Vocational versus general education: employment and earnings over the life course in Switzerland

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Abstract

After the great recession, international organizations have actively promoted vocational training as a measure to fight youth unemployment. However, while vocational degrees give workers a head start in the labour market, such degrees may become obsolete sooner and leave older workers vulnerable to technological change. We compare the employment and earnings over the life course for holders of vocational and general education at the upper-secondary level in Switzerland, the OECD country with the highest share of youth undertaking vocational education. We use a proxy-cohort design with the Swiss Labour Force Survey and Swiss Household Panel. The results show that employment prospects remain as good for vocational as for general education over the second half of people's careers. However, vocational education is associated with substantially lower earnings once workers enter their thirties, and this disadvantage is larger among women than men. While vocational degrees protect against unemployment, they come at the cost of flat earnings curves over the life course.

Keywords: vocational training, wages, education, employment, life course, Switzerland

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1. Introduction

In the wake of the Great Recession, vocational education has become a widely advocated policy solution to staggering rates of youth unemployment. A tighter link between the skills provided by vocational training and the skills demanded by employers should ease the transition from school to work. The OECD (2013) propagated Germany and Switzerland's apprenticeship systems in particular, which combine learning in the workplace with lessons at vocational schools. Consequently, government delegations flock to Berlin and Bern in order to study – and possibly emulate – these systems of vocational education and training (VET).[1]

In the short run, vocational education and particularly apprenticeships have several attractive features. As employers contribute to the development of degrees and teaching curricula, the vocational skills obtained are immediately instrumental in the labour market. This helps young people to transit into the world of work and leads to lower youth unemployment (Shavit and Müller 1998). However, while VET may enable young people to find a good match at the beginning of their career, it may leave older workers vulnerable to technological change and shifts in the occupational structure. Over the life course, job-specific skills learnt in vocational training may become obsolete at a faster rate than general skills learnt in academic curricula. Accordingly, the advantages of VET in smoothing the entry into the labour market may have to be weighed against potential disadvantages later on in the career.

However, there may be no reversal of fortunes over the life course between holders of vocational and holders of general education – because what really counts may be getting off to a good start. The idea is that initial experiences in the labour market crucially shape later working life. As VET facilitates youth integration into the workplace, it may lay the foundation for a successful career. On the contrary, prolonged youth unemployment may have

a scarring effect on subsequent work experiences (Gangl 2006) – and securing a stable job may be more difficult for young people with general schooling than apprenticeships.

Several influential studies have recently taken up this issue, notably Forster et al. (2016) and Hanushek et al. (2017). They examine the age-employment curve associated with different types of education and find a higher employment probability for VET than general education at the start of workers' career, but a reversing pattern in later life. However, both studies use a cross-sectional survey on adult competencies and thus rely on a single measurement in time. This forces the authors to interpret the employment situation of a given age group in the year of the survey as an early or late career outcome that is valid for all age groups, regardless of the birth cohort. This assumption is valid if the social and economic context in which different cohorts made their educational choices and entered the labour market remained constant between the 1950s and 2000s. Given the extent of educational expansion, technological progress and occupational upgrading over the period under study, this seems a strong assumption.

Consequently, we try to contribute to this debate by adopting a life course perspective and focussing on a single birth cohort. We use data that cover almost three decades and allow us to compare how the employment prospects and earnings vary by age for a cohort of individuals born between the mid-1950 and mid-1960s who either obtained an upper-secondary *vocational* or *general* degree as their highest education.[2]

Our analysis focuses on Switzerland, the OECD country with the highest share of youth who attend a work-based (dual) VET course after the end of compulsory school: 60 per cent in 2011. If VET pays off anywhere, then it should be in Switzerland's apprenticeship system, which trains for both blue-collar and white-collar occupations, leads to nationally standardized skill certificates and enjoys broad support from employers (Hoffman and Schwartz 2015).

We use the Swiss Labour Force Survey, years 1991 to 2014, to construct a pseudo cohort of individuals observed in successive years. For greater robustness, we follow the practice of "identical analysis of parallel data" (Firebaugh 2008) and replicate our analysis with longitudinal data from the Swiss Household Panel (1999-2015).

In the next section, we contrast three expectations on the long-term returns to vocational education. We then present Switzerland's educational system and discuss our data, measures and model. The results section compares the age-earnings and age-employment curves for workers with upper-secondary vocational and general education. We conclude by discussing the policy implications of our findings.

2. Vocational training and the life course

When evaluating the merits of vocational education, pundits commonly resort to the youth unemployment rate as the key indicator. In the same vein, a large body of research compares different educational tracks by focusing on labour market entry (e.g. Shavit and Müller 1998, Müller and Gangl 2003). Yet information on the first few years of workers' trajectory leaves us with only a partial picture of their career. VET may provide useful skills for an occupational field at the time of training and thereby ease entry into the labour market. Yet it is an open question as to whether these same skills are still valuable when workers are in their mid-forties and older. On this question, we distinguish three competing expectations: (i) cumulative advantage in favour of vocational education, (ii) reversal of fortunes in favour of general education, (iii) identical outcomes for general and vocational education once heterogeneity is taken into account.

2.1 Cumulative advantage over the life course

Work-based VET has the key advantage of integrating practice into the learning process and thus ensuring close correspondence between the acquired skills and the actual requirements of firms. Thereby, it smooths the school-to-work transition (Wolter and Ryan 2011: 523). These advantages should be particularly marked in countries where VET is occupationally specific, offering specialized training for hundreds of detailed occupations and taking place in a dual system that combines school- and work-based learning. If, in addition, the vocational education system is standardized and delivers national qualifications that are recognized by employers, a vocational degree likely gives young workers a head start in the labour market (Bol and van de Werfhorst 2011, Grønning et al. 2018).

Countries with VET systems that meet these criteria such as Austria, Germany or Switzerland have particularly low youth unemployment rates (OECD 2010: 12, 170). Furthermore, it is not only on the country level, but also within these countries that VET stands out as easing the transition to work. Based on the German Socio-Economic Panel (SOEP) 1984-1990, Winkelmann (1996: 666) finds that the unemployment rate right after the end of education is 23 percentage points lower for apprenticeship graduates than for university graduates. Apprentices obtain early on workplace experience that facilitates the transition to a job. More importantly, for many of them the search issue does not arise in the first place. One year after graduation, 36 per cent of Swiss apprentices and over 50 per cent of German apprentices still work for their training firm (Dionisius et al. 2009: 16; Protsch and Solga 2015: 522).

Avoiding a prolonged period of youth unemployment may be crucial for the subsequent career as an early failure in the labour market possibly triggers a mechanism of cumulative disadvantage. Unemployment early on in the career may leave scars on workers because it reduces their human capital, confidence and psychological readiness for work, and may thus

make them less attractive to prospective employers (DiPrete and Eirich 2006: 287). Life history data from the Netherlands (Luijkx and Wolbers 2009) and European data from SHARELIFE (Hank and Brandt 2014: 739) suggest that non-employment early in working life indeed has a scarring effect on the subsequent career. These arguments lead to a first expectation:

Upper-secondary vocational education should ease the entry into the labour market and thus facilitate the advancement of a career, leading to higher employment participation and earnings over the life course than upper-secondary general education.

2.2 Reversal of fortunes over the life course

A second expectation derives from the argument that vocational training provides specific skills, whereas academic schooling produces general skills (Becker 1964). In this view, vocational training programmes that provide students with a narrow and highly specific set of skills should lead to a better initial match in the labour market and to higher starting wages. This is the reason why VET enjoys broad public support in German-speaking countries: a practical education from which young people graduate knowing a specific trade. However, it is also the reason why the U.S. has largely eliminated vocational education as a separate track in secondary schools: specific skills linked to a trade become outdated too rapidly (Hanushek et al. 2017).

While the specificity of vocational skills should not be overestimated – they are clearly transferable beyond single firms (Winkelmann 1996: 668, Müller and Schweri 2015) – vocational degrees are closely linked to single occupations. The Swiss VET system offers school-leavers apprenticeships in 230 occupations, the German VET system in 328 occupations. Specializing in a given occupation may be valuable at a given moment in time, but carries the risk that the skills specific to this occupation are obsolete one or two decades

later. Newspaper typesetters and switchboard operators are two occupations that have disappeared, travel agents and postal clerks two occupations that may follow them in a near future (Oesch 2013).

VET's strong focus on practical skills may come at the cost of neglecting general skills. In Germany and Switzerland, apprentices typically spend one to two days per week at vocational schools and three to four days in the workplace where they engage in on-the-job training. One to two days of schooling per week do not allow much instruction time for general skills such as literacy, numeracy and foreign languages – all the less so because half of instruction time goes to subjects related to apprentices' vocational skills (OECD 2013: 82).

By contrast, general skills may not prepare youth well for entry into the labour market. Yet they are probably more adaptive and transferable, thereby providing a stronger basis for further learning. Workers with general skills may thus be better equipped to respond to technological change and to switch occupations more easily. In comparison, a vocational degree may have a shorter half-life over the career. The initial labour market advantage of vocational over general education may therefore decrease, and possibly reverse, with age.

Based on data from the International Adult Literacy Survey (IALS), Hanushek et al. (2017) find that people with vocational qualifications aged 40 and less benefit from an employment advantage, whereas people older than 40 are at a disadvantage relative to individuals with general education. The trade-off between initial employment gains from vocational education and employment losses later on seems particularly marked in Denmark, Germany and Switzerland, three typical apprenticeship countries. Forster et al. (2016) use the more recent PIAAC data and, controlling for numeracy skills, find that in terms of employment probabilities graduates from general education programmes catch up, and surpass, vocational graduates at the age of 45 for men and 36 for women – with no significant differences across countries.

The finding that vocationally trained workers suffer a faster depreciation of their skills than those with a general education is also reported by Weber (2014) for the Swiss Labour Force Survey 1998-2009 and Dearden et al. (2002) as well as Brunello and Rocco (2017) for Britain's National Child Development Study. These arguments lead to a second expectation:

The initial employment and earnings advantage of workers with upper-secondary vocational education turns into a disadvantage over the life course, as upper-secondary general education leads to better employment and earnings prospects over the second half of workers' careers.

2.3 Identical outcomes

A third expectation does not anticipate different labour market outcomes for holders of different *types* of education, as opposed to different *levels*. According to this view, both the advantages and disadvantages of holding a vocational degree are overdone. To begin with, occupational mobility is large and vocational education does not lock workers into a single occupation. In Germany, between 30 and 50 per cent of vocationally trained workers are employed in a different occupation than the one for which they were initially trained (Winkelmann 2006: 93-4).

At the same time, if VET provides skills that are widely portable, this also leads to the question 'whether it makes sense to train as many mechanics, bakers or carpenters, if probabilities are high that they will leave their trade or never take it up in the first place' (Meyer 2009: 36). Moreover, the initial labour market advantage of apprenticeship graduates should not be overestimated. Based on the SOEP 1984-1990, Winkelmann (1996: 671) finds that once the transition to work was made, graduates from general education were employed in jobs that were as stable as those of apprenticeship graduates. While the matching process

takes longer for holders of general education, they catch up quickly over the first few years of work.

Different labour market outcomes for vocational and general education may primarily result from two sources of heterogeneity: heterogeneity of vocational degrees and population heterogeneity, that is, the selection of different people into different educational tracks. The first source relates to the widely varying quality of apprenticeships and depends on at least three dimensions: (i) firm size: larger firms provide more demanding workplace learning than small businesses. (ii) sector: the public sector tend to offer more structured VET programmes than the private sector; (iii) level of intellectual requirement: requirements vary widely across occupation and, in the case of Switzerland, are much higher in some apprenticeships such as electronics technicians and draughtsman than in others such as butchers and flooring installers (Stalder 2011). The differences in employment prospects and earnings may thus be larger across vocational degrees than they are between vocational and general education.

The second source of heterogeneity relates to selection effects. Young people (and their parents) choose a given educational track based on their ability, social origin and interest. Since entry into general schools is often conditional on examinations, individuals with higher ability and a more privileged background may prefer a general education to VET. Even in countries where vocational degrees enjoy broad recognition such as in Switzerland, pupils who eventually take up an apprenticeship perform worse, on average, in the PISA test than pupils who continue in a baccalaureate school (Wolter et al. 2014: 119).

If there is strong heterogeneity among people who take up vocational and general education, it is possible that VET pays off for some individuals but not for others. Based on the British National Child Development Study, Dearden et al. (2002: 269) find that the wage premium from vocational qualifications is twice as high for individuals having low ability in reading and mathematics than for those having high ability. The vocational route may thus be

of critical importance for less academically able and more practically oriented students. By reducing the drop-out rate from high schools and increasing the share of students taking on a post-compulsory education, VET may generate important benefits (Wolter and Ryan 2011: 551). A comparison between holders of general and vocational degrees at the upper secondary level may not adequately capture these benefits.

What does the empirical evidence tell us? Malamud and Pop-Eleches (2010) control for selection by using an educational reform in Romania in 1973 that prolonged general education for everybody and reduced the duration of VET. Despite this general increase in formal schooling, they find no difference in earnings between the pre- and post-reform cohorts. Similarly, an analysis of the National Education Longitudinal Survey for the US shows no systematic advantage of general education over vocational tracks once selection effects are controlled for (Meer 2007). These arguments give rise to a third expectation:

If one accounts for the heterogeneity of vocational degrees and the selection into different tracks, there is no difference in employment and earnings over the life course between holders of upper-secondary vocational and general education.

3. Institutional context, data and methods

3.1 Institutional context

Our empirical analysis focusses on Switzerland, an ideal country to analyse the pay-off that general and vocational degrees have over the life course. After nine years of compulsory education (six years of primary and three years of secondary schooling), the Swiss educational system offers the choice between two main options: VET or baccalaureate school.

Two thirds of a given age cohort embark on vocational education: 60 per cent in a company-based ‘dual’ apprenticeship and an additional 6 per cent in a school-based form of VET (Wolter et al. 2014: 107). Apprenticeships are called dual because they combine two

learning places, the training firm and the vocational school (and, additionally, include intercompany courses).

Close to a third of an age cohort remains in general education: 20 per cent enter a baccalaureate school that gives direct access to universities and close to 10 per cent go to another upper-secondary specialised school (Federal Office for Statistics 2013). Women are more likely than men to enrol in the upper-secondary general track, whereas men outnumber women in the vocational track. Unlike in Germany, it is unusual in Switzerland for youth to embark on an apprenticeship after obtaining a baccalaureate.

It takes a similar number of years to obtain a vocational degree or a baccalaureate. For most occupations, the nationally recognized VET diplomas (EFZ in German, CFC in French) require three years of training – a series of more complex occupations require four years. It thus takes, altogether, between 12 and 13 years to earn a vocational diploma as compared to 12 to 13 years needed to obtain the baccalaureate (not counting the two years of pre-school or kindergarten). Among the latter group, a sizeable proportion may obtain a few years of university education without graduating. Accordingly, we possibly underestimate their effective years of education by measuring it with the highest degree that they acquired.

Both tracks continue at the tertiary level. While a general baccalaureate degree gives access to universities, the vocational baccalaureates – introduced in the 1990s – entitle youth to study at the universities of applied science. The initial transition rates to universities or universities of applied science are much higher for graduates with general degrees (95 per cent) than vocational degrees (23 per cent) (Babel 2018: 6). However, another third of holders of vocational degrees eventually enrol in advanced professional education and training – and thus obtain a degree at the tertiary level. Although the proportion of Switzerland's population having a degree from a university or university of applied science has risen rapidly over the

last two decades, it is still low in international comparison (29 per cent of men and 27 of women aged 25 to 64 in 2014) (Federal Office of Statistics database).

3.2 Data

Our analysis is based on 24 annual surveys of the Swiss Labour Force Survey (SLFS), covering the years 1991 to 2014.[3] We increase the robustness of our results by following the practice of "identical analysis of parallel data" (Firebaugh 2008) and estimate the same model on an additional dataset, the Swiss Household Panel (SHP), 1999-2015 (Tillmann et al. 2016). The replication across datasets allows us to gauge the uncertainty in the results that may be due to errors commonly found in surveys linked to coverage, sampling, non-response or measurement. In addition, although the SLFS provides us with larger samples and covers a longer period, the SHP has the advantage of containing information on respondents' social origin (education and occupation of both parents).

We impose two restrictions on the analytical sample of the SLFS. First, we limit our analysis to a pseudo-cohort of respondents born between 1954 and 1966. This specific cohort has obtained upper-secondary education and entered the Swiss labour market in the 1970s and 1980s in a period of very low unemployment and an ongoing transition from a still sizeable manufacturing sector to a dominant service economy. Moreover, this cohort is large enough to provide us with a sufficient number of observations for every single year of age between 25 and 60. In the smaller sample of the SHP, we need to construct a larger birth cohort – 1950 to 1979 – in order to get valid estimates for each single year of age.

Second, we exclude individuals who are still in education and limit our analyses to individuals who have no more – and no less – than upper secondary education, either general or vocational. This allows us to compare individuals where only the *type*, but not the level or duration of education varies. In both datasets, we reduce the number of individuals who will

eventually obtain a tertiary degree by limiting the observation window to ages 25 to 60.[4] In the SHP, we exclude all individuals from our analysis who obtain, in later waves, a tertiary degree. This leads us to omit 150 individuals with general education and 273 with vocational education from our analytical sample.

Note that for a majority of labour force participants in Switzerland, the highest education is at the upper-secondary level. For our birth cohort 1954-1966, this is the case for 55 per cent – 46 per cent with upper-secondary *vocational* education and 9 per cent with upper-secondary *general* education. Individuals with tertiary education account for 28 per cent and 16 per cent have not completed any upper-secondary education. Table Web A.1 in the web-appendix provides descriptive statistics.

When applying these restrictions, we obtain 55,391 observations for the 1954-1966 cohort of people aged between 25 to 60 with no more and no less than upper-secondary education. This provides us with an average of 701 observations for men and 837 for women per year of age. In the Swiss Household Panel, our analytical sample is smaller with 5,566 individuals observed over an average of 6.2 years, which means a total of 34,640 observations. Per year of age, this corresponds to an average of 375 observations for men and 587 observations for women.

3.3 Variables

Our analysis focuses on individuals' labour market outcome measured with two dependent variables: employment and work income. Employment is coded as 1 if respondents are working for a minimum of 8 hours per week and 0 if working less than 8 hours per week or not at all. We replicate our results with an alternative specification of 20 hours per week. Earnings are measured with gross hourly work income in constant 2011 Swiss francs (CHF), which we calculate by dividing monthly work income by the number of hours worked.[5] We

include the self-employed, but exclude respondents who are in marginal employment (working less than 8 hours per week). While we impute earnings where missing,[6] we remove wages lower than 12 CHF and higher than 300 CHF per hour.

Our key independent variables are education and age. In most analyses, we simply distinguish two types of education. Upper-secondary vocational education includes dual and school-based VET obtained in curricula of three to four years (including the minority of apprentices obtaining a vocational baccalaureate). Upper-secondary general education includes baccalaureate schools and, more marginally, other general schools with usually at least three years of post-mandatory schooling. For the descriptive analysis, we also show results for individuals with no upper secondary education (compulsory education or short upper-secondary level programs of no more than two years) and for individuals with tertiary education (university, university of applied science and tertiary vocational degrees).

We check for the varying quality of vocational degrees by distinguishing six types of VET, based on respondents' studied occupation that is available in the SLFS: (1) agricultural and construction occupations; (2) technical and industrial production occupations; (3) technical office and computer science occupations; (4) commercial and clerical occupations; (5) occupations in private consumer services; (6) occupations in health and social services. While firm size, sector and the intellectual requirement of an apprenticeship would give us a better measure of quality, there is no information on these features in our two datasets.

Measures for respondent's social origin are only available in the SHP. We use five categories to distinguish fathers' education, mothers' education, fathers' social class and mothers' social class.[7] Additionally, we control for resident permit and, in the SLFS, for nationality (in 20 categories), for Switzerland's 26 cantons and for nine types of residential community (from small village to large urban centre).

3.4 Selection

The allocation of young people into different educational tracks is not random, but riddled with selection effects. We do not have a silver bullet to deal with selection, but use a multi-pronged strategy to reduce its impact.

We focus on a given cohort and thus do not compare the labour market outcomes of individuals who were educated and entered the labour market in different historical periods. We further narrow down our analytical sample to individuals whose highest educational attainment is at the upper-secondary level and who thus typically spent 12 to 13 years in full-time education. Thereby, we exclude both the least motivated students who did not obtain a degree at the upper-secondary level and the most able students who went on to either post-secondary vocational or university education.[8]

More generally, male students from a lower class origin, the German-speaking and rural cantons are more likely to go to the vocational track, whereas female students from a higher class origin, the French-speaking cantons and cities are more prone to choose the general track (Wolter et al. 2014: 107). We thus control for canton, type of municipality, nationality (which, in our birth cohort, correlates with class origin) and, in the SHP, for both parents' education and social class. Moreover, we run all our analysis separately for men and women.[9]

While we are confident that these measures – and notably the comparison between holders of upper-secondary vocational and general education in a given cohort – go some way to reducing selection, we do not have an explicit causal design, but present population associations.

3.5 Estimation method

We test the arguments about the evolution of employment and earnings over the life course in a simple regression setup. The equation of our linear regression is given as:

$$y_i = \beta_1 + \beta_2 educ_i + \beta_3 age_i + \beta_4 age_i^2 + \beta_5 age_i^3 + \beta_6 age_i^4 + \beta_7 educ_i * age_i + \beta_8 educ_i * age_i^2 + \beta_9 educ_i * age_i^3 + \beta_{10} educ_i * age_i^4 + \beta_{11} W_i + \epsilon_i$$

Our dependent variable y_i is, in a first equation, a binary measure of employment (0/1) and in a second equation the logarithm of hourly wages for an individual i at time t. W_i is a vector of controls and ε_i is the error term. Our two main predictors are a dichotomous measure for the type of upper-secondary education, $educ_i$, which measures the initial labour market prospects of vocational relative to general education, and the interaction between education and age $educ_i * age_i$ which accounts for a differential age-evolution of the two educational groups.[10]

As the descriptive results will show, employment and earnings do not follow a linear trend, but evolve in a polynomial pattern over the life-course. Therefore, we estimate a model with age squared, cubed and to the power of four (age_i^2, age_i^3, age_i^4) with the respective interactions terms between education and age: $educ_i * age_i^2$, $educ_i * age_i^3$ and $educ_i * age_i^4$. We help readers to interpret our results by graphically plotting them. Note that we use individual cross-sectional survey weights for the descriptive results, but not for the regression models in order to avoid accounting twice for the same socio-demographic control variables.

4. Empirical results

4.1 Employment over the life course

We begin our analysis by describing the evolution of employment for the cohort born between 1954 and 1966. Figure 1 shows how the employment rate varies by age for men and women with different types and levels of education. Over most of the life course, individuals with tertiary education have the highest and individuals without post-mandatory schooling the lowest employment rate among both men and women.

If we focus on the bulk of the cohort who has upper-secondary education, we find men with VET to have a substantial employment advantage over men with general education up to the age of around 40. While the difference becomes smaller thereafter, vocationally trained men are not overtaken, in terms of the employment rate, by men with upper-secondary general education in the second half of their careers.

For women, we do not observe an employment advantage of VET over general education at the start of the careers. On the contrary, up to the age of 35, vocationally trained women have lower employment rates than women with general education. After that age, they catch up and the two groups with vocational and general upper secondary education evolve in parallel until their retirement.

Figure 1: Employment rate for types of education by age

Figure 1a: Men

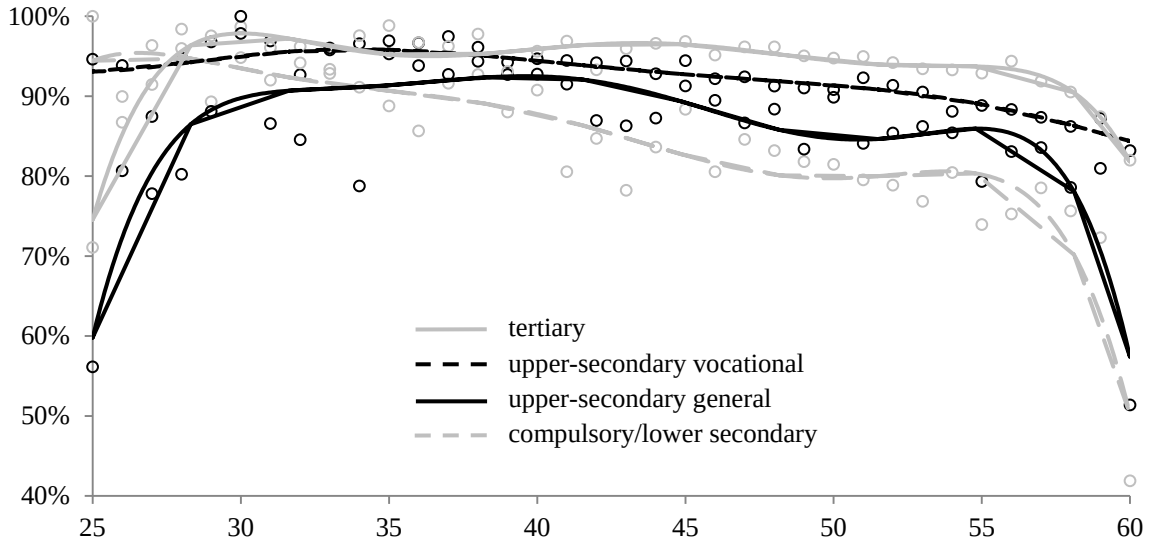
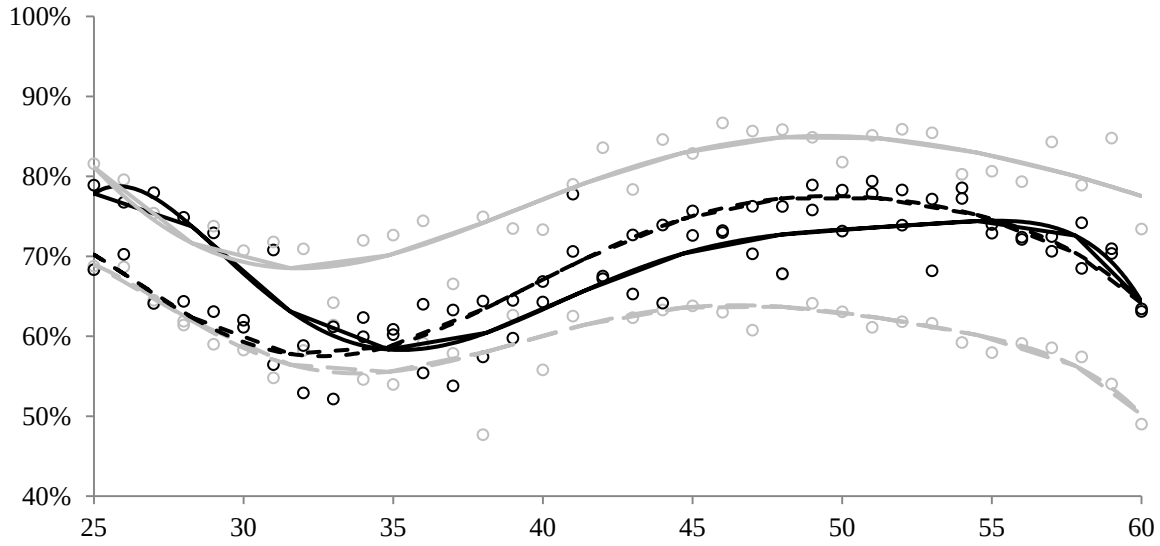


Figure 1b: Women



Data: SLFS1991-2014 (for cohort born 1954-66)
Note: employment of a minimum of 8h per week. Dots represent the mean employment rate at each age for the four educational groups. Lines show the polynomial trend lines.

If we choose a more restrictive definition of employment – at least 20 hours of work per week – we observe a similar pattern for men, but the employment advantage of the vocationally trained becomes larger. For women, the exclusion of small part-timers leads to a drop in the employment rate of 10 percentage points and the early employment advantage of general education over VET becomes smaller (see Figure Web A.1 in the web-appendix).

In a second step, we estimate a multivariate linear probability model on the employment prospects for men and women with upper-secondary vocational and general education. Since age is entered as a polynomial term with several interactions, we make sense of the results by plotting in Figure 2 the difference between vocational and general education (that is, we show the average marginal effects). Both datasets suggest that there is a large initial employment advantage of vocationally trained men over men with general education. While this advantage becomes smaller over time and virtually disappears in the early thirties, it never turns into a disadvantage. Holders of vocational qualifications therefore do not have a harder time

securing employment over the second half of their career than individuals with general education – if anything, their employment prospects seem slightly better. For women, the differences are smaller and suggest that the employment rates of the two educational groups do not vary in a systematic matter. While women with general education may have somewhat higher employment rates in their early thirties than vocationally trained women, the key finding is that the employment prospects of women with either vocational or general education are very similar over the life course.

Do these results also hold if we examine unemployment instead of employment, and thus exclude people from our analysis who are inactive for other reasons (notably linked to family or health)? We introduce all our control variable into a linear probability model on unemployment (Moffitt 1999) and plot the difference predictive margins between holders of vocational and general education. The result shows that the two educational groups do not vary in their unemployment risks over the life course (see Figure A.1 in the appendix). The difference oscillates between +3 and -2 percentage points and does not reach statistical significance for any year of age for either men or women. In Switzerland's context of low ambient unemployment, labour market prospects seem to be better captured by employment rates than unemployment rates.

Figure 2: difference in employment by age for upper-secondary vocational relative to general education (average marginal effects)

Figure 2a: Men – SLFS, cohort 1954-66

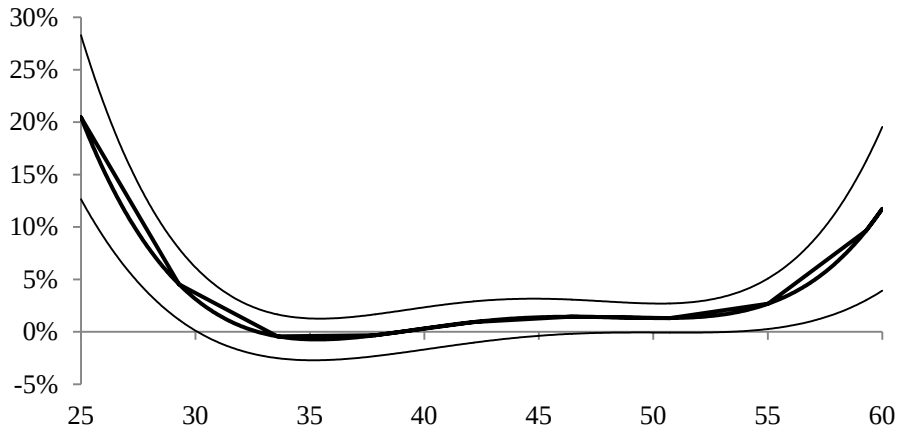


Figure 2b: Women – SLFS, cohort 1954-66

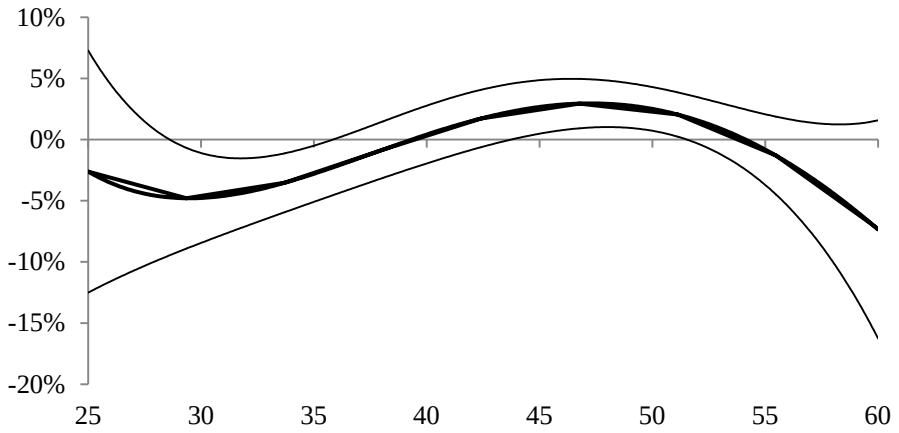


Figure 2c: Men – SHP, cohort 1950-79

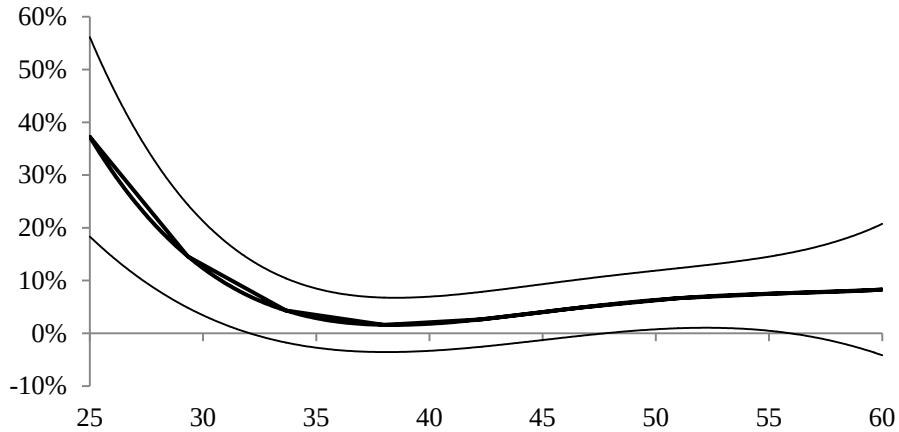
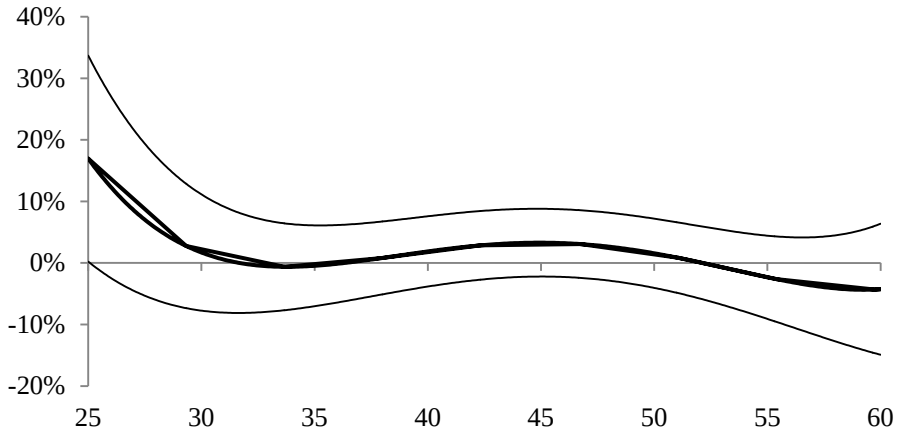


Figure 2d: Women – SHP, cohort 1950-79



Note: average marginal effects based on a linear regression (coefficients shown in Table A.1 in the appendix). Thinner lines represent the 95% confidence intervals. The analyses were replicated with a binomial logistic regression and show to the same age-earnings curves, leading to identical conclusions (results available from the authors).
Data: SLFS1991-2014, SHP 1999-2015

We return to the outcome variable of employment and estimate the same model as in Figure 2 for an older (1941-53) and younger birth cohort (1967-79). The results do not change with respect to those found for our target cohort 1954-66. For the older birth cohort – which we observe over the ages 40 to 60 –, we detect no differences in employment rates between holders of vocational and general education. For the younger cohort – which we observe over the ages 25 to 45 –, we find a higher employment rate of holders of vocational education until the age of 26 for women and until the age of 33 for men (see predicted values in Figure A.2 in the appendix). It is noteworthy that, in terms of employability, vocational education seems to have remained as instrumental for younger as older cohorts.

4.2 Earnings over the life course

Figure 3 shows how hourly work income varies by age for different levels and types of education. Contrary to our findings for employment, general education offers a clear advantage in terms of earnings. Already at the age of 30, men and women with no more than upper-secondary general education receive higher hourly work income than those with upper-secondary vocational training (although note that both educational groups remain well beneath the earnings of workers with tertiary education). After the age of 30, the earnings of workers with upper-secondary general education continue to increase, whereas the earnings curve of vocationally trained workers is almost as flat as that of individuals without post-mandatory schooling. As a result, the gap in hourly earnings widens over the life course in favour of workers with general education.

Figure 3: median hourly work income for types of education by age (in 2011 Swiss francs)

Figure 3a: Men

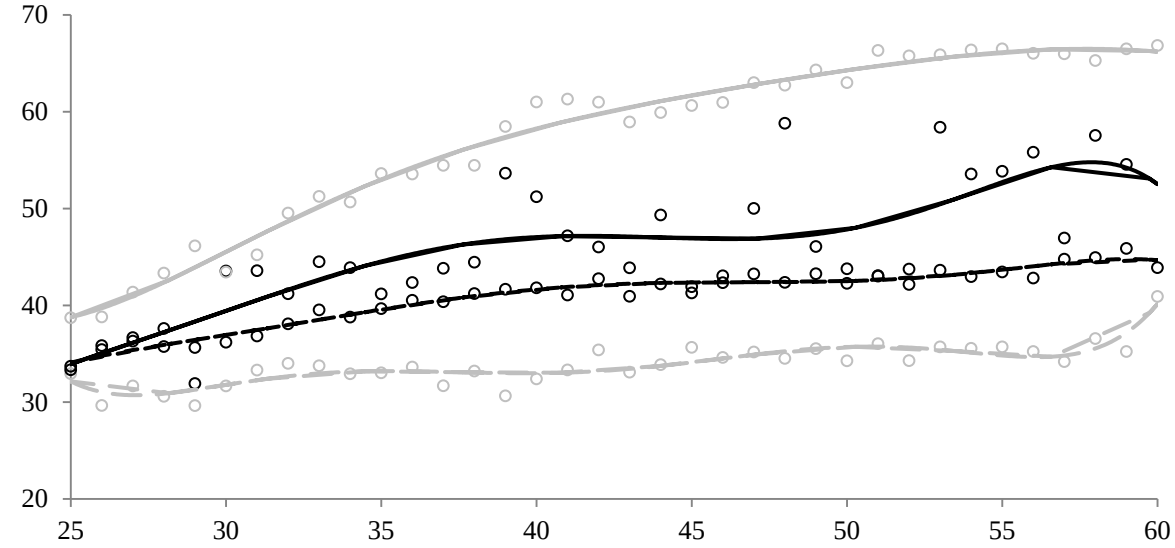
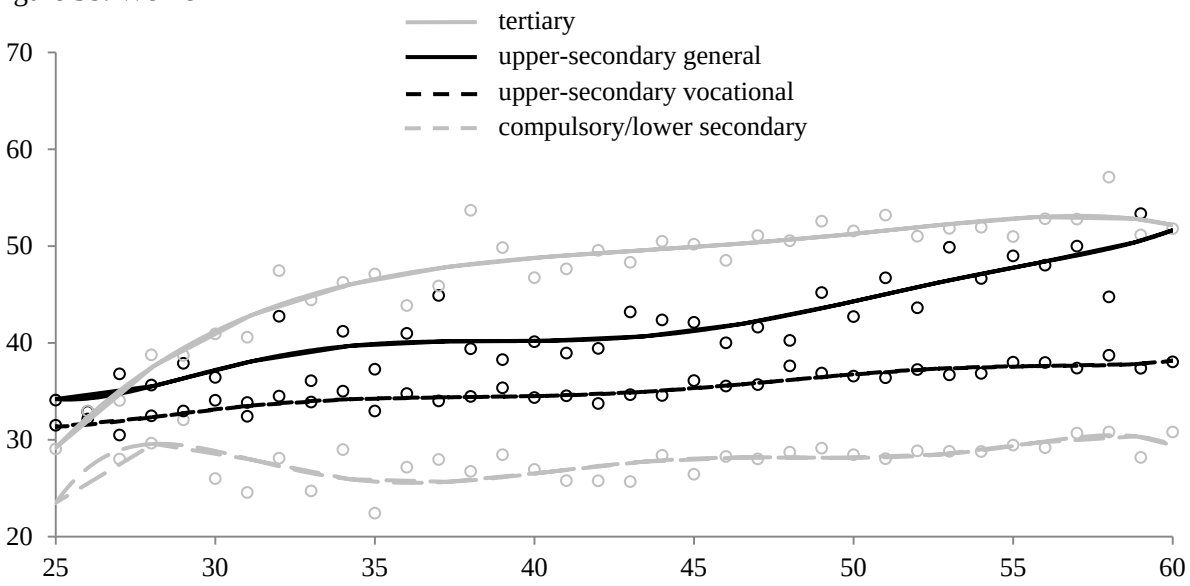


Figure 3b: Women



Data: SLFS1991-2014 (for cohort born 1954-66)

Note: Dots represent the mean earnings at each age for the four educational groups. Lines show the polynomial trend lines.

Our multivariate models confirm these findings. In Figure 4, we plot again the difference of work income over ages 25 to 60 between holders of upper-secondary vocational education and holders of upper-secondary general education (see Table A.2 in the appendix for the coefficients). At the age of 25, hourly work income is comparable for the two educational groups for men, with a slight but non-significant advantage for holders of VET. Yet,

thereafter, earnings increase more for general than vocational education until the growth curve levels off and the difference stabilizes when workers reach their forties. Women with general education have higher hourly wages already at the age of 25 than women with vocational education. The SLFS suggests that at the age of 40, workers with general education earn 12 (men) to 13 per cent (women) more per hour than their vocationally trained colleagues. While the analysis for the SHP is based on a smaller sample and repeated observations, thus producing larger confidence intervals, it leads to the same basic finding that the life-cycle earnings-curve is significantly steeper for general than vocational education. The result is an earnings advantage of general over vocational training that is large for women, but more contained for men.

If we estimate the same model for an older (1941-53) and younger birth cohort (1967-79), we obtain similar findings as for our target cohort 1954-1966. For the older birth cohort (observed over the ages 40 to 60), hourly wage are higher after the age of 40 for both men and women having general education as compared to vocational education. For the younger cohort 1967-79 (observed over the ages 25 to 45), we find for men a similar hourly wage at the age 25 for the two educational groups, but the earnings curve is again steeper for the holders of general education (see predicted values in Figure A.3 in the appendix). For women, we observe an earnings advantage for general education already at the age of 25.

Figure 4: difference in hourly wages (in %) by age for upper-secondary vocational relative to general education (average marginal effects)

Figure 4a: Men – SLFS, cohort 1954-66

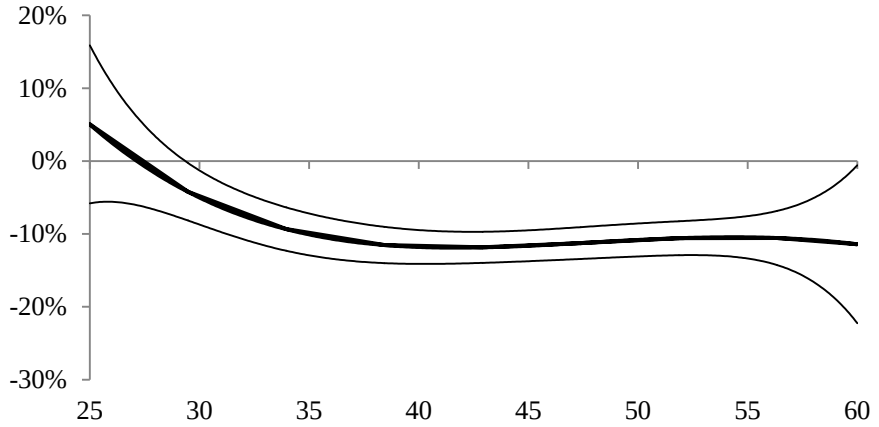


Figure 4b: Women – SLFS, cohort 1954-66

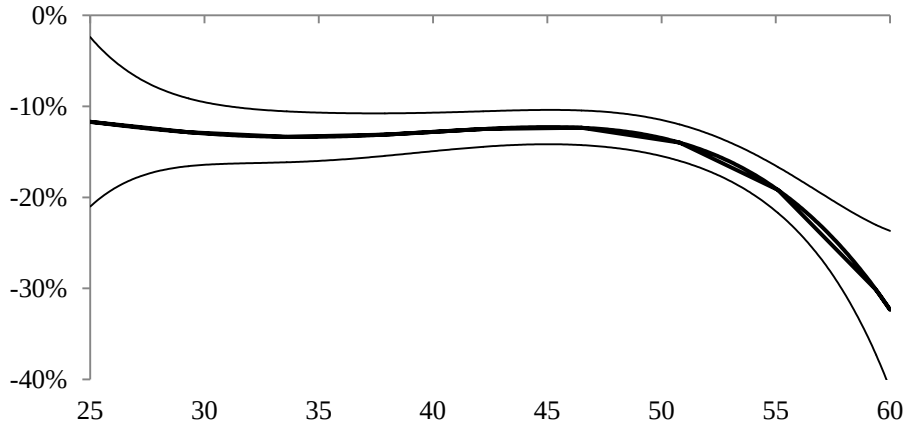


Figure 4c: Men – SHP, cohort 1950-79

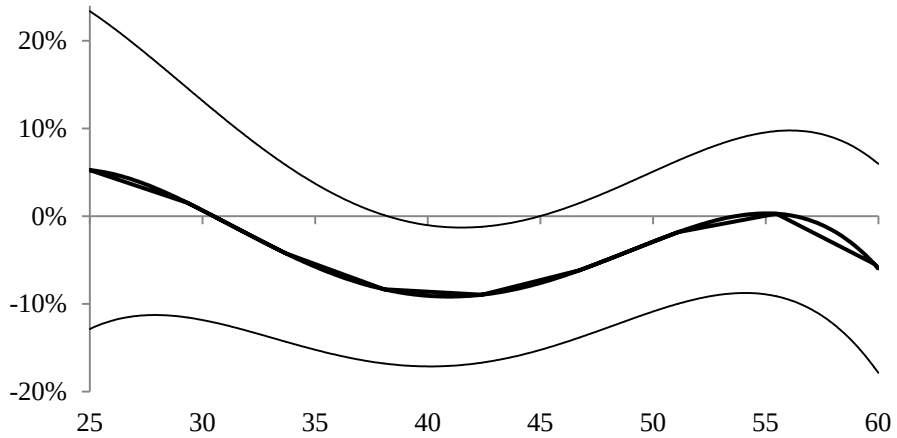
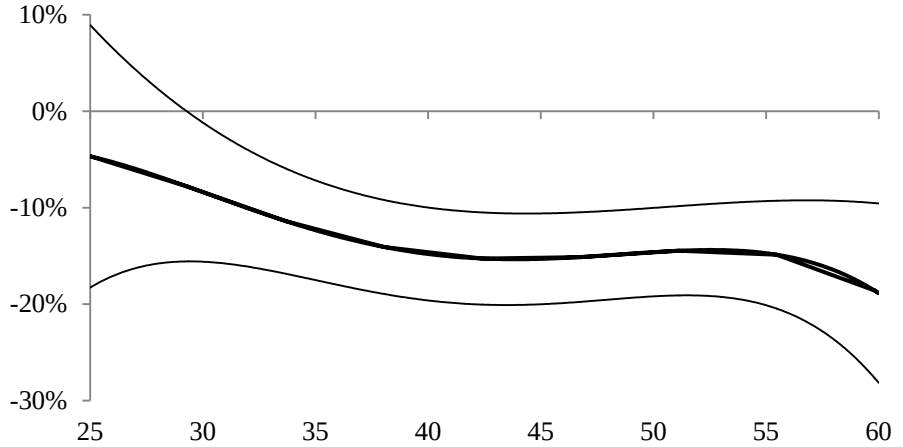


Figure 4d: Women – SHP, cohort 1950-79



Note: average marginal effects based on a linear regression (coefficients shown in Table A.2 in the appendix). Thinner lines represent the 95% confidence intervals.
Data: SLFS1991-2014, SHP 1999-2015

4.3 Robustness tests

Up to now, we have treated VET as a homogeneous type of education. However, the labour market value of a vocational degree may depend on the occupation in which it was obtained. We therefore calculate hourly earnings for each of the six fields of vocational training discussed above (see Figure Web A.2 in the web-appendix). While there are substantial differences in earnings across vocational fields, the conclusions remain unchanged: General education is associated with higher hourly earnings than every single one of the six fields of VET that we distinguish. The first runner-up are vocational degrees in technical and industrial production occupations followed by vocational degrees in commercial and clerical occupations. By contrast, the lowest hourly earnings are paid for vocational degrees in private consumer services, including occupations such as vendors, waiters or hairdressers.

Finally, the question arises as to whether individuals with vocational training succeed in working longer hours and thereby compensate for their lower hourly earnings. We address this question by calculating the *annual* earnings of people working at least 8 hours per week (see Figures Web A.3 and A.4 in the web-appendix).[11] While the earnings gaps between workers in the two educational groups are similar when we use annual instead of hourly work income, annual work incomes show a clearer advantage of VET for men and a smaller advantage of general education for women at the beginning of careers. Men with vocational degrees obtain higher annual earnings than their colleagues with general education up to the age of 27, whereas vocationally trained women have a similar annual work income than women with general education until the age of 28. Thereafter, we observe again a reversal of fortunes as annual earnings increase more for holders of general than vocational education.

5. Discussion and conclusion

Our paper has examined three arguments about the long-term prospects of vocationally trained workers. A first argument expects them to keep and extend their initial labour market advantage over the life course. A second argument presumes that vocational skills become more quickly obsolete than skills obtained in general education, leading vocationally trained workers to fall behind those with general education. A third argument expects very similar labour market outcomes by types of education once heterogeneity of vocational degrees and selection into tracks are accounted for.

Our analysis does not designate a clear winner among these three arguments. With respect to employment, our findings support the first thesis. In Switzerland, vocational training is associated with a substantial employment advantage at the beginning of the career for men, but not for women. Contrary to the idea that vocationally trained workers are outpaced by structural change, we find that their employment rates remain high over the entire career and do not fall beneath those of workers with general education – contrary to what Hanushek et al. (2017) find for their small cross-sectional samples. Moreover, our analysis shows no systematic differences across birth cohorts and suggests that the labour market prospect of vocational relative to general education has not deteriorated over time. While these finding may be specific to Switzerland and its context of low unemployment, Forster et al. (2016) show that the age-employment curves of vocationally trained workers vary little across OECD countries.

Results are different for earnings, where our findings support the second argument. Men, but not women, with upper-secondary general education struggle with a slower start in the labour market. However, once they launch their career, their wage curves are steeper than for vocationally trained workers. As a result, there is a reversal of fortunes between the two

educational groups as workers with general education earn higher work income from their thirties onwards, regardless whether one looks at hourly or annual earnings.

A final result worth noting relates to gender differences: the nexus between education and labour market outcomes looks different for men than women. It is standard practice in labour economics to limit analyses to men and then extrapolate these results to the entire population (e.g. Hanushek et al. 2017: 52, Malamud and Pop-Eleches 2010: 44). This is misleading with respect to the labour market outcomes associated with vocational education. While vocationally trained men have a significant employment advantage in early careers over men with general education, this is not the case for vocationally trained women. This result is consistent with the finding by Forster et al. (2016) that the early-career advantage of vocational education reverses faster into a disadvantage for women than men.

Why would vocational education be more instrumental for men than women? Vocational education was originally devised to train craftsmen and is thus still more relevant to, and possibly of higher quality in, traditionally male- than female-dominated occupations (OECD 2012: 53). In addition, skills learnt in firm-based vocational training are more specific and thus less well portable from one firm to another. This smaller portability of specific skills may make vocational education less attractive to women who plan to interrupt their career in order to raise a family. Likewise, if employers anticipate that more women than men quit their job for family reasons, they will be less inclined to invest into the job-specific skills of their female than their male employees (Esteve-Abe 2005: 190).

The finding that vocational education provide better employment prospects to men – and general education to women – echoes the evolution of Switzerland's baccalaureate rate over the last 25 years. In 1990, women equalled men's baccalaureate rate for the first time (at 13.5 percent). Since then, women's baccalaureate rate continuously climbed (to 24.5 per cent in

2015), whereas men's rate has more or less stagnated at 17 percent. It looks as if youth and their parents examine labour market signals closely before making educational choices.

In policy terms, these findings caution against the overly enthusiastic endorsement of vocational education. While vocational degrees facilitate the transition from school to work and hence protect against youth unemployment, they may also seem to limit workers' long-term productivity and thus come at the cost of flat earning curves over the life course. In other words, vocational training reduces the risk of unemployment and downwards social mobility, but may also limit the likelihood of entry into the upper-middle class and upwards social mobility (Breen and Goldthorpe 1997: 283).

These findings also point to the crucial importance of further education for career advancement. While continued adult education is skewed – in Switzerland as elsewhere in the OECD – towards individuals with university degrees, Switzerland's professional education and training (PET) system offers many progression opportunities for graduates of upper secondary vocational education. No less than 20 percent of Switzerland's labour force held a PET degree in 2009 and had thus joined – at the mean age of 30 – the growing ranks of workers with a tertiary education (OECD 2013: 13). An initial degree at the tertiary level – be it a bachelor or a PET degree – may thus increasingly become the standard entry-level education on the labour market as individuals with tertiary degrees become the largest educational group, in Switzerland as elsewhere in Western Europe.

Finally, we wish to caution against the over-generalization of our findings. They refer to a specific cohort, country and historical period – and coincide with the transition from an industrial to a service-based economy in the context of low unemployment. With on-going digitalization, globalization and educational expansion, young adults who obtain an upper-secondary vocational degree today may well face different employment prospects in the

second half of their careers than did the Swiss cohort that left the educational system in the 1970s and 1980s.

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Appendix – Figures

Figure A.1: difference in unemployment rates by age for upper-secondary vocational relative to general education (average marginal effects)

Figure A.1a: Men – SLFS, cohort 1954-66

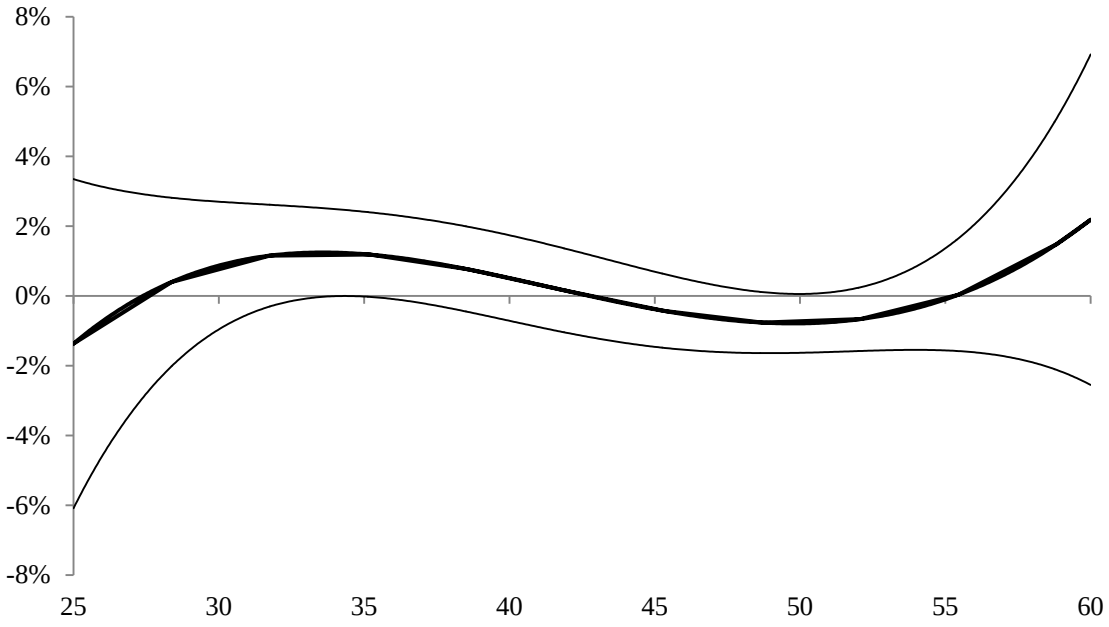
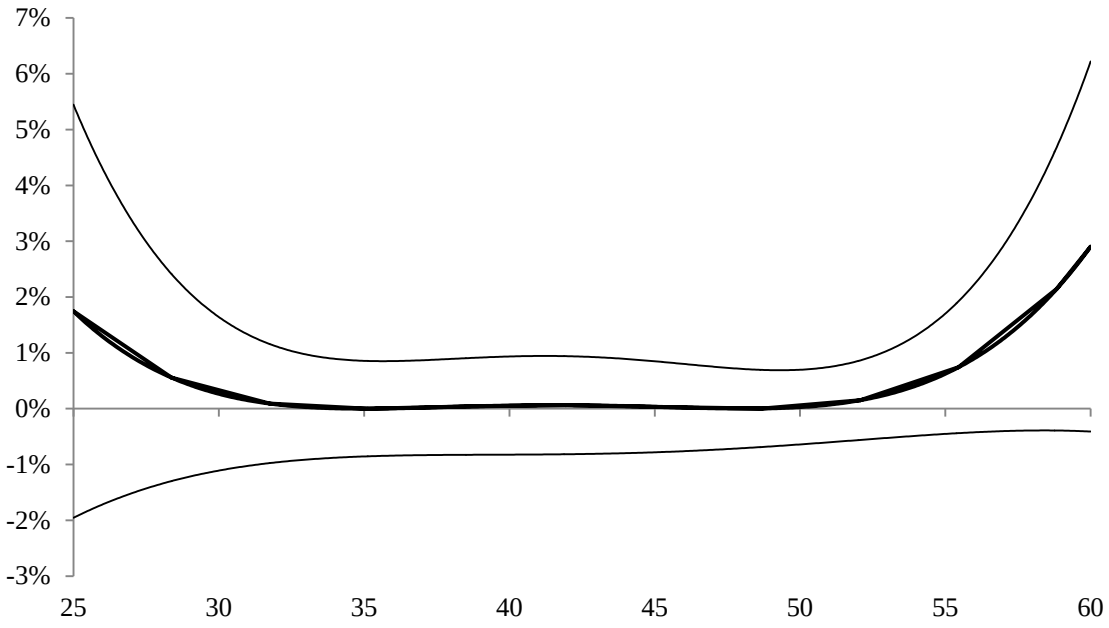


Figure A.1b: Women – SLFS, cohort 1954-66



Note: average marginal effects based on a linear regression (see legend of Table A.1 in the appendix for information on the control variables)

Data: SLFS1991-2014

Figure A.2: difference in employment by age for upper-secondary vocational relative to general education (average marginal effects) for two birth cohorts

Figure A2.a: Men – SLFS, cohort 1941-53

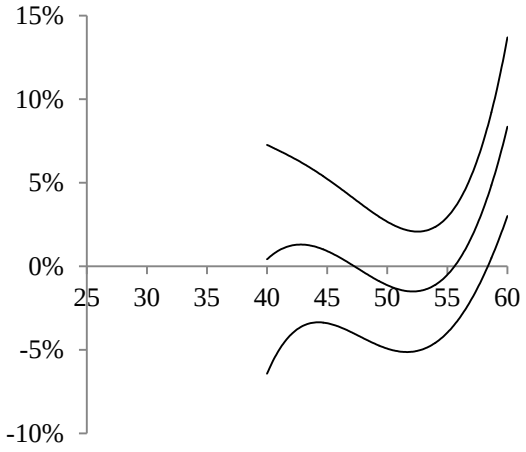


Figure A2.b: Women – SLFS, cohort 1941-53

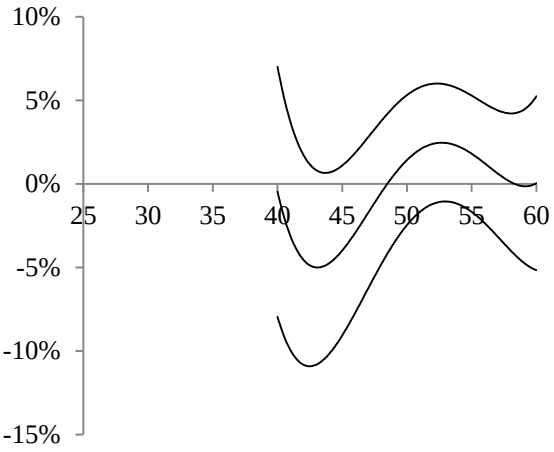


Figure A2.c: Men – SLFS, cohort 1967-79

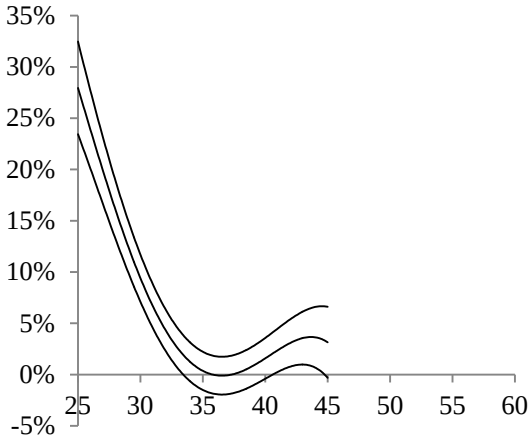
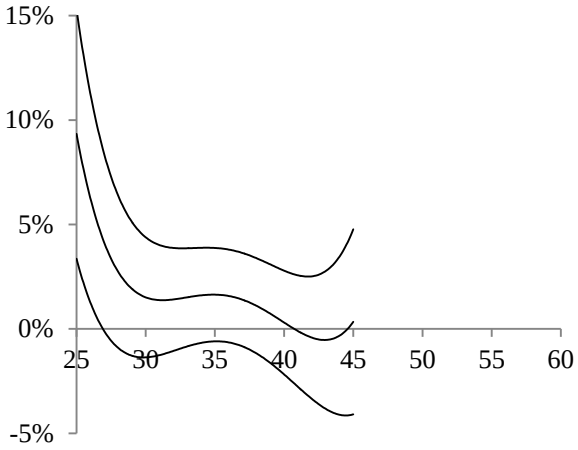


Figure A2.d: Women – SLFS, cohort 1967-79



Data: SLFS1991-2014

Note: average marginal effects based on a linear regression on employment (see Table A.1 for control variables). Outward lines represent the 95% confidence intervals.

Figure A.3: difference in hourly wages (in %) by age for upper-secondary vocational relative to general education (average marginal effects) for two birth cohorts

Figure A3.a: Men – SLFS, cohort 1941-53

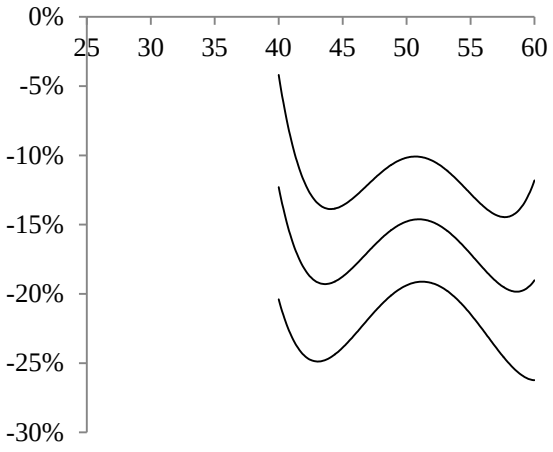


Figure A3.b: Women – SLFS, cohort 1941-53

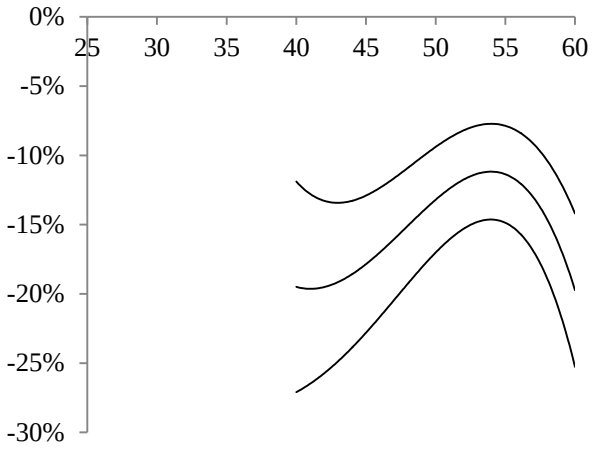


Figure A3.c: Men – SLFS, cohort 1967-79

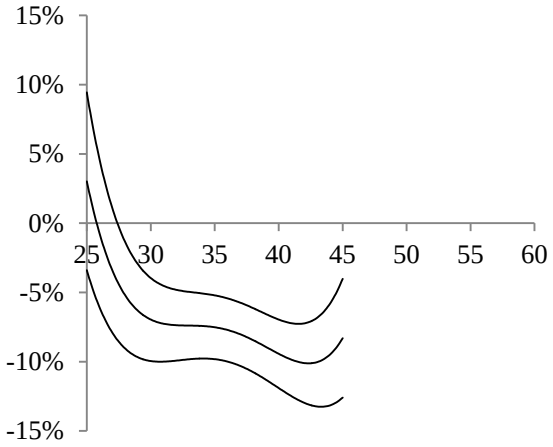
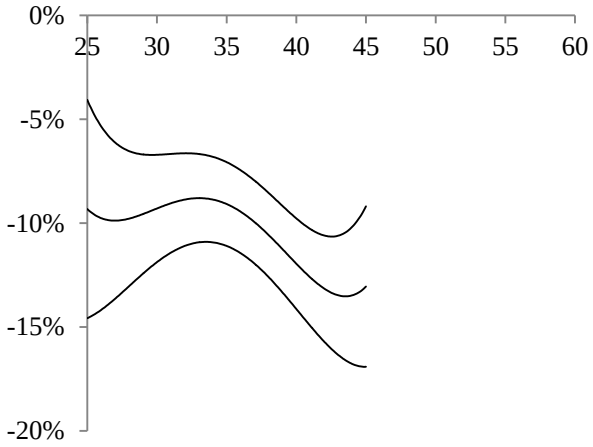


Figure A3.d: Women – SLFS, cohort 1967-79



Data: SLFS1991-2014

Note: average marginal effects based on a linear regression on hourly wages (see Table A.2 for control variables). Outward lines represent the 95% confidence intervals.

Appendix - Tables

Table A.1: linear regression coefficients for being in employment (min. 8 hours per week)

		Men				Women			
		without controls		with controls		without controls		with controls	
		coeff	SE	coeff	SE	coeff	SE	coeff	SE
SLFS, cohort 1954-66	age	**11.1**	2.51	**8.47**	2.48	-3.88	2.83	-5.36	2.82
	age^2	**-3.89**	0.92	**-2.92**	0.91	1.17	1.03	1.75	1.03
	age^3	**0.59**	0.15	**0.44**	0.15	-0.15	0.17	-0.24	0.16
	age^4	**-0.03**	0.01	**-0.03**	0.01	0.01	0.01	0.01	0.01
	educ: voc	**9.95**	2.69	**8.70**	2.66	2.92	3.22	2.22	3.20
	age*educ: voc	**-9.43**	2.69	**-8.19**	2.65	-2.96	3.19	-2.17	3.18
	age^2* educ: voc	**3.30**	0.98	**2.86**	0.97	1.03	1.17	0.73	1.16
	age^3* educ: voc	**-0.51**	0.16	**-0.44**	0.15	-0.15	0.19	-0.10	0.19
	age^4* educ: voc	**0.03**	0.01	**0.03**	0.01	0.01	0.01	0.01	0.01
	constant	**-10.8**	2.51	**-8.14**	2.48	5.26	2.84	**6.614**	2.83
	Adjusted R^2	0.013		0.043		0.016		0.029	
	N	25,168		25,168		29,667		29,667	
SHP. cohort 1950-79	age	**11.7**	4.51	**11.7**	4.48	0.54	4.769	0.45	4.69
	age^2	**-3.89**	1.64	**-3.88**	1.63	-0.45	1.716	-0.42	1.68
	age^3	**0.57**	0.26	**0.57**	0.26	0.12	0.268	0.11	0.26
	age^4	**-0.03**	0.02	**-0.03**	0.02	-0.01	0.015	-0.01	0.02
	educ: voc	7.54	4.72	7.76	4.68	8.44	5.315	8.14	5.25
	age*educ: voc	-6.22	4.66	-6.44	4.63	-8.00	5.231	-7.64	5.15
	age^2* educ: voc	1.90	1.69	1.97	1.68	2.77	1.880	2.63	1.85
	age^3* educ: voc	-0.25	0.27	-0.26	0.27	-0.41	0.293	-0.39	0.29
	age^4* educ: voc	0.01	0.02	0.01	0.02	0.02	0.017	0.02	0.02
	constant	**-12.1**	4.56	**-12.1**	4.54	0.65	4.833	0.45	4.69
	Adjusted R^2	0.055		0.074		0.011		0.029	
	N	13,378		13,378		20,494		20,494	

SLFS: Swiss Labor Force Survey 1991-2014, SHP: Swiss Household Panel 1999-2015

Controls included in both datasets: canton, type of municipality, residence permit. Additionally for SLFS: nationality. Additionally for SHP: fathers' and mothers' education, fathers' and mothers' social class.

Notes: we use random effect models in the SHP due to the panel structure of the data and report robust standard errors. Age variables have been divided by 10 (i. e. age 25 is expressed as 2.5, age 45 as 4.5).

Bold: significant at $p<0.05$.

Table A.2: linear regression coefficients for (log) hourly work income

		Men				Women			
		without controls		with controls		without controls		with controls	
		coeff	SE	coeff	SE	coeff	SE	coeff	SE
SLFS, cohort 1954-66	age	4.22	3.55	0.63	3.41	1.41	2.76	-1.73	2.71
	age^2	-1.19	1.30	0.10	1.25	-0.39	1.01	0.80	0.99
	age^3	0.14	0.21	-0.05	0.20	0.04	0.16	-0.15	0.16
	age^4	-0.01	0.01	0.00	0.01	0.00	0.01	0.01	0.01
	educ: voc	4.12	3.79	2.11	3.63	1.73	3.13	-0.50	3.07
	age*educ: voc	-3.60	3.77	-1.65	3.62	-1.66	3.12	0.62	3.06
	age^2* educ: voc	1.12	1.38	0.44	1.32	0.51	1.14	-0.34	1.12
	age^3* educ: voc	-0.15	0.22	-0.05	0.21	-0.06	0.18	0.07	0.18
	age^4* educ: voc	0.01	0.01	0.00	0.01	0.00	0.01	-0.01	0.01
	constant	-1.61	3.56	1.92	3.43	1.84	2.76	4.77	2.72
	Adjusted R^2	0.020		0.101		0.035		0.094	
	N	22,665		22,665		20,806		20,806	
SHP. cohort 1950-79	age	-3.93	5.20	-4.12	5.09	1.07	3.35	1.28	3.41
	age^2	1.89	1.86	1.99	1.81	-0.26	1.20	-0.35	1.23
	age^3	-0.35	0.29	-0.37	0.28	0.03	0.19	0.05	0.19
	age^4	0.02	0.02	0.02	0.02	-0.00	0.01	-0.00	0.01
	educ: voc	-3.03	5.59	-3.97	5.48	-0.69	3.86	-1.37	3.90
	age*educ: voc	3.72	5.47	4.73	5.37	0.98	3.79	1.67	3.83
	age^2* educ: voc	-1.59	1.95	-1.98	1.92	-0.49	1.36	-0.73	1.38
	age^3* educ: voc	0.28	0.30	0.35	0.30	0.09	0.21	0.13	0.22
	age^4* educ: voc	-0.02	0.02	-0.02	0.02	-0.01	0.01	-0.01	0.01
	constant	6.06	5.31	6.14	5.20	1.95	3.40	2.00	3.47
	Adjusted R^2	0.070		0.121		0.040		0.076	
	N	11,369		11,369		12,819		12,819	

SLFS: Swiss Labor Force Survey 1991-2014, SHP: Swiss Household Panel 1999-2015

Controls included in both datasets: canton, type of municipality, residence permit. Additionally for SLFS: nationality. Additionally for SHP: fathers' and mothers' education, fathers' and mothers' social class.

Notes: we use random effect models in the SHP and report robust standard errors. Age variables have been divided by 10 (i. e. age 25 is expressed as 2.5, age 45 as 4.5).
Bold: significant at $p<0.05$.

Web Appendix - Figures

Figure Web A.1: employment rate by type of education and age, 20h per week

Figure Web A.1a: Men – cohort 1954-66

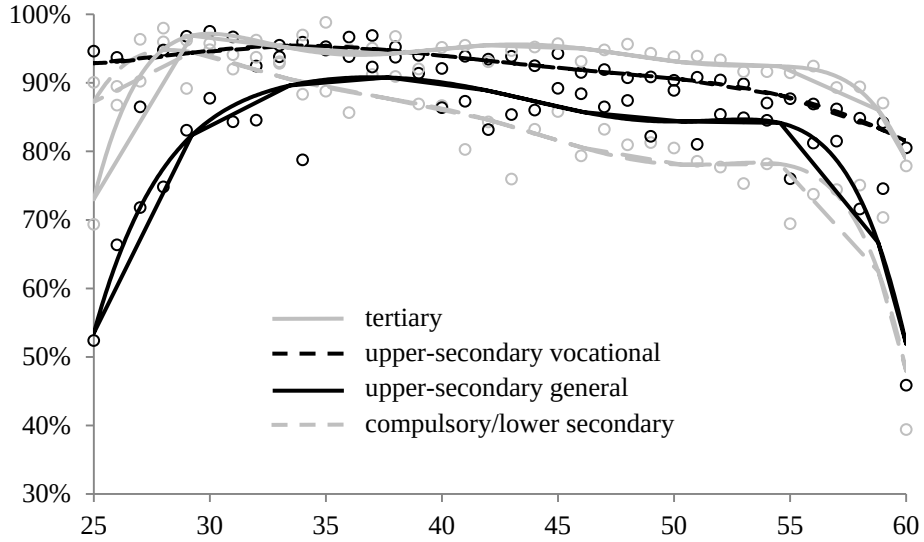
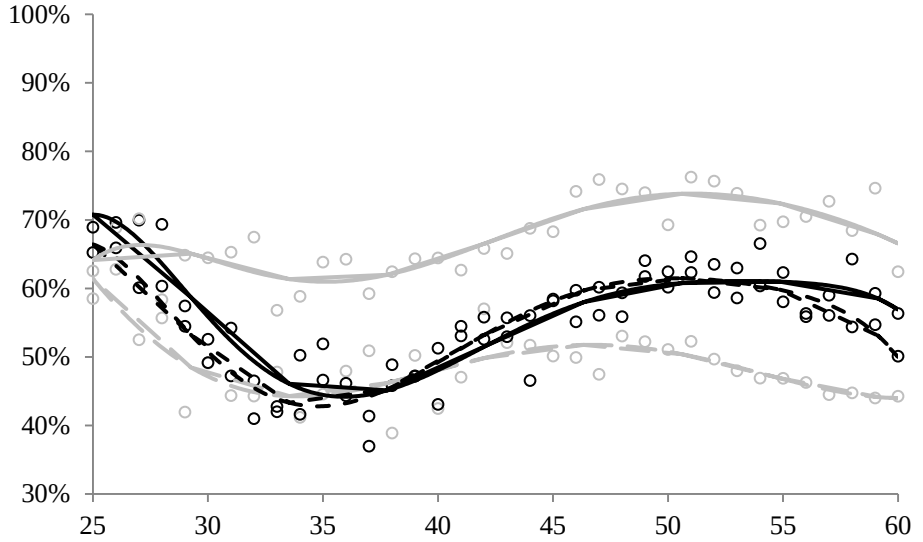


Figure Web A.1b: Women – cohort 1954-66



Note: employment of a minimum of 20 hours per week
Data: SLFS1991-2014

Figure Web A.2: median hourly work income (in constant 2011 Swiss francs) for six fields of upper-secondary vocational education

Figure Web A.2a: Men

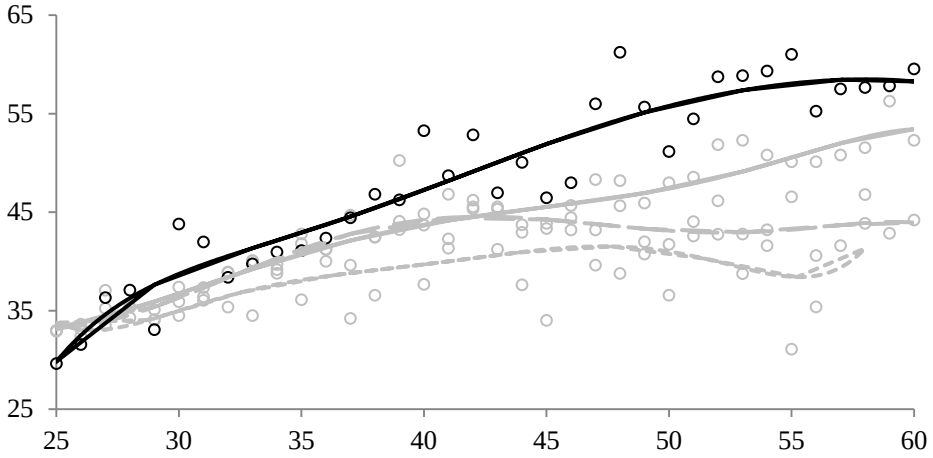


Figure Web A.2b: Women

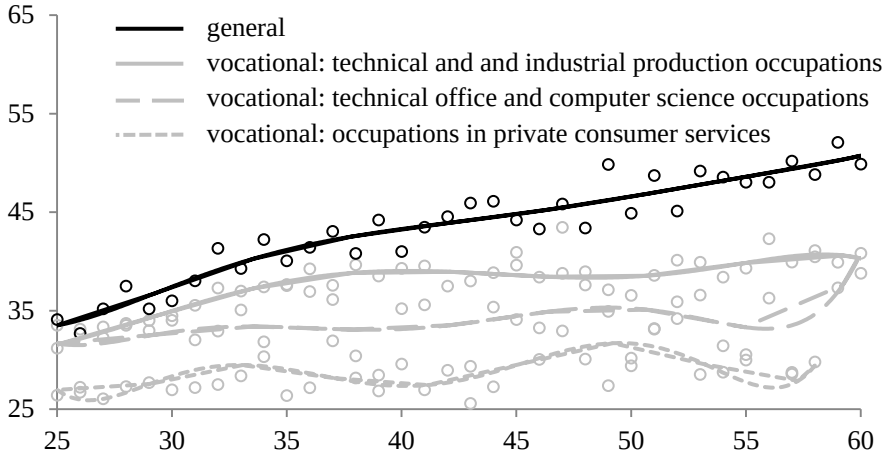


Figure Web A.2c: Men

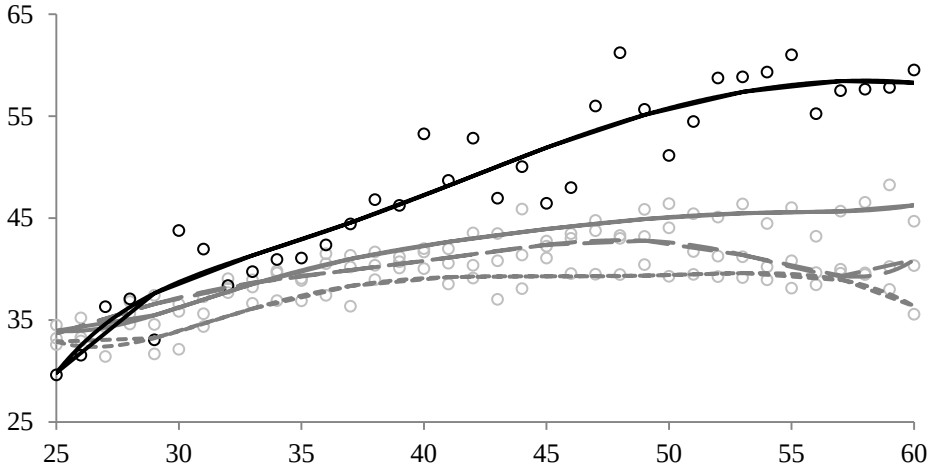
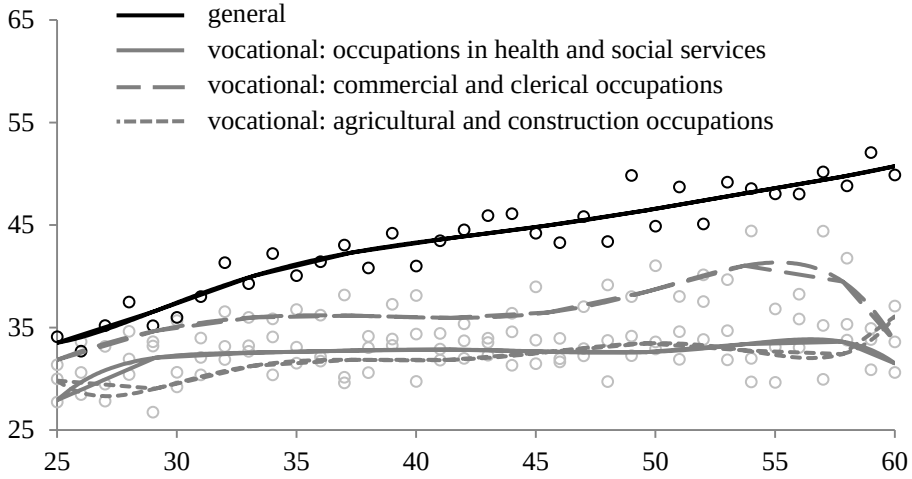


Figure Web A.2d: Women



Data: SLFS1991-2014 (for cohorts born 1941-53, 1954-66, 1967-79)

Figure Web A.3: difference in annual work income (in %) by age for upper-secondary vocational relative to general education (average marginal effects)

Figure Web A.3a: Men – SLFS, cohort 1954-66

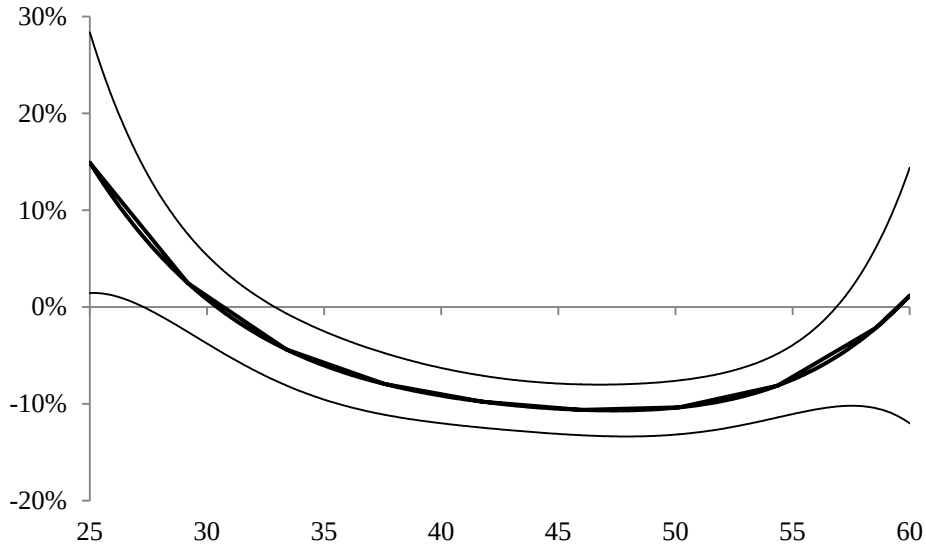
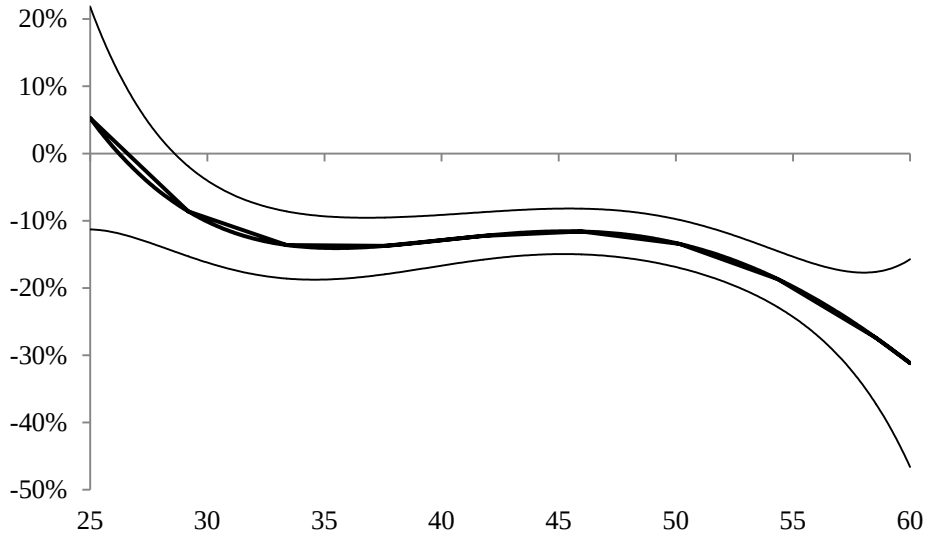


Figure Web A.3b: Women – SLFS, cohort 1954-66



Note: average marginal effects based on a multivariate linear regression on annual work income
Data: SLFS1991-2014

Web-Appendix Tables

Table Web A.1: descriptive statistics of the variables used in the analysis

	Swiss Labor Force Survey (SLFS)			Swiss Household Panel (SHP)		
Variable	*mean*	*min*	*max*	*mean*	*min*	*max*
Education: upper-secondary vocational	0.84	0	1	0.84	0	1
Education: upper-secondary general	0.16	0	1	0.16	0	1
Gender: men	0.44	0	1	0.39	0	1
Gender: women	0.56	0	1	0.61	0	1
Age	43.05	25	60	44.09	25	60
Gross annual work income (after imputation for the SLFS)	68,270	1,843	252,400	66,740	1,590	255,400
Hourly work income	36.94	12	300	44.91	12	300
Number of hours worked per week	34.67	0	45	32.39	0	45
Work (no condition of number of hours): yes	0.83	0	1	0.83	0	1
Work (no condition of number of hours): no	0.17	0	1	0.17	0	1
Work (minimum 8 hours per week): yes	0.80	0	1	0.81	0	1
Work (minimum 8 hours per week): no	0.20	0	1	0.19	0	1
Work (minimum 20 hours per week): yes	0.72	0	1	0.69	0	1
Work (minimum 20 hours per week): no	0.28	0	1	0.31	0	1

SLFS: n=123,155 (individual observations); 97,941 observations for individuals working at least 8 hours per week and providing information on work income. Cohort 1941-1953 n=23,250, cohort 1954-1966 n=55,391, cohort 1967-1979 n=44,514

SHP: n=5,566 (individuals), N=34,622 (person-year observations); 4,485 individuals working at least 8 hours per week and providing information on work income (24,200 person-year observations)

Table Web W.2: Highest level of educational attainment by age, cohort 1954-1966, men

	compulsory/ lower secondary	upper-secondary vocational	upper-secondary general	tertiary
25-29	9%	53%	12%	26%
30-34	11%	47%	7%	34%
35-39	12%	47%	7%	34%
40-44	14%	44%	5%	37%
45-49	14%	42%	5%	39%
50-54	13%	41%	5%	41%
55-60	14%	41%	5%	39%

Data: SLFS1991-2014

Table Web W.3: Highest level of educational attainment, cohort 1954-1966, women

	compulsory/ lower secondary	upper-secondary vocational	upper-secondary general	tertiary
25-29	16%	55%	15%	14%
30-34	16%	54%	14%	16%
35-39	19%	49%	14%	18%
40-44	19%	48%	13%	20%
45-49	21%	45%	10%	24%
50-54	22%	46%	9%	24%
55-60	24%	45%	9%	22%

Data: SLFS1991-2014

Endnotes

[1] See for instance: *Wall Street Journal* "Germany's new export: jobs training", 14. 6. 2012. *Guardian* "Apprenticeships: why we would do well to value them more highly", 27. 8. 2012. *The Economist* "Ein neuer Deal? Germany's vaunted dual-education system is its latest export hit", 1. 6. 2013.

[2] Our comparison thus focuses on individuals who hold a full upper-secondary vocational certificate or a full upper-secondary general maturity certificate (ISCED 3a for general and ISCED 3b for vocational or categories 2c_voc and 2c_gen according to the CASMIN classification). In our cohort of interest, this is the highest level of education of 54 per cent.

[3] We do not use the SLFS's rotating panel, but only include, for each respondent, the first observation.

[4] Individuals continue to obtain tertiary education after their early twenties. However, Tables W.2 and W.3 in the web-appendix show that this applies to a similar extent to holders of upper-secondary vocational as to holder of upper-secondary general education after the age of 25. Selectivity into tertiary education seems therefore to be comparable for the two groups over ages 25 to 60.

[5] The number of hours is based on the exact full-/part-time status given by the respondents and, where this information is missing, on the actual number of hours worked per week.

[6] In the SLFS, we impute missing earnings data using multiple imputations (package "mice" in R, using five imputations) based on a regression model including age, age^2, age^3 age^4, type

of education, 26 cantons, type of municipality, residential permit as well as nationality. More complex models that additionally include sector, ISCO and job responsibility lead to the same results. Likewise, when comparing the results based on imputed earnings with results obtained with listwise deletion of missing data, we find very similar outcomes (results are available from the authors).

[7] For education, we use: (1) no more than compulsory education; (2) upper-secondary vocational education; (3) upper-secondary general education; (4) tertiary education, (5) missing. For social class, we use: (1) low-skilled working class including machine operators and elementary occupations in production, sales and services; (2) skilled working class including craft workers, clerks and skilled sales and service workers; (3) lower-middle class of associate managers, semi-professionals and technicians; (4) upper-middle class of managers and professionals; (5) Missing. Occupations were coded on the basis of the International Standard Classification of Occupations (ISCO) 1988 at the 4-digit levels. The Stata codes are available from the authors.

[8] We did an additional analysis of the PISA reading competencies with TREE-data (TREE 2016, Transitions from Education to Employment. DOI 10.23662/FORS-DS-816-5), a cohort study of young adults in Switzerland. These data suggest that individuals who stopped after upper-secondary general education had better reading skills at the age of 16 than those who ended their educational careers with a vocational degree (median scores of 502 and 544 respectively). At the same time, both educational groups had *higher* reading scores at the age of 16 than individuals without upper-secondary education (445) and *lower* scores than individuals who eventually achieved a university degree (575).

[9] We tested – and discarded – two instrumental variables widely used in the literature: institutional school differences and mothers' education (Card 1999: 1822). We used the baccalaureate rate in a given canton in a given year for girls and boys. This rate is set by each canton independently and varies over time and across cantons: if it is low, average students are less likely to go to a baccalaureate school and more likely to choose VET. Unfortunately, the baccalaureate rate turned out to be a weak instrument that leads to biased estimates. Likewise, the correlation between mothers' education and children's education is low and the instrument weak.

[10] Hanushek et al. (2017: 57-8) argue, somewhat optimistically, that this model emulates a difference-in-differences approach where the coefficient of $educ_i$ includes any selectivity into types of education that are not captured by W_i, whereas the interaction $educ_i * age_i$ identifies the causal effect of different types of education over the life course.

[11] SLFS provides information on the effective annual work income, regardless of working hours. For this analysis, we discarded the work income of people who are not in the labour market or employed in marginal jobs (working less than 8 hours per week), left away outliers (the top and bottom percent of the distribution) and imputed missing values (see footnote 5).