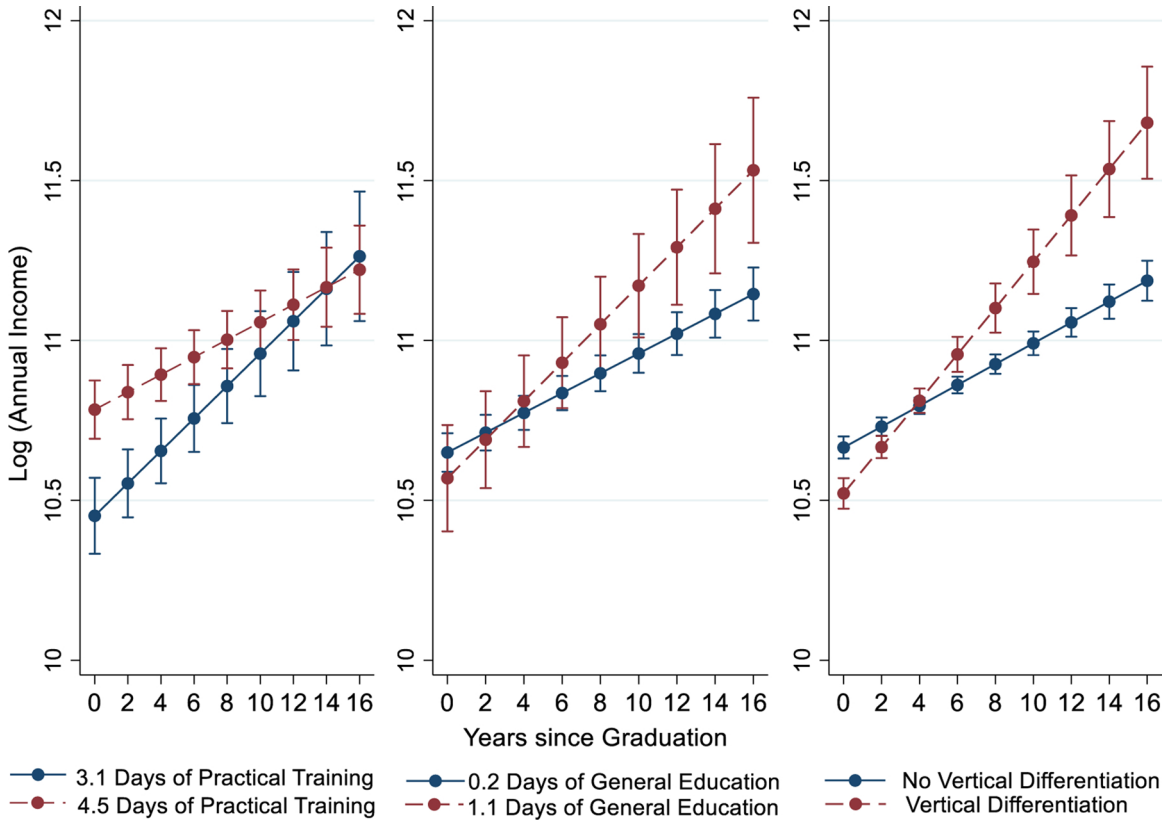

Fig. 3. Predicted income and institutional characteristics by years since graduation.
Note: Predicted Margins with 95 % Conf. Int. depicted at the highest and lowest observed levels of the institutional characteristics based on Model 3, 4 and 6 respectively. Fixed portion only. General education and practical training is measured in days per week.

employees, firms with 20–100 employees, and firms with more than 100 employees, as well as a missing category. Table A1 in the Appendix gives a descriptive overview of the institutional characteristics and the controls.

3.3. Analytical strategy

First, to analyse the association between our institutional characteristics and income, we estimate linear multilevel regression models, which reflect the hierarchical structure of the data with individuals nested within training occupations. These models take into account that the independence assumption is often violated with nested data (Gross & Gross, 2016). We fit a null model, a model that includes only the institutional characteristics (Table 4, Model 1), and a main model (Model 2) that includes all the explanatory variables. In addition, the variance components of a model without occupational level variables (Model 1.1) and a model without the institutional characteristics (Model 1.2.) are presented in Table 3. A full overview of all models is given in Table A2 in the Appendix. These random intercept models are based on the specifications in Eq. (1).

$$Y_{ij} = \beta_0 + \beta_1(institutional\ characteristics)_j + \beta_2(months\ since\ graduation)_{ij} + \beta_q X_{qij} + \beta_r Z_{rj} + \mu_j + \varepsilon_{ij} \quad (1)$$

where Y_{ij} is the logged early income for person i, who trained in occupation j, and β_0 is the intercept. The regression coefficients for the institutional characteristics are termed β_1, and at the individual level, the regression coefficient for months since graduation is termed β_2. We have q control variables X, which vary at the individual level (e.g. gender), and r control variables Z, which vary at the occupational level (e.g. intellectual requirement level). Finally, μ_j is the unaccounted variance between the training occupations, and ε_{ij} is the residual error term. All continuous variables at both the individual level and the occupational level are grand mean centred. Thus, the wage effects in Model 1 and Model 2 pertain to individuals with average sample characteristics: employees at the beginning of their careers, with 47.9 months of experience and 24.5 months tenure.

Second, interactions between months since graduation and practical occupation-specific training (Model 3), general education (Model 4), occupation-specific theoretical training (Model 5), and vertical differentiation (Model 6) are each tested separately. We specify a random slope at the occupation level for months since graduation. Consequently, the slope (the effect of months since graduation) can vary between occupations. Although this is also plausible theoretically, the main reason for the specification is statistical. Not including a random slope for lower-level variables involved in a cross-level interaction could bias the statistical inference (Heisig & Schaeffer, 2019).

Table 2
Average annual income by selected training occupations.

	Training Occupation	Average Income in CHF	N Individuals
High Income	IT Specialist	65 679	126
	Bricklayer	62 785	130
Middle Income	Electrician	54 124	280
	Commercial employee	53 349	1078
Low Income	Healthcare assistant	48 212	158
	Hairdresser	43 808	251

Table 3
Variance Components.

	Model 1.1 Individual Level Variables Only		Model 1.2 Individual Level and Occupational Level Control Variables		Model 2: All Variables	
	Estimate	Std.Err.	Estimate	Std.Err.	Estimate	Std.Err.
Var(between individuals) (Null Model: 0.166***)	0.140 ***	0.003	0.140 ***	0.003	0.140 ***	0.003
Var(between occupations) (Null Model: 0.026***)	0.009 ***	0.002	0.007 ***	0.002	0.006 ***	0.002
ICC (Null Model: 0.135)	0.060		0.045		0.038	
R^2 Individual level (Raudenbusch & Bryk)	0.155		0.157		0.159	
R^2 Occupational level (Raudenbusch & Bryk)	0.654		0.746		0.787	
N Individuals	6123		6123		6123	
K Occupations	211		211		211	

Note: ICC = intraclass correlation. The full models are presented in Table A.2 in the Appendix.

$$Y_{ij} = \beta_0 + \beta_1(inst.\ char.)_j + \beta_2(months\ since\ grad.)_{ij} + \beta_3(inst.\ char.)_j(months\ since\ grad.)_{ij} + \beta_q X_{qij} + \beta_r Z_{rj} + \mu_{0j} + \mu_{1j}(months\ since\ grad.)ij + \varepsilon_{ij} \quad (2)$$

The specifications for the random slope models are depicted in Eq. (2). The term β_3 represents the interaction effects (months since graduation with practical / theoretical occupation-specific training, general education and vertical differentiation). The two error terms μ_{0j} and μ_{1j} express the between-occupation variance of the intercepts and the slopes, respectively. Thus, the term $\mu_{1j}(months\ since\ grad)ij$ represents the extent to which the effect of time since graduation varies across occupations. The main variance components are presented in Table 3 (complete information in the Appendix, Table A2). We calculate the explained variance at the occupation level according to Raudenbush and Bryk (2002) $(1 - (\sigma^2_{\mu 0|m} / \sigma^2_{\mu 0|null}))$. Last, significant interaction effects are also illustrated graphically by plotting the predicted income level dependent on the institutional characteristics (Fig. 3).

4. Results

There is considerable variation in average income between the training occupations, as Table 2 illustrates with some of the most prevalent training occupations. Hairdressers, for example, earn only around two thirds of bricklayers' average incomes. The multivariate regression analyses show that a substantial proportion, 13.5 %, of the total variation in income can be attributed to differences between the occupations (Table 3, ICC of the null model). When considering only the variation between occupations, the full model (Model 2) explains 78.7 % of the income variation (R^2) at this level). Individual-level explanatory variables, i.e. compositional effects, explain 65.4 % of the occupation-level variation (Model 1.1). Occupation-specific control variables explain a further 9.1 % (0.746 − 0.654), and institutional characteristics another 4.2 % (0.787 − 0.746). However, this last figure is a conservative estimate of the explanatory power of institutional characteristics. Additional analyses (not shown) reveal that the institutional characteristics explain more than twice as much (9.0 %) of the income variation between occupations if we reduce the sample to those who work in their trained occupation with a maximum of 12 months of experience (detailed results available upon request). A probable explanation is that after some years of experience, VET is no longer the sole provider and signal of labour-market-relevant skills. This holds even more for workers who changed their occupation and no longer work in their trained occupations.

Turning to the regression coefficients in Table 4, we first consider the effect of vocational specificity, starting with the type of skill and manner of skill acquisition. In line with our second hypothesis (H2a), the findings show that high proportions of practical occupation-specific training go along with higher income after labour market entry. An additional day of practical training is associated with 14.4 % higher annual income (see Model 2). Furthermore, we expected that the income advantage of those with the highest proportions of practical training should diminish with experience, because practical skills may lose their value when skill requirements in the training occupation alter due to technological change (H2b). The significant negative interaction effect in Model 3 confirms this hypothesis. Although large proportions of practical training offer an income advantage throughout most of the early career, the increase in income with experience is less steep for workers who trained in programmes with large proportions of practical training than for those with low proportions (see Fig. 3). In contrast to practical training, we expected neither theoretical occupation-specific nor general education to have a significant direct effect on income. The effect of these two variables are neither statistically significant in Model 1 nor when controlling for individual and further occupation-level variables (Model 2), and thus confirm hypotheses H1a and H3a. Further, we argued that general and occupation-specific education in vocational school should be more important after some years of experience than immediately after labour market entry (H1b and H3b). The results confirm only the first of these assumptions. Model 4 and Fig. 3 show that the interaction between time since graduation, our proxy for experience, and general education is significant and positive, as predicted in hypotheses H1b. One year of experience is associated with a 3.1 % income gain for those with the lowest proportion of general education (0.24 days a week), and a 6.0 % gain for those with the highest proportion of general education (1.1 days a week).[12] However, the association between theoretical occupation-specific education and income does not vary with experience in the labour market (see Model 5). Occupation-specific education does not affect income either directly after labour market entry or after some years of experience. Considering the third dimension of specificity, we hypothesized that a narrow skill set should increase productivity and thus income due to higher specificity (H4). The results show that the income effect of training in a narrow training programme is negative but does not reach statistical significance (see Model 1 and 2). Thus, we cannot confirm our hypothesis. Further research would be needed to assess whether this is due to two countervailing mechanisms, as suggested by (Coenen et al., 2015). A narrow skill set might have a detrimental effect on income because it is likely to hamper occupational flexibility.

Overall, these findings imply that it is important to consider not only the skill type but also the manner of skill acquisition when assessing the effect of vocational specificity on income. Based on these

[12] The effect of general education does not decrease, when we exclude the occupations with very high levels of general education (outliers) from the analysis.

Table 4
Linear Random Intercept and Linear Random Slope Models (dependent variable: log of annual income).

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	Coef.	Std.Err.	Coef.	Std.Err.	Coef.	Std.Err.	Coef.	Std.Err.	Coef.	Std.Err.	Coef.	Std.Err.
Institutional Characteristics												
Practical Occupation-Specific Training	0.128	0.089	0.144 *	0.067	0.169 *	0.066	0.160 *	0.066	0.172 **	0.067	0.165 *	0.067
Theroetical Occupation-Specific Education	−0.091	0.128	−0.080	0.090	−0.050	0.092	−0.057	0.092	−0.050	0.093	−0.052	0.092
General Education	−0.033	0.165	−0.003	0.113	0.084	0.112	0.053	0.112	0.092	0.114	0.042	0.114
Narrowly Defined Skill Set	−0.018	0.030	−0.004	0.021	0.002	0.020	0.000	0.020	0.000	0.020	0.000	0.021
Vertical Differentiation	−0.167 ***	0.017	−0.060 ***	0.016	−0.040 *	0.016	−0.036 *	0.016	−0.040 *	0.016	0.028	0.020
Exam Standardisation	−0.200 **	0.067	−0.127 **	0.048	−0.111 *	0.048	−0.110 *	0.048	−0.115 *	0.049	−0.112 *	0.049
Interactions												
Practical Occupation-Specific Training*Months since Graduation					−0.001 *	0.001						
General education*Months since Graduation							0.003 **	0.001				
Theoretical Occupation-Specific Education*Months since Graduation									0.000	0.001		
Vertical Differentiation*Month since Graduation											0.003 ***	0.001
Occupational Level Controls												
Labour Market Opportunities			0.203 ***	0.043	0.215 ***	0.043	0.213 ***	0.043	0.213 ***	0.043	0.213 ***	0.043
Intellectual Requirement Level			0.027 **	0.009	0.034 ***	0.009	0.033 ***	0.009	0.034 ***	0.009	0.031 ***	0.009
Individual Level Controls												
Months since Graduation			0.003 ***	0.000	0.003 ***	0.000	0.003 ***	0.000	0.003 ***	0.000	0.003 ***	0.000
Intercept	10.80 ***	0.024	10.81 ***	0.024	10.826 ***	0.024	10.82 ***	0.024	10.83 ***	0.024	10.82 ***	0.024
N Individuals	6123		6123		6123		6123		6123		6123	
K Occupations	211		211		211		211		211		211	

Significance level: *p ≤ .05; **p ≤ .01; ***p ≤ .001.
Random intercept Model (Model 1–2) and Random slope models (Models 3–6) with a random slope for time since graduation at the occupational level. All continuous variables are grand mean centred.
Control Variables Included: Gender, Migration Background, Number of Diplomas, in Further education, Tenure, Firm Change, Change of Occupation, Region and Firm Size. The full models are presented in Table A2 in the Appendix.

results, we conclude, first, that practical occupation-specific training in the firm is the main provider of labour-market-relevant skills, which determine VET learners' productivity and thus income immediately after labour market entry. Second, general education taught in vocational school provides individuals with skills that can be converted into productivity after a few years of experience. One likely reason for this is that general education equips individuals with analytical and problem-solving skills. Third, the reason for the insignificant effect of theoretical occupation-specific education could be a lack of knowledge transfer between vocational school and the workplace. This interpretation is supported by insights from educational science, which show that the transfer process depends on the application of skill and knowledge in a variety of situations as well as learning to abstract and generalize the processes (Klieme, 2004; Weinert, 1998).

We analyse vertical differentiation by comparing the income of individuals who trained in higher tracks in vertically differentiated training field with that of those who trained in untracked occupations. Contrary to our hypothesis H5a, we find a negative effect for the former group. Workers who trained in the more demanding track in vertically differentiated fields have a 6.0 % lower income than those who trained in occupations without vertical differentiation (Model 2). This effect is almost three times as high in Model 1, without the control variables. Stepwise modelling reveals that the initially very strong negative effect of vertical differentiation decreases mainly when including months since graduation (results not shown). The two-year tracks were first introduced in 2005. Thus, the strong initial effect of vertical differentiation likely arises because diploma holders who trained in tracked fields, on average have less work experience than those who trained in untracked programmes. A possible reason for the remaining significant negative effect of tracking could be that employers may be tempted to reduce labour costs by substituting labour market entrants from the higher track with lower-priced ones from the lower track, who do not greatly differ regarding their occupation-specific skills (for a detailed discussion of the conditions for wage pressure and substitution see Brynjolfsson & McAfee, 2014; Levy & Murnane, 2004). Consequently, diploma holders who trained in tracked occupations may face competition at labour market entry from less expensive federal certificate holders who trained in a two-year programme. In contrast to diploma holders from untracked training fields, individuals from tracked occupations may be forced to adjust their initial wage expectations downwards.

Further, we tested whether a positive effect of vertical differentiation emerges with increasing labour market experience (H5b). Fig. 3 further shows the predicted income level depending on months since graduation for higher track diploma holders in vertically differentiated fields and diploma holders in undifferentiated training occupations (see also Model 6). Workers who trained in tracked training fields experience a wage penalty in the first years after labour market entry but catch up after about three years of experience. Over time, those from vertically differentiated training fields seem to profit from the more demanding training in the higher track, which is likely to facilitate further learning and the accumulation of human capital. The ensuing steeper positive income trajectory compared to those in untracked occupations is likely a result of the concomitant increase in productivity.

We expected exam standardization to have a positive impact on income (H6). However, we do not find support for this hypothesis. On the contrary, the standardization index remains significant and negative even when including individual- and occupation-level control variables. Individuals who trained in occupations where exams are highly standardized have lower incomes than those who trained in occupations where exams are less standardized. Training in occupations with the highest level of exam standardization is associated with a 12.7 % lower income than training in an occupation with the lowest level of standardization. These unexpected findings suggest that centralized exam regimes do not enhance the productivity or the signalling value of VET certificates. A first reason could be that centralized exams do not set incentives for teaching and learning practical skills and thus do not improve the quality of young workers' labour-market-relevant skills and knowledge. Second, locally defined exams might be better suited to testing locally relevant practical and vocational skills and send a clearer signal on these skills than centralized exams.

Our results for the individual- level control variables confirm findings from previous research. We therefore do not discuss these any further but turn directly to the impact of the occupation-level controls. We find a positive and significant association between income and occupation-specific labour market opportunities. More open positions and less competition give applicants higher bargaining power and employers less flexibility when setting wages, which leads to higher income for the employees. Further, those who trained in occupations with higher intellectual requirements have higher incomes than those who trained in occupations with lower intellectual requirements. Both findings are in line with our expectations. They also imply that the effects of specificity and standardization are not spurious or due to differences in occupation-specific intellectual requirement level or job opportunities.

5. Conclusion

This paper sheds light on the mechanisms leading to income differences during the early career by comparing the training characteristics of VET occupations. In line with previous research, we find that, although we compare occupations at the same education level and with similar training duration, significant income differences remain between the occupations (e.g. Bol & Weeden, 2014; Pfister et al., 2017). Curriculum-based measures enable us to analyse how several institutional dimensions and subdimensions of Swiss training programmes at the upper-secondary level are related to these observed income differences. We thus contribute to the literature by exploiting the heterogeneity in VET regarding the levels of standardization, vocational specificity, and vertical differentiation.

We found that practical training is favourable for income levels during the early career, while general education becomes more important with experience on the labour market. This is in line with our hypotheses and supports the notion that while practical experience is the main driver of positive outcomes at labour market entry (see also Jonker et al., 2006; Polidano & Tabasso, 2014), general education pays off in the longer run (see also Korber & Oesch, 2019). We also found that vertical differentiation has a detrimental effect on income in the short run, but that this can be compensated with increasing experience. Exam standardization had a negative effect on income. Lastly, and contrary to our expectations, both theoretical occupation-specific lessons and the broadness of the training occupation were found to be irrelevant for earning levels of VET diploma holders.

Based on these results, we highlight four theoretical implications. First, our findings show that the institutional characteristics of the training programmes explain part of the variation between occupations in income. Therefore, occupation-level mechanisms should receive more attention in the development of theories on the wage setting process. Second, the concept and operationalization of vocational specificity needs to be refined and should include both the type of skills imparted and the manner of skill acquisition. These different subdimensions impact labour market outcomes to different degrees and in different phases of the career. A high level of vocational specificity has a positive impact on income only if the skills are taught in a practical and firm-based manner. The insignificant effect of theoretical occupation-specific education highlights the need for further research on the transfer of this type of knowledge between vocational schools and the workplace. Given the opposing influences, it is not surprising that dichotomous or unidimensional measurements of specificity are often unable to explain labour market outcomes.

Third, our results support the recent and still-scarce evidence that the relationship between training characteristics and labour market

outcomes has a temporal dimension and depends on workers' career stages. The examples of general education and vertical differentiation show that some become more important as individuals gather more experience. From a social policy perspective, this implies that certain training characteristics offer a trade-off between imparting immediately deployable skills on the one hand and enhancing flexibility and continued learning on the other. This is supported by Lavrijsen and Nicaise (2017), who show that general education, which coincides with lower income prospects directly after labour market entry, increases the likelihood of further education.

Fourth, our findings imply that the relationship between the institutional characteristics of educational programmes and labour market outcomes is context dependent. Put differently, the skill development and signalling power of educational qualifications also depends on the interplay between labour market structures and characteristics of educational programmes. An illustration is the unexpected negative effect of exam standardization on income. It implies that in occupationally segmented and structurally heterogeneous local labour market settings, output standardization may undermine the productivity or the signalling power of vocational education and training diplomas. Context dependence also becomes apparent when considering our findings on vertical differentiation. The potentially positive impact on income due to the selection of high-ability individuals and a homogenous student composition in vertically differentiated tracks may be hampered by competitors with similar short-term (but inferior long-term) productivity. This situation occurs if the educational system offers standardized labour-market oriented training programmes, which are generally less demanding but teach similar practical skills.

Our study also has some limitations. Most importantly, we are not able to document causality between institutional dimensions and income. This would require longitudinal data and measures of individual intellectual abilities. However, the latter disadvantage is mitigated considerably by controlling the intellectual requirement levels of the different occupational programmes, which serve as a proxy for the average intellectual abilities of the diploma holders. Furthermore, we could only shed light on the early career of workers with an upper-secondary VET diploma. The long-term effects of the characteristics of VET programmes beyond the first few years after labour market entry remain unexplored. In particular, our sample does not allow for testing how transitions into higher education after VET mediate the effect of institutional characteristics on income. Furthermore, it is unknown whether the relationship between institutional dimensions and income differs between social groups, e.g. by gender. Estévez-Abe (2005), for example, argues that across the life course, the investment in specific and general skills pays off differently for men and women. Last, we would like to stress the relevance of our finding in light of the prevalent unequal access to training occupations in the apprenticeship market (Imdorf, 2017; Protsch & Solga, 2016). If barriers to entering an occupation coincide with favourable institutional settings, institutional differences between occupations can reinforce existing inequalities in the labour market.

Funding

This paper was funded by the Swiss National Science Foundation as part of the project titled Institutional characteristics of initial vocational education and training in Switzerland: How do they affect young people's early labour market outcomes and transitions to higher education? (grant number 100017_156204).

Declaration of Competing Interest

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Acknowledgements

Earlier versions of this paper were presented at the RC28 spring meeting in Seoul 2018 and the ECSR in Lausanne 2019, and we would like to thank the participants as well as two anonymous reviewers for their valuable comments.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.rssm.2020.100495.

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