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The two choices that students in many Western European countries must make during their educational career are the type of education (vocational vs. academic) and the subject area (the specific field of education). However, most studies on the effect of education on earnings consider only one of these two factors. In addition, most of these studies focus exclusively on average returns and neglect the variance of the returns, thus overlooking important aspects of the nature of the returns to education such as the risk in human capital investments. In this study, we consider both factors type of education and subject area at the same time to estimate earning returns and to examine how much these two factors contribute to the variance of earnings in later careers. We use the Swiss Adult Education Survey from 2011 and construct a sample of individuals with tertiary level educational degree, estimating earnings regressions and decomposing the variance in earnings for type of education and subject area. Decomposition results show that field of education, relative to subject area, explains double the variation in earnings. Given our findings that earnings relate more to subject area than to type of education, the question of which type of education—academic or vocational—an individual chooses is less relevant than the question of which field he or she chooses to specialize in.

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Introduction

During their educational career, many students in Western Europe make decisions about two critical educational factors. The first factor, the type of education, implies the decision between vocational and academic education. The second factor, the subject area, involves the choice of a specific field of study. However, while the literature shows that these two factors both have an impact on earnings in the individuals' later career, the results for type of education are mixed.

On the one hand, previous research finds that academic education is more beneficial than vocational education (Conlon, 2005; Dearden, McIntosh, Myck, & Vignoles, 2000; Heijke & Koeslag, 1999). On the other hand, results from countries with stronger vocational educational systems[1] show reasonable—and in some cases even higher—earnings returns for vocational education (Tuor & Backes-Gellner, 2010; Wolter & Weber, 1999). For subject area, results are consistent across studies, showing that the most profitable fields are engineering, health, and business, and the least profitable are education, the social sciences, and the humanities (Altonji, Blom, & Meghir, 2012; Finnie & Frenette, 2003; Rumberger & Thomas, 1993; Thomas, 2000; Thomas & Zhang, 2005).

Although studies on the effect of education on later earnings are numerous, they tend to limit their focus in two critical areas. First, they consider either type of education or subject area; only one study focuses on both factors (Glocker & Storck, 2014).[2] Second, when analyzing monetary outcomes of education, most of these studies focus exclusively on average returns, neglecting the variance of the factors they are examining. These studies thus overlook important aspects of the nature of returns to education (Harmon, Hogan, & Walker, 2003), such as risk in human capital investments or heterogeneity in returns to education.

Thus far, no study shows how much the two factors type of education and subject area contribute to variation in earnings. In this paper, we focus on examining both factors at the same time to examine how much they contribute to the variance of earnings in later careers. We decompose the variance in earnings for type of education and subject area, allowing us to quantify the separate contribution of each of the two factors to the variation in earnings. Thus, this analysis shows the importance of the two factors in determining later earnings.

[1] Graf (2013) underline that Austria, Germany, and Switzerland are countries whose educational systems have a strong focus on vocational education and training, especially at upper-secondary level.

[2] Glocker and Storck (2014) use the German Micro Census to analyze earnings risk and returns of investments of 70 fields of education, distinguishing between vocational and academic education. Results show that university education is not always the most profitable paths.

To quantify the effect of each factor, we proceed in two steps. In the first step, we estimate ordinary least squares regressions in the form of a Mincer-like earnings equation. Instead of the continuous variable "years of schooling," we create dummies for type of education and subject area. For the choice of educational type, we distinguish between purely vocational, purely academic, and mixed education, i.e., individuals who combine vocational and academic education. For the choice of the subject area, we form the following five categories: (1) Commercial, (2) Health, (3) Science, Technology, Engineering and Math (STEM), (4) Social & Service, and (5) Mixed Fields, i.e. individuals who combine different fields.

In the second step, to analyze the importance of individual educational choice variables on the variation of earnings, we compute a variance decomposition to analyze the importance of individual educational choice variables on the variation of earnings. In so doing we follow the argument by Harmon et al. 2003 and focus on heterogeneity in returns to education. We compute the variances of the dependent variable ln(earnings) and of the returns of our explanatory variables type of education and subject area. We then calculate the ratio of the variance in returns to type of education and the variance in returns to subject area relative to the variance in earnings explained by our model. This variance decomposition allows us to quantify the separate contribution of the two educational choice variables to the variation in earnings.

To estimate the relative effect of the two educational choice factors, we use the Swiss Adult Education Survey (CH-AES) from 2011 and construct a sample of about 1200 individuals, all of whom have a tertiary educational degree.

The results of the Mincer-like earnings equation show that both type of education and subject area have a statistically significant impact on the returns to education. For type of education, academic and mixed education yield higher returns than vocational education. For subject area, Commercial is the most profitable field. Returns for Health and Mixed Fields are 2% lower than those of Commercial, but not statistically significant. STEM has 9% lower returns than Commercial, while individuals with a degree in the Social & Service fields earn 30% less than those at the highest end of the spectrum. The results of the variance decomposition show that 9% of the explained variance in earnings is attributable to the type of education, whereas nearly 17% is attributable to the subject area. Consequently, subject area explains almost double the variation in earnings.

Given our findings that earnings relate more to subject area than to type of education, policy discussions about the educational system in general and study choices in particular should draw at least as much attention on the choice for subject area than for the type of education.

Background

Previous research shows that both type of education and subject area have an impact on the individual's later earnings (see, e.g., Hanushek, Wößmann, & Zhang, 2011, Dearden et al., 2000, Altonji et al., 2012).

Most studies on returns to education do not differentiate between vocational and academic education (see, e.g., Card, 1999). Dearden et al., 2000 underline that these studies using "years of schooling" do not consider potential productivity differences between one year of academic education vs. one year of vocational education and training, instead implicitly assuming that returns for both types are equal. Their study therefore differentiates between the two types and estimates returns to vocational and academic education. [3] Results show that they differ: They are higher for academic qualifications compared to vocational qualifications at the same level. Conlon, 2005 find similar results in the United Kingdom, as do Heijke & Koeslag, 1999 for the Netherlands.

However, results on the effect of vocational and academic education on earnings are mixed in European countries (Ryan, 2001). Results from countries with stronger vocational education systems show that vocational education is favorable in terms of monetary and non-monetary outcomes and—in some cases—even better than academic education: Weber & Wolter, 1999 present a literature overview for wages and human capital in Switzerland, a country with a strong focus on vocational education. In addition to private returns of years of schooling, they focus on both returns of type of education and returns to experience. Referring to a study by Sheldon, 1992, they emphasize the heterogeneity between returns to academic and vocational education. Wolter & Weber, 1999 furthermore calculate returns to different types of education in terms of life income[4], concluding that any type of post-compulsory education is worthwhile. Moreover, they find no significant differences between any types of

[3] The authors work with three different data sources from the United Kingdom: National Child Development Study from 1991; International Adult Literacy Survey from 1995; Labour Force Survey from 1998.

[4] Their cost-benefit model is based on Psacharopoulos (1987), Psacharopoulos (1994), Wolter (1994), Alsalam and Conley (1995) and the OECD (1998)

post-compulsory education. Further studies show that vocational education is indeed favourable in terms of monetary and non-monetary outcomes (see, e.g., Geel & Backes-Gellner, 2011; Tuor & Backes-Gellner, 2010). Thus, distinguishing between academic and vocational education when examining returns to education is clearly important for European educational systems with strong vocational components.

For subject area, empirical results differ less. Rumberger & Thomas, 1993 measure the impact of field of education, school quality, and educational performance on earnings in the United States. They use hierarchical linear modeling as a statistical technique, finding evidence that all types of qualitative factors have an influence. In terms of the field of education, engineering and health yield the highest gains, followed by science and math, and business. The social science and the humanities, along with education, yield the lowest returns. Thomas, 2000 and Thomas & Zhang, 2005 find similar results for the U.S, and Finnie & Frenette, 2003 for Canada, respectively. Thomas, 2000 analyzes the effect of college quality, academic performance and college major on initial earnings and debt ratios of U.S. college graduates. For field of education, i.e. college major, the results are identical: Engineering and health-related majors yield the highest returns, whereas education and humanities are the least lucrative fields. Finnie & Frenette, 2003 analyze field-of-education differences in earnings for three cohorts of bachelor's degree holders in Canada. Among other results, they find the highest returns for health and engineering and the lowest returns for the social sciences and the humanities; results remain robust even when they include different sets of control variables.

Thomas & Zhang, 2005 measure the impact of college quality and academic major on earnings for a representative cohort receiving a baccalaureate degree in 1993. They find significant variation across different types of tertiary academic degrees, with the highest returns for business, engineering, and health. Finally, Altonji et al., 2012 present an overview of selected papers on returns to field of study and conclude that estimates are consistent across field and across time. Results show a high premium for engineering, followed by science and business. Again, the social sciences, the humanities and education are the fields yielding relatively low monetary returns.

Finally, an increasing number of studies focus on the (residual) variance of earnings and on the variance of returns to education. These studies emphasize that the variance shows evidence regarding important aspects that mean returns do not take into consideration, e.g. risk of human capital investments or heterogeneity in returns to education. Regarding

(residual) variance of earnings, Bonin, Dohmen, Falk, Huffman, & Sunde, 2007 show that individual risk attitudes and occupation earnings risk are correlated, indicating that less risk-averse individuals are sorted into occupations with more variance in earnings. Hartog & Vijverberg, 2007 argue that individuals care about the distribution and the skewness of earnings and empirically test whether higher earnings risk requires higher expected returns.

Christiansen, Joensen, & Nielsen, 2007 argue that different educational careers differ in terms of returns and in terms of risk. As individuals have heterogeneous utilities regarding risk and return of an education, both the mean and the variance of a specific human capital investment have an influence on their educational decision. They therefore focus on risk-return properties of human capital investments and find strong heterogeneity in returns and returns per unit of risk across fields. However, although they focus on both, type and field of education, their study does not provide evidence of these two factors at the same level. As an example, they compare an upper secondary vocational education (Bank Office Clerk Apprenticeship) with a tertiary academic education (Master of Science in Economics). Their comparison of fields on the same level, a strategy to reduce potential ability bias, focuses only on individuals with a tertiary academic educational degree and excludes vocational education.

Regarding heterogeneity in returns, Harmon et al. (2003) identify two causes of variation in returns to education: heterogeneity and risk. Whereas heterogeneity refers to differing returns to education among individuals due to factors known by the individual, but unobservable to the econometrician, risk refers to factors unknown by both, the individual and the econometrician. In contrast to other studies, they therefore prefer the expression "dispersion" to "risk", since variation in the returns to education includes heterogeneity and risk. They then estimate the standard deviation of returns among individuals and find a high dispersion in returns to education. Regarding changes of mean return and dispersion across time, they do not find a trend.

In sum, both type of education and subject area have significant effects on later earnings. As the results for type of education are heterogeneous, differentiating between vocational and academic education is therefore essential. In contrast, the results for subject area are more homogeneous. Given that both factors have an effect on later earnings, analyses focusing on the monetary effect of education must take the individual's entire educational career take into consideration. In addition, given that the variances of earnings and of returns to education reflect further important aspects, such as risk or heterogeneity, taking into consideration the variance of earnings and the variance of returns to education is inalienable.

Data, Sample and Variables

To calculate the contribution of the two factors, type of education and subject area, to the variance in earnings, we are interested in a country having vocational education on the upper secondary and the tertiary level and providing detailed data regarding the two factors type of education and subject area.

The Swiss Adult Education Survey (CH-AES) is especially appropriate for our purposes. This survey is part of the Swiss Federal population census and started in 2011, using computer-assisted telephone interviewing. CH-AES contains data about the labor market status, socioeconomic background, and formal and non-formal education of 13,000 individuals. CH-AES covers the individual's whole educational career. Moreover, as it makes available detailed descriptions of the type and the field of all educational choices that an individual has made, the survey is particularly appropriate for our study. To create a better understanding of our variables, we first describe the Swiss educational system, in which academic and vocational education coexist at the upper secondary and the tertiary levels.[5]

The Swiss Educational System

After nine years of compulsory schooling, students about ages 15, 16 choose either a vocational or an academic upper secondary education. Approximately 60% of all Swiss students choose a dual-track Vocational Education and Training program (VET) (SKBF 2010, p. 112). These programs combine on-the-job training in the form of a paid apprenticeship in a host company, with theoretical teaching at school. Graduates receive an "Advanced Federal Certificate" and continue working as skilled workers within their respective occupational fields, in either the training company or a new one (Tuor & Backes-Gellner, 2010, p. 498).

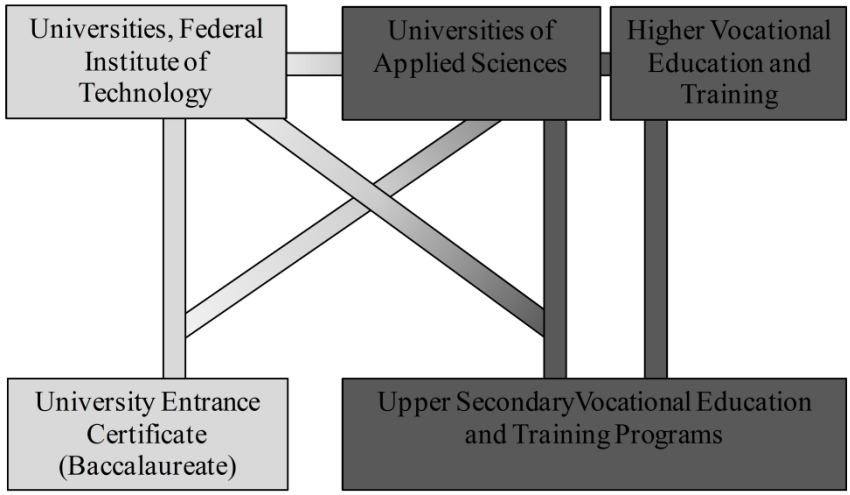
Individuals with an upper secondary vocational degree have several options for tertiary education. On the one hand, they can continue following the vocational track, because the Swiss educational system offers a variety of opportunities with different objectives. These opportunities comprise, amongst others, of Universities of Applied Sciences and Higher VET institutions. On the other hand, individuals with a VET degree can choose academic tertiary education if they fulfill certain requirements.

[5] All information regarding the Swiss educational system come from Schweizerische Koordinationsstelle für Bildungsforschung (SKBF) (2007), SKBF (2010), SKBF (2014), and Bundesamt für Berufsbildung und Technologie BBT (2009).

In contrast to other Western countries, only around 20% of Swiss students completing compulsory schooling actually choose the academic track, i.e., obtain an University Entrance Certificate (Baccalaureate) (SKBF 2010, p. 17). This Baccalaureate allows its holders unrestricted access to all tertiary academic institutions in Switzerland, i.e., universities and Federal Institutes of Technology. Moreover, if they complete a traineeship in their intended field of study, individuals with a BAC degree also have access to UAS.

Figure 1 presents the Swiss educational system.[6] It shows that the system provides vocational and academic education at the upper secondary and the tertiary levels, and allowing for permeability between and within the two levels.

Figure 1: The Swiss Educational System



Source: Own illustration, based on SKBF, 2007; SKBF, 2010; SKBF, 2014.

Independent and Explanatory Variables

To measure the contribution of the dimensions type of education and subject area to variation in earnings, we create two independent variables as follows: For the variable type of education we distinguish between purely academic, purely vocational, and mixed educational careers. Purely academic careers are those educational paths that exclusively include academic components, i.e. Baccalaureate and a study at a university or at a Federal Institute of Technology. Purely vocational careers are educational paths that exclusively include vocational components, i.e., any type of VET program, a study at a University of Applied Sciences, or a degree of a Higher VET institution.

[6] Universities of Teacher Education, as well as upper-secondary specialized schools are not included in the illustration, as these institutions are not relevant for our analysis.

Mixed careers are those that include both academic and vocational educational components.[7] On the one hand, mixed careers can start either in an upper-secondary academic institution and end in a tertiary vocational institution, e.g., a Baccalaureate plus a traineeship plus a study at a University of Applied Sciences. On the other hand, these are careers that start in an upper-secondary vocational institution and end in a tertiary academic institution, e.g., a VET program plus, after having fulfilled the special requirements, a study at a university. Theoretically, numerous combinations of mixed careers are possible. However, we focus on the most common ones and include only those individuals who switch only once between vocational and academic education.

For the variable subject area, we follow the literature (see, e.g., Altonji et al., 2012, Finnie & Frenette, 2003, or Rumberger & Thomas, 1993 for a literature overview of different classifications) and distinguish among five groups. We create dummy variables for Commercial, Health, STEM, and Social & Service.[8] Finally, we create a fifth group for those individuals who change their field of study during the educational career, Mixed Fields.[9]

Our labor market outcome, the variable ln(earnings), is the logarithmic gross income of the yearly earnings. For individuals who work part-time, we calculate the equivalent full-time earnings. In addition, to control for potential part-time effects, we include a part-time dummy (Part-time).

[7] We include the category "mixed type of education" because the results of previous research show that combining vocational and academic education might lead to higher outcomes. Kang and Bishop (1989), for example, estimate the effect of vocational coursework for U.S. high school graduates who did not attend college on labor market outcomes. They find large benefits for students choosing a modest level of vocational courses, in comparison to students exclusively focusing on academic courses. However, as these benefits decrease after the completion of more than three or four courses, Kang and Bishop conclude that results indicate decreasing returns of specialization, and complementarities between academic and vocational courses. Bishop and Mane (2004) find similar results for the U.S. In Europe, Tuor and Backes-Gellner (2010) calculate return rates and risk measures of purely academic, purely vocational and mixed paths that all lead to a tertiary degree. They conclude that the labor market rewards mixed educational paths and that these results indicate complementarities between academic and vocational education.

[8] Hoeckel, Field, Justesen, and Kim (2010) find that the International Standard Classification of Education ISCED is a weak instrument for identifying vocational fields at the secondary and tertiary levels. We thus use the Swiss Standard Classification of Occupations 2000 from Bundesamt für Statistik (2003) and the ISCO-08 classification from International Labour Organization (2008) to identify and create homogeneous groups of subject areas. For further information, see Table A1 in the Appendix.

[9] We include the category "mixed field of education" because results of previous research show that combining different fields might lead to differing outcomes. Del Rossi and Hersch (2008), for example, focus on the impact of double majors on earnings in the U.S and find, among other results, that combinations of business with the group science/math yield returns of more than 50% compared to the returns for single major in any of these fields. Hemelt (2010), working with the same data, finds that, irrespective of the first major, second majors computer science, engineering, and business and administration lead to an increase in earnings.

Sample

Our sample consists of employed individuals between 25 and 64 years old. These individuals have finished their educational careers and are part of the workforce, i.e. they are neither retired nor unemployed. We furthermore drop teachers and individuals with degrees from upper-secondary specialized schools, as their type of education is attributable neither to vocational nor academic education. As we focus on individuals with a tertiary level degree, we drop all individuals who did not complete compulsory school, who did not complete any upper secondary education, or who did not complete any tertiary level education. Furthermore, we drop all individuals who switched more than once between vocational and academic education, as they are very seldom and very special cases.

In addition, we exclude individuals in the armed forces and individuals whose formal education is exclusively in a manual labor field, i.e. with exclusively vocational education. Finally, following Gerfin, Leu, & Nyffeler, 2003, we drop the highest and the lowest percentile of the earnings distribution. Our final sample contains 1161 individuals.[10]

The descriptive statistics in Table 1 show a mean of ln(earnings) of 11.505, corresponding to a yearly income of approximately 100,000 CHF. These statistics show that 34% of the individuals in our sample follow the purely vocational track, about 43% have a purely academic educational career, and about 23% have a mixed educational career.

For subject area, Commercial and STEM contain the largest number of individuals: Commercial contains 33%; STEM, 26%. Health and Mixed Fields contain 16%, and 15%, respectively, of all individuals with a tertiary level degree. The smallest group, at 9%, is Social & Service.

[10] We lose more than 40% of the 13000 individuals because we do not have information about their earnings; in addition, further 30% of individuals drop out because they do not have a tertiary education; finally, the restrictions for the age (9%), the teachers (4%) and individuals working in manual fields (3%) lead to further losses in our sample. Notice that we do not include individuals whose first language is Rhaeto-Romanic, because they consist a small minority; the unrestricted sample contains only 18 such individuals, the restricted 1 individual.

Table 1: Descriptive Statistics

Variable		N	Mean	Std. Dev.	Min	Max
	ln(earnings)	1161	11.5058	0.4938	9.741	13.082
Type of Education						
	Vocational	1161	0.3351	0.4722	0	1
	Academic	1161	0.4332	0.4957	0	1
	Mixed	1161	0.2317	0.4221	0	1
Subject Area						
	Commercial	1161	0.3282	0.4697	0	1
	Health	1161	0.1628	0.3693	0	1
	STEM	1161	0.2618	0.4398	0	1
	Social & Service	1161	0.0930	0.2906	0	1
	Mixed Fields	1161	0.1542	0.3613	0	1
Covariates	Men	1161	0.5090	0.5001	0	1
	German	1161	0.5736	0.4948	0	1
	French	1161	0.3635	0.4812	0	1
	Italian	1161	0.0629	0.2428	0	1
	Self Employed	1161	0.0999	0.3000	0	1
	Foreign	1161	0.2377	0.4259	0	1
	Part-time	1161	0.3333	0.4716	0	1
	Exp: 0-2	1161	0.1309	0.3375	0	1
	Exp: 3-5	1161	0.1413	0.3484	0	1
	Exp: 6-8	1161	0.1602	0.3670	0	1
	Exp: 9-13	1161	0.1559	0.3629	0	1
	Exp: 14-18	1161	0.1344	0.3412	0	1
	Exp: 19-25	1161	0.1344	0.3412	0	1
	Exp: 26 +	1161	0.1430	0.3502	0	1

Source: Own calculations, based on CH-AES

Estimation Strategy

To quantify the contribution of type of education and subject area to the variance in earnings, we follow the argument by Harmon et al. 2003 and focus on heterogeneity in returns to education. However, whereas Harmon et al. 2003 estimate the standard deviation of returns to education among individuals using a random coefficient model, we focus on the variance of the two factors type of education and subject area.

We proceed in two steps: In the first step, we estimate ordinary least squares (OLS) regressions in the form of a Mincer-like earnings equation, including variables for schooling, experience and experience squared[13]. However, instead of the continuous variable years of schooling, we use dummies that represent our two factors type of education and subject area. For type, we distinguish between purely vocational, purely academic and mixed education, i.e., individuals who combine vocational and academic education. For subject area, we distinguish between our five categories; these are (1) Commercial, (2) Health, (3) STEM, (4) Social & Service, and (5) Mixed Fields, i.e., individuals who combine different fields.

Finally, we include a set of control variables independent of educational choice[14]: a dummy for being self-employed, a dummy for being male (Men), for linguistic region (French, Italian and German, with the base group German), for being foreign (Foreign), i.e., not a Swiss citizen, and for working part-time (Part-time). We regress these explanatory variables on the natural logarithm of earnings, our dependent variable. Our basic equation is the following:

$$\text{Equation (1)} \quad \ln(earnings) = T'\alpha + F'\beta + CV'\gamma + \varepsilon$$

In the second step, we compute the variances of the dependent variable ln(earnings), of the coefficients of the two independent variables of interest, type of education and subject

[13] CH-AES provides no information on experience or experience squared. We therefore use the numbers of years since the last completed education as a proxy. To measure the share of variance in earnings explained by experience, we create seven dummies: the first dummy comprises individuals with labor market experience of 0 to 2 years; the second of 3 to 5; the third of 6 to 8; he fourth of 9 to 13; the fifth of 14 to 18, the sixth of 19 to 25, the seventh of 26 and more years.

[14] Pereira and Martins (2001) emphasize that the inclusion of covariates related to education leads to a decrease in the coefficient of education, i.e. to biased returns to education.

area, and of the coefficients of our set of control variables.[15] Using Equation (1), the variance of observed ln(earnings) can be decomposed as[16]:

$$\text{Equation (2)}\quad Var(\ln(earnings)) = Var(T\hat{\alpha}) + Var(F\hat{\beta}) + Var(CV\hat{\gamma}) + 2Cov(T\hat{\alpha}, F\hat{\beta}) + 2Cov(T\hat{\alpha}, CV\hat{\gamma}) + 2Cov(F\hat{\beta}, CV\hat{\gamma}) + Var(\hat{\varepsilon})$$

We then show the ratio of variation in earnings explained by the variable type of education, respectively by the variable subject area: First, we calculate the sum of the variance in ln(earnings) explained by type of education, subject area, experience and the set of control variables. Second, we divide the respective variance and covariance components by this sum of explained variance. This variance decomposition allows quantifying the separate contribution of the dimension type and the dimension field of education to the variation in earnings.

[15] We replace each term of Equation (2) with the respective sample analogue to obtain a feasible version of the decomposition: For the variance of ln(earnings), we calculate

$$s_{yy} = \frac{1}{n-1}\sum(y_i - \bar{y})^2 \text{ , where } \bar{y} = \frac{1}{n}\sum y_i$$

For the variance of the coefficients of type of education and subject area, we calculate:

$$s_{TT} = \frac{1}{n-1}\sum(T\hat{\alpha}_i - T\bar{\hat{\alpha}})^2$$

$$s_{FF} = \frac{1}{n-1}\sum(F\hat{\beta}_i - F\bar{\hat{\beta}})^2$$

Finally, for the covariance between type of education and subject area, we calculate:

$$s_{TF} = \frac{1}{n-1}\sum(T\hat{\alpha}_i - T\bar{\hat{\alpha}})(F\hat{\beta}_i - F\bar{\hat{\beta}})$$

[16] In so doing we rely on Card, Heining, & Kline, 2013. Card et al. (2013) analyze the dramatic increase in wage inequality from 1985 to 2009 in West Germany by focusing on the variation in earnings. Relying on a model by Abowd, Kramarz, & Margolis (1999), they estimate person and establishment (i.e., firm) effects across time, and analyze how the increasing wage inequality relates to the two factors. A simple decomposition of the variance of earnings allows them to quantify how much person and establishment each contributes to the rise in wage inequality. Their results show that both dimensions have substantial effects: The change in the variance of the establishment component contributes only 25% to the increase in variation of earnings; the change in the variance of the person component contributes about 40%; and the covariance between the two components contributes about 34% to the increase in variation in earnings. However, whereas Card et al. (2013) study the effect of individual and establishment-specific factors over time, we analyze the importance of individual educational choice variables on the variation of earnings at one point in time. Hence, due to data restrictions, we do not apply the model by Abowd et al. (1999).

Results

The first step to quantify the dimensions type and field of education to variation in earnings implies Mincer-like earnings equations.

Table 2 shows the results of the Mincer-like earnings equation, including dummies for type of education and subject area instead of a continuous variable for years of schooling, as well as dummies for experience and a set of control variables.[17]

We gradually include the explanatory variables. Specification 1 comprises the regression of the dummies for type of education and experience on the natural logarithm of earnings. Specification 2 shows the regression of the dummies for subject area and experience on the natural logarithm of earnings. In addition to all educational choice variables, specification 3 includes a set of control variables for linguistic region, being male, self-employment, foreign nationality and working part-time.

Results for both factors are in line with previous literature. Regarding type of education, results show higher returns for academic and mixed education. Both are statistically significant on the one percent level. Their difference between them is statistically insignificant. Regarding subject area, Health and Mixed Fields show slightly lower returns that are statistically not significant in comparison to the Commercial. STEM yields an 8.8% lower return. The coefficient is statistically significant on the five percent level. Individuals who opt for the subject area Social & Service earn more than 30% less. The coefficient is statistically significant to any other field. Finally, results regarding experience and the control variables are in line with previous research.

[17] Table A2 in the Appendix shows the results for experience and all control variables.

Table 2

	ln(earnings)			
	Spec. 1	Spec. 2	Spec. 3	Spec. 4
Vocational	Base Group		Base Group	Base Group
Academic	0.0703**		0.1122***	0.1437***
	(0.0324)		(0.0345)	(0.0344)
Mixed	0.0483		0.0759**	0.1062***
	(0.0381)		(0.0380)	(0.0375)
Commercial		Base Group	Base Group	Base Group
Health		-0.0890**	-0.1047**	-0.0245
		(0.0421)	(0.0422)	(0.0421)
STEM		-0.0402	-0.0625*	-0.0883**
		(0.0365)	(0.0371)	(0.0364)
Social & Service		-0.3221***	-0.3512***	-0.3001***
		(0.0515)	(0.0521)	(0.0511)
Mixed Field		-0.0769*	-0.0459	-0.0227
		(0.0429)	(0.0438)	(0.0424)
Experience	Included	Included	Included	Included
Control Variables				Included
Constant	11.2239***	11.3468***	11.2890***	11.2411***
	(0.0434)	(0.0437)	(0.0473)	(0.0495)
Adjusted R-squared	0.0636	0.0902	0.0971	0.1631
R-squared	0.0700	0.0981	0.1064	0.1761
N	1161	1161	1161	1161
Prob>F	0.000	0.000	0.000	0.000

Source: Own calculations, based on CH-AES; standard errors are reported in parentheses; * statistically significant at the 0.1 level; ** at the 0.05 level; *** at the 0.01 level

The second step to quantify the effect of type of education and subject area to the variation in earnings is a variance decomposition regarding the two factors. We calculate how much type of education and subject area contribute to total variation in ln(earnings). Column one of Table 3 follows Equation 2 and shows the variances in ln(earnings) explained by the respective variance and covariance components. Column two shows these components' relative shares of the variance in ln(earnings) explained by the model. We calculate these shares dividing the respective variance or covariance component by the sum of the variance explained by our model.[18]

The first row of Table 3 shows that the variance of ln(earnings) is about 0.2438. Our explanatory variables explain 17.61% of the variance in ln(earnings), implying that our model has an r-squared of .1761.

The second and the third row depict the variance of the three dummies for type of education, vocational, academic and mixed, and the five dummies for subject area, Commercial, Health, STEM, Social & Service, and Mixed Fields, respectively. The variance for type of education is 0.0040 and the shares of the explained variance in ln(earnings) about 9%. The variance for subject area equals 0.0072 and the respective share of the explained variance in ln(earnings) about 9%. The covariance between type and field of education equals -0.0023 and contributes about 5% to the explained variance.

Rows four two nine show the variances and relative shares of experience and our set of control variables. Results for the dummies for experience and the dummy for gender are the largest: The variance equals 0.0140 for experience, and 0.0102 for gender, respectively. About 33% of the variance in ln(earnings) is attributable to experience, about 24% to gender. The shares of linguistic region, being self-employed, being foreign and working part-time concerning explained variation in earnings are between 3% and 5%.

Summing up, the factor subject area explains almost double of the explained variance in earnings, compared to the factor type of education.

[18] The relative shares of each variance and covariance components of total variance in ln(earnings) are available in Table A3 in the appendix.

Table 3

		Variance Decomposition	
		Variance	Share of explained
Total Variance of ln(Earnings)		0.2438	0.1761
Components of Variance:			
	Type of Education	0.0040	9.36
	Subject Area	0.0072	16.72
	Gender (Male)	0.0102	23.86
	Linguistic Region	0.0019	4.48
	Self-Employed	0.0002	0.37
	Foreign	0.0017	4.04
	Part-Time	0.0014	3.22
	Experience	0.0140	32.68

Source: Own calculations, based on CH-AES

Conclusion

Previous research shows that the two factors type of education and subject area of the individual's educational career are critical factors that have an effect on later labor market outcomes. Most studies on the effect of education on earnings consider only one of these two factors and focus only on returns, neglecting the variance. Our study is the first that takes into consideration both factors and that shows how much they contribute to variation in earnings.

To estimate the relative effect of the two factors, we first estimate Mincer-like earnings equations with dummies for type of education (vocational, academic, mixed) and subject area (Commercial, Health, STEM, Social & Service, Mixed Fields). Second, we decompose the variance in earnings for type of education and subject area and show how much the two factors contribute to the variance in earnings. We use the Swiss Adult Education Survey from 2011 and construct a sample of about 1200 individuals having a tertiary level educational degree.

The results of the Mincer-like earnings equation show that both type of education and subject area have a statistically significant impact on the returns to education. The results of

the variance decomposition show that 9% of the explained variance in earnings is attributable to the type of education, whereas nearly 17% is attributable to the subject area. Consequently, subject area explains almost double the variation in earnings.

Our analysis is of high policy relevance in the context of study choices, especially for countries whose educational systems include a strong vocational component. On the one hand, our results show that variation in earnings relates more to the subject area than to the type of education, meaning that the choice for a subject area, a specific field of education, is at least as important as the choice for a specific type of education. On the other hand, our results show that tertiary vocational education, as well as the combination of vocational and academic education is lucrative. Hence, upper secondary vocational education is not a dead end. As a consequence, the question of which type—academic or vocational—an individual chooses is less relevant than the question of which field he or she chooses to specialize in.

Future research might focus on potential differences among women and men. In addition, further analyses might focus on whether results for the factor type of education are consistent within each subject area, as well as on whether results for the factor subject area are consistent within type of education.

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Appendix: The Swiss Educational System

After nine years of compulsory schooling, students about ages 15, 16 choose either a vocational or an academic upper secondary education. Approximately 60% of all Swiss students choose a dual-track Vocational Education and Training program (VET) (SKBF 2010, p. 112). These programs combine on-the-job training in the form of a paid apprenticeship in a host company, with theoretical teaching at school. Graduates receive an "Advanced Federal Certificate" and continue working as skilled workers within their respective occupational fields, in either the training company or a new one (Tuor & Backes-Gellner, 2010, p. 498).[19]

Individuals with an upper secondary vocational degree have several options for tertiary education. On the one hand, they can continue following the vocational track, because the Swiss educational system offers a variety of opportunities with different objectives. First, individuals having obtained a Federal Vocational Baccalaureate during or after an upper secondary VET program have access to Universities of Applied Science. While these Universities of Applied Science have a status equal to conventional universities, their focus relative to teaching and research is different, because they emphasize practically oriented and applied research and development. Therefore, the studies they offer focus on practice, include general vocational training, and prepare their students for occupations that require the application of scientific knowledge and methods.

Second, VET graduates can acquire competencies needed in demanding occupational activities or activities with high responsibilities in Professional Education and Training colleges. Professional Education and Training colleges provide nationally approved core curricula that enhance technical and managerial expertise in the student's occupational field. Admission requirement are a VET degree, a Federal Vocational Baccalaureate or a Baccalaureate, as well as a certain amount of professional experience and/or a goal score on an aptitude test.

Third, Federal Professional Education and Training Diploma Examinations and Advanced Federal Professional Education and Training Diploma Examinations ("Meisterprüfung") constitute another tertiary vocational education option. These examinations assess whether candidates are able to perform demanding management-related

[19] Beyond these apprenticeships, an additional 10% of students go to full-time VET schools after compulsory education. Less than 5% of all students attend an upper-secondary specialized school (SKBF 2010, p. 17). Full-time VET schools do not offer work-based training, a characteristic peculiar to apprenticeship programs. Upper-secondary specialized schools provide both, an extensive general education and occupation specific knowledge, and prepare students for further professional education and training on the vocational tertiary level. In addition, upper-secondary specialized schools offer an upper-secondary specialized Baccalaureate for a specific occupation.

or technical activities. The Advanced Federal Professional Education and Training Diploma Examinations are more challenging, as they test field expertise of the candidate or his or her ability to manage independently a small or medium-sized business. Admission requirements for the Examinations are the equivalent of those of Professional Education and Training colleges. However, as opposed to Professional Education and Training college curricula, the Examinations' curriculum is not nationally approved. Only the mode and the content of the Examination are federally recognized.

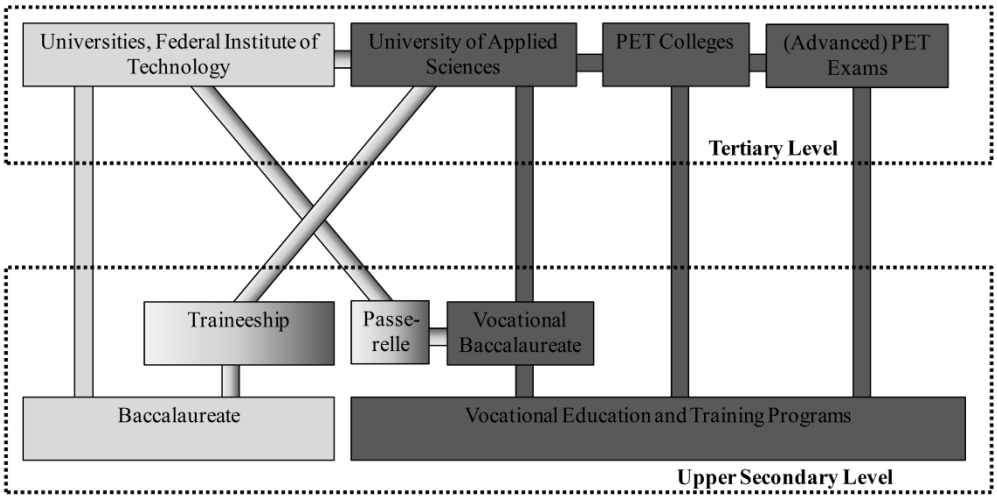
On the other hand, individuals with a VET degree can choose academic tertiary education, because a Federal Vocational Baccalaureate in combination with a good score on the University Aptitude Test allows access to academic tertiary institutions. Approximately 3% of the 2006 cohort of upper secondary students having a Federal Vocational Baccalaureate Degree enter a tertiary academic institution this way (Gallizzi, 2013, p. 9). In addition, students having a Bachelor's degree from an University of Applied Sciences can start with a Master's degree program at a conventional academic institution at the tertiary level.

In contrast to other Western countries, only around 20% of Swiss students completing compulsory schooling actually choose the academic track, i.e., obtain a Baccalaureate (SKBF 2010, p. 17). This Baccalaureate allows its holders unrestricted access to all tertiary academic institutions in Switzerland, i.e., universities and Federal Institutes of Technology. Moreover, if they complete a traineeship in their intended field of study, individuals with a Baccalaureate degree also have access to Universities of Applied Sciences.

Figure A1 presents the Swiss educational system.[20] It shows that the system provides vocational and academic education at the upper secondary and the tertiary levels, and allowing for permeability between and within the two levels.

[20] Universities of Teacher Education, as well as upper-secondary specialized schools are not included in the illustration, as these institutions are not relevant for our analysis.

Figure A1: The Swiss Educational System



Source: Own illustration, based on SKBF, 2007; SKBF, 2010; SKBF, 2014.

Table A1: Subject Area of education and ISCO

Subject Area	ISCO-08 classification
Commercial	1, 24, 261, 2631, 33, 3411, 4, 52
Health	22, 2634, 32, 53
STEM	21, 25, 31, 35
Social & Service	262, 2632, 2633, 2635, 2636, 264, 265, 3412, 3413, 342, 343, 51, 54
Excluded: MAN	6, 7, 81, 82, 83, 9

Source: Own illustration, based on Bundesamt für Statistik (2003) and International Labour Organization (2008)

Table A2

	ln(earnings)			
	Spec. 1	Spec. 2	Spec. 3	Spec. 4
Vocational	Base Group		Base Group	Base Group
Academic	0.0703**		0.1122***	0.1437***
	(0.0324)		(0.0345)	(0.0344)
Mixed	0.0483		0.0759**	0.1062***
	(0.0381)		(0.0380)	(0.0375)
Commercial		Base Group	Base Group	Base Group
Health		-0.0890**	-0.1047**	-0.0245
		(0.0421)	(0.0422)	(0.0421)
STEM		-0.0402	-0.0625*	-0.0883**
		(0.0365)	(0.0371)	(0.0364)
Social & Service		-0.3221***	-0.3512***	-0.3001***
		(0.0515)	(0.0521)	(0.0511)
Mixed Field		-0.0769*	-0.0459	-0.0227
		(0.0429)	(0.0438)	(0.0424)
Experience: 0-2 years	Base Group	Base Group	Base Group	Base Group
Experience: 3-5 years	0.1026*	0.0820	0.0805	0.0678
	(0.0538)	(0.0532)	(0.0530)	(0.0514)
Experience: 6-8 years	0.2216***	0.2098***	0.2000***	0.1995***
	(0.0523)	(0.0516)	(0.0515)	(0.0500)
Experience: 9-13 years	0.2888***	0.2644***	0.2659***	0.2677***
	(0.0526)	(0.0520)	(0.0518)	(0.0506)
Experience: 14-18 years	0.3556***	0.3455***	0.3460***	0.3286***
	(0.0545)	(0.0538)	(0.0536)	(0.0522)
Experience: 19-25 years	0.3295***	0.3191***	0.3136***	0.2992***
	-0.055	(0.0538)	(0.0536)	(0.0523)
Experience: > 26 years	0.3715***	0.3503***	0.3510***	0.3256***
	-0.054	(0.0532)	(0.0530)	(0.0521)
German				Base Group
French				-0.0442
				(0.0290)
Italian				-0.1759***
				(0.0562)

Gender (Men)				0.2023***
				(0.0315)
Self-employed				-0.0421
				(0.0451)
Foreign				-0.0977***
				(0.0329)
Parttime				-0.0788**
				(0.0326)
Constant	11.2239***	11.3468***	11.2890***	11.2411***
	(0.0434)	(0.0437)	(0.0473)	(0.0495)
Adjusted R-squared	0.0636	0.0902	0.0971	0.1631
R-squared	0.0700	0.0981	0.1065	0.1761
N	1161	1161	1161	1161
Prob>F	0.000	0.000	0.000	0.000

Source: Own calculations, based on CH-AES; standard errors are reported in parentheses; * statistically significant at the 0.1 level; ** at the 0.05 level; *** at the 0.01 level

Table A3

	Variance Decomposition	
	Variance	Share of explained
Total Variance of ln(Earnings)	0.2438	0.1761
Components of Variance:		
Type of Education	0.0040	9.36
Subject Area	0.0072	16.72
Experience	0.0140	32.68
Gender (Male)	0.0102	23.86
Linguistic Region	0.0019	4.48
Self-Employed	0.0002	0.37
Foreign	0.0017	4.04
Part-Time	0.0014	3.22
Components of Covariance		
Cov(Type, Subject Area)	-0.0023	-5.38
Cov(Type, Gender)	0.0001	0.28
Cov(Type, Linguistic Region)	-0.0007	-1.66
Cov(Type, Self-Employed)	-0.0001	-0.17
Cov(Type, Foreign)	-0.0012	-2.70
Cov(Type, Part-Time)	0.0000	0.04
Cov(Type, Experience)	0.0002	0.55
Cov(Subject Area, Gender)	-0.0004	-0.98
Cov(Subject Area, Linguistic Region)	0.0008	1.84
Cov(Subject Area, Self-Employed)	0.0001	0.14
Cov(Subject Area, Foreign)	0.0002	0.43
Cov(Subject Area, Part-Time)	0.0006	1.38
Cov(Subject Area, Experience)	0.0001	0.20
Cov(Gender, Linguistic Region)	0.0000	-0.09
Cov(Gender, Self-Employed)	0.0000	-0.03
Cov(Gender, Foreign)	0.0001	0.20
Cov(Gender, Part-Time)	0.0034	8.00
Cov(Gender, Experience)	0.0030	6.90
Cov(Linguistic Region, Self-Employed)	0.0000	0.06
Cov(Linguistic Region, Foreign)	0.0001	0.14
Cov(Linguistic Region, Part-Time)	0.0000	0.06
Cov(Linguistic Region, Experience)	-0.0008	-1.93
Cov(Self-Employed, Foreign)	0.0000	-0.11
Cov(Self-Employed, Part-Time)	0.0000	0.08
Cov(Self-Employed, Experience)	-0.0004	-0.84

Cov(Foreign, Part-Time)	-0.0003	-0.74
Cov(Foreign, Experience)	0.0001	0.14
Cov(Part-Time, Experience)	-0.0002	-0.54

Source: Own calculations, based on CH-AES