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HOW EDUCATIONAL TRACK DETERMINES WAGES IN EARLY CAREERS. PANEL EVIDENCE FOR SWITZERLAND

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How educational track determines wages in early careers. Panel evidence for Switzerland

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Abstract

Vocational education and training (VET) is known to ease the entry into the labour market by providing specific skills more readily applied in a given occupation. In comparison, general education graduates may face more difficulties entering the labour market due to a lack of work-related skills. However, general education graduates may be better rewarded after several years of experience, while VET graduates may stagnate in jobs and pay-levels similar to those at labour market entry. This paper analyses whether VET graduates have a decreasing wage advantage on general education graduates in their twenties. Early careers of youth are analysed by drawing on data of the Swiss Transition from Education to Employment (TREE) cohort study. We follow a cohort of youth from the end of their upper secondary education (apprenticeship or baccalaureate degree) up to the age of 30. This paper uses a matching method to account for selection based on academic achievement and social origin of students before they choose vocational or general education. Our results suggest that both VET and general education graduates earn similar hourly wages at the entry into the labour market once we take this selection into account. The second main finding is that six years of work experience, female general education graduates earn significantly more than female VET graduates.

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1   Introduction

One of the aims of education is to prepare youth to enter the labour market. In many OECD countries, two different tracks at the upper secondary level try to take up this challenge: the general – or academic – track and the vocational one. While the former tends to focus more on general skills such as languages, mathematics and science, the latter focuses more on work-related skills and prepares youth for a specific occupation. Defenders of general education argue that general skills are adaptive and flexible, and prepare youth for a career in different occupations and sectors in a context of rapid technological change (Krueger and Kumar 2004, Hanushek et al. 2017). Contrariwise, VET advocates argue that vocational education prepares youth better to enter the labour market by providing VET trainees with skills that are directly applicable in a given job (Shavit and Müller 1998, Ryan 2001, Gangl et al. 2003, Breen 2005).

There is some evidence supporting both sides. Recent research (Cörvers et al. 2011, Forster et al. 2016, Hanushek et al. 2017) shows that while VET successfully prepares youth to enter the labour market, holders of general education have an advantage towards the end of their careers both in terms of employment and wages. These studies present some differences among countries but a similar trend of a later disadvantage in careers for VET graduates in most of them. VET seems to ease a smooth, immediate transition into the labour market, but also to increase the risk of unemployment later in the career and lower wage growth than general education.

However, this research is based on cross-sectional datasets and therefore cannot distinguish between age and cohort effects. It is not a given that youth entering the labour market a certain year will be subjected to the same circumstances later in their careers as older workers observed the same year. We address this issue by following a single cohort of school leavers in their early labour market career. Furthermore, we address the question of selection, which is often (partly) neglected in the existing body of literature. Some individual characteristics are indeed known to have an impact on both the type of education followed and the situation on the labour market (notably earnings). Characteristics that could introduce this selection bias include social origin such as parents' education and class (Erikson and Jonsson 1996, Goldthorpe 1996, Erikson and Rudolphi 2009), migration background, and socio-geographical context (Imdorf et al., 2014, Glauser and Becker 2016). Furthermore, cognitive skills may not only have a direct influence on the choice of track (notably if the general track favours high-achieving students), but also be likely to impact future earnings, disregarding the school track attended. It is then difficult to isolate the net effect of education on labour market outcomes. Our study aims at assessing the impact of education on labour market outcomes while reducing the selection bias as much as possible.

This article[1] addresses the question of how the type of upper secondary education, be it vocational or general, affects wages in early careers. Our contribution is focused on youth in Switzerland, a country where VET enrolment is frequent: In 2016, 68 per cent of all school leavers enrolled in VET tracks at

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[1] In a previous version, this contribution has been accepted as part of a cumulative doctoral thesis submitted to the University of Lausanne (Korber 2019).

upper secondary level[2]. We use the Swiss cohort panel study TREE (Transitions from Education to Employment) (Gomensoro and Meyer 2017), which follows up a school leavers cohort from the end of compulsory school (age 16) up to the age of 30. By matching students on the basis of their PISA reading score, social origin, migration background and geographic region at the age of 16 – i.e. before the beginning of the upper secondary track – we adopt a quasi-experimental design to address the aspects of selection mentioned above. We also address the question of a different return on general and vocational education for men and women, due to stronger gender segregation in vocational than academic programmes and, possibly, due to a lower inclination of employers to invest in firm-specific skills of female rather than male employees.

We first present our hypotheses on how different types of education lead to different early careers. We then discuss the problem of selection, before presenting the data and matching method used for our analyses. Results support our hypothesis of a larger experience payoff for general education graduates when comparing them to VET graduates. However, at tertiary level education, general degrees do not fare better than vocational ones. Contrary to our expectations, we do not find higher starting wages for labour market entrants with VET rather than general education degrees.

2   Vocational versus general education

A seminal literature discusses the advantages of vocational education for entering the labour market and presents empirical evidence of its effectiveness (e. g. Shavit and Müller 1998, Ryan 2001, Gangl et al. 2003, Breen 2005). This literature has been completed more recently by articles analysing the labour market situation of VET graduates not only immediately after graduation, but also after extended periods of labour market experience (Cörvers et al. 2011, Forster et al. 2016, Hanushek et al. 2017). By examining early careers with a focus on the evolution of earnings after several years of work experience, our article draws together these two strands of the literature.

2.1   Situation at the entry into the labour market

Empirical research on the school-to-work transition and youths' situation on the labour market tends to show favourable employment outcomes for (standardised) VET. At the individual level, it tends to ease the transition from school to work (Ryan 2001, Müller and Gangl 2003, Wolter and Ryan 2011). At the aggregate level, it seems to lead to lower unemployment rate, notably in countries with strong vocational programmes such as Austria, Germany, the Netherlands or Switzerland (Shavit and Müller 2000, Breen 2005, Quantini and Manfredi 2009, OECD 2010, Bol and Van de Werfhorst 2011). The advantage of vocational education seems larger in countries with a strong firm-based system of apprenticeships (Shavit and Müller 2000, Iannelli and Raffe 2007).

Several reasons may explain why VET eases labour market entry. First, the close link between the training system and the labour market helps to prepare apprentices directly for the labour market (Shavit and Müller 2000, Van de Werfhorst 2011). This is clearly the case in terms of technical skills,

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[2] Federal Statistical Office website, 2018

but may also apply to the acquisition of work autonomy and social skills such as the relationship with colleagues and customers. Second, if vocational education is standardised, it leads to degrees that are easily "readable" for employers who then know precisely what kind of tasks a VET graduate is able to perform in a specific occupation. This mechanism is related to the signalling effect of a degree (Spence 1973, Arum and Shavit, 1995). Finally, the possibility to follow a vocational track, focused on practice and concrete tasks, helps youth with limited skills or interest for the academic track to continue their education until the end of the upper secondary level (Wolter and Ryan 2011), which may improve their employment prospects in comparison with youth failing to obtain any post-compulsory degree whatsoever.

In countries such as Switzerland, the difference between VET and general education graduates may not only pertain to labour market access, but also to wages[3]. After the end of their training, VET graduates are immediately ready to work on specific tasks, contrary to general education graduates. If the former do not have formal experience, the fact that their training included the performance of "real", i.e. productivity-oriented tasks in a company (usually, more than half of their total training time) plays a similar role (Shavit and Müller 2000). For this reason, they are likely to be productive right away and can expect a wage that does not differ much from their more experienced peers directly.

Contrariwise, general education graduates have acquired academic skills in different domains, but these skills are usually not directly linked to a professional context or to the specific demand of a company. For this reason, their first salary after completing their education may be lower than for VET graduates, reflecting their (initial) lower productivity. Consistent with this argument, VET graduates have higher initial wages than general education graduates in Germany (Hanushek et al. 2017), the Netherlands and the United Kingdom (Cörvers et al. 2011). This leads us to formulate a first hypothesis:

Hypothesis 1: workers with a VET degree have a higher salary than those with general education at their entry into the labour market.

2.2   Wage growth over the life course

If the type of education has an impact on the likelihood of finding a job and on the starting wage, the first years of work experience are crucial for the evolution of wages. After several years of experience, general education graduates may benefit from both general skills – due to their education – and specific skills – due to their work experience. If this combination is well rewarded on the labour market, it should give them the opportunity to move to better-paid positions. Contrariwise, VET graduates may not acquire significantly different skills during their first years of work than during their apprenticeship, considering that the aim of the apprenticeship is to prepare youth to be ready for a specific occupation. The extent to which their productivity at work – and thus their wages –increases with experience may be more limited.

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[3] In a context of low unemployment as in Switzerland (less than 5 per cent of the adult population and around 8.5 per cent of 15-24 year olds over the period of 2012-2014, ILO definition, Federal Statistical Office), wages may be a better indicator of differences between the groups than employment.

While employment over the entire career associated with VET has been examined in several articles (Cörvers et al. 2011, Brunello and Rocco 2015, Forster et al. 2016, Hanushek et al. 2017, Korber and Oesch 2018), only few studies compare the evolution of wages for VET and general education graduates. Cörvers et al. (2011) show that initial earnings advantages for VET graduates as compared to general education graduates in Germany (where it is largest), the Netherlands (where it is smallest) and the United Kingdom decrease over the career. The two earnings curves intersect after approximately six years of work experience.

Drawing on cross-sectional micro-census data in Germany, Hanushek et al. (2017) show a higher wage at the beginning of the career for VET graduates, but a larger experience payoff for workers with general education over time. Accordingly, workers with general education overtake those with vocational education at the age of around 30.

Similarly, Korber and Oesch (2019) find for Switzerland hourly wage advantages for general education graduates in comparison with VET graduates: in the case of men after the age of 30, for women after the age of 27. The analysis of annual income shows similar results, but since the group with general education works fewer hours per week, it catches up with VET graduates somewhat later in the career: at the age of 34 for men and 29 for women.

The quoted body of literature confirms the smooth entry in the labour market for VET graduates, in line with the literature on the school-to-work transition. However, the life course perspective highlights the fact that the advantage for VET graduates tends to decrease, or even disappear, over the career. It is essential, then, to not only study the situation at entry into the labour market, but also wage development over the career, which leads us to our second hypothesis:

Hypothesis 2: the wage returns to experience are larger for workers with general education than for those with vocational education.

3   The issue of gender

Despite a general trend towards greater gender equality, occupational gender segregation is still substantial in Western countries (Charles and Grusky 2005, Hout and Di Prete 2006, Pan 2015), including Switzerland, where it has been described as the "most pronounced and persistent form of segregation on the Swiss labour market" (Deutsch et al. 2005, quoted by Imdorf et al. 2014: 14). Gender segregation is not a feature of the past. Young workers continue to enter the labour market in gender-segregated jobs, both in terms of occupation and sectors (Triventi et al. 2015). With comparable skills profiles, girls and boys do not follow the same tracks, but rather gender-typical ones (Jonsson, 1999).

This segregation would not be problematic in terms of earnings if male and female occupations were equally paid. However, occupations dominated by men tend to be better paid than those dominated by women (England et al. 2007, Murphy and Oesch 2016). Consequently, the segregation in different occupations seems to account for a considerable part of the gender wage gap (Fitzenberger and Kunze, 2005). Our interest lies not on the gender wage gap itself, but on the wages associated with different types of education – and whether this association differs for men and women. In this context, it is

important to note that gender segregation seems to be more pronounced in occupations accessed through VET rather than academic programmes (Meyer 2009, Buchmann and Kriesi 2012, Eberhard et al. 2015).

This situation is due to at least four reasons. First, VET is more gender-orientated than academic education (Imdorf et al. 2015). Secondly, in vocational education the occupation is chosen earlier in the life course: after mandatory school, the students going on to general upper secondary education have more time to choose an occupation or a training track than students who start an apprenticeship. In Switzerland, the latter have to choose a training occupation as early as at age 14 or 15. At this age, the capability of asserting a gender-atypical choice may be reduced, partly due to more pronounced identity challenges at a younger age (Gottfredson 2002, Buchmann and Kriesi 2012).

A third possible reason is the difference of social origin and the higher propensity to make gender-atypical choices among students with well-educated parents (Imdorf et al. 2015). Children of parents with low education are more likely to undertake an apprenticeship than children of parents with higher education, partly due to social reproduction mechanisms (Erikson and Jonsson 1996). Gender roles may thus weigh more heavily among youth whose parents have lower levels of education, whereas the choice of gender-atypical occupations seems more encouraged by parents with a higher education and by their network (Koppetsch 2001 in Imdorf et al. 2015, Kriesi and Buchmann 2014).

A fourth reason relates to the employer side of the equation. Several studies have shown the difficulty for women to be accepted as an apprentice in typically male occupations (Fuller et al. 2005, Imdorf 2013, Kergoat 2014). Arguments such as physical strength, "natural" skills or the difficulty of integrating a few women in a mostly male workforce may be used by employers in order to avoid hiring a young woman apprentice in such occupations.

As VET is closely linked to the labour market, the choice of the training occupation is highly correlated with the occupation performed later in life. For this reason, women having completed an apprenticeship more often work in gender-typical occupations than women having completed general education (Buchmann and Charles 1995). Since female occupations are less well-paid than male occupations, we expect lower relative wage returns to VET for women than for men.

Furthermore, Estévez-Abe (2005) argues in her skill-based approach that specific skills are not rewarded in the same way for men and women, due to employers' expectation that women are more likely to quit their job for family reasons. This argument is particularly relevant for early careers, where the likelihood of having a child is high. According to this approach, employers are interested in investing into the firm-specific skills of their male rather than their female employees, because they expect the return on investment, linked to the employee's duration of work in the firm, to be smaller for women than for men. Consequently, we expect lower wage returns to vocational education relative to general education for women than men during early careers.

Based on the gender differences and on hypothesis 1 (workers with VET have a higher salary than those with general education at their entry into the labour market), we formulate a third hypothesis:

Hypothesis 3: *As compared to vocational education, general education provides better wage perspectives in early careers for women than for men.*

4 The issue of selection

The literature investigating the difference between vocational and general education faces the thorny issue of selection. (Self-)selection into an educational track is indeed not random, but linked to several factors such as school achievement, social background (Erikson and Jonsson 1996, Goldthorpe 1996, Erikson and Rudolphi 2009) and cultural context (Imdorf et al. 2014, Glauser and Becker 2016). If not properly taken into account, these factors create a bias because they affect both the allocation to a track and labour market outcomes such as wages.

The unequal access of students to different educational tracks based on their social background is a central issue in sociology and educational sciences. Boudon (1974) theorised the primary and secondary effect of social background on educational attainment. The primary effect relates to the fact that children from advantaged backgrounds tend to benefit from more resources and a better learning environment, helping them to perform better at school than those from disadvantaged backgrounds. The secondary effect, in turn, relates to the fact that children from different social backgrounds make more or less ambitious educational choices.

Another approach to explain the lower rate of children from modest social backgrounds in the general tracks is the rational action theory (see Boudon 1974, Goldthorpe 1996). It argues that individuals make decisions rationally based on cost and benefit, and depending on their own interests. In the context of educational choice, the cost not only include tuition fees and learning material, but also a place to live near the university or the absence of a salary during the years of education, compared to the possibility of working. The benefit is linked to the future position on the labour market, and can include income, severity of working conditions, but also social prestige. The expected benefit of a situation may vary depending on the available information and individual expectations. Following this theory, students from more modest backgrounds may choose vocational education rather than general education in order to be salaried and become independent from their parents earlier. Furthermore, the likelihood of success is also taken into account. It seems plausible that students from modest backgrounds and their parents estimate the likelihood of failure to be higher in the academic track (due to lower odds of receiving parental help in case of school difficulties, for example). Finally, the academic track is also more costly, as, in relative terms, additional years of study require more financial resources from low-earning than from high-earning parents (knowing that apprenticeships are not only free of charge, but rather provide the apprentice with a small wage).

Many studies show that students from disadvantaged background have more difficulties in accessing a high level of education than those from more advantaged ones, *even when controlling for cognitive skills* (see for example Erikson and Jonsson 1996, Bukodi et al. 2014). Consequently, children of lower

educated parents tend to be overrepresented in the vocational track in comparison with the general one, which is partly due to social reproduction mechanisms (Erikson and Jonsson 1996).

When trying to identify a causal effect of the type of education on wages, one has to take this selection bias into account. Else, results are informative and help to observe the difference between groups, but it cannot be determined if the difference is causal or purely correlational. In order to be able to identify a causal link between the type of education and wage, an experimental design should therefore ideally be adopted. As this proves to be impossible for obvious and practical reasons, we adopt a quasi-experimental design, which means that we simulate a situation where the data are generated by a process approaching a random assignment. In this paper, we use a matching method to account for the selection, matching individuals who will eventually follow a different type of education at upper secondary level (vocational vs. general), but who are, at the age of 15, as similar as possible with regard to relevant characteristics such as reading abilities, school track, social origin, migration background and geographical context. By comparing the wages of two individuals who were almost identical at the end of compulsory schooling, but who chose or have seen selected to a different track of education, we come close to a causal relationship between type of education and wage.

5   Data and Method

5.1   Data

We analyse the entry into the labour market using the TREE panel dataset.[4] It follows up a cohort of youth who completed compulsory school in 2000 and allows us to analyse early careers while taking into account cognitive skills, academic achievement and social background. TREE used the PISA 2000 test as baseline survey, following up the Swiss PISA sample by means of nine panel waves between 2001 and 2014 (average age 16-30). The initial sample size was more than 6,000 students. However, the number of respondents was halved in 2014 due to attrition.

For our analyses, we restrict the sample to the respondents who replied to the question about their situation on the labour market in the survey waves of interest. Our focus is on the situation after the end of upper secondary education, which means in 2005 (wave 5, at the age of 21) at the earliest. All respondents who provide information on their situation in waves 5 to 9 are taken into account for the descriptive results. In a second step, we focus on waves 8 and 9 to calculate regression models and keep respondents for whom the hourly wage was possible to calculate (wage and hours of work per week are available) and for whom information used for the matching was available (the list of variables used for the matching is presented in section 5.3). Our sample is unbalanced as some respondents dropped out in later waves. We use the population weights (truncated and calibrated grossing-up factor weights) for each wave for the descriptive results, and the non-response correction weights for the regression models in order to control for attrition bias.

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[4] TREE: Transitions from Education to Employment, Cohort 1 – 2000-2014 [Dataset]. University of Bern. Distributed by FORS, Lausanne, 2016, version 1.0.0. https://doi.org/10.23662/FORS-DS-816-5

Table 1 presents the number of respondents and the composition of the sample for each survey wave of interest. In 2005, the majority of the students had finished upper secondary education in either the general (academic) or vocational track. However, a quarter of the weighted sample had not finished upper secondary education (yet) and is presented in a separate line.

From the age of 23 already, general education graduates represent somewhat less than 30 per cent of the cohort, while VET graduates represent around 60 per cent and individuals without an upper secondary degree 10 per cent. Men and women are not equally distributed among the educational tracks. We observe at age 30 (wave 9) that 53 per cent of women hold a VET degree, 36 a general education degree, and 11 per cent no upper secondary degree. The respective rates for men are 72, 17 and 11 per cent. Vocational education is thus largely more common among men than women.

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Table 1: Sample size and composition, wave 5 to 9

	Wave 5	Wave 6	Wave 7	Wave 8	Wave 9
Year	2005	2006	2007	2010	2014
number of observations	3,566	3,332	2,943	2,452	2,280
average age	20.8	21.8	22.8	25.8	29.8
% women	55%	56%	56%	52%	57%
% vocational	48%	55%	60%	64%	61%
% general	26%	29%	30%	27%	28%
% no upper secondary (yet)	26%	16%	10%	9%	11%

Data: TREE
We use the truncated and calibrated grossing-up factor (population weights) for each wave.

5.2 Dependent and independent variables

Our dependent variable is the gross hourly wage, transformed with the logarithm to approximate a normal distribution. We only consider the wage of respondents fully in the labour market, which means individuals for which gainful employment is their main activity. The median hourly wage in our sample is 32.4 Swiss francs for men and 30.7 for women.[5] This variable is calculated from different answers to the question "How much do you earn?" adapted to fit each situation such as monthly salary,

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[5] The inflation between 2010 and 2014, the two measurement points for wages, was 0.01%. Since this value is very close to zero we do not account for inflation.

hourly wage, etc. We present the variable without the extreme values (lower than 12 and higher than 70).

Our main independent variable is the type of upper secondary education that the respondents completed: general or vocational. The category *general* includes general education baccalaureate degrees and other diplomas of general education at upper secondary level[6], while the category *vocational* represents VET graduates.[7] The vocational baccalaureate is embedded in the vocational track and thus considered as a vocational (rather than a general) degree. While the distinction between vocational and general education is made at the upper secondary level, we also include completion of tertiary level education in our analysis, in order to control for the level of education.

The second independent variable is work experience. It is calculated by adding respondents' employment spells. Even when we consider respondents at waves 8 and 9 only (main models), work experience is calculated taking into account all their previous work experience, mentioned in each survey wave. We calculate work experience by taking into account only job spells in a similar occupation (same ISCO 08 code at the two-digit level). This measure focuses on experience that is relevant for the observed wage and avoids possible "noise" created by the work experience in completely different occupations than the one observed (notably in student jobs such as waiters, sales assistants or security guards). This is especially important in early careers, when the relative length of employment spells in different occupations may be important in comparison with the experience in occupations similar to the one observed. We remove the few outliers having mentioned more than 7 years of experience at wave 8 and more than 11 years at wave 9. Median work experience is 47 months for men and 49 for women in the sample composed of waves 8 and 9 (used for the regressions).

We do not control for other variables such as the occupation or working conditions. These variables are posterior to the choice of education and directly influenced by it (the choice of a vocational track pre-determines, to a considerable extent, the choice of occupation and working conditions). Including them would mean that we run the risk of over-controlling – or controlling away – the effect of education on wages. We only include the fact of having achieved a degree at the tertiary level of education, because this is part of the educational achievement.

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[6] More precisely, this category includes in German: "Maturitätszeugnis (gymnasiale Maturität)", " Diplom (Diplommittelschule/Fachmittelschule) ", " Fachmaturitätszeugnis (nach DMS) ", " Diplom (Handelsmittelschule)/Handelsdiplom" and "Lehrerseminar/Lehrpatent" // in French: "Certificat de maturité (maturité gymnasiale)", "Diplôme (école de culture générale, école de degré diplôme)", "Certificat de maturité spécialisée (après une ECG/EDD)", "Diplôme (école supérieure de commerce)/Diplôme de commerce" and "Diplôme (formation d'enseignant)/brevet d'enseignement, formation pédagogique secondaire".

[7] More precisely, this category includes in German: "Eidgen. Fähigkeitszeugnis (EFZ) / Lehrabschluss(zeugnis)", "Berufsmaturitätszeugnis (Berufsmatur)" and "Anlehrabschluss/ eidg. Berufsattest" // in French: "Certificat fédéral de capacité (CFC)/ Apprentissage (certificat)", "Certificat de maturité professionnelle (maturité professionnelle)", "Attestation de formation élémentaire/Attestation".

5.3   Matching method

As mentioned previously, we use a matching design. This method aims at comparing – by matching – individuals with the same characteristics (i.e. school track, cognitive skills, social origin, etc.) but who differ with respect to the element of interest (i.e. the type of education). The effect of the treatment (i.e. type of education) is thus not calculated between individuals having nothing in common, but between individuals having similar characteristics.

We use entropy balancing, a specific method of matching using a reweighting scheme (see Hainmueller 2012). We use this distance method instead of an exact matching procedure because some of our matching variables are continuous (reading literacy score and canton-specific track distribution of students) and creating categories to find "exact twins" (comparison of individuals with identical values for variables used for the matching) is less precise than keeping the entire information from continuous variables. The entropy balancing presents the advantage of keeping the entire sample for the analyses by attributing a weight to each observation based on the distance to other observations. With this method, we compare the sample of VET graduates to a simulated sample of holders of general education. This simulated sample is calculated on the base of the existing sample, weighted with the variables selected for the matching. These variables are: PISA literacy scores, track attended at lower secondary school[8]; respondents' social origin based on father's and mother's level of education measured by the International Standard Classification of Education (ISCED) recoded to avoid small categories (1-2-3; 4-5; 6); migration background (whether the respondent arrived before the age of 5 or was born in Switzerland, as compared to those who immigrated later); cultural/geographical context, measured by the cantons' gender-specific proportion of students attending the vocational resp. the general education track in 2000, the year when the respondents had to choose their upper secondary educational track. In the appendix, we present the sample characteristics before and after the matching (Table A.1).

We do a robustness check using another distance method of matching, the nearest neighbours from propensity score matching (for more details, see Heckman et al. 1997, Dehejia and Wahba 1999). Contrary to entropy balancing, we only keep the treated and the matching untreated cases in the analysis sample.

5.4   Regression model

Our model analyses the effect of the type of upper secondary education (general or vocational) and work experience on wage. As the effect of work experience may differ between VET and general education graduates, we also include an interaction term between these two variables. We measure these effects by estimating the following regression model:

$$y_i = \beta_1 + \beta_2 voc_i + \beta_3 experience_i + \beta_4 voc_i * experience_i + \epsilon_i$$

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[8] In the year of the baseline survey (2000), most Swiss cantons used a tracked school system at the lower-secondary level (22 of the 24 cantons surveyed – 6 cantons with two tracks, 14 cantons with three tracks, and 2 cantons with four tracks).

We add the variable *tertiary* (the fact of having completed a tertiary level education or not) as a control variable, as well as the variable gender (*male*) to test our third hypothesis. To catch the full picture, we also introduce the interaction between those variables and the main ones in our model. The assumption of a linear link between experience and wage is based on theory, and the fact that our data only cover the early career (the effect of experience on wages during the entire career is usually modelled with experience squared). During this phase of the career, we expect wages to grow linearly with experience, without the possibly curvilinear effect of experience during the last part of the career. In the appendix, we present (Figure A1) the plots of hourly wage depending on the experience.

Our panel data contain repeated measurements of the same individuals over time. As we need to apply the weights produced by the matching, we use a mixed rather than a random effects model. The structure of the dataset does not allow us to monitor respondents' earnings month by month, or even year by year. However, if we observe higher overall wages for more experienced workers, we can deduce that experience pays off. We use the term experience payoff rather than wage growth because we mainly observe the overall effect of experience on wage rather than the evolution of each respondent's personal salary. We subsequently interpret the coefficient of *vocational* as the difference between initial wages of VET vs. general education graduates, and we add the coefficients of *experience* and *vocational*experience* to obtain the wage returns to experience for VET graduates. The experience payoff of general education graduates is the coefficient *experience*.

6   Selection into vocational or general education

After the end of compulsory school, youth are (self-)selected into either the vocational or general track. As previously mentioned, this selection is not random, but linked to factors such as school abilities, social origin and context. Before taking into account this selection in further analyses, we present in Table 2 the link between school track, reading literacy score, socio-demographic characteristics and the type of upper secondary education completed.

Table 2: Linear regression model for the likelihood of holding a VET degree at upper secondary level (in comparison with a general education degree)

	coefficient	standard error
School abilities		
PISA score (reading)	**-0.002**	0.000
Track: - pre-gymnasial		
- extended academic requirements	**0.360**	0.020
- basic academic requirements	**0.364**	0.027
- no (formal) tracking	**0.124**	0.039
Origin and context		
Father's ISCED: 1-2-3		
4 and 5	-0.005	0.025
6	**-0.142**	0.025
Mother's ISCED: 1-2-3		
4 and 5	0.014	0.024
6	**-0.065**	0.025
In Switzerland before age 5	-0.055	0.041
Cantonal share of graduates from upper secondary general education	**-0.012**	0.001
Constant	**1.558**	0.080
Adjusted R2	0.342	
N	2257	

TREE, individuals observed in waves 8 and 9, independent variables from wave 1

Dependent variable: general education=0, vocational education=1

We observe a significant effect of the reading literacy score: students with higher scores are more likely to complete general rather than vocational education. The coefficient is not easy to interpret, with score ranging from 253 to 791. We attempt to facilitate interpretation with a transformation: a move from centile 25 (score 494) to centile 75 (score 595) increases the likelihood of getting a general degree by 16 percentage points (101*0.002)[9]. School performance is also operationalised in terms of the track attended at lower secondary level, the variable having the larger effect of the model on the (self-)selection into vocational or general education. With the academically most demanding track (pre-gymnasial) as the reference category, we observe that the likelihood of obtaining a vocational degree is 36 per cent higher for students who attended tracks with extended and basic academic requirements.

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[9] Since the dependant variable is binary, we can interpret the coefficient from the linear regression as percentages.

Even when controlling for reading literacy and track attended at lower secondary level, which are both influenced by social origin, we still find a significant difference in the likelihood to attend a vocational track depending on parental level of education. Children from parents with a higher level of education (ISCED 6) are more likely to follow the general track than children of parents with a lower level of education (ISCED 1, 2 or 3). The effect is stronger for the father's level of education (14 per cent) than for the mother's (6 per cent). Finally, we see the importance of the context. At comparable levels of literacy, school performance and social origin, students from cantons with a high percentage of general education students tend to be more likely to achieve a general education degree. While the respective rates range from 7.6 to 32.7 per cent depending on the canton and gender, a move from centile 25 (13.4 per cent) to centile 75 (22.1 per cent) increases the likelihood to obtain a general education degree by 10 percentage points.

7 Labour market situation after general or vocational education

As both VET and general education programmes last 3 to 4 years, upper secondary qualifications are achieved at the age of 21 for most of the respondents, which corresponds to wave 5 of the TREE data. Five years after the end of compulsory school (in 2005), between 60 per cent of male and 72 per cent of female VET graduates are reporting gainful employment as their main activity. This rate increases over time to 90 (men) and 85 (women) per cent in 2014 (age 30). In parallel, the proportion of individuals who are still in education gradually drops from 13 (men) and 11 (women) per cent in 2005 (age 21) to 6 (men) to 2 (women) per cent in 2014.

Around 30 per cent of young men continue their education after completing upper secondary VET (age 23), over twice as many as among young women (9 per cent). Right after their apprenticeship, men are also overrepresented in the category "other" which signifies that they are neither in education, employment, or training (category called "NEET") (28 per cent). One explanation is that some of them are doing the compulsory military or civil service (compulsory for men only in Switzerland). In contrast, continuing education after upper secondary graduation is common in the general education tracks. This is the case for around 70 per cent of this group at wave 5 (age 21) and even 80 per cent two years after. At age 30, a large majority (85 per cent) of them has completed their education and is working. While the employment rate among men without any post-compulsory degree is at a comparable level, the rate among women without such a degree is distinctly lower (75 per cent).

After the end of upper secondary education, some of the respondents obtain a tertiary degree of education. In Figure 1 we therefore present the situation on the labour market between survey waves 5 and 9, which roughly cover the age span between 21 and 30. The results are broken down by the type of upper secondary education (general versus vocational) and by gender.
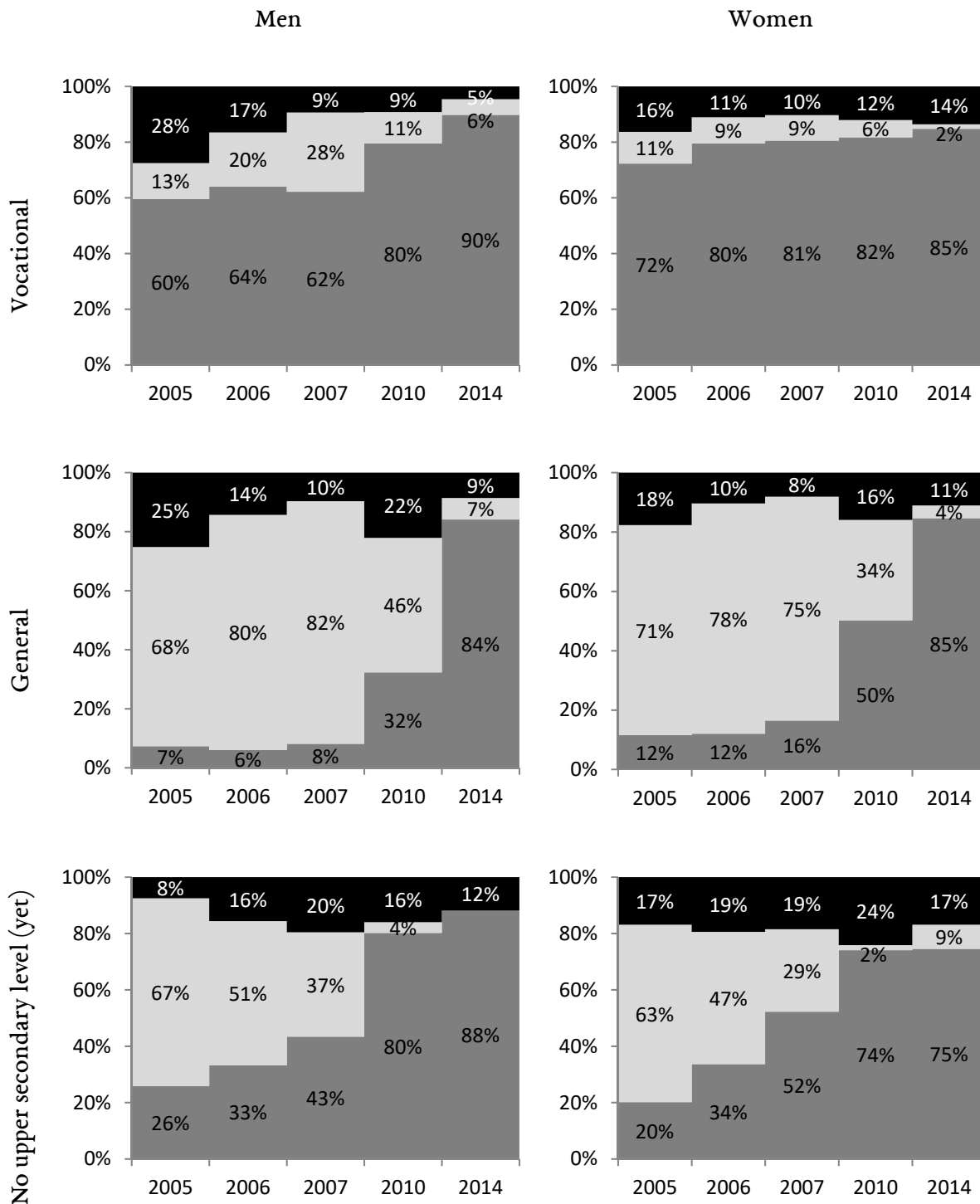
Five years after the end of compulsory school (in 2005), between 60 per cent of male and 72 per cent of female VET graduates are reporting gainful employment as their main activity. This rate increases over time to 90 (men) and 85 (women) per cent in 2014 (age 30). In parallel, the proportion of individuals who are still in education gradually drops from 13 (men) and 11 (women) per cent in 2005 (age 21) to 6 (men) to 2 (women) per cent in 2014.

Figure 1: Labour market situation of men and women by type of upper secondary education.

Wave 5 = 2005, average age: 21

Wave 9 = 2014, average age: 30

■ Work (minimum of 8 hours per week)
□ Education
■ Other (internship, travel, unemployment...)

TREE, waves 5 to 9 (2005-2014) with population weights

8   Hourly wage and work experience

Only a small – and possibly selective group – of general education graduates report their main status to be in gainful employment before wave 8. Consequently, our regression model only includes waves 8 and 9. These two waves also coincide with the period when most of the young adults complete tertiary education, which gives us the opportunity to control for this variable. We test our hypotheses by estimating the effect of a given type of upper secondary education, work experience, gender and the fact of having or not having obtained a tertiary degree on (log) hourly wages in Table 3. We present this model without matching, with matching by entropy balancing and with nearest neighbours propensity score matching. The main difference between the unmatched model and the matched models is that the "treatment" effect (i.e. the fact of having graduated from a VET or from a general education programme) is not statistically significant anymore in the latter case. This means that when we take selection into account, the difference between VET and general education graduates (i.e. the lower hourly wage for VET graduates) disappears. The other effects are rather stable: hourly wages for men are approximately 6 and 7 per cent higher than those for women[10], and hourly wages for tertiary graduates are 11 to 15 per cent higher for tertiary level graduates than for upper secondary level graduates. The table also reveals that the type of matching procedure has little effect on the results.

Table 3: Effect of the type of education and experience on wages
(linear regression coefficients on log hourly wages)

	Without matching		Matching entropy balancing		Matching Nearest neighbours	
	coeff.	robust std. err.	coeff.	Bootstrap std. err.	coeff.	Bootstrap std. err.
vocational	**-0.036**	(0.012)	-0.028	(0.020)	-0.023	(0.378)
experience	0.002	(0.002)	0.002	(0.003)	0.003	(0.003)
Male	**0.064**	(0.010)	**0.073**	(0.009)	**0.069**	(0.011)
Tertiary	**0.154**	(0.012)	**0.128**	(0.018)	**0.109**	(0.022)
constant	**3.351**	(0.015)	**3.352**	(0.028)	**3.348**	(0.037)
N observations	2257		2257		2150	
N individuals	1679		1679		1593	

TREE, waves 8 and 9 (2010, 2014), nonresponse correction weights.

Bootstrapping: 2000 replications; Number of nearest neighbours: 10.
Variables used for the matching:
    Skills and achievement: track, reading score in PISA test
    Origin: immigration in Switzerland after the age of 5 (yes/no), father's and mother's ISCED
    Regional context: gender-specific cantonal shares of graduates from "Gymnasium" in 2000 (continuous)
Note: Figures in bold characters are statistically significant at p<0.05. Standard errors are displayed in parentheses.

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[10] To get the percentage correspondence of the log income increase, we calculate exp(coeff)-1.

The link between education, experience and wages is complex, especially during early careers. Consequently, we need to investigate not only the simple effect of our variables on hourly wage, but also their interactions. Since the effect of experience on wage may differ not only with respect to the type of upper secondary education, but also with regard to gender and tertiary level graduation, all the possible interactions between those variables have to be controlled. As the regression table is difficult to interpret, we present the results graphically (see Figure 2), while displaying the regression table in appendix A.2.

Figure 2 Predicted hourly wages for VET and general education graduates at upper secondary level by months of work experience and gender

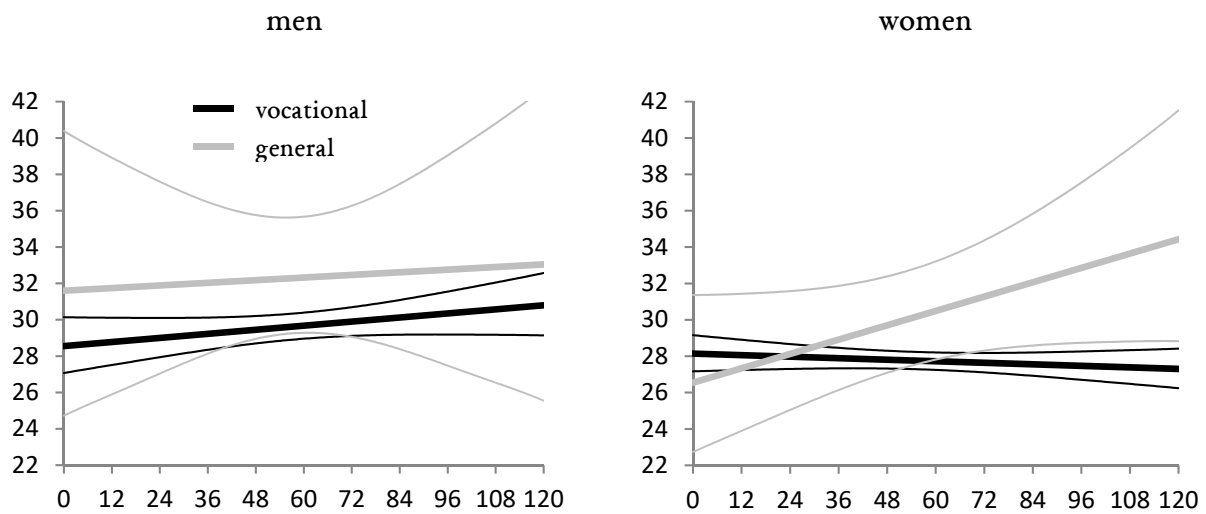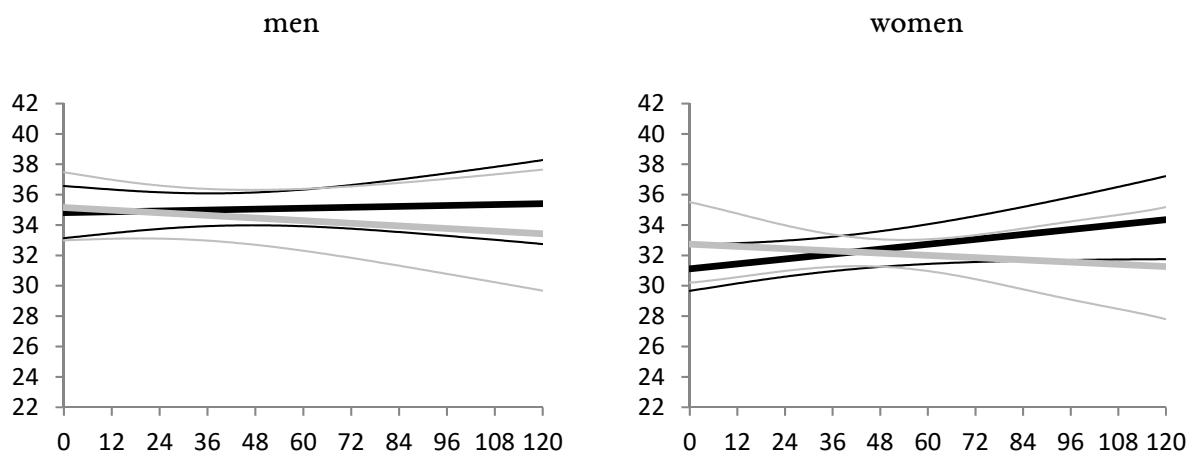*Figure 2a: no tertiary degree*

Figure 2b: with a tertiary degree

This figure is based on the models shown in Table A.2 (full model with entropy balancing matching) and shows 95% confidence intervals

TREE, waves 8 and 9 (2010, 2014), nonresponse correction weights

In Figure 2, we plot the hourly wages predicted by the full model for VET and general education graduates by work experience. In accordance with the simple model presented in Table 3, we find no significant difference of hourly wages between the two groups at their entry into the labour market. To one exception, the same is true if we account for years of experience, and level of educational attainment (i.e. tertiary vs. upper secondary degree) in the case of men. The exception pertains to women after 72 months (6 years) of work experience. In this case, we observe significantly higher wages for women having graduated from general education at upper secondary level when comparing them with VET graduates. Due to small sample sizes and ensuing large estimation errors, we see no other significant difference between vocational and general education graduates.

In order to be able to directly observe the difference between vocational and general education, we present the average marginal effects of vocational education on hourly wages by work experience in the Appendix (see Figure A.3).

9 Discussion

Our first hypothesis expects that workers with VET have a higher salary than those with general education at their entry into the labour market. Our results do not support this hypothesis: predicted hourly wages for inexperienced labour market entrants do not differ between VET and general education graduates, neither at upper secondary nor at the tertiary level.

On the other hand, our results partially support the second hypothesis, arguing that wage returns to experience are larger for workers with general education than for those with vocational education. This hypothesis is indeed supported for women with an upper secondary level of education only, but not for the other categories (men at the upper secondary level or tertiary level and women at the tertiary level). After six years of experience, women with general upper secondary education have significantly higher hourly wages than women with vocational upper secondary education. This result is in line with the results from Cörvers et al. (2011), who found higher wages for general education graduates with six years of experience.

Our third hypothesis is rather complex, arguing that relative to VET, general education offers better wage perspectives at the entry into the labour market for women than for men. In other words, we expect that the wage difference between VET and general education graduates is smaller for women than for men. Our hypothesis is not supported by our results. However, we observe larger experience returns on wages for women with general education than for female VET graduates, which shows that the effect of the type of education on wages is indeed different for men and women during early careers.

The non-confirmation of hypotheses one and three suggests that vocational and general education provide similar hourly wages during early careers once we take selection into account. Considering our findings, this seems to be the case: in the simple model without interaction (Table 2), the significant negative effect of vocational education on hourly wage disappears when using the matching method.

In order to better understand returns to vocational and general education, we could also split tertiary education into vocational and general education. However, we refrain from doing so as the distinction between vocational and general education is less clear at the tertiary level than at the upper secondary one. Universities of applied sciences are a good example of education which mixes general disciplines with applied ones, preparing students to specific occupations such as nurse or engineer, for example. Architects are also trained for a specific occupation, while most (academic) university students are not. Tertiary education is in most cases not strictly vocational or general.

10   Conclusion

This paper addresses the recent debate about the wage returns to vocational and general education (see notably Forster et al. 2016, Hampf and Woessmann 2017, Hanushek et al. 2017), suggesting that vocational education is associated with higher entry wages, but more modest wage increases. Its main contribution is to directly address selection by using longitudinal data from a homogenous youth cohort and to match individuals in their last year of compulsory schooling (and thus before they choose to continue their education in the vocational or the general track) on the basis of their school abilities, social origin and regional context. The TREE data and matching design thus provide the opportunity to go one step further in studying the returns to VET, with hard-to-get information such as academic achievement and social origin being measured before the (self-) selection into the vocational or general track takes place.

This paper has compared the evolution of wages during early careers between VET and general education graduates at upper secondary level. Contrary to our expectation, we found no difference of hourly wages between the two groups. Those results suggest that when taking selection into account, the type of education is not a determinant of wages during the first years of the career. The second main finding is the significantly higher hourly wages, after six years of work experience, of women with a general upper secondary degree in comparison with female VET graduates. This result highlights different experience returns on wage depending on the type of education for women. However, it is important to mention that this effect is not visible for (female) graduates from tertiary level education, but for upper secondary graduates only.

In the context of the debate about the advantages and disadvantages of vocational and general education, our results suggest that three crucial factors have to be taken into account: a.) the issue of selection, b.) gender differences in interaction with the type of education, and c.) the variation of outcomes depending on the type of education at upper secondary and tertiary levels of education. In order to assess whether these findings hold for countries other than Switzerland as well, we encourage future research on returns to vocational education to take those aspects into account.

There are some limitations to this contribution. While our quasi-experimental design helps us to deal with the issue of selection bias, it does not solve it completely. It is important to remember that while matching can emulate a quasi-experimental design, it does not deal with unobservable characteristics. Furthermore, cognitive skills and school achievement are measured by means of the PISA literacy

score and previous lower secondary school track attendance, which give us a general idea of skills and achievement, but not the full picture.

Our data also come with some limitations. They enable us to observe respondents only until the age of 30, and as a consequence the effect of each type of education on the entire labour market career cannot be addressed (yet).[11] Furthermore, limited (sub-)sample size leads to large estimation errors, leaving the question open whether the absence of (statistically significant) effects is due to the fact that they do not exist or that the data just do not provide sufficient measuring power.

Furthermore, studying returns to upper secondary VET degrees in a context like Switzerland meets the limitation of the absence of a perfect counterfactual. While upper secondary VET prepares youth to enter the labour market and can thus be considered as a "final" training, the role of general education at upper secondary level is primarily to prepare youth for higher education, i.e. an intermediate credential without specific relevance for the labour market.

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[11] Another survey wave is being carried out in 2019 at average cohort age of 35.

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12 Appendix

Figures

Figure A.1: Experience and hourly wages

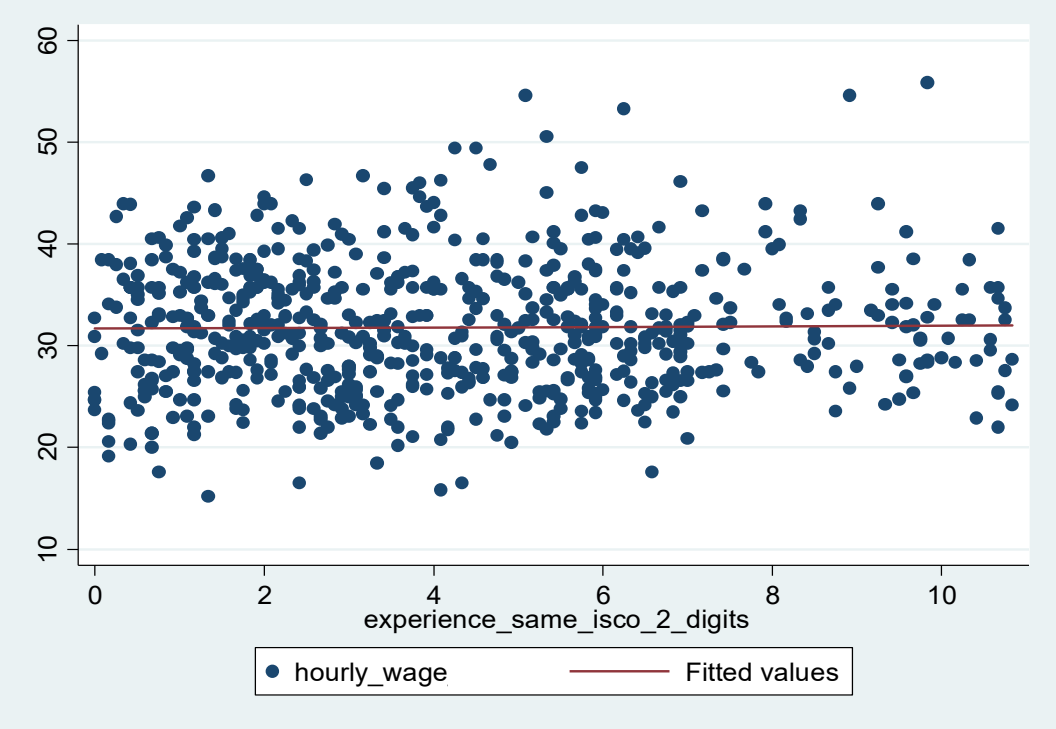*Figure Aa: male VET graduates*

Figure Ab: male general education graduates

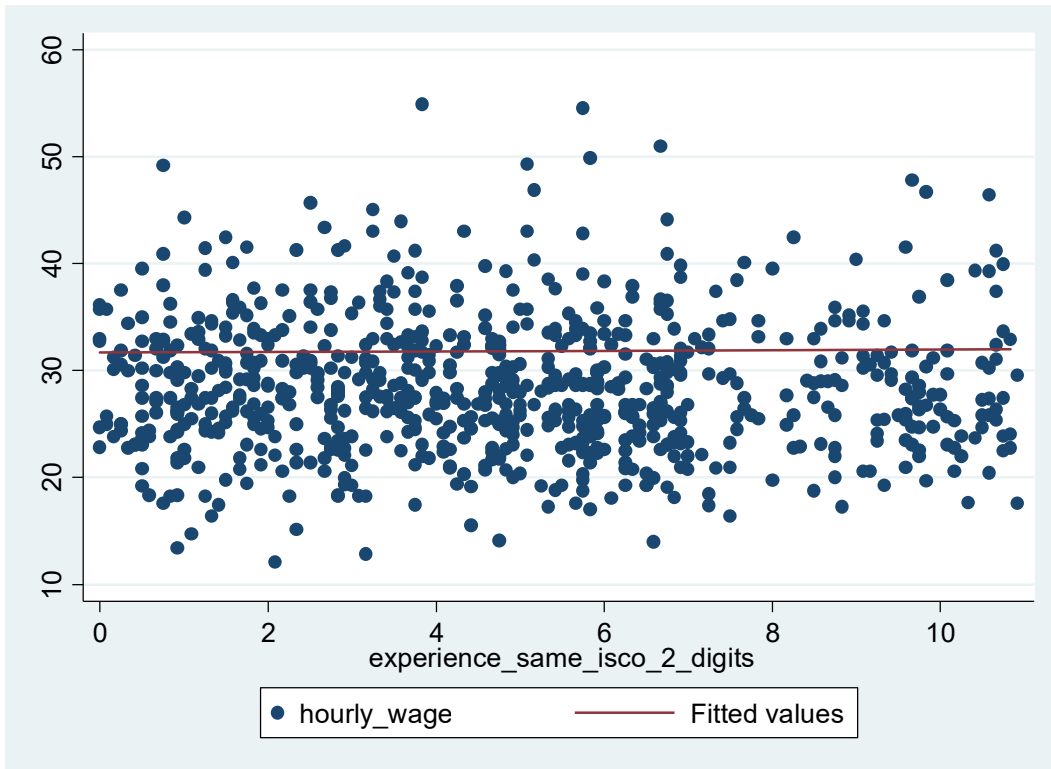*Figure Ac: female VET graduates*

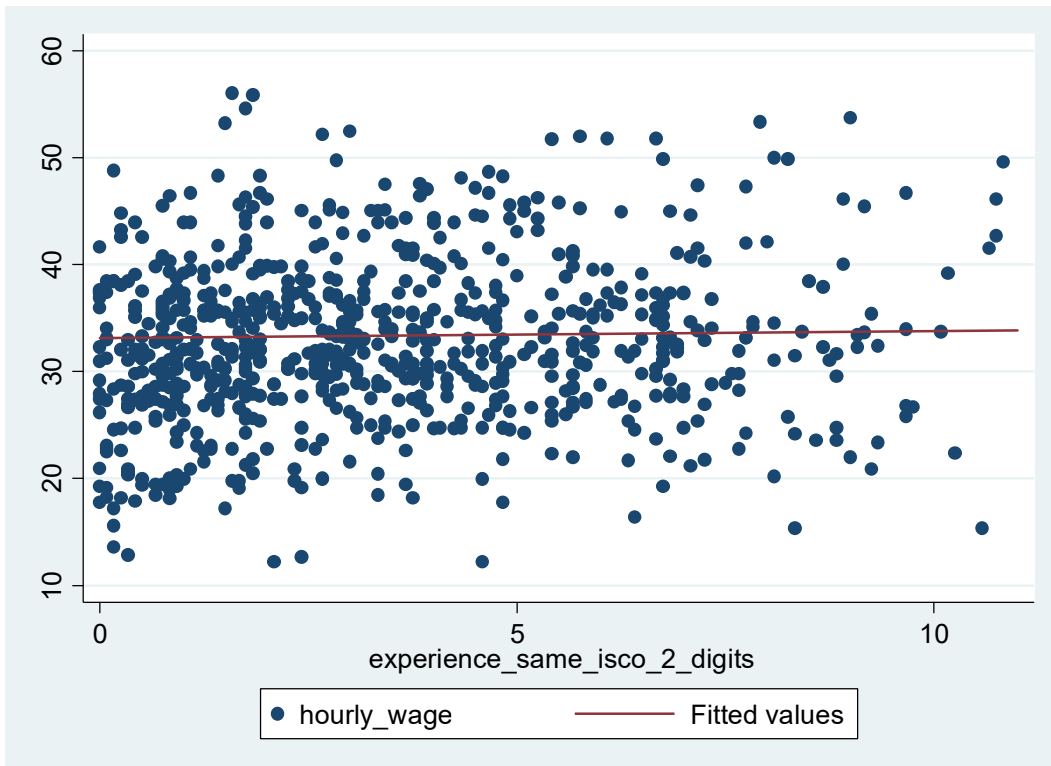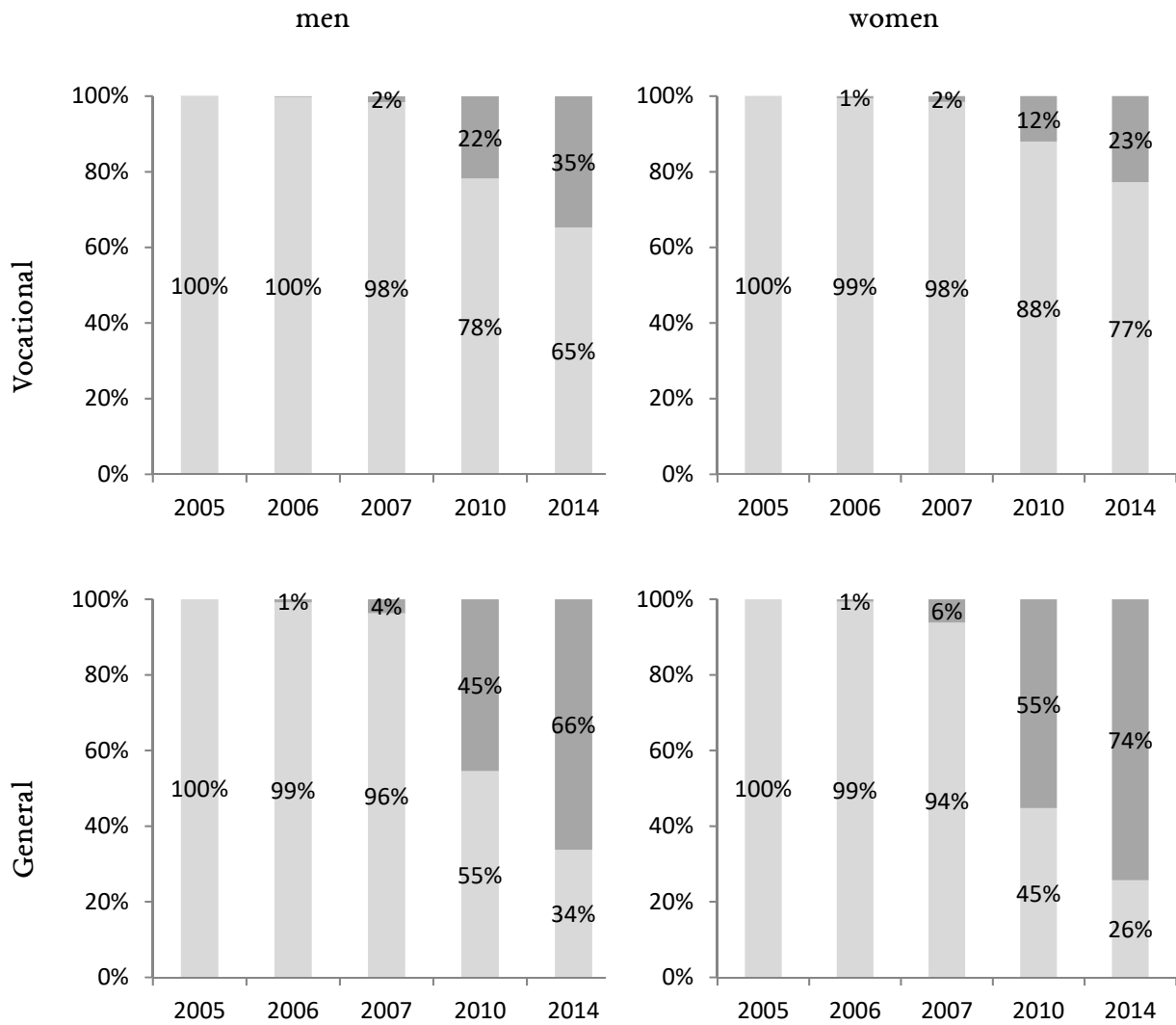*Figure Ad: female general education graduates*

Figure A.2: Share of respondents with a tertiary level degree by type of upper secondary education

Wave 5 = 2005, average age: 21
Wave 9 = 2014, average age: 30
N = number of observations

No tertiary degree
Tertiary degree

men

women

Vocational

General

TREE, waves 5 to 9 (2005-2014), non-response correction weights

Figure A.3: Predicted evolution of wages for upper secondary vocational education (relative to upper secondary general education) by years of work experience
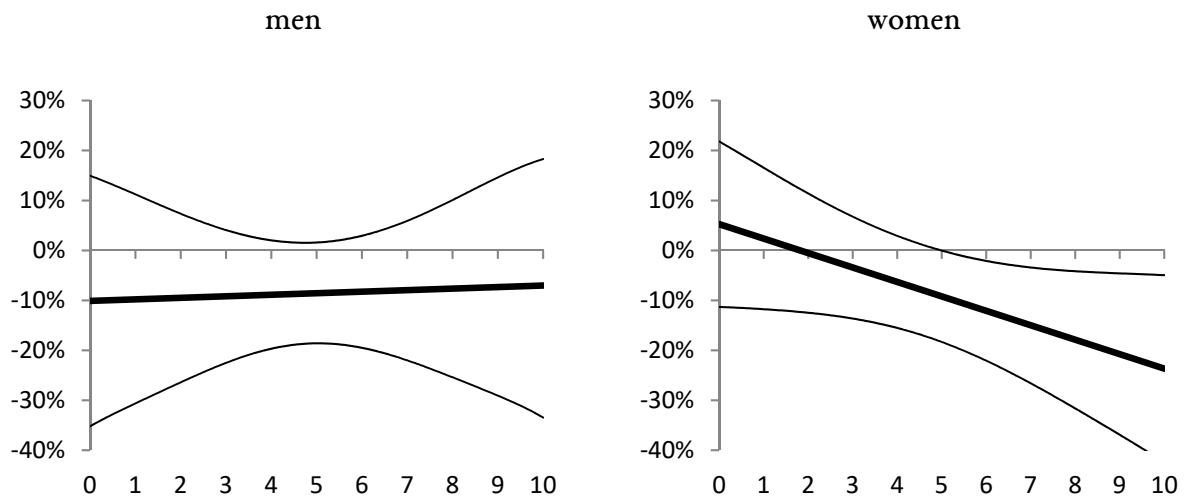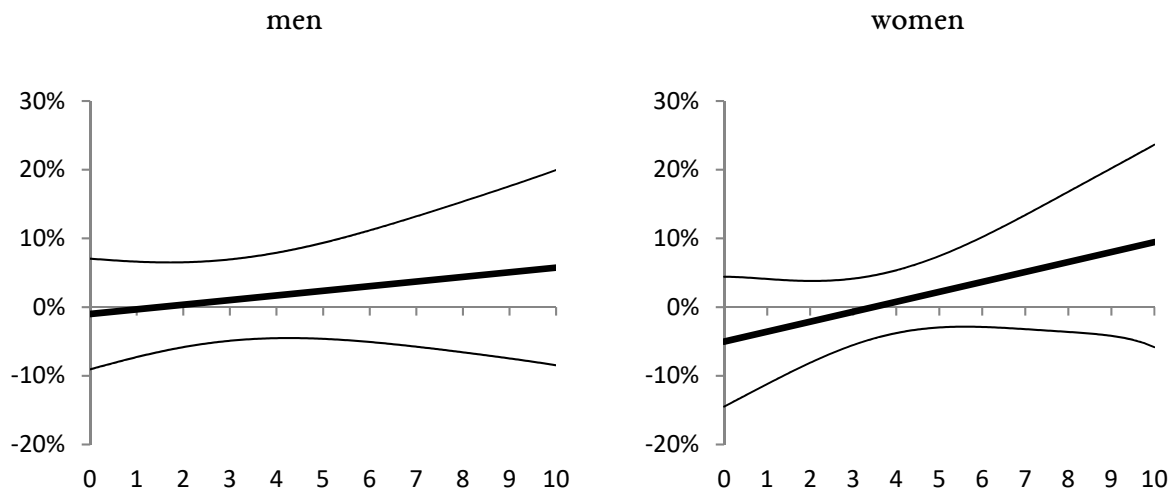
Figure A.3a: no tertiary degree

men   women

Figure A.3b: with a tertiary degree

men   women

This figure is based on the models shown in Table A. (full model with entropy balancing matching) and shows 95% confidence intervals

TREE, waves 8 and 9 (2010, 2014), nonresponse correction weights

Tables

Table A.1: Sample characteristics before and after matching

	Before reweighting						After reweighting					
	vocational			general			vocational			general		
	Mean	Variance	Skewness	Mean	Variance	Skewness	Mean	Variance	Skewness	Mean	Variance	Skewness
School abilities												
PISA score (reading)	499.8	6268	-0.4669	565.1	5097	-0.1047	499.8	6268	-0.4669	499.8	5985	-0.2851
Lower secondary track attended: - pre-gymnasial												
- extended academic requirements	0.413	0.243	0.352	0.208	0.165	1.440	0.413	0.243	0.352	0.413	0.243	0.353
- basic academic requirements	0.313	0.215	0.808	0.062	0.058	3.630	0.313	0.215	0.808	0.313	0.215	0.808
- no (formal) tracking	0.059	0.056	3.742	0.053	0.050	3.992	0.059	0.056	3.742	0.059	0.056	3.742
Origin and context												
Father's ISCED: 1-2-3												
4 and 5	0.334	0.222	0.706	0.287	0.205	0.942	0.334	0.222	0.706	0.333	0.222	0.707
6	0.294	0.208	0.905	0.552	0.247	-0.211	0.294	0.208	0.905	0.294	0.208	0.905
Mother's ISCED: 1-2-3												
4 and 5	0.351	0.228	0.624	0.331	0.222	0.716	0.351	0.228	0.624	0.351	0.228	0.624
6	0.221	0.172	1.345	0.460	0.248	0.162	0.221	0.172	1.345	0.221	0.172	1.345
In Switzerland before age 5	0.083	0.076	3.033	0.077	0.071	3.177	0.083	0.076	3.033	0.083	0.076	3.034
Cantonal share of graduates from upper secondary general education	18.54	38.45	0.826	21.23	49.89	0.299	18.54	38.45	0.826	18.55	32.67	0.533

The matching was performed for individuals (and not for observations) on the final sample. Vocational=treatment

Descriptive statistics of the matching weight: Mean: 1.08, Std. Dev.: 3.22, Min: 0.002, Max: 100.32

Table A.2: *Effect of the type of education on wages*
(linear regression coefficients on log hourly wages), full model

	coeff.	bootstrap std. err.
vocational	0.053	(0.085)
experience	0.026	(0.015)
vocational*experience	-0.029	(0.015)
tertiary	**0.204**	(0.096)
vocational*tertiary	-0.103	(0.102)
experience*tertiary	-0.030	(0.018)
vocational*experience*tertiary	**0.043**	(0.019)
male	0.168	(0.146)
male*vocational	-0.154	(0.150)
male*experience	-0.021	(0.027)
male*vocational*experience	0.032	(0.028)
male*tertiary	-0.097	(0.166)
vocational*tertiary*male	0.194	(0.173)
male*tertiary*experience	0.021	(0.030)
vocational*tertiary*male	-0.040	(0.031)
constant	**3.285**	(0.082)
N observations	2257	
N individuals	1679	

TREE, waves 8 and 9 (2010, 2014), nonresponse correction weights

Bootstrapping: 2000 replications; Number of nearest neighbours: 10

Variables used for the matching:

Skills and achievement: track attended at lower secondary level, PISA reading literacy score

Origin: arrival in Switzerland after the age of 5 (yes/no), father's and mother's ISCED

Regional context: gender-specific cantonal share of graduates from upper secondary general education ("gymnasiale Maturitätsquote")

Note: Bold is statistically significant at p<0.05; standard errors in parentheses.