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DOES VOCATIONAL EDUCATION GIVE A HAPPY START AND A LOUSY END TO CAREERS? EMPLOYMENT AND EARNINGS OVER THE LIFE COURSE IN SWITZERLAND

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Abstract

Since the Great Recession, vocational training has been advocated as the solution against high youth unemployment. It gives workers a head start in the labor market and may thus lead to better careers. Yet vocational skills may also become obsolete sooner and leave older workers vulnerable to technological change. We address this issue by comparing earnings and employment over the life course for vocational and general education at the upper-secondary level. We do so for Switzerland, the OECD country with the highest share of youth undertaking vocational education and training (VET), using the Swiss Labor Force Survey 1991-2014 and the Swiss Household Panel. We find that employment prospects for older workers with VET are as good as those for workers with general education. However, general education is associated with higher earnings than VET once workers enter their thirties. There are strong gender differences: Among men, life-cycle earnings with VET exceed those of workers with general education, whereas among women, general education is associated with higher earnings.

Keywords

vocational education and training | apprenticeship | earnings | employment | life course | specific skills | 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. International organizations propagate the example of Germany and Switzerland's apprenticeship systems in particular, which combine learning in the workplace with lessons at vocational schools (OECD 2013). Consequently, government delegations from all over the world 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, VET has several attractive features. As employers are closely implicated in the development of degrees and teaching curricula, the vocational skills obtained are instrumental in the labor market. This enables young people to be integrated into the world of work early on – and the aggregate outcome is lower youth unemployment. However, while VET may help young people to find a good match at the beginning of their working life, 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 thus become obsolete at a faster rate than general skills learnt in more academic curricula. Accordingly, the advantages of VET in smoothing the entry into the labor market may have to be weighed against potential disadvantages later on in the career (Foster et al. 2016, Hanushek et al. 2016).

At the same time, 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 (OECD 2010a). The idea is that initial experiences in the labor 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 appears more difficult for young people with general schooling than with work-based apprenticeships.

We contrast these two hypotheses by analyzing the evolution of employment and wages over the life course for workers with upper-secondary vocational and workers with upper-secondary general education. We thus examine whether VET pays off in the long run in terms of employment prospects and earnings.

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 percent in

2011.² 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 study the life course implications of vocational versus general education with pooled cross-sectional data from the Swiss Labor Force Survey, years 1991 to 2014. We replicate our analysis with longitudinal data from the Swiss Household Panel, years 1999 to 2013, which allows us to account for differences in social origin.

In the next section, we contrast different hypotheses on the long-term returns to vocational education and training. We then present Switzerland's educational system and discuss our data, measures and model. The results section provides evidence on the age-earnings and age-employment profiles for workers with upper-secondary vocational and upper-secondary 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 labor market entry (e. g. Shavit and Müller 1998, Gangl et al. 2003). However, 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 labor 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 hypotheses: (i) cumulative advantage in favor of vocational education, (ii) reversal of fortunes in favor of general education, (iii) identical outcomes for general and vocational education once we account for heterogeneity.

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 the production systems. Thereby, it smooths the school-to-work transition (Wolter and Ryan 2011: 523). These advantages should be particularly marked in countries where VET is focused and occupationally specific (rather than general and diffuse), offering

specialized training for hundreds of detailed occupations (Shavit and Müller 2000: 34). 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 labor market.

Countries with VET systems that meet these criteria such as Austria, Germany or Switzerland have particularly low youth unemployment rates (OECD 2010b: 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 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' early attachment to the labor force provides workplace experience that facilitates the transition to a job. More importantly, for many apprenticeship graduates the search issue does not arise in the first place. One year after graduation, 36 percent of Swiss apprentices and over 50 percent of German apprentices still work for their training firm (Dionisius et al. 2010: 16; Protsch and Solga 2015: 522).

It may be crucial for the subsequent career to avoid a prolonged period of unemployment early on in the working life as an early failure in the labor market may trigger a mechanism of cumulative disadvantage. Unemployment early on in the career may scar workers because it reduces their human capital, confidence and psychological readiness for work, and thus make them less attractive to prospective employers (DiPrete and Eirich 2006: 287).

Empirical evidence based on life history surveys from the Netherlands (Luijkx and Wolbers 2009) and the European SHARELIFE data (Hank and Brandt 2014: 739) suggest that non-employment early in working life indeed has a scarring effect on the subsequent career. The association between early and later unemployment may be due to some unobserved characteristics of workers such as low ability or impaired health. However, Scarpetta et al. (2010) use an exogenous measure – the unemployment rate at labor market entry – and still find that adverse conditions at the beginning of workers' careers have a long-term effect on their employment prospects and earnings in five European countries and the US. These elements lead us to formulate a first hypothesis:

Hypothesis 1: Upper-secondary vocational education should ease the entry into the labor 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 hypothesis builds on the argument that vocational training provides specific skills, whereas academic schooling leads to general skills (Becker 1964). In this view, the more specific a vocational training program is, the better the initial match in the labor market and the higher the initial earnings. 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. And it is 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. 2016).

While the specificity of vocational skills should not be overestimated – they are clearly transferable beyond single firms (Winkelmann 1996: 668) – vocational degrees are closely linked to single occupations. The Swiss VET system offers school-leavers apprenticeships in 230 occupations, the German VET system in 400 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).

A look at Switzerland suggests that VET systems are outpaced by the structural change in the economy. In 2000, the share of apprentices within the workforce was 7 percent in agricultural occupations, 12 percent in manufacturing and construction occupations, but only 4 percent in service occupations. More surprisingly, between 1970 and 2000 the share of apprentices increased in agricultural, manufacturing and construction occupations, but fell in service occupations (Sheldon 2008). In other words, apprentices are increasingly overrepresented in declining occupations and increasingly underrepresented in growing occupations.

Why is there an apprenticeship bias towards jobs in crafts and manufacturing? On one hand, employers in structurally weak sectors may be interested in staffing their firms with apprentices. On the other hand, growing service occupations may require skills in terms of abstract thinking and communication that are more easily obtained by general education than workplace learning. VET's strong focus on practical skills and labor market readiness may therefore 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).

General skills may not prepare youth well for entry into the labor market. Yet they are probably more adaptive and transferable, and thus provide a better basis for further learning. Workers with general skills may thus be better equipped to respond to technological change and switch occupations (Goldin 2001: 277). In comparison, a vocational degree is expected to have a shorter half-time over the life course. As such, the initial labor market advantage of vocational over general education may decrease, and then reverse, with age (Hanushek et al. 2016: 2; Woessmann 2015: 12).

What does the empirical evidence tell us? Based on the International Adult Literacy Survey (IALS), conducted in 18 countries between 1994 and 1998, Hanushek et al. (2016) find that people with vocational qualifications benefit from an employment advantage up to the age of 40 and, after that, are at a disadvantage. The trade-off between initial employment gains from vocational education and employment losses later on is particularly marked in Denmark, Germany and Switzerland, three typical apprenticeship countries.

The finding that vocationally trained workers suffer a faster depreciation of their skills than those with a general education is also made by Weber (2014) for the Swiss Labor Force Survey 1998-2009 and Goldsteyn and Swedberg (2014) for sibling data stemming from the Swedish population register. Cörvers et al. (2011) find for Germany and the United Kingdom that individuals with general education begin to earn higher wages than the vocationally trained after around six years of experience. Likewise, Dearden et al (2002) find for Britain's National Child Development Study and the UK-LFS that, for a given educational level, wages are higher for academic than vocational qualifications. These elements lead us to formulate a second hypothesis:

Hypothesis 2: 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 is of greater use in the second half of workers' careers.

2.3 Identical outcomes

A third hypothesis does not expect different labor market outcomes between 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 percent of vocationally trained workers are

employed in a different occupation than the one for which they were initially trained (Winkelmann 2006: 93-4). Evidence from Switzerland points to as least as much occupational mobility for vocationally trained workers (Sheldon 2008: 39, 42).

However, if VET provides skills that are widely portable, this also leads to questioning ‘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 labor market advantage of apprenticeship graduates should not be overestimated. Based on the German Socio-Economic Panel 1984-1990, Winkelmann (1996: 671) finds that once the transition to work was made, graduates from general education were in no less stable employment than apprenticeship graduates. While the matching process takes longer for holders of general education, they catch up quickly over the first few years of work.

More generally, different labor 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. Concerning the first source, it is well known that the quality of apprenticeships varies widely. Apprenticeships in banks and large industrial firms tend to provide more demanding workplace learning than those in small construction firms, food outlets and shops. Likewise, intellectual requirements are high in some apprenticeships such as electronics technicians and draftsmen, but comparatively low in others such as butchers and flooring installers (Stalder 2011). The differences in employment prospects and earnings may be as large or larger across vocational degrees as 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 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 at-risk 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 may not adequately capture these benefits.

There is empirical evidence supporting this view. 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 taken into account (Meer 2007). These elements lead us to formulate a third hypothesis:

Hypothesis 3: once we account 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 analyze 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 percent in a company-based ‘dual’ apprenticeship and an additional 6 percent in a school-based form of VET (Wolter et al. 2014: 107). Apprenticeships are dual because they combine two learning places, the training firm and the vocational school. Apprentices’ everyday life is structured by the training firm and resembles more that of employees than students (Meyer 2009: 33).

A third of an age cohort remains in general education: 25 percent enter a baccalaureate school that gives direct access to universities and 5 to 10 percent go to another upper-secondary specialized school (Federal Office for Statistics 2013).

There are strong regional and gender disparities in the proportion of youth choosing either vocational or general education: VET is more widespread in German-speaking than in French-speaking Switzerland, in the countryside than in cities, and among men than women (Wolter et al. 2014: 107). Unlike in Germany, it is very rare in Switzerland for youth to embark on an apprenticeship after obtaining a baccalaureate.

The time it takes to obtain a vocational degree or a baccalaureate is comparable. For most occupations, the nationally recognized VET diplomas 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 the 12 years needed to obtain the baccalaureate (not counting the two years of pre-school or kindergarten).

3.2 Selection

The allocation of young people into different educational tracks is not random. On the contrary, educational choices are riddled with selection effects. We do not have a silver bullet to deal with selection, but use a multi-pronged strategy to try and reduce its impact. A first measure is to narrow down our analytical sample to individuals whose highest educational attainment is at the upper-secondary level and who thus typically spent about twelve years in full-time education. Thereby, we exclude both the least motivated students who stopped after compulsory school and the most able students who went on to either post-secondary vocational or tertiary education.

Entry into baccalaureate schools is conditional on having high grades or on passing an examination. More academically inclined students tend to prefer the general to the vocational track. In a first step, we therefore deal with positive selection into general education. However, 80 percent of students graduating from a baccalaureate school go on to study at university (Meyer and Hupka-Brunner 2012: 131) – and thus quickly drop out of our sample. Consequently, those individuals who go no further than upper-secondary general education are negatively selected among those who initially went to a baccalaureate school.

More generally, among individuals with upper secondary education, the likelihood to choose VET tends to be higher for lower-class boys from rural cantons in Eastern Switzerland than upper-class girls in the urban cantons of Basel or Geneva. As a second measure to reduce selection, we control for canton, the type of municipality and, in the SHP, for both parents' education and social class. Moreover, we run all our analyses separately for men and women.

As a third measure, we tested – but discarded – two instrumental variables widely used in the literature: mothers' education and institutional school differences across cantons (Card

1999: 1822). The correlation between mothers' education and children's education is low and the instrument thus weak. While we rejected this instrument on empirical grounds, also the theoretical rationale seems shaky. Not only educational choices, but also innate ability and work ethics are likely to be correlated between mothers and children – and more highly educated mothers also have more economic and social capital to directly invest into their children's career. As a second instrument, we tested 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 (Glauser and Becker 2016). However, the baccalaureate rate also turned out to be a weak instrument that would lead to biased estimates. Again, this instrument not only raises empirical, but also theoretical issues. Institutional school differences tend to be endogenous to the labor market: In urban (rural) cantons, the baccalaureate rate is higher (lower) because these service-centered labor markets demand more (less) people with general education.

In the absence of convincing instrumental variables or good measures of school ability and motivation, we likely deal with selection effects and unobserved characteristics that affect both educational choice and labor market outcomes. While we are confident that the comparison between holders of upper-secondary vocational and general education goes some way to reducing selection, we do not have an explicit causal design, but present population associations.

3.3 Data

Our empirical analysis takes advantage of the availability of two different data sources. Our first choice is the pooled cross-sectional data from the Swiss Labor Force Survey (SLFS), years 1991 to 2014, which provides us with a large number of observations, information on the usual labor market variables as well as on the first occupation that workers qualified for.³

We replicate our results with the longitudinal data from the Swiss Household Panel (SHP), years 1999 to 2013. Based on a smaller sample, the SHP provides us with additional information on workers' social origin – fathers' and mothers' occupation and education (Voorpostel et al. 2010). The use of a second dataset enables us not only to check the robustness of our models, but also allows us to account for differences in social origin.

We impose two restrictions on our analytical sample. First, to make sure that most people finished their upper secondary education, we restrict our analysis to individuals aged from 20 to the legal retirement age.⁴ Second, we limit most of 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. Note that for a majority of labor force participants in Switzerland, the highest education is at the upper-secondary level. Over the period 1991-2014, this was the case for 55 percent of the working-age population – 46 percent with upper-secondary vocational education and 9 percent with upper-secondary general education.

When merging the 24 rounds of the Swiss Labor Force Survey 1991 to 2014 and applying these restrictions, we obtain 162,178 valid observations (individuals with upper-secondary education). In the Swiss Household Panel, our analytical sample is much smaller with 6,999 individuals having upper-secondary education. However, these individuals are observed over an average of 6 years, giving us a total of 40,473 valid observations.

3.4 Dependent and independent variables

Our analysis focuses on individuals' labor market outcome measured with two dependent variables: employment and annual work income. The first variable informs us of the employability of workers with different educational profiles and 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 verify our results with an alternative specification of 20 hours per week. The second variable, gross annual work income in constant 2011 Swiss francs (CHF), measures individuals' earnings potential and thus gives us an idea about their productivity. For these analyses, we exclude respondents who are in marginal employment (working less than 8 hours per week) and remove the lowest and highest one percent of the distribution.⁵

In order to check for earnings differences linked to hours worked, we also compute hourly earnings by dividing annual work income by the number of hours worked. We calculate the number of hours based on the exact full-/part-time status given by the respondents and, where this information is missing, of the actual number of hours worked per week.

Our key independent variables are the type of education and age. In most analyses, we simply distinguish two types. 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 more than 3 years training. In order to convey a sense of where the graduates of these two types of

education work, we provide a list of the most common occupations or previous occupations of individuals with either general or vocational upper-secondary education (see Table A.2 in the appendix). For the descriptive analysis, we also show results for individuals with no upper secondary education (including lower secondary education and short upper-secondary level programs of no more than two years) and those with tertiary education (including tertiary VET, a degree from a technical college or a university degree).

Since there may be heterogeneity in the quality of different vocational degrees, we distinguish six types of VET based on the ISCO-code of the studied occupation: (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 (vendors, waiters, hairdressers, etc.); (6) occupations in health and social services. Information on the occupation studied is available for the majority of vocationally trained workers in the Swiss Labor Force Survey, but only for a minority in the Swiss Household Panel Survey (for those respondents of wave 1 who were included in the retrospective life history survey 2002).

Unfortunately, another independent variable, social origin, is only available in the Swiss Household Panel. We use four measures of respondents' social origin: father's education, mother's education, father's social class, mother's social class. For education, we distinguish five categories: (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 an aggregated version of the schema proposed by Erikson and Goldthorpe (1992) and code it based on the occupations measured with ISCO-88 at the 4-digit level. We distinguish five classes: (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.⁶

Additionally, we control for resident permit and (in the SLFS only) for nationality, in 20 categories. We control for the calendar year and further introduce two geographic indicators, one accounting for Switzerland's 26 cantons and one distinguishing nine types of residential communities from small villages to large urban centers. The descriptive statistics of our main variables are shown in table A.1 in the appendix.

3.5 Estimation method

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

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

We use the same model to determine employment and earnings. 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 annual wages for an individual i at time t . W_i is a vector of controls such as nationality, canton, municipality, year of the survey and social origin 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 separates general from vocational degrees and an interaction between education and age $educ_i * age_i$.

The effect of age on employment and, above all, earnings is likely to be non-linear. Accordingly, we follow standard procedure in labor economics and also enter age as a squared term age_i^2 . Considering the shape of employment rate and earnings across the life-course shown in the descriptive results, the squared effect is not enough to model our dependent variables, especially for women. For this reason, we also use age cubed and age to the power of four. If there is a difference between the two types of education (vocational vs general) over the life course, it will be picked up by the four interactions terms, $educ_i * age_i$, $educ_i * age_i^2$, $educ_i * age_i^3$ and $educ_i * age_i^4$. Since the real difference between the two educational groups is given by the addition of nine parameters (education, the different age terms and the interaction terms), we make the interpretation of results easier by first, showing the predicted values in graphs and second, by showing a simplified model with only age, age^2 , education, and the interaction between age and education. To take the longitudinal structure of the Swiss Household Panel into account, we calculate random effect models and report the robust standard errors for this dataset.

4. Descriptive results

4.1 *Employment over the life course*

We begin our analysis by describing the evolution of employment over the life course based on the pooled cross-sections of the Swiss Labor Force Survey 1991-2014. Figure 1a and 1b show how the employment rate (measured with a minimum of 8 hours of paid-work per week) varies by age for men and women depending on whether they have compulsory, upper-secondary vocational, upper-secondary general, or tertiary education. While the dots show the effective values, the line is based on weighted scatterplot smoothing (LOWESS) and grasps the general trend.

In Switzerland, men with VET have a substantial employment advantage over men with tertiary education up to the age of around 30, and up to the age of 35 over men with upper-secondary general education. This is not surprising insofar as both categories – upper-secondary general and tertiary education – include individuals who may still be studying for a tertiary degree in their twenties⁷. Between the ages of 35 and 55, differences are minimal as the employment rate exceeds 80 percent for all four educational groups. Still, employment is most frequent among men with tertiary education and least frequent among men with compulsory education only. In-between, men with upper-secondary vocational have slightly better employment prospects than men with upper-secondary general education. Contrary to our hypothesis 2, vocationally trained men are not overtaken, in terms of employment, by men with upper-secondary general education in the middle or towards the end of their careers.

The situation is different for women. VET gives women an employment advantage over both upper-secondary general and tertiary education up to the late twenties. After that age, women with tertiary education have substantially higher employment rates. Around the age of 30, women with upper-secondary general education catch up with their vocationally trained colleagues and the two groups have very similar employment rates until their retirement. In comparison, the employment rate is substantially lower among women with compulsory education, especially after the age of 50.

In sum, after the age of 30 for women and 35 for men, employment rates for vocational and general upper-secondary education are comparable. In terms of employment prospects over the life course, VET seems preferable to general education among men, but not among women. If we choose a more restrictive definition of employment – 20 hours of paid-work per week – we observe the same patterns and trends, the main difference being that by excluding small part-timers, women's employment rate drops by about 10 percentage points (see Figure A.1 in the appendix).

Figure 1a: Men

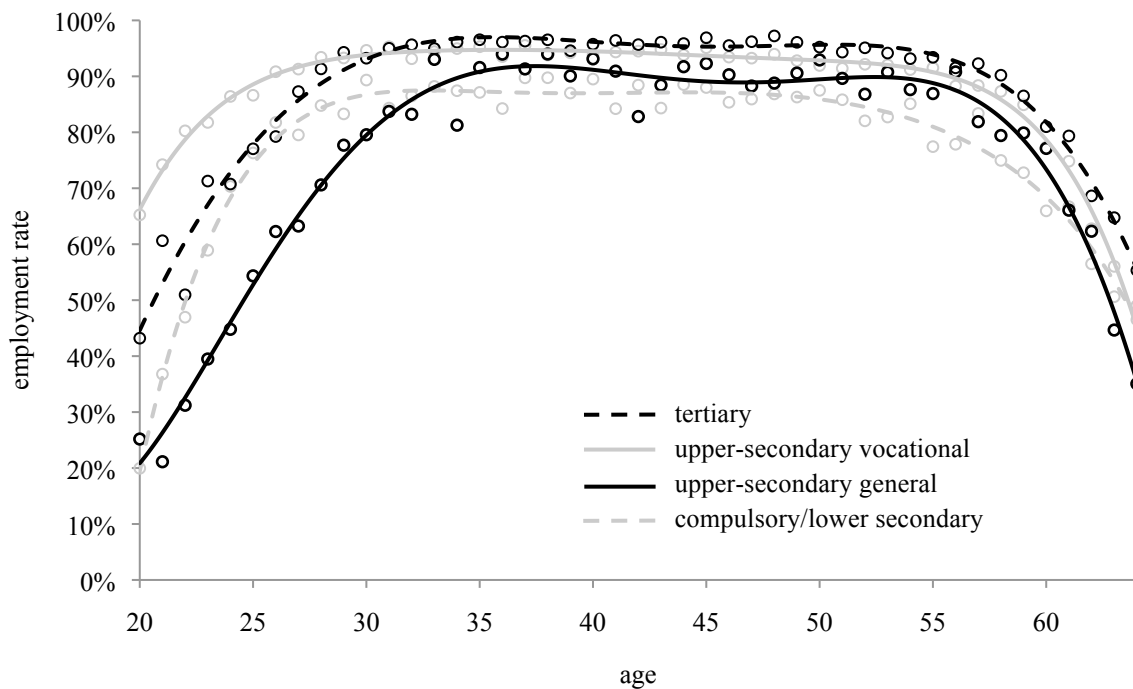


Figure 1b: Women

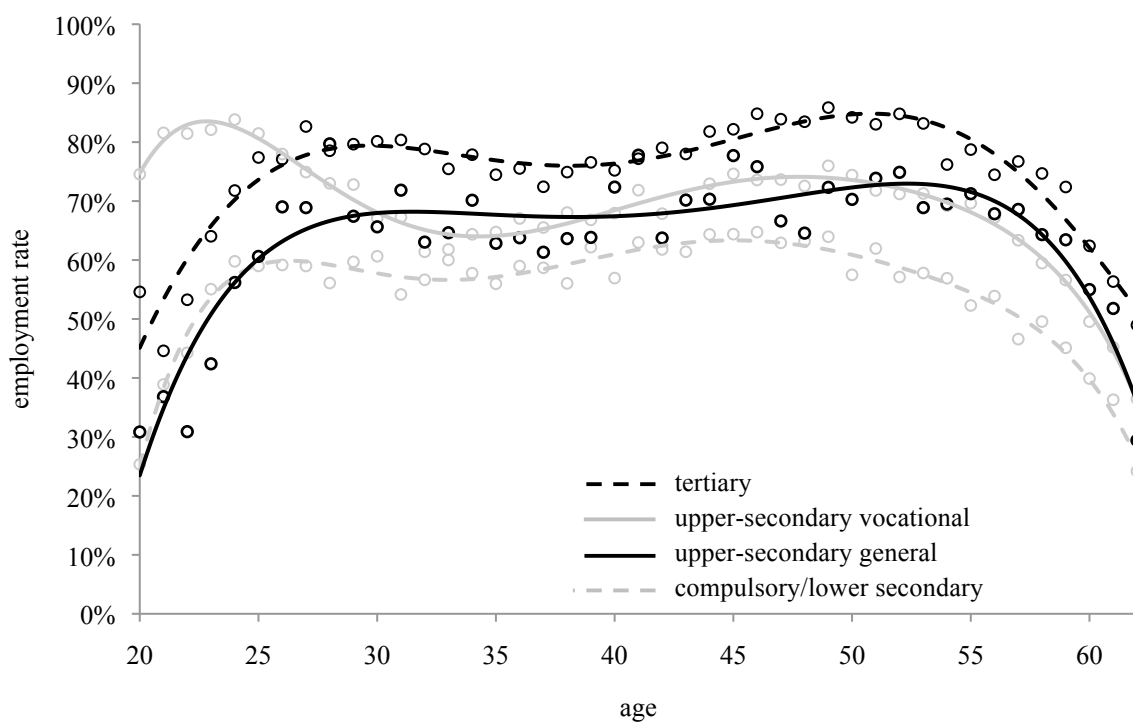


Figure 1: Employment rate (minimum 8 hours per week) for men and women by level and type of education (based on the Swiss Labor Force Survey, 1991-2014)

4.2 Earnings over the life course

We turn to earnings and show in figures 2a and 2b how annual work income differs by age for holders of compulsory, upper-secondary vocational, upper-secondary general, and tertiary education. Contrary to employment, the initial earnings advantage of having VET wears off for both men and women after a few years in the labor market. While vocationally trained men and women begin their careers in their early twenties with higher annual earnings than those with upper-secondary general education, there is a reversal of fortunes around the age of 30 years for both men and women.

Clearly, workers with upper-secondary general education have a steeper life-cycle earnings curve than workers with VET. Within the group of upper-secondary general education, earnings of workers aged 50-59 exceed earnings of those aged 30-39 by 38 percent for men and by 19 percent for women. The earnings advantage of vocationally trained workers in their fifties over vocationally trained workers in their thirties is much smaller, amounting to 10 percent for men and 4 percent for women.

The higher annual earnings for upper-secondary general education are not driven by the number of hours worked, but by higher hourly earnings (see Figure A.2 in the appendix). Hourly pay for upper-secondary general education equals that of vocational education already at labor market entry for both men and women. Over the life course, the hourly earnings gap then constantly widens in favor of workers with upper-secondary general education. When comparing the median hourly earnings over workers' entire careers, we find that upper-secondary general education is associated, relative to VET, with a premium of 19 percent for men and 22 percent for women.

Figure 2a: Men

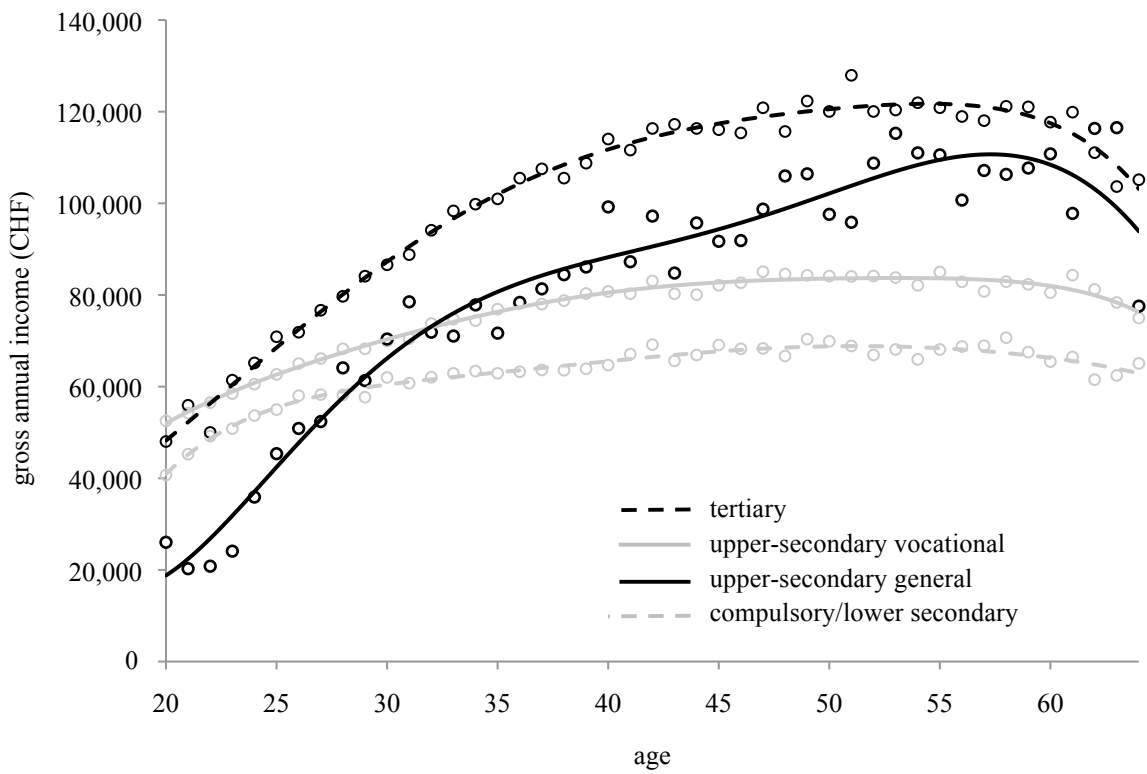


Figure 2b: Women

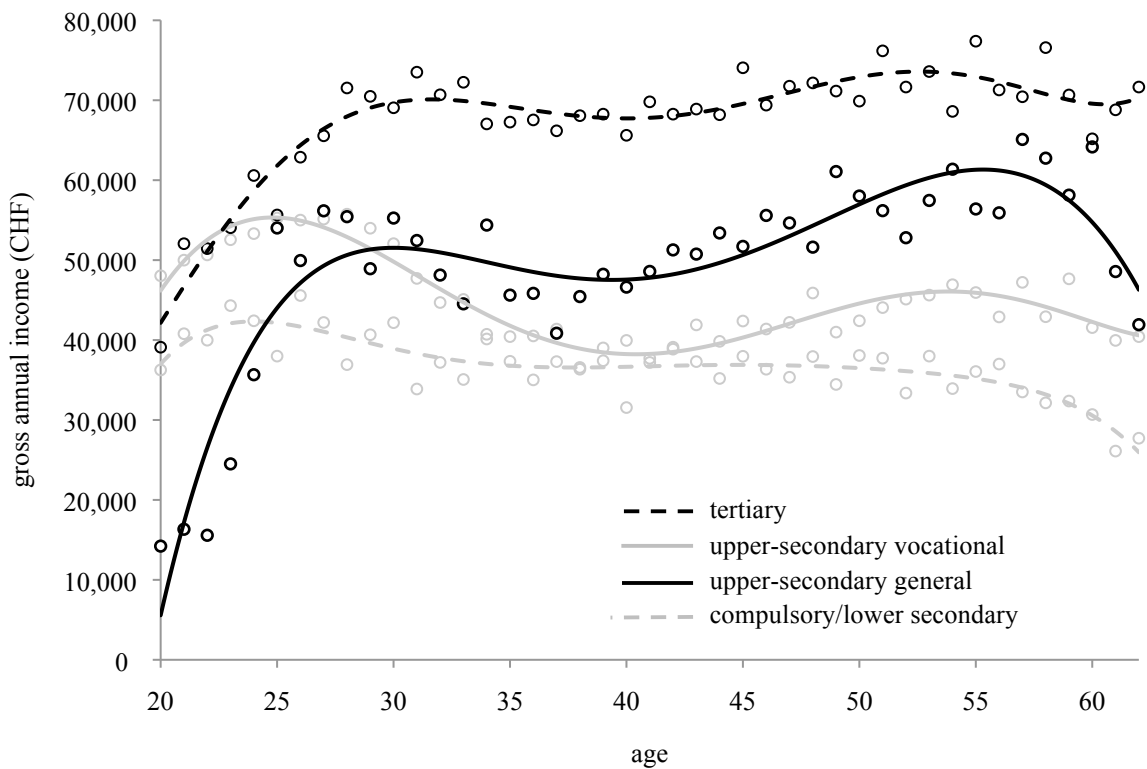


Figure 2: median annual work income by level and type of education (based on the Swiss Labor Force Survey 1991-2014)

Up to now, we have treated VET as a homogeneous type of education. However, the labor market value of a vocational degree may depend on the occupation in which it was obtained and we therefore disaggregate annual work income for the six fields of vocational training discussed above. While there are substantial differences in earnings across vocational fields, the conclusions drawn from simply comparing VET with upper-secondary general education remain unchanged: After the mid-thirties, general education is associated with higher median earnings than any field of VET (see Figures A.3 and A.4 in the appendix).

When summing up median earnings from ages 20 to 64 and assuming that an individual was employed every year, upper-secondary general education has the highest pay-off over the life course. Among the six fields of vocational training, the first runners-up are technical and industrial VET occupations with 1 (women) and 7 percent (men) lower life-cycle earnings, followed by VET in commercial and clerical occupations with 4 (women) and 10 percent (men) lower earnings. At the bottom end of vocational fields are VET occupations in private consumer service. Having obtained an apprenticeship in an occupation such as vendor, waiter or hairdresser is associated with 18 (men) and 28 percent (women) lower work income over the life course as compared to upper-secondary general education.

Our analysis controls for age and calendar year, but ignores potential cohort differences in employment prospects and earnings for workers with either vocational or general upper-secondary education. We address this shortcoming by comparing the employment rate and work income of six birth cohorts (see Figures A.5 and A.6 in the appendix). These comparisons show that there are no cohort differences in employment among vocationally trained men. In contrast, for men with general education, we observe a slight decrease in the employment rate among younger cohorts. For women, employment rates have increased among the younger cohorts, especially for the holders of an upper-secondary vocational degree. With respect to work income, we observe stability for individuals with VET, whereas younger cohorts of men with general education seem to earn slightly less than older cohorts.

These analyses suggest that cohort effects do not matter for vocationally trained individuals. On the contrary, ignoring cohort effects possibly leads us to overestimate the employment rate and earnings potential for younger cohorts of workers with upper-secondary general education.

5. Multivariate results

We re-examine our descriptive results by using multivariate analysis. We also replicate all analyses based on the Swiss Labor Force Survey with the Swiss Household Panel (SHP). Henceforth, we restrict our analysis to individuals with no more and no less than upper-secondary education, either vocational or general.

We estimate two linear regression models for our two dependent variables of employment (0/1) and annual work income. A first model only includes education (vocational versus general), age (as well as age squared, cubed and to the power four) as well as the interaction terms between education and age. A second model adds controls for the calendar year, the canton of residence, the type of municipality, nationality and residence permit. In the SHP, we additionally account for social origin by integrating measures for mother's and father's education and mother's and father's social class. We estimate these models for men and women separately.

While we use the full model 2 to graphically plot our results, we show in Tables 1 and 2 the coefficients of a simplified model with only age squared and one age-education interaction (for the full model, see Tables A.3 and A.4 in the appendix). For both our outcomes of employment and earnings, we find a positive linear effect for VET and a negative interaction between VET and age. Both effects are significant for men and women, and suggest that VET and general education give rise to different employment-earnings profiles over the life course. The relationship between VET and age is curvilinear: VET is beneficial for employment and earnings at the beginning of the career, but this positive effect decreases with age.

Table 1: OLS regression coefficients for being in employment (min. 8 hours per week), simplified model

	Men				Women				
	without controls		with controls		without controls		with controls		
	estimate	std. e	estimate	std. e	estimate	std. e	estimate	std. e	
SLFS	age	0.063	0.001	0.064	0.001	0.037	0.001	0.038	0.001
	age ²	-0.001	0.000	-0.001	0.000	-0.000	0.000	-0.000	0.000
	educ: voc	0.543	0.012	0.523	0.012	0.373	0.014	0.364	0.014
	age*educ: voc	-0.010	0.000	-0.010	0.000	-0.008	0.000	-0.008	0.000
	constant	-0.613	0.015	-0.607	0.016	-0.117	0.019	0.000	0.020
	Adjusted R ²	0.134		0.149		0.038		0.057	
N	74,964		74,964		87,214		87,214		
SHP	age	0.059	0.003	0.057	0.004	0.041	0.003	0.049	0.004
	age ²	-0.001	0.000	-0.001	0.000	-0.000	0.000	-0.001	0.000
	educ: voc	0.482	0.059	0.472	0.059	0.239	0.052	0.289	0.051
	age*educ: voc	-0.008	0.002	-0.008	0.002	-0.004	0.001	-0.005	0.001
	constant	-0.478	0.074	-0.418	0.087	-0.151	0.068	-0.127	0.087
	Adjusted R ²	0.174		0.185		0.028		0.053	
N	16,348		16,348		24,125		24,125		

SLFS: Swiss Labor Force Survey 1991-2014, SHP: Swiss Household Panel 1999-2013

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

Note: for random effect models, we report the robust standard errors and overall adjusted R².

Coefficients in bold are significant at p<0.05.

Table 2: OLS regression coefficients for log annual work income, simplified model

	Men				Women				
	without controls		with controls		without controls		with controls		
	estimate	std. e	estimate	std. e	estimate	std. e	estimate	std. e	
SLFS	age	0.079	0.001	0.080	0.001	0.009	0.002	0.010	0.002
	age ²	-0.001	0.000	-0.001	0.000	0.000	0.000	0.000	0.000
	educ: voc	0.665	0.019	0.641	0.019	0.505	0.025	0.536	0.030
	age*educ: voc	-0.016	0.000	-0.016	0.000	-0.015	0.001	-0.015	0.001
	constant	9.153	0.025	9.209	0.025	10.288	0.036	10.418	0.045
	Adjusted R ²	0.141		0.179		0.014		0.044	
N	64,086		64,086		60,013		60,013		
SHP	age	0.122	0.006	0.114	0.007	0.055	0.008	0.054	0.009
	age ²	-0.001	0.000	-0.001	0.000	-0.000	0.000	-0.000	0.000
	educ: voc	1.064	0.145	1.029	0.143	0.960	0.142	0.973	0.141
	age*educ: voc	-0.021	0.003	-0.021	0.003	-0.023	0.004	-0.023	0.004
	constant	7.951	0.171	8.131	0.182	8.661	0.184	9.240	0.213
	Adjusted R ²	0.244		0.264		0.017		0.051	
N	13,014		13,014		15,141		15,141		

SLFS: Swiss Labor Force Survey 1991-2014, SHP: Swiss Household Panel 1999-2013

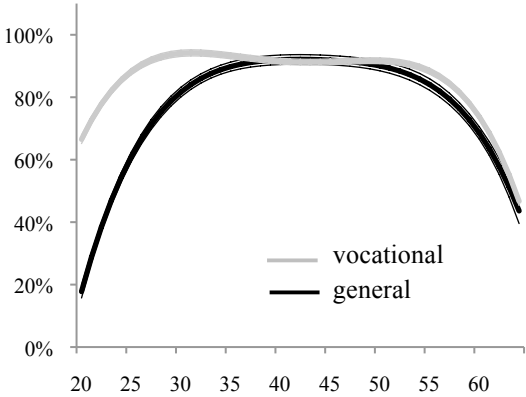
Controls included: both datasets: year, canton, type of municipality, residence permit; Additionally for SLFS: nationality; Additionally for SHP: fathers' and mothers' education, fathers' and mothers' social class.

Note: for random effect models, we report the robust standard errors and overall adjusted R².

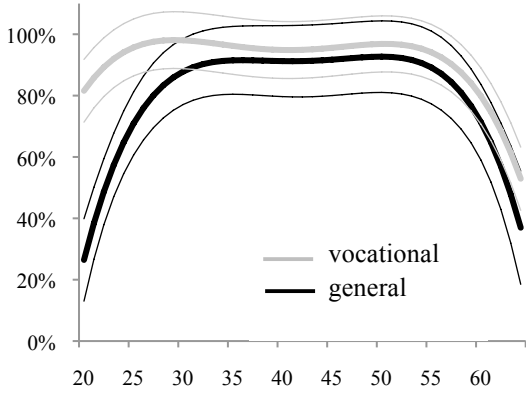
Coefficients in bold are significant at p<0.05.

We plot the results for the full model graphically in Figures 3a to 3d by computing the predicted employment rate by age for the modal category of a Swiss citizen living in an urban center in the canton of Zurich in 2012 (whose parents, in the SHP, have both upper secondary vocational education and belong to the skilled working class). Holders of vocational qualifications do not have a harder time securing employment over their life course than individuals with general education. Restricting the analysis to men, the opposite seems true: while there are no significant differences after the age of 27 (SHP) or 36 (SLFS), these results suggest that men with VET have an employment advantage over those with general education at the beginning of their career – and no disadvantage at the end. For women, we observe the same differences over the first years of their careers: Vocationally trained women are more likely to be employed up to the age of 30. However, beyond 30 women with upper-secondary general education catch up and possibly overtake those with VET.

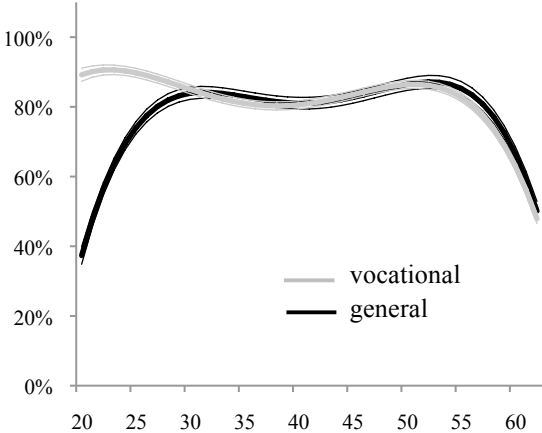
3a: Men – Swiss Labor Force Survey 1991-2014



3b: Men – Swiss Household Panel 1999-2013



3c: Women – Swiss Labor Force Survey 1991-2014



3d: Women – Swiss Household Panel 1999-2013

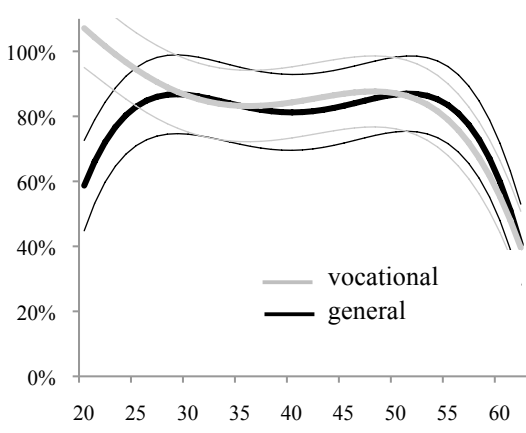
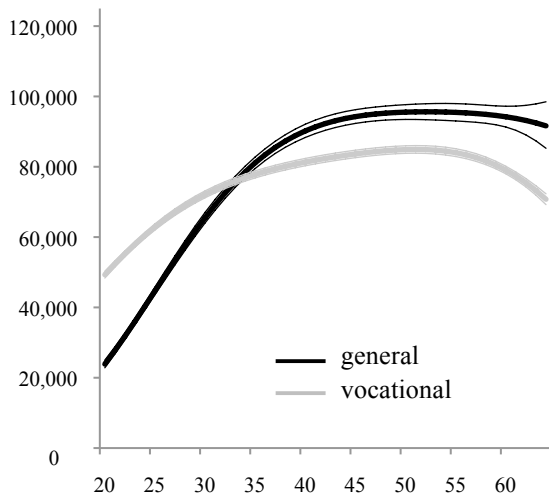


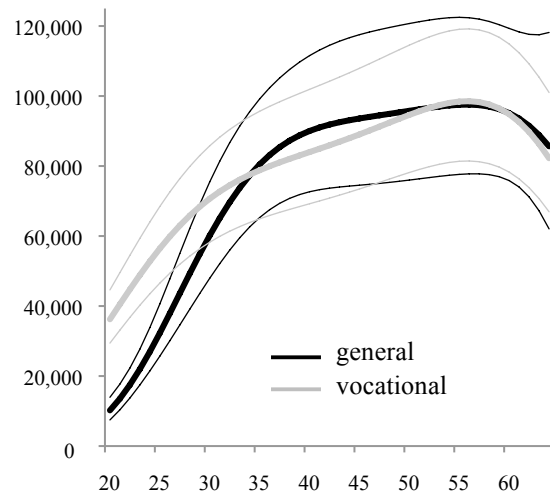
Figure 3a-d: probability to be in employment (minimum 8 hours per week) by type of education (predicted values for a Swiss national in Zurich city in 2012 based on OLS)

In figures 4a to 4d, we plot the evolution of annual work income over the life course. While the analysis based on the SHP is less precise due to an important number of missing data about the annual work income and no strong model to impute them, the substantial conclusions are the same regardless of whether we take the SLFS (left-hand quadrants) or the SHP (right-hand quadrants). For men, our estimates suggest that vocationally trained workers earn significantly more than those with general education up to an age of 26 (SHP) to 31 (SLFS), but thereafter fortunes reverse and those with general education receive substantially higher incomes. For women, the vocationally trained obtain higher work income for up to the age of 24 (SHP) to 27 (SLFS). Yet thereafter, the trend reverses into a permanent earnings advantage for women with general education until the age of retirement.

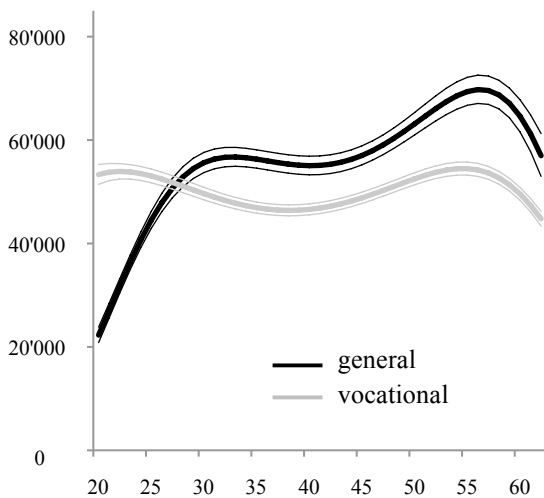
4a: Men – Swiss Labor Force Survey 1991-2014



4b: Men – Swiss Household Panel 1999-2013



4c: Women – Swiss Labor Force Survey 1991-2014



4d: Women – Swiss Household Panel 1999-2013

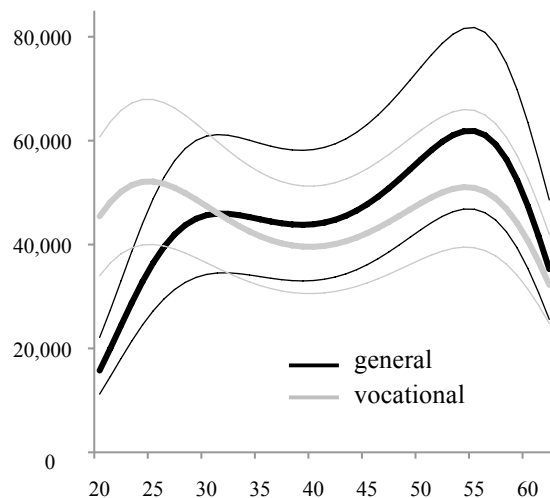


Figure 4 a-d: annual work income by type of education (predicted values for a Swiss national in Zurich in 2012 based on OLS)

In a final analysis, we address the question of whether higher employment rates of vocationally trained workers outweigh their lower annual earnings. For this reason, we weight the predicted annual work income at each age from 20 to 62/64 by the predicted employment rate at the same age. By computing the sum of employment-weighted earnings over the entire career, we are able to calculate up to which age VET produces higher work income than general education.

The results are displayed in Table 3 for both datasets. Once we weight annual work income by the probability of being in employment (using the full model), we find that having a VET qualification is associated with higher earnings than general education for men from the age of 20 up to the age of 34 (SLFS) to 36 (SHP). For women VET is linked to higher employment-weighted income between the age of 20 and 28. At the end of their twenties, women with general education catch up with their vocationally trained colleagues and begin to earn higher annual earnings.

However, the initial employment handicap is not easily compensated. When comparing total work income over the life course weighted by the likelihood to be working, we find that vocationally trained men have life-cycle earnings that exceed those of men with general education by 3.1 (SLFS) to 14.8% (SHP). While workers with general education have higher hourly earnings than workers with VET for the whole of their lives and higher annual earnings for two thirds of their lives, the employment disadvantage of the early years is difficult to overcome. The scenario for women is different. Over their life course, women with general education earn between 5.8 (SLFS) and 10.1% (SHP) more than vocationally trained women.

Of course, these results hinge on the fact that our analysis begins at the age of 20 when many individuals with upper-secondary general education are still in full-time tertiary education – and eventually leave the group of people with upper-secondary generation around the age of 25. Accordingly, if we restrict our sample to people aged 25 to 62 (women) and 64 (men), the earnings advantage of vocationally trained men shrinks to 9.6 percent (SHP) or turns into a disadvantage of 2.1 percent (SLFS) relative to men with general education. For women, the earnings advantage over the life course of general education relative to VET increases to between 14.6 (SLFS) and 19.7 percent (SHP) percent if we discard the years prior to 25. Considering the larger number of observations and the better quality of the earnings in the SLFS than the SHP, we put greater confidence in the results given by the SLFS.

Table 3: Years with income advantage and total income advantage (employment-weighted) for workers with upper-secondary vocational or general education

		Swiss Labor Force Survey (SLFS)		Swiss Household Panel (SHP)	
		(1) OLS without controls	(2) OLS with controls	(1) OLS without controls	(2) OLS with controls
Age bracket with higher income for VET (for general)	men	20-37 (38-64)	20-34 (35-64)	20-38 (39-45) 46-64	20-36 (37-46) 47-64
	women	20-28 (29-62)	20-28 (29-62)	20-29 (30-62)	20-28 (29-62)
Total income advantage over life course	men	VET: 7.5%	VET: 3.1%	VET: 15.0 %	VET: 14.8%
	women	general: 5.6%	general: 5.8%	general: 5.4%	general: 10.1%

The complete model is used to predict the employment rate and the annual income with the SLFS. Due to a small sample size, we used a simpler model for the SHP, without age cubed and age to the power of four.

6. Conclusion

Our paper has examined three hypotheses about the long-term prospects of vocationally trained workers. A first hypothesis expects them to keep and extend their initial labor market advantage over the life course. A second hypothesis expects VET to become more quickly obsolete than general education, leading vocationally trained workers to fall behind those with general education. A third hypothesis expects very similar 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 the three hypotheses. With respect to employment, our findings support hypothesis 1. In Switzerland, vocational training is associated with a substantial employment advantage at the beginning of the career. For men, but not for women, a slight employment advantage persists thereafter – although without giving rise to a process of cumulative advantage. 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. Individuals with VET qualifications are not pushed into unemployment or inactivity once they reach their fifties. In Switzerland, middle-aged workers

with upper-secondary vocational education have employment prospects that are as good as those of workers with upper-secondary general education – in a labor market that traditionally features low unemployment rates.

Results are different with respect to earnings, where our evidence supports hypothesis 2. Workers with upper-secondary general education struggle with a slower start in the labor market. However, once they launch their career, their subsequent earnings curves are much steeper than for workers with VET. As a result, once workers have reached their mid-thirties, we observe a reversal of fortunes between the two educational groups. The finding that general education is associated with higher earnings than vocational education also holds if we disaggregate VET into different occupational fields. Consistent with Hanushek et al. (2016) and hypothesis 2, the earnings of workers with general education continue to increase over a longer period and reach a higher level than that of workers with a vocational degree.

A final result worth noting relates to gender differences: the nexus between education and labor market outcomes looks very different for men than women. It is standard practice in labor economics to limit analyses to men and then extrapolate these results to the entire population (e.g. Hanushek et al. 2016: 7, Malamud and Pop-Eleches 2010: 44). This is clearly misleading with respect to the labor market outcomes of VET. Our findings for employment-weighted earnings over the life course show that men benefit more from upper-secondary vocational than general education, whereas women obtain higher earnings with an upper-secondary general education than with VET.

In other words, Switzerland's apprenticeship system offers men vocational degrees which are at least as attractive as a baccalaureate in terms of employment prospects and total earnings over the life course. For women, however, a baccalaureate clearly carries higher returns than a vocational degree. Interestingly, these gender differences echo the evolution of Switzerland's baccalaureate rate over the last 25 years. In 1990, women equaled men's baccalaureate rate for the first time (at 13.5 percent). Since then, women's baccalaureate rate continuously climbed (to 23.5 percent in 2014), whereas men's rate has more or less stagnated at 17 percent. It seems that youth and their parents examine labor market signals closely before making educational choice.

7. Notes

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

² The work-based (dual) and school-based forms of VET together add up to as much as two-thirds of a year’s cohort (Wolter et al. 2014: 107).

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

⁴ For men, the legal retirement age was 65 years over the period of observation. For women, it was raised from 62 to 63 and then from 63 to 64 years. Since the number of women still working at the ages 63 and 64 is low, we limit the female sample to ages 20 to 62.

⁵ In the Swiss Labor Force Survey, we impute missing earnings data with a regression model that contains age, year, canton, type of municipality, residential permit and nationality, occupation studied, hours worked, sector of activity, current occupation, and employment status. This allows us to reduce the number of missing observations from 15,460 (12.5% of the workers) to 147 (0.1%).

⁶ We coded occupations based on the Swiss Standard Classification of Occupations 2000 at the 5-digit levels. The Stata codes are available from the authors.

⁷ If we exclude students from the analysis, the employment rate increases for individuals aged 20 to 30 from 53% to 72% for men with upper-secondary *general* education, but remains almost unchanged for men with upper-secondary *vocational* education (from 87% to 89%).

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9. Appendix

Appendix – tables

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

<i>Variable</i>	Swiss Labor Force Survey			Swiss Household Panel		
	<i>mean</i>	<i>min</i>	<i>max</i>	<i>mean</i>	<i>min</i>	<i>max</i>
Education: upper-secondary vocational	0.86	0	1	0.84	0	1
Education: upper-secondary general	0.14	0	1	0.16	0	1
Gender: men	0.46	0	1	0.40	0	1
Gender: women	0.54	0	1	0.60	0	1
Age	41.56	20	64	43.58	20	64
Annual work income ¹	65,903	1,810	252,000	64,984	1,571	251,800
Hourly work income	40.61	12	300	43.60	12	300
Number of hours worked per week	34.97	0	45	32.69	0	45
Work (no condition of number of hours): yes	0.79	0	1	0.77	0	1
Work (no condition of number of hours): no	0.21	0	1	0.23	0	1
Work (minimum 8 hours per week): yes	0.76	0	1	0.78	0	1
Work (minimum 8 hours per week): no	0.24	0	1	0.22	0	1
Work (minimum 20 hours per week): yes	0.68	0	1	0.66	0	1
Work (minimum 20 hours per week): no	0.32	0	1	0.34	0	1

SLFS: n=162,178 (individual observations); 122,318 observations for individuals working at least 8 hours per week and providing information on income

SHP: n=6,999 (individuals), N=40,473 (person-year observations); 5,137 observations for individuals working at least 8 hours per week and providing information on income (31,501 person-year observations)

¹ After imputation for the Swiss Labor Force Survey

Table A.2: the 17 most common occupations or previous occupation of individuals with general or vocational upper-secondary education, ISCO 2 digits – the 3 most common occupations are highlighted in gray (based on the Swiss Labour Force Survey 1991-2014)

	Men				Women			
	general		vocational		general		vocational	
	N	%	N	%	N	%	N	%
1000 Legislators, senior officials and managers (undefined)	321	3.6%	2150	3.2%	236	1.6%	1271	1.8%
2100 Physical, mathematical and engineering science professionals	429	4.9%	1654	2.5%	110	0.8%	325	0.4%
2300 Teaching professionals	716	8.1%	297	0.4%	2,321	15.8%	892	1.2%
2400 Other professionals	513	5.8%	2,096	3.2%	559	3.8%	1,631	2.2%
3100 Physical and engineering science associate professionals	313	3.6%	4,872	7.4%	188	1.3%	1,370	1.9%
3200 Life science and health associate professionals	137	1.6%	785	1.2%	744	5.1%	6,693	9.2%
3300 Teaching associate professionals	682	7.7%	2,108	3.2%	2,081	14.2%	4,267	5.9%
3400 Other associate professionals	487	5.5%	3,741	5.7%	633	4.3%	3,732	5.1%
4100 Office clerks	489	5.6%	4,042	6.1%	1,320	9.0%	14,489	20.0%
5100 Personal and protective services workers	497	5.6%	3,689	5.6%	1,081	7.4%	7,410	10.2%
5200 Models, salespersons and demonstrators	298	3.4%	2,550	3.9%	752	5.1%	7,184	9.9%
6100 Market-oriented skilled agricultural workers	109	1.2%	2,552	3.9%	87	0.6%	1,279	1.8%
7100 Extraction and building trades workers	333	3.8%	7,185	10.9%	21	0.1%	247	0.3%
7200 Metal, machinery and related trades workers	209	2.4%	7,611	11.5%	90	0.6%	536	0.7%
7400 Electrical and electronics trades workers	114	1.3%	2,865	4.3%	48	0.3%	790	1.1%
8300 Drivers and mobile plant operators	233	2.6%	3,202	4.8%	17	0.1%	199	0.3%
9100 Cleaners and helpers	114	1.3%	981	1.5%	393	2.7%	2,474	3.4%
Missing	1,047	11.9%	1,613	2.4%	2,044	14.0%	6,704	9.2%
Total occupations shown in this table (without missing)	5,994	68.1%	52,380	79.2%	10,681	72.9%	54,789	75.5%
Total of individuals in each group	8,803	100.0%	66,161	100.0%	14,651	100.0%	72,563	100.0%

Table A.3: OLS regression coefficients for being in employment (min. 8 hours per week), complete model

	Men				Women				
	without controls		with controls		without controls		with controls		
	estimate	std. e	estimate	std. e	estimate	std. e	estimate	std. e	
SLFS	age	0.677	0.043	0.684	0.043	0.930	0.049	1.004	0.048
	age ²	-0.023	0.002	-0.023	0.002	-0.035	0.002	-0.038	0.002
	age ³	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.000
	age ⁴	-0.000	0.000	-0.000	0.000	-0.000	0.000	-0.000	0.000
	educ: voc	1.905	0.422	1.974	0.419	6.818	0.492	6.947	0.487
	age*educ: voc	-0.090	0.047	-0.096	0.046	-0.631	0.054	-0.641	0.054
	age ² * educ: voc	0.001	0.002	0.001	0.002	0.021	0.002	0.022	0.002
	age ³ * educ: voc	0.000	0.000	0.000	0.000	-0.000	0.000	-0.000	0.000
	age ⁴ * educ: voc	-0.000	0.000	-0.000	0.000	0.000	0.000	0.000	0.000
	constant	-6.655	0.391	-6.739	0.388	-8.285	0.439	-8.900	0.436
	Adjusted R ²	0.159		0.174		0.067		0.087	
N	74,964		74,964		87,214		87,214		
SHP	age	0.947	0.171	0.944	0.172	0.894	0.137	0.865	0.135
	age ²	-0.034	0.007	-0.034	0.007	-0.036	0.005	-0.034	0.005
	age ³	0.001	0.000	0.001	0.000	0.001	0.000	0.001	0.000
	age ⁴	-0.000	0.000	-0.000	0.000	-0.000	0.000	-0.000	0.000
	educ: voc	5.317	1.639	5.259	1.636	9.362	1.410	8.477	1.371
	age*educ: voc	-0.462	0.179	-0.457	0.178	-0.934	0.153	-0.832	0.149
	age ² * educ: voc	0.015	0.007	0.015	0.007	0.034	0.006	0.030	0.006
	age ³ * educ: voc	-0.000	0.000	-0.000	0.000	-0.001	0.000	-0.000	0.000
	age ⁴ * educ: voc	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	constant	-8.881	1.565	-8.801	1.575	-7.529	1.264	-7.119	1.250
	Adjusted R ²	0.217		0.228		0.061		0.090	
N	16,348		16,348		24,125		24,125		

SLFS: Swiss labor force survey 1991-2014, SHP: Swiss Household Panel 1999-2013

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

Note: for random effect models, we report the robust standard errors and overall adjusted R²

Coefficients in bold are significant at p<0.05.

Table A.4: OLS regression coefficients for log annual work income, complete model

	Men				Women				
	without controls		with controls		without controls		with controls		
	estimate	std. e	estimate	std. e	estimate	std. e	estimate	std. e	
SLFS	age	0.553	0.076	0.613	0.074	1.637	0.113	1.660	0.112
	age ²	-0.015	0.003	-0.017	0.003	-0.060	0.004	-0.061	0.004
	age ³	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.000
	age ⁴	-0.000	0.000	-0.000	0.000	-0.000	0.000	-0.000	0.000
	educ: voc	3.780	0.734	4.306	0.719	12.881	1.124	13.997	1.110
	age*educ: voc	-0.234	0.080	-0.284	0.078	-1.200	0.123	-1.251	0.121
	age ² * educ: voc	0.005	0.003	0.006	0.003	0.040	0.005	0.042	0.005
	age ³ * educ: voc	-0.000	0.000	-0.000	0.000	-0.001	0.000	-0.001	0.000
	age ⁴ * educ: voc	-0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	constant	3.666	0.696	3.096	0.682	-5.624	1.031	-5.678	1.020
	Adjusted R ²	0.143		0.180		0.024		0.050	
N	64,086		64,086		60,013		60,013		
SHP	age	1.535	0.395	1.454	0.393	2.534	0.340	2.337	0.346
	age ²	-0.048	0.015	-0.045	0.015	-0.096	0.013	-0.089	0.014
	age ³	0.001	0.000	0.001	0.000	0.002	0.000	0.001	0.000
	age ⁴	-0.000	0.000	-0.000	0.000	-0.000	0.000	-0.000	0.000
	educ: voc	10.165	3.833	9.720	3.785	14.113	3.464	12.862	3.465
	age*educ: voc	-0.796	0.407	-0.746	0.403	-1.308	0.377	-1.171	0.378
	age ² * educ: voc	0.023	0.015	0.021	0.015	0.045	0.015	0.040	0.015
	age ³ * educ: voc	-0.000	0.000	-0.000	0.000	-0.001	0.000	-0.001	0.000
	age ⁴ * educ: voc	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	constant	-7.131	3.716	-6.351	3.694	-14.298	3.105	-11.875	3.164
	Adjusted R ²	0.272		0.290		0.043		0.079	
N	13,014		13,014		15,141		15,141		

SLFS: Swiss labor force survey 1991-2014, SHP: Swiss Household Panel 1999-2013

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

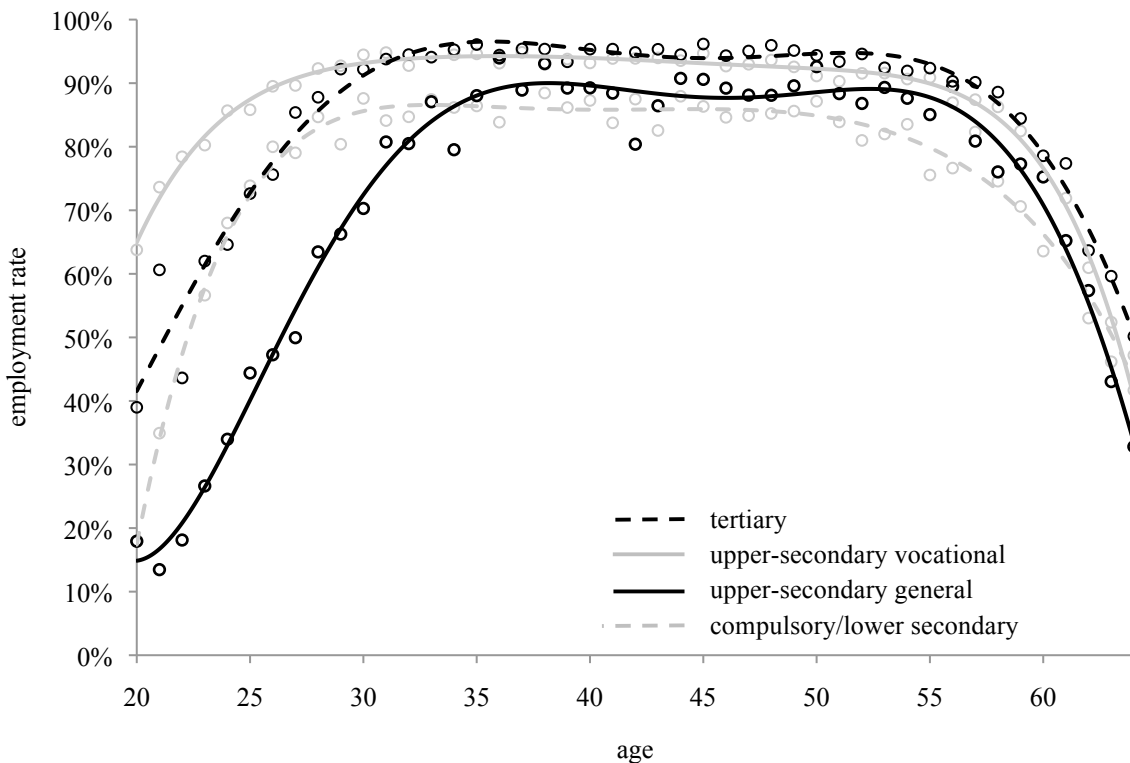
Note: for random effect models, we report the robust standard errors and overall adjusted R².

Coefficients in bold are significant at p<0.05.

Appendix – Figures

Figure A.1: employment rate 20 hours per week (based on the Swiss Labor Force Survey)

A.1a: Men



A.1b: Women

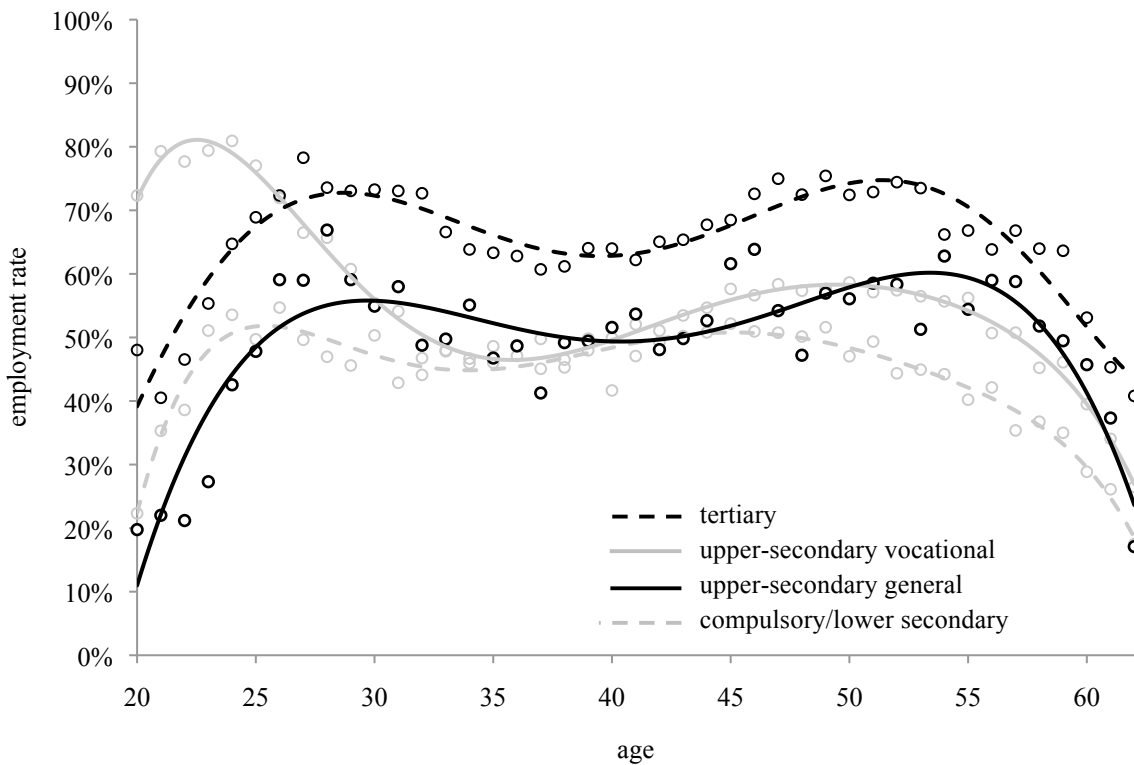


Figure A.2 median hourly earnings by level and type of education (based on the Swiss Labor Force Survey 1991-2014)

Figure A.2a: Men

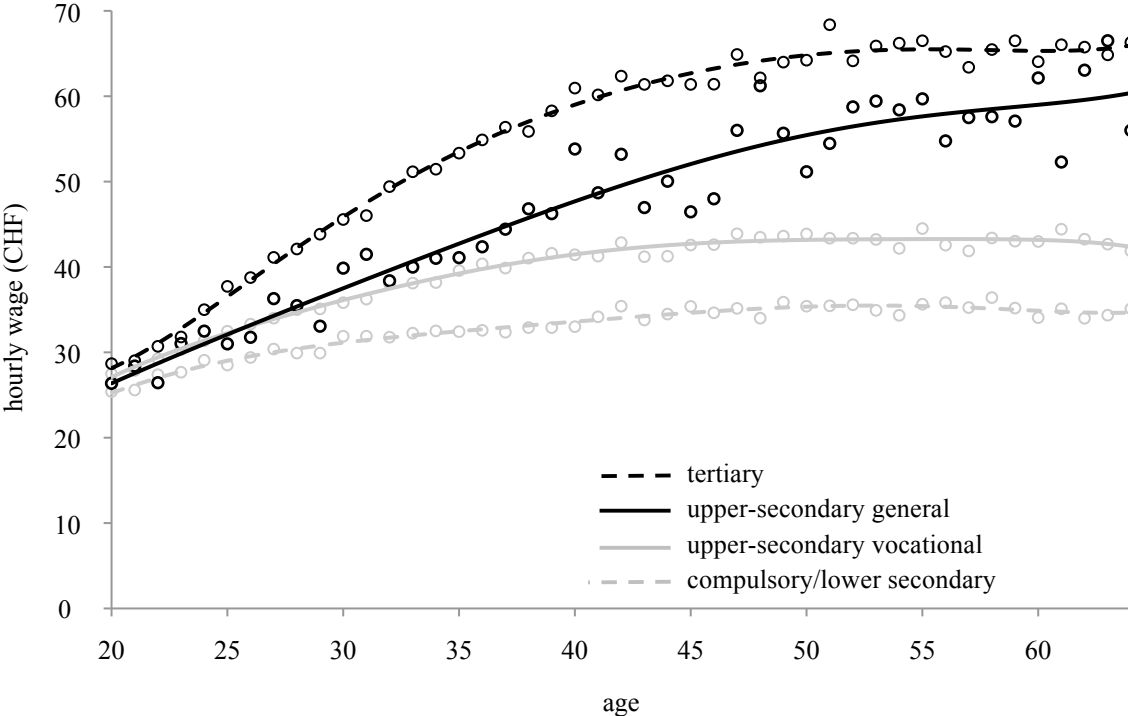


Figure A.2b: Women

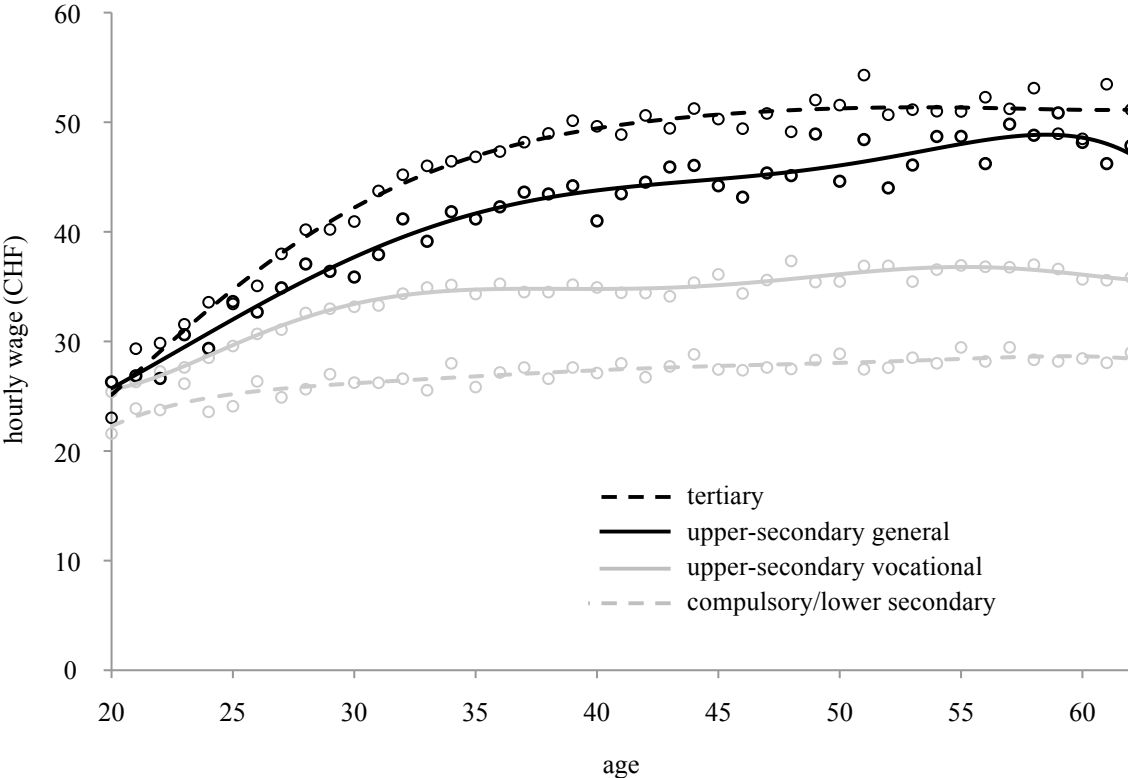


Figure A.3: median annual work income for men for different types of VET (based on the Swiss Labor Force Survey 1991-2014)

Figure A.3a: Men and types of VET (I)

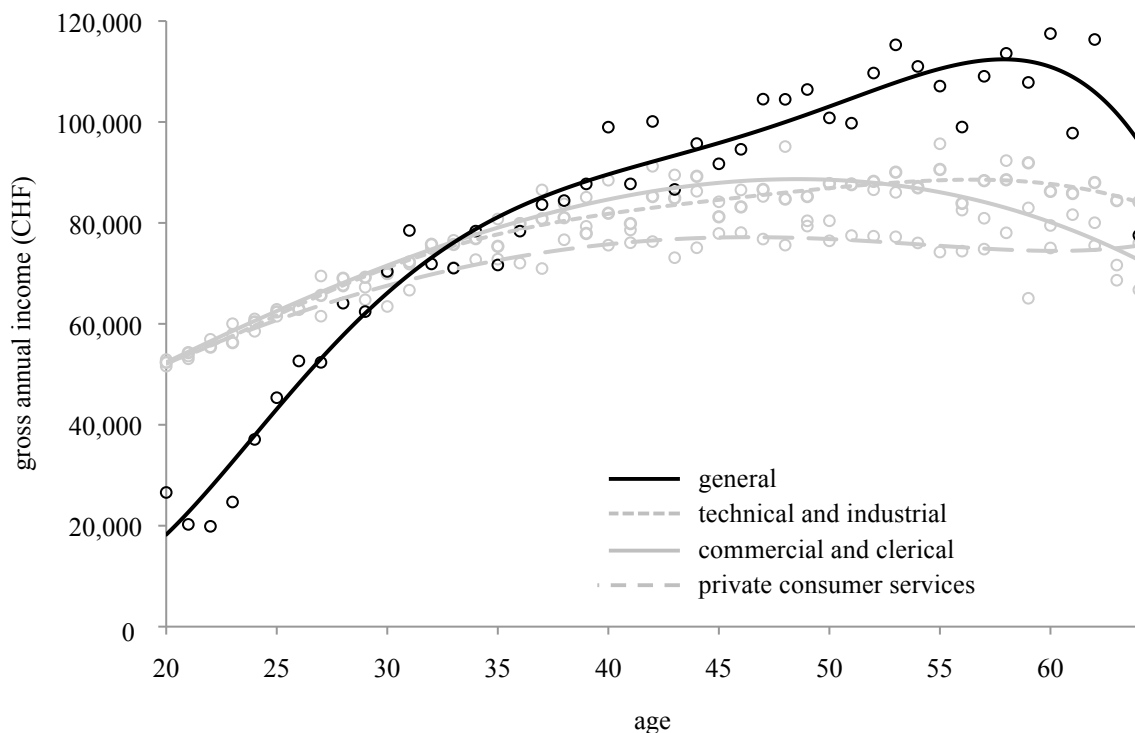


Figure A.3b: Men and types of VET (II)

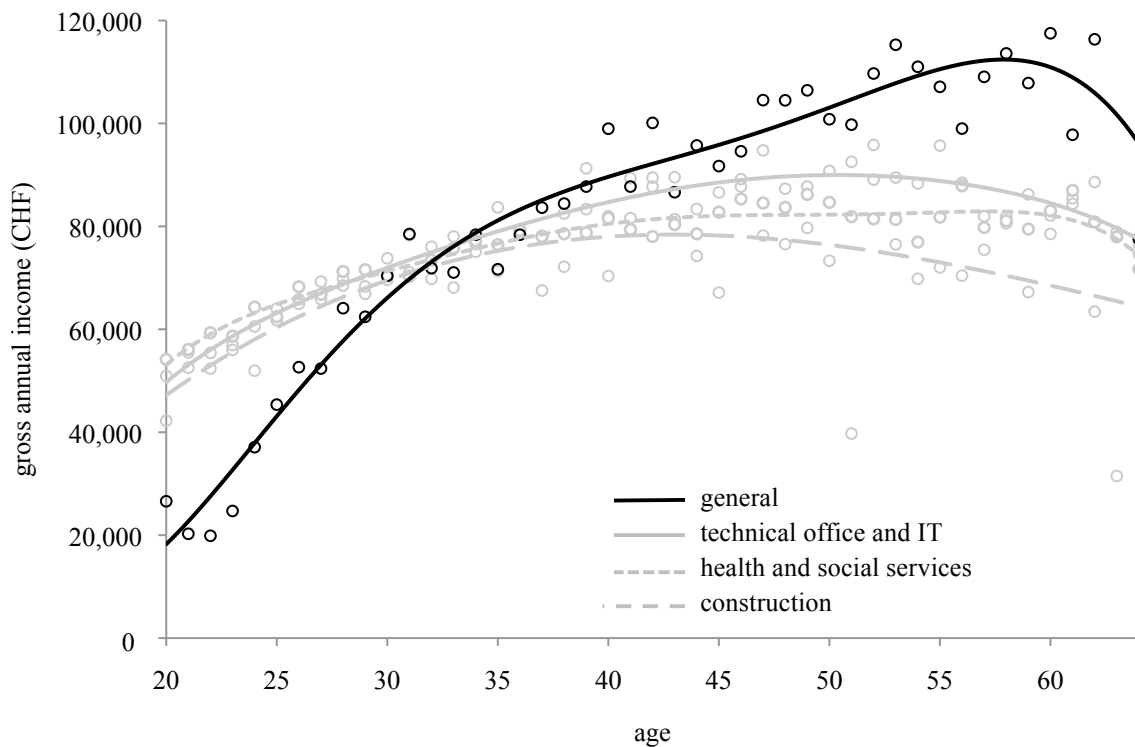


Figure A.4: median annual work income for women by different types of VET (based on the Swiss Labor Force Survey 1991-2014)

Figure A.4a: Women and types of VET (I)

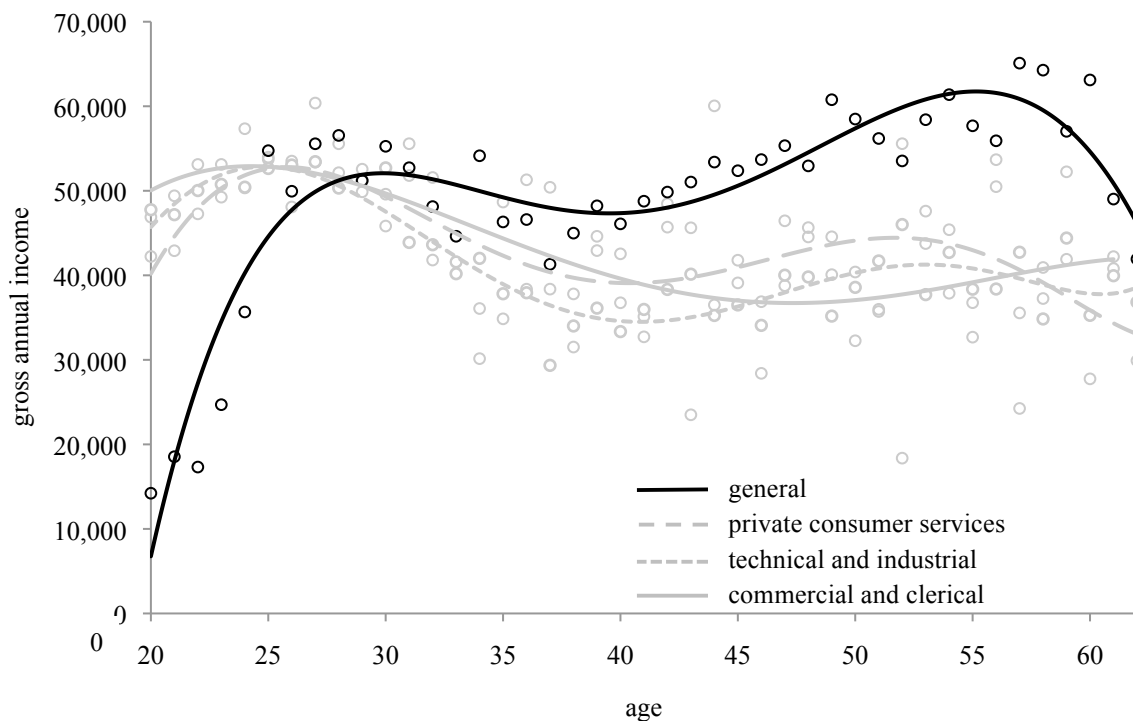


Figure A.4b: Women and types of VET (II)

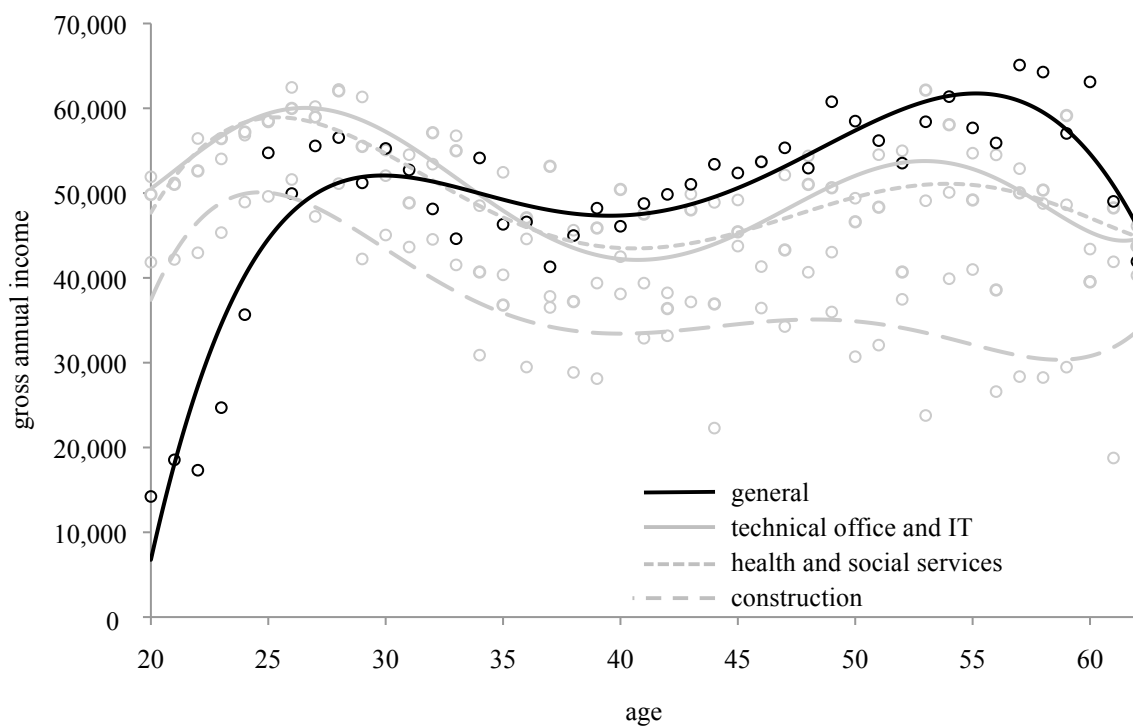


Figure A.5: median annual work income by type of education (based on the Swiss Labor Force Survey 1991-2014) for men by cohorts

Figure A.5a: General education, men

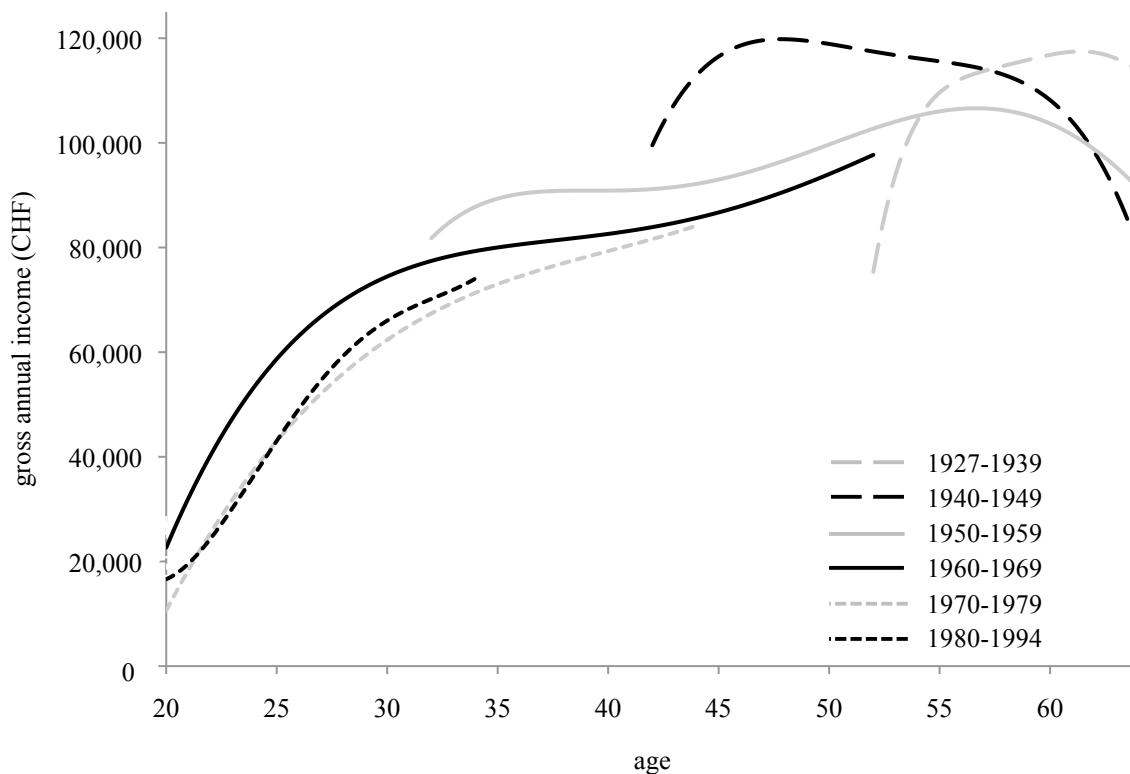


Figure A.5b: Vocational education, men

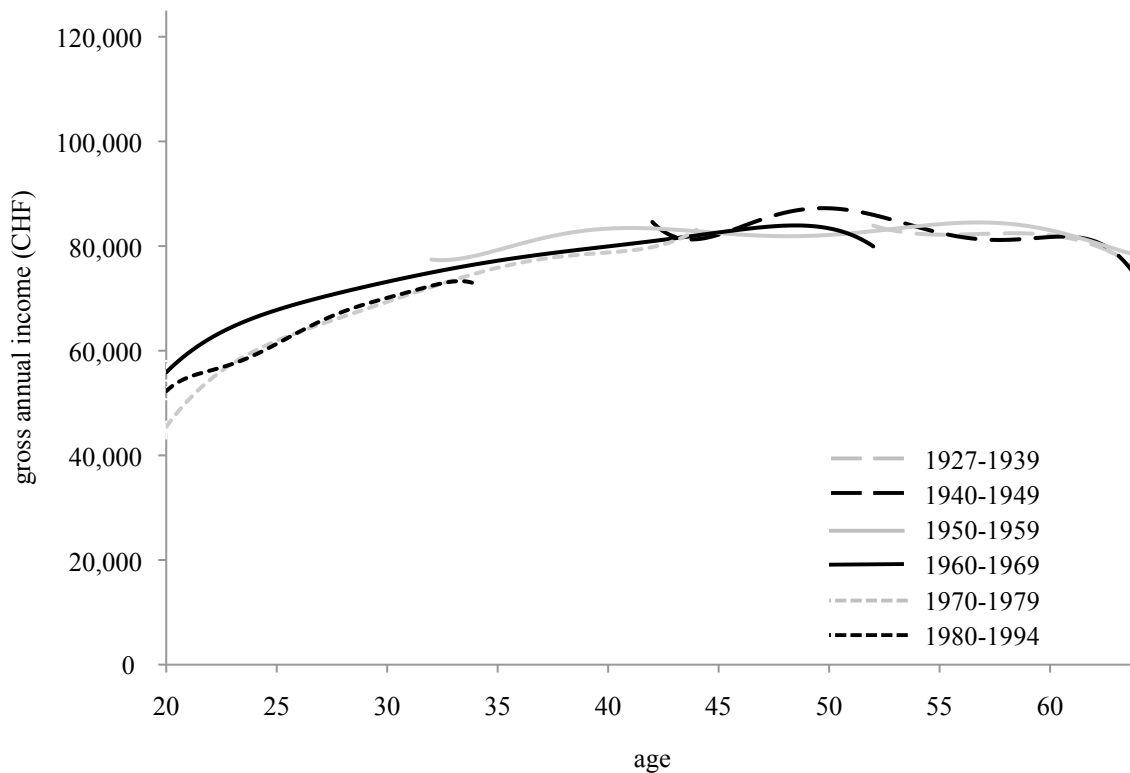


Figure A.6: median annual work income by type of education (based on the Swiss Labor Force Survey 1991-2014) for women *by cohorts*

Figure A.6a: general education, women

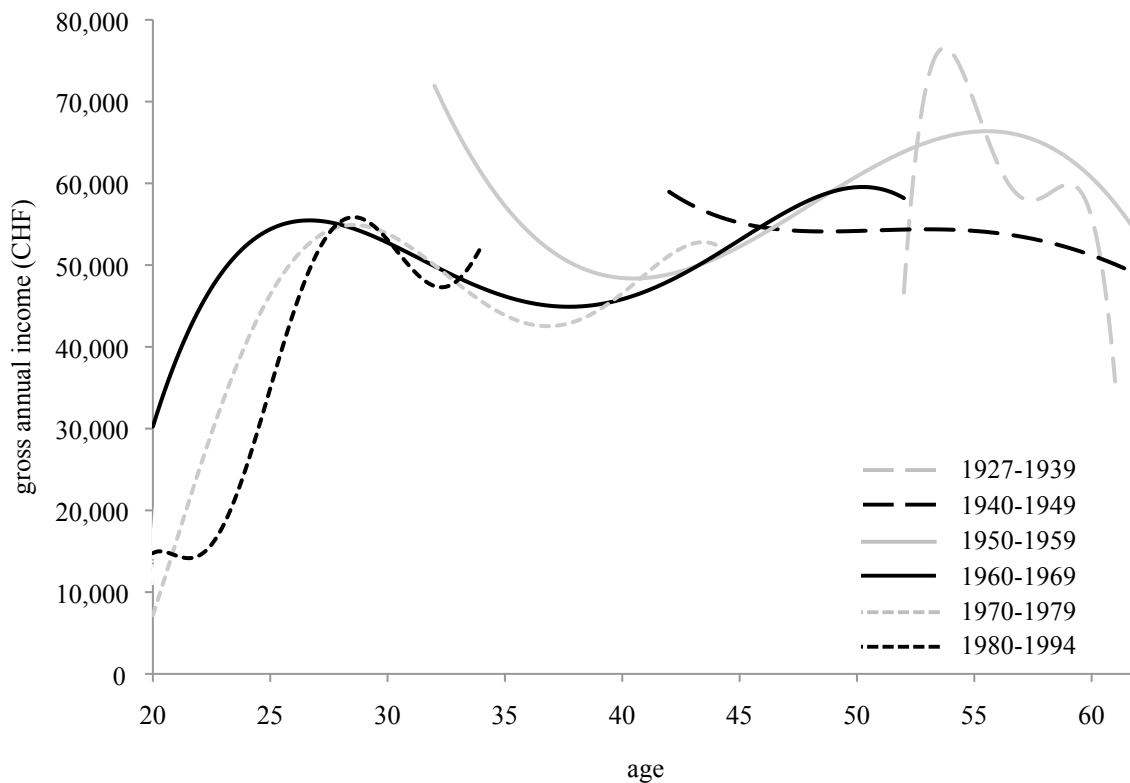


Figure A.6b: vocational education, women

