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ABHANDLUNGEN

Berufe und Geschlechterungleichheit

Skill Specificity of Upper-Secondary Training Occupations and the Gender Pay Gap

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Abstract Gender disparities in wages are still fairly large. On average, women earn less than men from the beginning of their careers. This article investigates whether young men and women with vocational education and training receive different returns for occupation-specific and general skills, a topic that has hitherto received little attention. Theoretically, we draw on a culturalist approach, as well as on the varieties of capitalism approach. The analyses are based on a combination of detailed occupation-level data on the specificity of training occupations and individual-level data from the Swiss Labour Force Survey on the incomes of upper-secondary vocational diploma holders. The results of multilevel regression models show that men's and women's incomes are affected by a complex interplay between gender and skill endowment. Occupation-specific vocational skills only secure a high income early in the careers of men who trained in male-typed or gender-neutral occupations. Women profit from a high proportion of general knowledge in their training. Furthermore, we find evidence for a general devaluation of female-typed skills. In sum, the findings suggest that employers' discriminatory remuneration practices, a gen-

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eral devaluation of female-typed skills and young people's rational skill investment decisions contribute jointly to the gender gap in income.

Keywords Gender wage disparities · Vocational specificity · General education · Occupational gender segregation · Vocational education and training · Varieties of capitalism · Devaluation theory

Berufliche Spezifität und Einkommensunterschiede zwischen Männern und Frauen

Zusammenfassung Geschlechtsspezifische Lohnunterschiede sind nach wie vor bedeutend. Im Durchschnitt verdienen Frauen bereits ab dem Beginn ihrer Berufslaufbahn weniger als Männer. Wir untersuchen in diesem Beitrag, ob junge Frauen und Männer mit Berufsbildung unterschiedliche Renditen für berufsspezifische und allgemeine Kenntnisse erhalten, ein Thema, das in der bisherigen Forschung wenig Beachtung gefunden hat. Theoretisch stützen wir uns sowohl auf die Devaluierungstheorie als auch auf die Varieties-of-Capitalism-Theorie. Detaillierte Indikatoren für die berufliche Spezifität der Ausbildungsberufe sowie Registerdaten für das Einkommen der Befragten werden den Individualdaten der Schweizerischen Arbeitskräfteerhebung zugespielt. Die Ergebnisse der Mehrebenenmodelle zeigen, dass das Einkommen von Personen mit einer Berufsausbildung in den ersten Erwerbsjahren von einem komplexen Zusammenspiel zwischen Geschlecht und Kompetenzausstattung beeinflusst wird. Berufsspezifische Kenntnisse erhöhen das Einkommen nur für Männer mit männlich konnotierten oder geschlechtsneutralen Ausbildungsberufen. Frauen profitieren von einem hohen Anteil an allgemeinbildendem Unterricht während ihrer Ausbildung. Darüber hinaus finden wir Hinweise auf eine generelle Abwertung von weiblich konnotierten Kenntnissen. Die Ergebnisse deuten darauf hin, dass diskriminierende Vergütungspraktiken der Arbeitgeber, eine allgemeine Abwertung der weiblich konnotierten Kompetenzen und rationale Ausbildungsentscheidungen junger Menschen gemeinsam zum durchschnittlich geringeren Einkommen der Frauen beitragen.

Schlüsselwörter Geschlechtsspezifische Lohnunterschiede · Berufliche Spezifität · Allgemeinbildung · Berufliche Geschlechtersegregation · Berufsbildung · Varieties of Capitalism · Devaluierungstheorie

1 Introduction

Gender disparities in wages are still fairly large in most Western countries. On average, women earn less than men, even when comparing individuals with the same education level, experience, and working hours (e.g. Blau and Kahn 2017; Grönlund and Magnusson 2013). This also holds true for Switzerland, where sizeable income disparities between men and women already occur at labour market entry (e.g. Bertschy et al. 2014; Combet and Oesch 2019). In this paper, we focus on the role of skills in the gender pay gap and draw on devaluation theory and the varieties

of capitalism approach. Both theoretical perspectives propose that by sorting into different occupations, men and women also acquire different skill sets, which in turn can explain some of the income disparities. The culturalist perspective argues that gender segregation is accompanied by a devaluation of female-typed skills and women's work (e.g. England 1992; Kilbourne et al. 1994). Numerous studies have shown that female-dominated occupations pay lower wages than gender-integrated or male-dominated ones (e.g. Bertschy et al. 2014; Busch 2013; England and Li 2006). Within a rational choice perspective, an alternative but rarely tested explanation is proposed by the varieties of capitalism (VOC) approach. This approach focuses on the distinction between firm-specific, occupation-specific, and general skills and argues that young men and women earn different wages because men invest more in well-paid specific skills and women in lower-paid general ones. Furthermore, men and women receive different returns for the same skills (Estévez-Abe 2005, 2012; Tam 1997).

In Switzerland, vocational education and training (VET) imparts a large proportion of occupation-specific skills, as well as some firm-specific and general skills. However, the skill mix differs considerably among the numerous training occupations within VET (Grønning et al. 2018). VET may therefore produce income inequalities by channelling young men and women into gender-typed training occupations, which may also differ in their proportions of specific and general training. Against this background, we ask two related questions: a) Do the returns to specific and general skills depend on the gender type of the training occupation? b) Are the returns to skills gendered? In other words, do young men and women receive equal returns for the same types of skills?

At labour market entry, gender differences in specific and general skills develop because men often undergo upper-secondary level vocational training, which provides specific skills, whereas women often enter baccalaureate school, which provides general knowledge (Eurostat 2017). Sparse evidence from Denmark and Germany implies that even within VET, women tend to choose school-based vocational training programmes more frequently than men (Estévez-Abe 2012; Protsch and Solga 2016). Furthermore, Heiniger and Imdorf (2018) find for Switzerland that men sort into training occupations with stronger links to the labour market and thus a higher level of specificity than the training occupations frequently chosen by women. We contribute to this literature in two respects. First, by exploiting the heterogeneity in Swiss VET to systematically assess the gender differences in skills, we go beyond the simple distinction between school-based and apprenticeship-based training. Second, the VOC literature has hitherto relied solely on country comparisons to test their theoretical framework. However, the mechanisms proposed by this approach describe how different education programmes within a country can influence individuals' skill endowment and thus their incomes. Therefore, we test the proposed mechanisms at an individual level.

To analyse the income levels of men and women with a VET diploma, we use the Swiss Labour Force Survey from 2003 to 2016. We combined it with data on the specificity level of the training occupations, which we collected from VET ordinances and curricula. These curriculum-based data enable us to measure general and specific skills more precisely than the dichotomous measurements used in most

research hitherto (Coenen et al. 2015; Hanushek et al. 2017; Korber and Oesch 2019). Furthermore, by including a range of control variables at the occupational level and using multilevel regression methods, we can isolate the effect of general and specific training from other potentially confounding characteristics of the training occupation.

2 Skills in Swiss Vet and Labour Market Entry

In Switzerland, about two thirds of a birth cohort enters VET, which consists of approximately 230 training programmes of 3 or 4 years' duration. At completion, they receive a federal VET diploma. The training occupations are governed collectively by the confederation, the cantons, and professional organizations. Thus, within each training occupation curricula and ordinances are standardized at a national level. Close to 90% of those in upper secondary VET finish a dual training programme, where training is provided in three locations: at the workplace, in inter-company courses and in vocational schools. In all training programmes, a large proportion of the skills and knowledge imparted during VET is occupation specific and highly labour market relevant because of the high involvement of employers in both setting the curricula and providing training (Wettstein et al. 2017). However, all training programmes also impart firm-specific and general skills, although to varying degrees. Whereas some programmes impart predominantly occupation-specific skills, others teach larger proportions of general education (Grønning et al. 2018). Although all apprentices also acquire some firm-specific skills, this skill type does not play a dominant role.[1]

Taken together, the dominant features of the VET system result in school-to-work transitions that follow what has been termed employment logic (Gangl 2003; Iannelli and Raffe 2007); VET diploma holders generally need little on-the-job training after vocational training and thus have favourable income prospects when working in their trained occupation (e.g. van de Werfhorst 2002), although the average income prospects vary among training occupations (Goggel and Zwick 2012). Employment in any occupation other than the trained one immediately after labour market entry often entails substantial wage penalties (Müller and Schweri 2015). This reduces the incentive to change occupation and invest in different skills (Imdorf et al. 2014). As a result, labour market allocation and initial income are strongly determined by the training occupation (Buchs et al. 2015; Kriesi et al. 2010).

[1] The reasons are, first, that large firms imparting a lot of firm-specific skills are infrequent in the Swiss labour market (Swiss Federal Statistical Office (BFS) 2018). Second, the high level of curriculum standardization prevents firms from emphasizing firm-specific skills.

3 Theoretical Considerations

3.1 Types of Skills and Sorting into Occupations

The culturalist perspective and the VOC perspective focus on two different skill dimensions held responsible for the gender wage gap: the gender type and the specificity of skills. Within the first perspective, some skills and tasks are considered to have a feminine or masculine connotation, whereas others are less associated with gender (Charles and Bradley 2009). Because occupations represent bundles of tasks that often have similar gender connotations, occupations and their corresponding skill sets can be classified as female-typed, male-typed, or gender-neutral (Anker 1997).

The VOC approach draws upon human capital theory, which distinguishes between occupation-specific, firm-specific, and general skills (Becker 1964). These skills differ by their transferability between employers or among occupations (Becker 1964) and the rate at which they decline or lose their value, termed the atrophy rate (Estévez-Abe 2012; Polachek 1981). General skills can be defined as skills with high transferability and low atrophy rates. They can be deployed across a wide range of occupations and situations within and outside the sphere of work, and they are less affected by technological and market changes. Thus, these skills hardly depreciate. Firm-specific skills are limited to one employer; they are not transferable and decline rapidly when not used. Occupation-specific skills are skills specific to one particular occupation, but they are transferable between employers within specific industries and occupations (Nawakitphaitoon 2014). Further, because they are more affected by technological development and decline during periods out of the workforce, they have higher atrophy rates than general skills (see also Polachek 1981). Hitherto, the transferability of skills, also termed broadness, has been scrutinized (e.g. Forster and Bol 2018; Müller and Shavit 1998). However, the relationship between skill atrophy and specificity and its consequences for gendered skill acquisition has hardly been discussed in the literature (for an exception see Estévez-Abe 2012).

Table 1 provides an overview of the two skill dimensions and shows how specific skills and general skills can be female-typed, gender neutral, or male-typed. However, more than half of the general skills taught in Swiss VET are female-typed.

In line with their emphasis of differing skill dimensions, these two theoretical strands claim that either cultural beliefs or rational decisions shape the sorting of men and women into different occupations. Seen from a culturalist perspective, so-

Table 1 Two skill dimensions with examples from Swiss vocational educational training

	Specific Skills	General Skills
Female-typed skills	Health, social, beauty care	Language, ethics
Neutral skills	Graphic design, laboratory methods	Searching for and recording information
Male-typed skills	Construction, using specific software	Financial reporting, understanding legal documents

cialization processes and young individuals' expression of gender identity follow gendered schemata (Charles and Bradley 2009; Ridgeway and Correll 2004). These gendered schemata are also internalized by gatekeepers such as parents, job counsellors or employers, who offer advice on the choice of training occupation or, in the case of employers, may be reluctant to hire apprentices of the "wrong" gender. Thus, women are channelled into female-typed occupations and men into male-typed occupations (Buchmann and Kriesi 2012; Kriesi and Imdorf 2019). In contrast, the rational choice approach argues that occupational choices are based on the returns to firm-specific, occupation-specific, and general skills, which differ between men and women. This assumption is supported by the VOC approach proposed by Estévez-Abe (2005, 2009, 2012). She claims that individuals seek to maximize their lifetime earnings while minimizing the risk of losing their investment in education (see also Becker 1964). For women, both work–family reconciliation and anticipated discrimination have an impact on this cost–benefit calculation. First, women have a higher likelihood of working part-time and of experiencing discontinuous working trajectories owing to unpaid care and household work. Second, employers are less willing to hire women for qualified and well-paid gender-integrated and male-dominated jobs, because statistically they have a higher likelihood of reducing working hours, missing worktime, and leaving work, resulting in less productive time (Aigner and Cain 1977; Arrow 1973). Thus, investment in firm- and occupation-specific skills, which are more prone to erode, represents a higher risk for women than for men (Polavieja 2008; Tam 1997). General skills, which provide flexibility on the labour market and attenuate statistical discrimination, represent a safer and more cost-efficient investment for women. Men do not anticipate job interruptions or discrimination and therefore do not perceive similar risks of their skills depreciating or declining. It is therefore safer and more profitable and consequently rational for men to invest in specific skills. In sum, these skill properties induce men to sort into education programmes with high proportions of specific training and women into programmes with high proportions of general education (Estévez-Abe 2012).

We argue that in a context where female-typed and male-typed occupations both vary in their levels of specificity, the rational choice approach and the culturalist approach can complement each other. Men might sort or be sorted into more specific occupations and women into more general occupations within the range of occupations perceived as acceptable for their gender identity (see Gottfredson (1981) for a discussion of "acceptable range").

3.2 Returns to Skills

Because different types of skills yield different returns, the sorting of men and women into training occupations imparting different skill sets can affect the gender pay gap. The culturalist approach argues that women earn less than men because their work has a lower cultural value and thus also lower monetary value (England 1992; Kilbourne et al. 1994). Consequently, women's performance and knowledge are generally less valued and lower paid than men's in all spheres of life (quantitative devaluation) (see also Hausmann et al. 2015). A further version of this approach, qualitative devaluation theory, assumes that the devaluation mainly pertains to fe-

male-typed skills and occupations. Consequently, and irrespective of the worker's gender, training providing female-typed skills should yield lower returns than training providing male-typed and gender-neutral skills. This argument is supported by findings showing that both female-dominated occupations (England and Li 2006; Leuze and Strauß 2009) and female-typed skills (Busch 2013; Grönlund and Magnusson 2013; Liebeskind 2004) yield lower returns than male-dominated occupations and male-typed skills. (For a contrary result see Leuze and Strauß 2016.) Because specific training in female-typed occupations provides predominantly female-typed skills and specific training in male-typed occupations provides mostly male-typed skills, this argument implies that *specific training in female-typed occupations should have a weaker positive effect on income than specific training in gender-neutral or male-typed occupations (H1)*.

Higher income in male-typed occupations could also arise because these training occupations impart a high proportion of well-paid occupation-specific skills, whereas female-typed training occupations impart higher proportions of less profitable general skills, as argued within the VOC framework. Occupation-specific skills are immediately deployable and employers do not face high costs for on-the-job training when diploma holders enter employment in the occupations they trained in. This leads to high productivity immediately after labour market entry. Workers are paid according to their productivity and training costs (Becker 1962; Mincer 1974). Thus, high levels of occupation-specific human capital have a positive impact on income at labour market entry, irrespective of the gender type of the specific skills. The positive effect of specific vocational training and vocational skills on income has been confirmed in a number of studies (Eggenberger et al. 2018; Hanushek et al. 2017; Jonker et al. 2006). Further, practical training at the workplace has been argued to impart individuals with more immediately deployable specific skills than school-based training, which leads to higher earnings (Jonker et al. 2006; Polidano and Tabasso 2014). Accordingly, we hypothesize that *the more occupation-specific training individuals have during VET, the higher their income will be at the beginning of their careers. This effect should be comparable in female-typed, male-typed and gender-neutral occupations (H2)*.

General skills are of less immediate practical use when entering a new job. Therefore, individuals with mainly general skills cannot achieve the same productivity level at labour market entry as individuals with mainly specific skills. However, general skills are transferable among occupations, which enhances opportunities for further learning and development (Hanushek et al. 2017) and do not depreciate (Estévez-Abe 2005). Individuals thus remain flexible both within their establishment and on the labour market. Research comparing those with a general and a vocational upper secondary degree find an increasingly positive effect of general education over the life course (Korber and Oesch 2019; Lavrijsen and Nicaise 2017). Because we focus on individuals at the beginning of their careers, we hypothesize that *general education should have a positive but smaller effect on income than specific training, irrespective of the gender type of the occupation (H3)*.

3.3 Gendered Returns to Different Types of Skills

The relationships between skills and income hypothesized above do not take gender into account. However, men and women may receive different returns for the same skills. The varieties of capitalism and the cultural approach differ somewhat in their explanations of this disparity.

One strand within the culturalist approach, expectation state theory, argues that the returns to female-typed, male-typed and gender-neutral skills depend on individuals' gender. It is argued that status characteristics determine how we evaluate men's and women's competences and performance (Berger et al. 1977). Status characteristics are cultural beliefs about the social value of competences and personality attributes. They can be diffuse (e.g., men are generally more competent than women; see also England 1992) or skill-specific. The latter affect expectations about the performance of specific tasks and determine how we evaluate men's and women's skills and abilities (Correll and Ridgeway 2006). Men are expected to be best at performing male-typed tasks, and women are expected to be best at performing female-typed tasks. Moreover, individuals possessing gender-atypical skills are considered to be less competent than those possessing gender-typical skills. The only empirical evidence we are aware of concerning this relationship is a study by Busch (2013), who finds that the lower income for men in female-typed occupations is related to men performing female tasks in these jobs. Accordingly, women who trained in female-typed occupations and men who trained in male-typed occupations are likely to benefit more from their occupation-specific training than employees who trained in gender-atypical occupations. Therefore, we hypothesize that *the returns to specific training in male-typed training occupations should be higher for men than for women, and the returns to specific training in female-typed occupations should be higher for women than for men (H4a)*. Furthermore, because the skills imparted during general education are predominantly female-typed, women should benefit the most from general education. This should be the case both in male-typed occupations and in gender-neutral and female-typed occupations. Thus, we hypothesise that *the returns to general education should be higher for women than for men, irrespective of the gender type of the training occupation (H5a)*. However, another strand within the culturalist approach, quantitative devaluation theory, argues that the gender type of the occupation should not matter for the returns to skills (England 1992). If women's work is less valued than men's work in general, as this perspective argues, *men should receive higher returns to both general education (H4b) and specific training (H5b) irrespective of the gender type of the training occupation*.

The VOC approach focuses on employers' investment rationale. It argues that employers have higher costs when losing employees with specific skills than when losing employees with general skills (Polachek 1981; Tam 1997). Search costs and costs for introductory on-the-job training for positions requiring specific skills are generally higher than those for positions at a similar qualification level requiring more general skills. Furthermore, because occupation-specific skills are more prone to depreciate than general skills, the productivity losses associated with work interruptions and low working hours are higher for those with specific skills than for those with general skills (Fuller 2008). Employers with a demand for specific skills

Table 2 Expected male–female differences in the returns to specific and general skills: overview of hypotheses 4 to 7

	Type of skill	Male-Typed	Gender-Neutral	Female-Typed	Hypothesis	Rationale
Culturalist Approach	Specific	♂	♂ ♀	♀	4a	Gendered expectations of men and women's abilities
	General	♀	♂ ♀	♂	5a	General skills mostly female-typed
	Specific and general	♂	♂	♂	4b and 5b	General devaluation of women's work
VOC Approach	Specific	♂	♂	♂	6	Gendered expectations of family-related work interruptions
	General	♂ ♀	♂ ♀	♂ ♀	7	No impact of expected interruptions (low skill depreciation)

♂ returns for men are higher, ♂ ♀ equal returns, ♀ returns for women are higher

therefore prefer to invest in male rather than female workers. Accordingly, *specific training should yield higher returns for men than for women (H6)*. VOC predicts similar returns for men and women for general skills, because these skills are less prone to depreciate. Thus, *the returns to general education should not differ between the genders (H7)*. Table 2 summarizes the hypotheses according to the VOC and culturalist approaches. Because the two approaches propose different causal mechanisms, hypothesis 4a contradicts hypothesis 6 and hypotheses 5a and 5b contradict hypothesis 7. Although the proposed mechanisms differ, hypotheses 4b and 6 predict the same outcome.

4 Data, Measures and Analytical Strategy

4.1 Data and Sample

Our analysis draws on two main data sources. We pool the waves of the Swiss Labour Force Survey (SLFS) between 2003 and 2016. The SLFS is a representative sample of the permanent Swiss adult population, and respondents are surveyed for up to 5 consecutive years. We combine these data with register data on income from the social protection on the labour market statistical project (SESAM). Register data reduces the frequent bias in self-reported income. Because we focus on the early career, we only consider employed individuals who had a maximum of 10 years of experience on the labour market after VET.[2] Half of the sample had no more than

[2] Ideally, we would restrict our sample to the year directly after labour market entry. However, because insufficient sample sizes would limit the statistical power of our analyses, we extend our observation window to the first 10 years. Tests using different cut-off points, including between 2 and 10 years of experience, show that the findings are robust irrespective of the number of years included.

3 years of experience and about two-thirds had no more than 5 years (for further descriptive statistics see Table A1 in the Online Appendix). We further restricted our sample to individuals who completed an upper secondary dual or school-based VET programme of 3 or 4 years' duration between the years 2000 and 2016 while between the ages of 17 and 25 years.[3] Self-employed respondents and those working abroad at the time of the surveys were excluded from the sample. Furthermore, respondents holding a tertiary-level degree were excluded because information on their initial training programme was lacking.

The SLFS data were combined with data on the specificity of each training occupation, which was collected from federal VET ordinances and curricula. They give detailed and comparable information on the number of lessons in the learning locations. The main variation in the specificity measures is between the training occupations. A smaller part of the variation is time dependent and due to revisions of the documents during the period in question (Grønning et al. 2018). The individual-level SLFS data were combined with the occupational-level data by using the title of the training occupation and the year of completion of the training. An accurate match with one of the 550 current or repealed ordinances was ensured by using the eight-digit occupational code of the training occupation in the SLFS (over 20,000 occupational titles), which serves as a basis for the Swiss Standard Classification of Occupations (SSCO2000) (BFS 2003). The final sample includes 8473 observations based on 6136 individuals who trained in 215 different training occupations.

4.2 Measures

The dependent variable is the log of the yearly (pre-tax) gross labour income in the year of the interview.[4] We dropped observations belonging to the highest or lowest wage percentage. For respondents working part-time we calculated full-time wage equivalents based on their employment percentage (yearly income*[100/employment percentage]). In order to control for a potential misspecification we included a dummy variable capturing part-time work.

At the individual level, the main explanatory variable is the gender of the respondent (Women: 1, Men: 0). At the occupation level, the *gender type of the training occupation* is identified with data from the Swiss census 2000 and based on the five-digit level of the SSCO2000. It distinguishes between female-typed (<70% female employees in the occupation), gender-integrated (30–70% females) and male-typed (>30% females) training occupations.

As yet, no consensus has arisen about how to operationalize skill specificity. The dichotomy between workplace- and school-based training programmes used in early comparative research (Jonker et al. 2006; Wolbers 2007) disregards the heterogeneity within education tracks (Forster and Bol 2018). A subsequent strand of research took this critique into account by focussing on the broadness of single education programmes, i.e. the transferability of the skills imparted. This concept is opera-

[3] A small minority ($N = 197$) receive their diploma before their 18th birthday. We retain them in the sample because early completion, for example, owing to early primary school enrolment, is possible.

[4] No other income sources are included.

tionalized by measuring mobility rates between occupations (e.g. Forster and Bol 2018; Vogtenhuber 2014), subjective assessments of the transferability of skills (e.g. Coenen et al. 2015; Muja et al. 2019) and the similarity of learning objectives in curricula (Eggenberger et al. 2018). Underlying these measures is the assumption that the sum of skills imparted is equal in all training programmes. However, some training programmes might provide large amounts of both skill types whereas others might provide little of either. Furthermore, these operationalisations rely solely on the transferability of skills, whereas the atrophy rate is neglected. However, atrophy is a crucial aspect of skill specificity in explaining gendered returns to skills. More transferable skills are not necessarily less subject to technological or market change. To answer our research question, both aspects should therefore be taken into account. Using information from VET curricula allows us to distinguish between less transferable skills prone to depreciate (i.e. specific skills) and transferable skills that are highly unlikely to depreciate (i.e. general skills). Furthermore, we are able to simultaneously include continuous measures of both general and specific skills in the analysis.

The variable *general education* captures the number of days in general education in vocational school per week. This includes language lessons and lessons in history, ethics, society, politics, law and economics. The aim of these lessons is to provide apprentices with competences that enable them to "navigate in their personal life context and in society as well as to handle private and professional challenges" (State Secretariat for Education 2006, p. 1). Although some of the knowledge is more relevant in some training occupations, such as ethics in healthcare and languages in tourism, the teaching focuses on skill development independently of the occupation. Thus, these skills have a low atrophy rate. General education ranges between 0.24 and 1.10 days a week (Table A1). The variable for *occupation-specific training* is the average number of specific training days per week across all three training locations (see the section Skills in Swiss VET and Labour Market Entry). In the firm, apprentices acquire practical occupation-specific skills through training and work experience. Basic theoretical occupation-specific knowledge is provided in vocational school. Intercompany courses teach practical skills that are not provided in the firm for safety reasons or because of firm specialization. These specific skills need to be updated continuously through work experience to avoid depreciation. Occupation-specific training ranges between 3.60 and 5.08 days a week.[5] The construction of both skill measures followed two rules: (1) eight lessons are equal to one day of training; (2) one year is equal to 47 weeks of training.

We control for potential occupation-level confounders of the relationship between types of skills and wages. Because occupation-specific demand and supply of labour are highly relevant to the wage-setting process within occupations (Brunner and Kuhn 2014), we include an indicator measuring respondents' *occupation-specific job opportunities* when they entered employment at their current workplace. The index captures the ratio of annual occupation-specific job openings (two-digit level of SSCO2000) for diploma holders and unemployed with a vocational diploma weighted by the access probability of the opening with a given credential (see Sac-

[5] Legally a working week (including vocational school and intercompany courses) cannot exceed 5.5 days.

chi et al. (2016) for details). The Swiss Job Monitor Data (Sacchi 2014) was used to measure the demand side, i.e. job openings, whereas administrative records of all unemployed, the placement services and labour market statistics, were used to estimate the supply side. Higher numbers on the index are associated with better opportunities. In order to account for variation in intellectual requirements and student heterogeneity between the training occupations, we used Stalder's (2011) classification of the *intellectual requirement level*, ranging from low requirements (1) to high requirements (6). Unclassified occupations were given the rating of a similar occupation within the same occupational field with the same training duration. Further, we included a dummy for *vertical differentiation*, which indicates whether there is a 2-year training programme leading to a federal certificate within the same occupation. Last, we included the *share of large firms* (>100 employees) in each training occupation.[6] Large firms provide higher quality training than smaller firms because they often have internal labour markets and train apprentices to meet their own demand for a qualified workforce (Soskice 1994).

Individual-level control variables include information on *marital status* (single, married/civil union or divorced/separated), if respondents have *children* under the age of 15, *migration background* (born outside of Switzerland or foreign citizenship), if the respondents participated in *further education* (baccalaureate or tertiary degree) at the time of the survey and if they had completed a *school-based training programme* or one or more *degrees* at upper secondary level.[7] This last variable distinguishes the majority who completed one federal diploma from those who also completed a 2-year training programme leading to a federal certificate and those who also completed a baccalaureate[8] or several federal diplomas. Experience, working conditions and firm characteristics are controlled for by including the number of *months since graduation, tenure* in months (excluding time during apprenticeship), *managerial position, frequent overtime, part-time-work* (less than 80%), *fixed-term contract, size of firm* and seven geographical *labour market regions*. In addition, we measured *change in occupation* since training by comparing the two-digit SSCO2000 code of the training occupation and the current occupation and *workplace change* since the apprenticeship by comparing tenure and time since training.

4.3 Analytical Strategy

First, to assess whether men and women tend to sort into occupations that impart different proportions of specific and general skills, we look at the distribution of skills by gender with kernel density plots. This provides a valid picture of the distribution across the whole range. Second, we analyse men's and women's returns to skills by running random intercept models. These analyses enable us to account for the person-years as well as for the clustering of individuals into training occupations,

[6] The calculations are based on the two-digit SSCO2000 classification and a pooled dataset of the SAKE waves from 2003 to 2016.

[7] The results remain stable when individuals with school-based VET are excluded.

[8] Because only a tiny proportion of VET diploma holders also hold an academic baccalaureate, we combine them with those holding a vocational baccalaureate (22 observations).

thus reducing the risk of assuming a significant relationship where there is none (Gross 2016). Owing to the change in SLFS panel rotation in 2010, more than half of the respondents are observed at one time point only.[9] Nevertheless, we include the person-years in our model because correlated measurement errors are likely

Table 3 Determinants of Income

	Model 1		Model 2	
	Coefficient	Standard Error	Coefficient	Standard Error
Main Explanatory Variables				
Gender Type of Occupation (Reference: Male-Typed Occupation)				
Gender-Neutral Occupation	–0.023	0.022	–0.021	0.022
Female-Typed Occupation	–0.075***	0.017	–0.072***	0.017
Occupation-Specific Training (Days per Week)	–	–	0.130*	0.057
General Education (Days per Week)	–	–	0.154	0.090
Women	–0.032**	0.012	–0.030*	0.012
Variance Components				
Variance between Occupations (Null Model: 0.022***)	0.004***	0.001	0.004***	0.001
Variance between Individuals (Null Model: 0.114***)	0.076***	0.003	0.076***	0.003
Variance within Individuals (Null Model: 0.058***)	0.054***	0.002	0.054***	0.002
ICC Occupation Level (Null Model: 0.115)	0.031	–	0.028	–
ICC Individual Level (Null Model: 0.587)	0.566	–	0.568	–
R^2 Occupational Level[a]	0.816	–	0.831	–
N Person-Years	8473			
N Persons	6136			
N Occupations	215			

Random Intercept Models
Control variables included at the occupation level: job opportunities, intellectual requirement level, vertical differentiation, share of large firms
Control variables included at the individual level: migration background, children, marital status, frequently working overtime, number of diplomas, in further education, school-based training, months since graduation, tenure, management position, firm change since graduation, change in occupation, fixed-term contract, part-time work, firm size, region. For full model see Table A2 in the Online Appendix
Significance level: *$p \leq 0.05$; **$p \leq 0.01$; ***$p \leq 0.001$
[a]Raudenbush and Bryk (2002) R^2 at the occupation level

[9] Until 2010, respondents were surveyed annually for 5 consecutive years. From 2010 onwards, individuals were interviewed four times over a period of 18 months. We use only annual data for both time periods. For individuals surveyed after 2010, we therefore have a maximum of two observations.

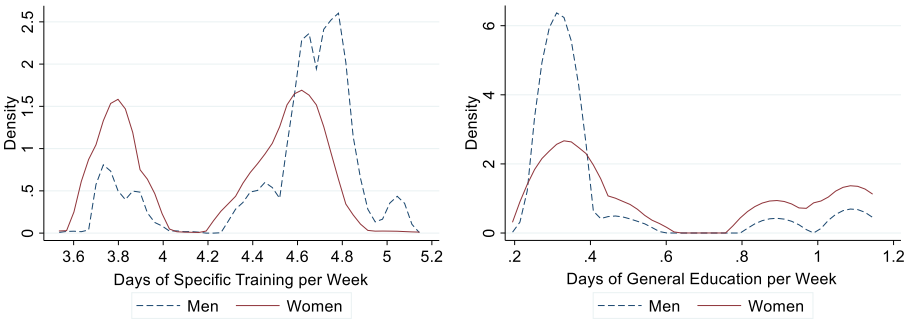

Fig. 1 Occupation-Specific Training and General Education in Swiss Training Occupations

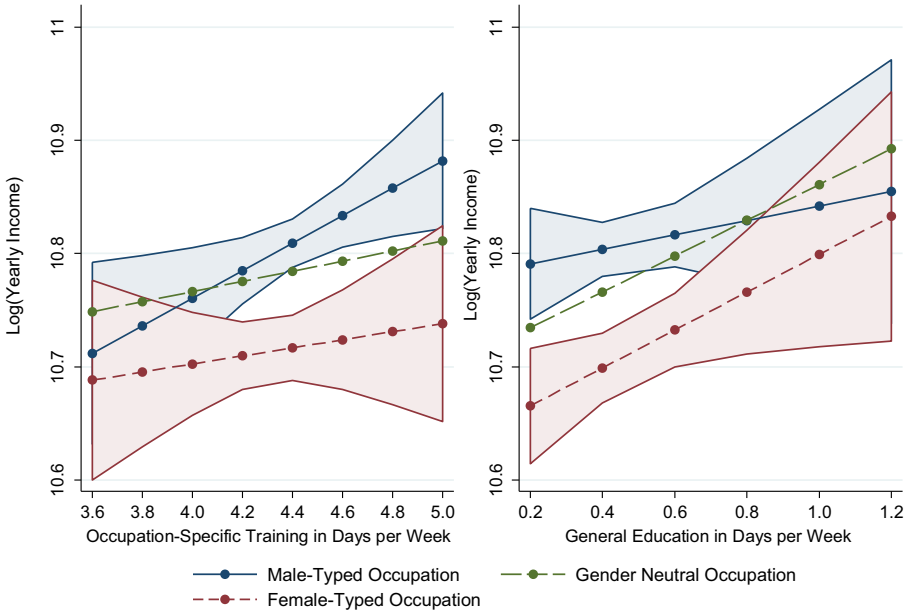

Fig. 2 Predicted Income of Occupation-Specific Training and General Education in Female-Typed, Male-Typed and Gender-Neutral Training Occupations. (Linear Prediction based on Models 3 and 4, Fixed Portion, Predictive Margins with 90% Cis for Male- and Female-Typed Occupations)

for those surveyed several times. Our random intercept models are based on the following specification:

$$\begin{aligned} Y_{\text{ijk}} =& \beta_p X_{\text{pijk}} + \beta_1(\text{Gender})_{jk} + \beta_q Z_{\text{qjk}} + \beta_2(\text{Gender Type})_k \\ &+ \beta_3(\text{Specific Training})_k \\ &+ \beta_4(\text{General Education})_k + \beta_r A_{rk} + v_k + \mu_{jk} + \varepsilon_{\text{ijk}}, \end{aligned}$$

where Y_{ijk} is the logged early income in year i for person j, who trained in occupation k. We have p control variables X, which vary between the years within each person (e.g. part-time work, tenure), q control variables Z, which vary at the

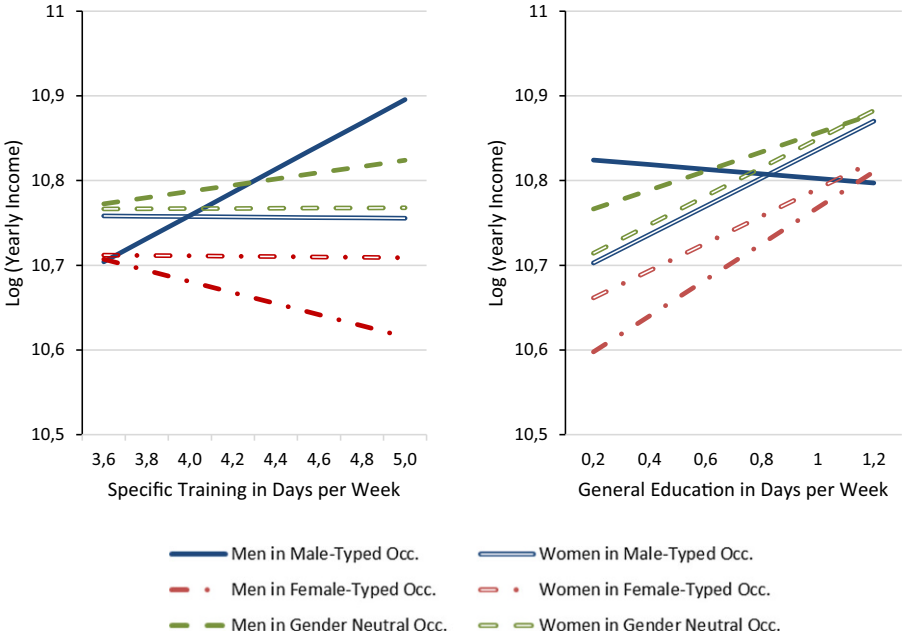

Fig. 3 Predicted Income of Occupation-Specific Training and General Education for Men and Women in Male-Typed, Female-Typed and Gender-Neutral Training Occupations. (Linear Prediction based on Models 5 and 6, Fixed Portion)

individual level (e.g. migration background), and r control variables A, which vary at the occupational level. The term β_1 is the effect of gender and β_2 to β_4 are the effects of our main explanatory variables at the occupational level: the gender type of the occupation, specific training and general education. Finally, v_k and μ_{jk} are the error terms at the occupational and individual levels, whereas ε_{ijk} is the residual error term.

For the regression analysis, all continuous variables were grand mean centred. Model 1 includes the gender type of the occupation, gender and the control variables. In Model 2, we add our specificity measures. Next, we test an interaction effect between the gender type of the occupation and specific training (Model 3) and the gender type of the occupation and general education (Model 4). Last, Models 5 and 6 estimate interactions between the gender type of the training occupation, the respondents' gender and the skill type. Models 1 and 2 are depicted in Table 3. Models 3 to 6 are shown in Table A2 in the Online Appendix. The predicted income values (log) are illustrated in Fig. 2 (Models 3 and 4) and Fig. 3 (Models 5 and 6).

5 Results

5.1 Descriptive Results—Gender Differences in Skills

In the first step, we examine the association between gender and skill specificity of the training occupation. Figure 1 shows kernel density plots for occupation-specific and general skills. They illustrate that the range of general and specific training is considerable. Training occupations vary substantially in the degree to which they impart specific and general skills and knowledge. It is important to consider this heterogeneity in specificity within the VET system when assessing the impact of specific and general training on labour market outcomes.

Furthermore, the range of specific training is similar for the group of female-typed (3.60 to 4.76 specific training days a week), male-typed (3.60 to 5.05 days of specific training) and gender-neutral training occupations (3.60 to 5.08 days of specific training; results not shown). Thus, some female-typed occupations are very specific, whereas some male-typed training occupations rather emphasize general education. However, in absolute numbers, men and women sort into occupations with different levels of specific and general education and training. Women tend to sort into training occupations that emphasize general education and provide the least specific training, whereas men predominantly sort into training occupations with more specific training and only a basic level of general education.

5.2 Multivariate Results—Income Differences Between Men and Women

We find that women have a significantly lower income than men when including gender as the only covariate in a regression model without random intercepts for occupations (β women = –0.094, se = 0.009; model not shown). We can thus confirm previous findings that women on average earn less than similarly qualified men during the first years of their careers (Bertschy et al. 2014; Combet and Oesch 2019). At first glance, the gender pay gap of 9.4 percentage points is smaller than the average income difference between men and women within the vocationally qualified Swiss workforce (Kaiser and Möhr 2019). A likely reason is the young age and still fairly homogenous work experience of the respondents in our sample. However, the difference is substantial if we consider that most of our respondents have not yet begun families; thus, employment patterns do not yet differ by gender owing to family considerations. Furthermore, an initial difference has lasting implications because entry conditions influence individuals' long-term wage trajectories (Brunner and Kuhn 2014).

The effect of gender decreases to –0.026 (se = 0.014) when including random intercepts for the occupations in the model (model not shown). Thus, a comparison of the effect of gender in the models with and without random effects for the training occupation suggests that the gender pay gap is three times as large if we do not account for the sorting into training occupations. As previous research leads us to expect, the overwhelming part of the gender pay gap in early careers is due to women entering lower-paid occupations (Bertschy et al. 2014). After including the control variables, the gender pay gap increases to 4.7 percentage points (model

not shown). Adding the gender-type of the occupation (Model 1; Table 3) and the measures for occupation-specific and general training (Model 2) reduces the gender pay gap somewhat. However, women remain disadvantaged even when comparing men's and women's income in occupations with the same gender type and the same amount of general education and occupation-specific training.

5.3 Multivariate Results—The Returns to Different Types of Skills

Turning to the income differences between occupations, the intra-class correlation coefficient of the null model indicates that 11.5% of the total variance in income can be attributed to differences between the training occupations (Table 3). Thus, allocation into training occupations matters for income during the first years of labour market entry. Considering the variance only at the occupation level, we find that the control variables explain 74.7% of the variation at this level (model not shown). The gender type of the occupation can explain a further substantial part, 6.9%, of the differences in average income between the occupations (see R^2 at the occupation level in Model 1; $0.816 - 0.747 = 0.069$). Including the general and specific training in Model 2 does not change the explained variance at the occupation level substantially. Thus, the specificity of the training explains only a minor part of the differences in income levels between the occupations.

In accordance with previous research, we find that individuals in female-typed occupations earn significantly less than those in male-typed occupations (Model 1) (e.g. England and Li 2006; Leuze and Strauß 2009). This is also the case when we control for skill specificity (Model 2). Thus, the lower income in female-typed occupations is not due to the training in these occupations being less occupation-specific.

To answer our first research question, whether the returns to specific skills depend on the gender type of the occupation, we include an interaction between the gender type of the training occupation and specific training and general education (Models 3 and 4 in Table A2; Fig. 2). This allows us to test hypotheses 1 to 3. First, if we compare the level of the effects in Fig. 2, we find that individuals who trained in female-typed occupations earn significantly less than individuals who trained in male-typed occupations, independent of the level of specific or general training. Individuals with an average number of days of specific training and general education earn 9.4 percentage points less in a female-typed occupation than in a male-typed occupation. The income in gender-neutral training occupations is slightly lower than in male-typed occupations. However, the difference is not significant in either of the models.

Second, we consider the slopes of the effects of specific training (Fig. 2, left side) to assess whether the returns to occupation-specific skills depend on the gender type of these skills. Specific training has a positive effect on income in all occupations. This is consistent with the VOC assumptions that occupation-specific skills gained during training enhance labour market entrants' productivity and thus lead to higher wages. It is also in line with research showing that people with vocational upper-secondary education have an income advantage at the beginning of their careers over those with general upper-secondary education (Hanushek et al. 2017). However,

an increase in occupation-specific training pays off less in female-typed and gender-neutral occupations than in male-typed occupations. One more day of specific training in a female-typed occupation is associated with an increase in income of 3.6 percentage points, whereas the corresponding increase in a male-typed occupation is 12.1 percentage points. Thus, as hypothesis 1 predicts, the returns to specific skills are higher in male-typed occupations than in female-typed occupations, which is in line with the culturalist approach. Consequently, we cannot confirm our second hypothesis that specific skills pay off equally in male-typed, gender-neutral and female-typed occupations, as predicted by the VOC approach.

Third, we consider the slopes of the effects of general education (Fig. 2, right side). General education has a positive effect on income in all occupations. However, the slope is steeper in female-typed and gender-neutral occupations than in male-typed occupations. In female-typed occupations, one more day of general education is associated with an income increase of 16.7 percentage points, whereas the corresponding increase in male-typed occupations is 6.4 percentage points. Thus, the rational-choice argument that specific skills pay more than general knowledge during early careers holds true only in male-typed occupations. In female-typed and gender-neutral occupations, the reverse is the case. Women in female-typed and gender-neutral occupations receive higher returns for general education than for specific training. Therefore, we cannot confirm our third hypothesis that general education yields lower returns than specific training, irrespective of the training occupation. In sum, the results in Fig. 2 suggest that male-typed and to some extent gender-neutral skills have a higher value on the Swiss labour market than female-typed skills. This evidence points towards a devaluation of skills considered to be female, and contests the prediction of the VOC approach that specific female-typed skills are as valuable as specific male-typed skills.

5.4 Multivariate Results—Unequal Returns to Skills for Men and Women

In this section, we analyse our second research question, whether men and women receive different returns to the same type of skills (see Models 5 and 6 in Table A2; Fig. 3 and Table 4). To test whether men have higher returns to specific skills than women (hypotheses *H4a, H4b* and *H6*), we interact the gender of the employees with the gender type of the training occupation and the specific training. The results on the left side in Fig. 3 show that men profit more from male-typed specific skills than women. In male-typed training occupations, men and women with 4 days of specific training are paid equally, whereas in occupations with 5 days of specific training a week, men have no less than 14.0 percentage points higher income than women. The higher returns to specific skills for men than for women is also manifest

Table 4 Summary of Results

Type of skill	Male-Typed	Gender-Neutral	Female-Typed
Specific	♂	(♂)	(♀)
General	♀	♂ ♀	♂ ♀

♂ returns for men are higher, ♂ ♀ approximately equal returns, ♀ returns for women are higher
Results in parentheses are not statistically significant

in gender-neutral occupations, although not as pronounced and not statistically significantly. For those who trained in female-typed occupations, we see the opposite trend. Men with high levels of female-typed specific skills earn less than men with low levels of female-typed specific skills, whereas for women, the level of female-typed specific skills has no effect on income. However, the difference between the genders in female-typed occupations is not significant.

The results in Fig. 3, left side, leads us to reject our sixth hypothesis, based on VOC, that specific training has a positive effect on income independent of the gender type of the skills. It seems that the value of occupation-specific skills depends on the fit between the gender of the job incumbent and the job itself, which is in line with the culturalist approach (*H4*). Thus, men are rewarded for acquiring male-typed skills and penalized for acquiring female-typed skills. Furthermore, employers seem to be particularly reluctant to invest in women for jobs requiring substantial male-typed occupation-specific skills, possibly because they doubt their abilities to perform within a male-typed domain.

To test whether the returns to general education differ between men and women (*H5a, H5b* and *H7*), we interact the employee's gender with the gender type of the training occupation and general education. The results in Fig. 3, right side, show that in male-typed occupations, general education is associated with higher income for women but not for men. Men and women in female-typed and gender-neutral occupations receive positive and similar returns to general education. Furthermore, the income differences between men and women in these two types of occupations are not significant.

The pattern in Fig. 3 (right side), supports a combination of the VOC and culturalist approaches. The comparable returns to general skills for women and men in female-typed and gender-neutral occupations is in line with hypothesis *H7* and the VOC approach. Thus, in female-typed and neutral occupations the amount of general education has virtually no influence on the gender pay gap. This result suggests that employers are willing to invest in women with a lot of general skills, possibly because these skills are flexible and do not depreciate when employees are out of the workforce. Nevertheless, the higher returns to general education for women than for men in male-typed occupations could in part also be due to employers' expectations that women with a lot of general skills will perform better than men with the same amount of general skills, because these skills are female-typed.

Taken together, the results in Fig. 3 show that over most of the skill distribution, women have lower income levels than men in both male-typed and gender-neutral occupations. Only in female-typed occupations do men not have higher incomes. However, the slopes show that the returns to skills are not consistently higher for men than for women, as proposed by quantitative devaluation theory. Thus, we cannot confirm our hypotheses *H4b* or *H5b*. Furthermore, the results confirm the findings in Fig. 2 that the largest difference in income is between male-typed and female-typed occupations, with male-typed occupations yielding the highest returns (see also the discussion in the section Multivariate Results—Income Differences Between Men and Women). This is in line with the qualitative devaluation theory, which claims that female-typed skills have less value on the labour market than male-typed skills.

6 Conclusion

The persistent gender pay gap is widely discussed both in academia and amongst the broader public. The unequal distribution of men and women across occupations has been identified as one possible reason. However, the mechanisms that explain the relationships between gender, occupations and income are still insufficiently explored. By analysing whether young men and women receive different returns for general and specific skills and whether these returns depend on the gender type of the occupation, we aimed to shed more light on this gap.

In summary, we are able to confirm that, in Swiss VET, men train more often in programmes imparting large proportions of occupation-specific skills, whereas women more often choose programmes with larger proportions of general education. Second, workers in male-typed occupations have a higher income than workers in female-typed occupations. Third, high occupational specificity increases young people's income after labour market entry, although only for men in male-typed and to a lesser extent gender-neutral occupations. Fourth, a high proportion of general education pays for both women and men in gender-neutral and female-typed occupations. Fifth, the correspondence between gender and gendered occupation-specific skills pays for both men and women.

Taken together, these findings show that the incomes of men and women in their early careers are affected by a complex interplay between gender and occupation-specific skill endowment. However, the sole recourse to either cultural devaluation theory or the varieties of capitalism approach falls short in explaining the patterns observed, which suggests that various forces are at work simultaneously. At first glance, the lower returns of women for most skills and types of occupation is in line with quantitative devaluation, which claims that women's work is generally devalued irrespective of their skills. However, the finding that men receive even lower returns than women for general education and for female-typed occupation-specific skills runs counter to this explanation. The result that male and female workers in male-typed occupations have higher incomes than their counterparts in female-typed occupations supports the qualitative devaluation thesis, which assumes that female-typed skills and work are generally devalued and thus pay less. This mechanism seems to be reinforced for men who acquire female-typed skills and therefore experience a mismatch between their gender and the gender type of their occupation. Similarly, women are penalized for a lack of (female-typed) general skills. Women with little general knowledge and a high proportion of female-typed occupation-specific skills even experience a general devaluation of their occupation-specific skills and an additional penalty because of a lack of expected general skills. This supports the assumption that performance and competence expectations are particularly low for men with low-valued female-typed specific skills and for women with only a limited amount of general education, and leads to lower incomes for both groups.

The wage penalty for women may also be due to mechanisms proposed by the VOC approach. A lack of transferable skills that do not decline or depreciate over time could signal higher productivity losses, because women are expected to take more time off work than men. Thus, for employers to acknowledge women's skill

level and adjust their wages accordingly, our results suggest that their skills must be both female-typed and general. Both the devaluation of female-typed skills and the high returns to general skills for women suggest that the overall gender pay gap in Switzerland could decline if more men invested in (occupation-specific or general) female-typed skills. Furthermore, our results suggest that different returns to the same skills for men and women shape the allocation of young individuals into different training occupations. The findings are in line with the rational choice argument that men and women invest in the skills that provide the highest returns. Men acquire male-typed or gender-neutral occupation-specific skills, which yield the highest returns at labour market entry. Women benefit less from these skills, and thus enter occupations imparting more general knowledge. However, our results do not rule out that employers act as gatekeepers and hinder young women and men from entering certain occupations (Fuller et al. 2005). It is likely that both mechanisms are at work and reinforce each other.

The result for specific training also indicates that, at least in Switzerland, the prevalent empirical finding that vocational skills secure high wages in early careers (Hanushek et al. 2017; Jonker et al. 2006) only holds true for young men who trained in male-typed or gender-neutral occupations. We find no evidence that women or men who trained in female-typed occupations benefit from highly specific training. As a consequence, the gender pay gap in Switzerland could even rise if a higher proportion of women invested in male-typed (or gender-neutral) specific skills.

Our results and conclusions pertain to upper-secondary VET in a country where VET and the labour market are strongly linked and occupationally segmented. Recent studies imply that the relationship between skills acquired during education and gendered labour market outcomes is weaker in countries with weaker linkage (Imdorf et al. 2014; Smyth and Steinmetz 2015). In countries where VET is less prevalent or is school-based rather than firm-based, the gender pay gap could be less pronounced, because the education system imparts more general education, which is more favourable for women. A comparative design would be needed to investigate this question further. In addition, our results could be biased because we use a proxy for experience, time since training. However, this is mitigated by the fact that the respondents in our sample are rather young (mean age 23), mostly unmarried (87%) and without family obligations (92%). Last, we cannot control a potential selection bias into tertiary education by gender. Given that, on average, men with vocational education and training still have higher transition rates to higher education (Buchmann et al. 2007), this may lead to an underestimation of women's income disadvantage. Further research based on longitudinal data is necessary to overcome these data restrictions.

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