Rates of Return and Risk-Return Trade-Offs to Different Educational Paths: Vocational, Academic and Mixed*

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Abstract

This paper investigates the rates of return and the risks of different types of educational paths (after compulsory education). We distinguish a purely academic educational path from a purely vocational path and a mixed path with loops through both systems. We use Lazear's jack-of-all-trades theory on entrepreneurship to derive hypotheses about the labour market outcome attached to different types of educational paths. We expect the outcome to be systematically different for entrepreneurs vs. employees: entrepreneurs are required to have a broad range of skills which the labor market rewards with a premium for broadness; employees are specializists who are within firms combined with other specialized employees who all earn an income according to their highest level of spezialized skill. Accordingly, we expect a broader educational background to pay for individuals who become entrepreneurs but not for employees. In contrast, individuals with strongly specialized educational backgrounds are better off becoming employees. Our hypotheses are tested based on the Swiss Labor Force Survey (SLFS). We calculate the rate of return and the risk associated with different types of educational paths and find our empirical results to be consistent with our hypotheses.

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1. Introduction

Although it is has been shown over and over again that type and level of education crucially determine an individual's labor market success, we know almost nothing about the labor market value of combinations of different types of education. On the one hand, there are individuals entering the labor market who have either taken a purely academic or a purely vocational educational path. On the other hand, we also observe a considerable number of individuals whose educational path includes a loop through both systems. Thus, it is neither adequate to just include the highest educational degree nor is it adequate to ignore different types of paths an individual can take to receive its complete bundle of educational degrees and knowledge. In our study we therefore compare the labor market value of different types of educational paths particularly including mixed educational path (i.e. the above mentioned combinations of both types of education). The question we are primarily interested in is whether mixed educational paths happen to be a detour or whether they are even rewarded in the labor market and - if they are rewarded - for whom? This is of particular importance given that in many countries the first educational decisions have to be taken in a very early age which may induce an interest or a need for corrections in later stages. Consequently, especially in countries with early tracking this is a very important policy issue.

However, evidence on the labor market value of different types of educational paths in general and on the comparison of straight versus mixed educational paths in particular is virtually nonexistent. There is one exception we are aware of[1]: Dearden et al. (2002) demonstrate that a purely academic curriculum is associated with a higher wage premium than a purely vocational curriculum. It should, however, be noted that once the authors take account of years of study an educational path leading to higher-level vocational qualifications compares favorably to a purely academic curriculum. Interestingly, the authors additionally provide some evidence indicating that combinations of academic and vocational qualifications do not yield an unusually high wage premium.

To study the effect of different types of educational paths we use Lazear's jack-of-all-trades theory on entrepreneurship to derive hypotheses about the labour market outcome attached to different paths. We expect the outcome to be systematically different for entrepreneurs and employees. Following Lazear's (2005) jack-of-all-trades theory, occupations for entrepreneurs are typically characterized by a broad range of skill requirements and a

[1] Sociological research on complete educational paths concentrates on the impact of social inequality (e.g. see Hillmert/Jacob 2003) and is thus not within the scope of this study. Moreover, we explicitly focus on education and, thus, consciously abstract from life-long learning in this study. For the impact of the attainment of different qualifications (formal education or training) later in life see e.g. Conlon (2005).

balanced set of skills is rewarded by an income premium on the labor market. In contrast, employees are considered to be specialists who are required to have specialized knowledge in a limited number of skills. Specialized employees are within firms combined with other specialized employees who all earn an income according to their specialization level. Accordingly, individuals with a broader set of skills are better of becoming an entrepreneur and should earn an income premium in comparison to an employee with the same set of broad skills. Likewise, individuals with a strongly specialized set of skills are better off becoming employees and suffer from a lack of skill broadness as entrepreneurs.

In our paper we use these implications to study the labor market outcome of different types of educational path, i.e. pure vocational, pure academic or mixed vocational and academic. We test our implications based on the Swiss Labor Force Survey (SLFS), which not only covers the whole educational path of an individual (which is a necessary prerequisite for our study) but also provides a broad enough spectrum of different types of educational paths in order to test the effect of differences in educational paths on labor market outcomes. We calculate the rate of return and the risk associated with different types of educational paths and find our empirical results to be consistent with our hypotheses.

Taken together our study is innovative in at least three ways. First, it presents a theoretical framework that explains a labor market premium to mixed educational paths under well specifiable conditions. Second, it goes beyond the existing empirical evidence on the jack-of-all-trades theory[2] by distinguishing different types of educational paths and by analyzing their returns according to the jack-of-all-trades theory. Third, we also investigate whether different educational paths are characterized by different risk-return trade-offs. So far, a few studies have already shown that individuals have to be compensated for risk associated with their educational decision (see e.g. Hartog 2005, Hartog/Vijverberg 2007a). Some studies have analyzed the risk-return properties focusing on the level of general education (Palacios-Huerta 2003), the level and field of education (Christiansen et al. 2007) or on labor market skills (Hartog/Vijverberg 2007b). However, it has not been analyzed whether there are systematic differences in the risk-return trade-off of vocational and academic education or a combination thereof.

The paper proceeds as follows: we first briefly describe the Swiss schooling system in order to be able to characterize the breath of different types of educational paths. In the subsequent chapters we present the main arguments of the jack-of-all-trades theory with respect to our study and analyze empirically whether there are differences in the return to education that are

[2] The existing empirical evidence so far supports the jack-of-all-trades aspect of entrepreneurship. See e.g. Lazear 2005 for U.S., Wagner 2003 or Wagner 2006 for Germany.

consistent with the theory. Moreover, we investigate the respective differences in the risk-return trade-off. The paper finishes with a summary and some preliminary policy implications.

2. The Swiss schooling system

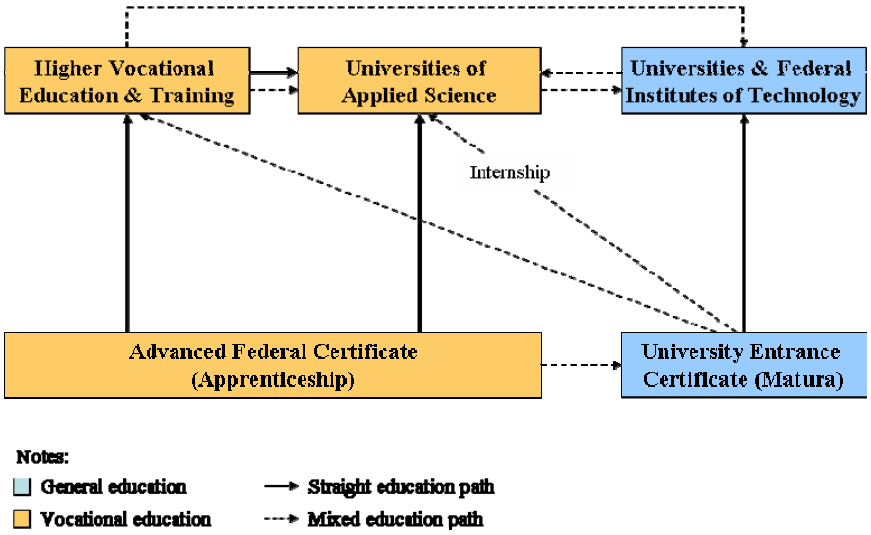
As in many countries the school system in Switzerland consists of parallel branches of vocational and academic (school or college) education. Having completed 9 years of compulsory school, two third of a youth cohort choose to pursue vocational education and training (OPET 2007), mostly within the so-called dual system of apprenticeship training with an on-the-job training component and a theoretical component taught at respective vocational schools. They receive an "advanced federal certificate" after graduation. Afterwards, most of them work as a skilled worker within their occupational field in the company they were trained or in a new company. However, they also have several options to continue their education. They may choose to go into *higher vocational education* and attend a "higher vocational education & training school" or a "university of applied sciences".[3] We will call this the *straight vocational educational path* in the following. Or, they may also choose to switch to the academic side of the educational system. This will be denoted as a *mixed educational path* with a university degree as the highest educational outcome.

Another alternative for students after compulsory education is to stay in the school system, attend gymnasium and obtain a "Matura" which gains them access to *higher academic education*, i.e. to all universities and to the prestigious federal institutes of technology. We will call this the *straight academic educational path* in the following. After gymnasium students may alternatively choose to switch to the vocational side of the educational system and thereby as well combine academic and vocational education denoted as a *mixed educational path* but with a vocational degree as the highest educational outcome. Figure 1 gives a simplified diagram of the Swiss educational system.[4]

[3] Due to various changes in the sector of higher tertiary education we will not distinguish between the two types of higher vocational education in the following.

[4] A detailed description of the educational system in Switzerland can be found in Weber et al. (2001: 285-287).

Figure 1: Swiss educational system



3. Labor market values of different educational paths

3.1 Theoretical analysis: the value of different skill bundles according to Lazear's jack-of-all-trades theory

In analogy to Lazear's (2005) jack-of-all-trades theory on entrepreneurship, we present a theoretical framework that provides an explanation for a labor market premium attached to mixed educational paths for entrepreneurs but not for employees. Lazear (2005) analyzes the occupational choice to become an entrepreneur as opposed to becoming an employee. His main argument is that in order to be a successful entrepreneur individuals have to be sufficiently skilled in a variety of areas while persons who work for others should specialize and excel in one type of skill. Accordingly, the model predicts that the probability of becoming an entrepreneur is greater for individuals with more balanced skills. According to Lazear (2005), we formalize our theoretical framework as follows: there are two types of skills, denoted x_1 and x_2. The return to skills depends on the type of professional status. On the one hand, occupations for employees are characterized by a job profile that requires specialized knowledge and is limited to a small number of skills. In these specialist occupations, the income is solely determined by the dominant skill, i.e. the skill in which a person has specialized and is thus generated by a so-called perfect substitute income function:

$$\text{Specialist income} = \max [x_1, x_2] \qquad (1)$$

On the other hand, in occupations for entrepreneurs both types of skills are required and the return depends on the weakest skill multiplied by a price parameter λ which represents the

labor market value of a specific bundle of skills. The jack-of-all-trades aspect is thus captured in a perfect complements income function (corresponding to a Leontief production function)[5]:

$$\text{Balanced income} = \lambda \min[x_1, x_2] \quad (2)$$

Taken together, an individual chooses to become an entrepreneur if and only if:

$$\lambda \min[x_1, x_2] > \max [x_1, x_2] \quad (3)$$

The occupational choice subject to the level of endowment of the two skills is now illustrated by means of the different types of educational paths. First we have the case of a straight vocational educational path. Persons who acquire vocational education are assumed to specialize in one type of skill, e.g. electricians know everything about electrical utilities, or hairdresser know everything about hairdressing, and bank clerks know everything about bank accounts, but each of them is typically restricted to his or her particular field. Thus, individuals with purely vocational educational paths are specialists according to Lazear's typology. They possess a high level of one particular skill (x_1) but no (or a low level) of other skills (x_2=0).[6] The condition to become an entrepreneur is not met:

$$\lambda x_2 = \lambda 0 < x_1 \quad (4)$$

Individuals with a straight vocational path are therefore expected to choose to become an employee receiving an income which is determined by their highest vocational degree. Secondly, we have the case of a straight academic educational path. We assume that academic education is typically not occupation specific but consists of know-how that is transferable to different types of occupations and job requirements. Academic education largely consists of general analytical skills which are helpful to analyze and solve a broad variety of real world problems. Therefore, we assume that individuals with purely academic educations are less specialized than individuals with purely vocational educations. Since those with a purely academic educational path have passed a number of different stages of academic education with different foci each, we categorize individuals with a purely academic educational path still as non-specialized. They are more likely to become an entrepreneur because

$$\lambda x_1 > x_2 \quad (5)$$

and we expect to see an income premium if these individuals are entrepreneurs.

The decision to become an entrepreneur crucially depends on the level of the parameter λ which is driven by demand and supply of entrepreneurial skill portfolios. If demand for a particular skill portfolio is high but supply of this particular skill portfolio is low the entrepreneurial premium λ is larger. In contrary, if demand for a particular portfolio is low but

[5] It should be noted that both income functions are derived from a more fundamental production function. The proof is given in Lazear (2005, 676-678).

[6] The knowledge imparted in vocational education is of course not limited to one specific skill. But in this simplified framework it has a comparatively high level of specialization as its main advantage.

supply is high the entrepreneurial premium λ is low. Given that in the educational system we analyze, i.e. the Swiss educational system, the availability of academic skills is rather scarce with for example in the year 2002 only app. 10% of the population having a university degree, we expect a rather large entrepreneurial premium for individuals with an academic degree.

Thirdly, we look at combinations of academic and vocational qualifications. Given that mixed educational paths consist of a higher variety of skills than straight educational paths, the probability to become an entrepreneur is higher and we expect income for mixed educational paths to be higher for entrepreneurs than for employees. Thus, the hypothesis to be tested can be separated into three parts and is as follows:

H1: First, individuals with mixed educational paths as entrepreneurs earn more than as employees. Secondly, individuals with purely academic educational paths as entrepreneurs are rewarded with an income premium compared to employees. Thirdly, specialized individuals, i.e. with a purely vocational educational path are better of as employees and receive higher earnings. (6)

However, for the individual educational decision we expect lifetime earnings to be the crucial determinant and, thus, we additionally test our implications considering costs and benefits associated with various educational decisions.

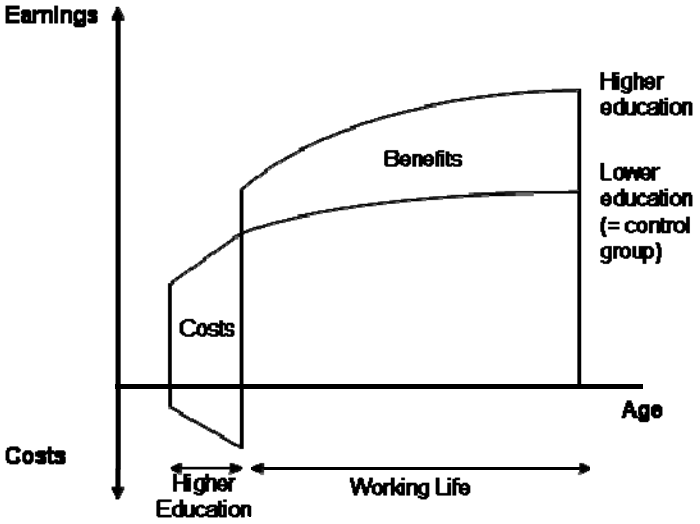
3.2 The cost-benefit model to explain individual educational decisions

In order to analyze the individual educational decision and to compare the rates of return to different educational paths, we use the cost-benefit model presented in Psacharopoulos (1987, 1995). We are interested in the private rates of return (as opposed to social rates of return) and focus on costs and benefits to the individual making the investment in human capital. The so-called opportunity costs comprise the major part of the total costs. As long as individuals attend school, they forgo earnings which individuals with the next lower level of education are paid. Obviously, there are also costs directly related to education, such as tuition fees, but compared to foregone earnings they are almost negligible.[7] While the costs of education are mostly incurred directly after compulsory school and thus during a comparably short time period, benefits are expected to accrue over the life-cycle. The benefits consist of the wage premium associated with having completed the next higher level of education (i.e. the difference between the earnings of more educated individuals compared to a control group involving individuals with less education.). As an example, Figure 2 shows the age-earnings

[7] Although this statement might not be generally true it certainly applies to Switzerland where a substantial part of the educational costs are incurred by the state.

profiles for individuals with higher education compared to those with the next lower level of education that form the control group.

Figure 2: The cost-benefit model



Source: Own diagram following Psacharopoulos (1987, 1995).

In order to compare the profitability of different educational paths our analysis relies on the approach presented by Psacharopoulos (1987): benefits and costs are discounted to a common point in time. The parameter of interest is the so-called internal rate of return, i.e. the discount rate at which the sum of discounted costs and the sum of discounted benefits exactly offset each other:

$$\sum_{t=1}^{T} \frac{(W_{HE} - W_{LE})_t}{(1+r)^t} = \sum_{k=1}^{K} \frac{(W_{LE} + C_{HE})_k}{(1+r)^k} \qquad (7)$$

where $(W_{HE}\text{-}W_{LE})$ is the wage premium for higher education *(HE)* compared to the wage of those who did not pursue higher education after completion of lower education *(LE)*. This wage premium accrues from the time the higher education is completed $(t=1)$ until retirement *(T)*. The right hand side of equation (7) represents the direct costs C_{HE} as well as opportunity costs W_{LE}. As already noted, the parameter of interest is the rate r at which the sum of discounted benefits and the sum of discounted costs equalize. This internal rate of return, thus, indicates the profitability of an investment in education.[8] The higher the internal rate of return, the more profitable the investment.

Concerning the educational system analyzed in this study there are two important facts to be mentioned: on the one hand, vocational educations are usually associated with a lower full-time equivalent of study than academic educations. On the other hand, mixed educational

[8] See Psacharopoulos (1987: 345) for a discussion why rate of return measures are typically used in cost-benefit studies (instead of calculating the net present value).

paths leading to the same type of tertiary education as straight educational paths consist of additional qualifications associated with a longer time of study. Therefore, in terms of the individual educational decision, we additionally test the following hypothesis:

H2: Considering time of study, educational paths with vocational education compare favorably to educational paths with academic education and the profitability of mixed educational paths is reduced in comparison to straight educational paths. (8)

3.3 Risk-return trade-offs

Since human capital investments not only involve differences in average income and internal rates of return respectively but also in income variance or risk, we are interested to see whether there is also a typical risk-return trade-off and whether these trade-offs differ dependent on the educational path chosen.[9] Theoretically, one would expect higher average earnings to be associated with a higher risk, therefore we expect to see that higher earnings are accompanied by higher income variance. Since entrepreneurs are typically assumed to have a higher risk tolerance we expect to observe a higher variance of income among entrepreneurs (all else equal) associated with a high average income. However, we expect that entrepreneurs are satisfied with a smaller entrepreneurial average income premium given a particular risk level. Therefore, the above stated hypotheses have to be specified:

H3: Generally, the higher the internal rate of return the higher the risk associated with a certain type of educational path. In particular, entrepreneurs receive a lower compensation for risks than employees. (9)

4. Methods to estimate returns and risks to different educational paths

To measure the rates of return and earnings risk to different educational paths we estimate a simple Mincer earnings function in the first step. Based on this estimation we then calculate internal rates of return for each educational path. As an alternative we use a nonparametric estimation procedure. Finally, we calculate the risks associated with different educational path and investigate the respective differences in the risk-return trade-off.

[9] Besides, there is also the risk of dropping out of school and the risk of becoming unemployed (see e.g. Wolter/Weber 1999a, Wolter/Weber 1999b). The latter will be considered in our empirical analysis. Unfortunately, there is no information available about the risk of dropping out of school separately for individuals distinguished by educational path, and, thus, the risk of dropping out of school cannot be considered.

4.1 Empirical analysis of the value of different skill bundles

To study earnings differences of various types of educational paths we included additional dummy variables (instead of using the continuous years of schooling variable) into the well-known earnings function of Mincer (1974). The basic equation we estimated can be written as:

$$\ln earnings = \alpha + \sum_i \beta_i \cdot educdum_i + \sum_{z=1}^{2} \chi_z \cdot \exp^z + \sum_i \sum_{z=1}^{2} \delta_{iz} \cdot educdum_i \cdot \exp^z + \varepsilon \quad (10)$$

We estimated an ordinary least square regression using the natural logarithm of earnings as dependent variable and several dummy variables (*educdum*) indicating different educational paths (i.e. especially various mixed educational pathways) and a quadratic function of experience (*exp*) as independent variables. In addition, we included interaction terms for education variables and experience as the experience-earnings profiles are assumed to vary by educational pathway.[10]

In order to test the above explained jack-of-all-trades theory for different types of educational paths we also estimated a different specification of the extended Mincer earnings function by including a dummy variable indicating an entrepreneur or an employee and interaction variables with the educational paths dummies. Thus, the second specification looks as follows:

$$\ln earnings = \alpha + \sum_i \beta_i \cdot educdum_i + \gamma \cdot entpr + \sum_i \eta_i \cdot entpr \cdot educdum_i + \sum_{z=1}^{2} \chi_z \cdot \exp^z + \sum_i \sum_{z=1}^{2} \delta_{iz} \cdot educdum_i \cdot \exp^z + \varepsilon \quad (11)$$

Equations (10) and (11) show that our set of independent variables is strongly restricted to education and experience variables as well as the professional status involved in the educational decision because including additional control variables (which are affected by the original educational decision) would result in biased estimates. Pereira/Martins (2001) show that including covariates representing post-educational decisions results in an underestimation of the impact of education on wages.

With respect to the two potential biases typically discussed in connection with returns to education, i.e. ability bias and measurement error (Griliches 1977, Card 1999), we assume that in empirical studies they are more or less canceled out as for example shown in a study of

[10] The existence of different experience-earnings profiles by educational attainment has already been shown by Psacharopoulos/Layard (1979) and has recently been confirmed by Brunello/Comi (2004) for several European countries including Switzerland.

Dearden (1999): the effect of omitted ability and family background completely cancels out the bias associated with measurement error and composition bias.[11]

4.2 The cost-benefit model: rates of return to different types of educational paths

Since we are interested in net returns we cannot ignore that different educational paths differ in length and, as a result, in opportunity costs. Thus, we used the cost-benefit model presented in the previous chapter (3.2) to calculate net rates of return. We started with estimating the above mentioned earnings function (11). Based on the estimated coefficients, in a second step we then predicted age-earnings profiles for each educational path, separately for entrepreneurs and employees. In order to take into account opportunity costs, the earnings function was also estimated for individuals in the "control" group, i.e. those who stopped one step earlier in the respective educational path. Based on the estimated coefficients we again predicted age-earnings profiles for the control group. Following Psacharopoulos (1995: 8), we smoothed out the age-earnings profiles by moving averages and adjusted the estimated age-earnings profiles to anticipated real growth in earnings, unemployment and taxes. In a third step, we could then calculate the internal rates of return (IRR) based on the adjusted age-earnings profiles for each educational path, and in addition separately for entrepreneurs and employees. The IRR is the discount rate at which the streams of future benefits and costs cancel each other out. This measure allows a direct comparison of the profitability of different educational strategies.

Recently, the Mincer specification has become under criticism (see e.g. Heckman et al. 2008). It has especially be shown that the relationship between experience and earnings cannot simply be represented by a quadratic function (see e.g. Murphy/Welch 1990). Therefore, we alternatively use a nonparametric estimation procedure: we perform separate estimations for each educational path by professional status using locally weighted regression (Cleveland 1979). This procedure does not require the specification of a global function but smoothes the scatterplot of experience and earnings.

4.3 Estimating the income risks to different types of educational paths

To measure the income risk of an education decision Hartog/Vijverberg (2002) have derived various risk measures. We use the average squared coefficient of variance which measures the risk by the variations in relation to the respective level of income (because the same amount

[11] It is usually supposed that not controlling for ability or "good" family background leads to an upward bias of the estimated return to education, whereas measurement error in education and the fact that people self-select into the labor market is expected to be associated with a downward bias.

of variation has more severe consequences for small incomes than for large incomes). This risk measure is calculated as follows:

$$R_j = \frac{1}{N_j}\sum_{i=1}^{N_j}\left(\frac{Y_{ij} - \hat{Y}_{ij}}{\hat{Y}_{ij}}\right)^2 \qquad (12)$$

i.e. it uses the average squared ratio of the standard deviation (true earnings (Y) minus predicted earnings ($\hat{Y}$)) to the mean of predicted earnings ($\hat{Y}$).

5. Data: the Swiss Labor Force Survey (SLFS)

The Swiss Labor Force Survey has been conducted annually since 1991 and includes a representative sample of Swiss households. The main idea is to collect information about (individuals') working lives and the labor market in general. The SLFS is particularly suitable for answering the questions raised in this study. On the one hand, individuals' complete educational paths are reported in detail and individuals are asked to report their current professional status. On the other hand, the data set provides information about various labor market outcomes such as yearly (net) earnings or unemployment risk. The analysis is based on the surveys from 1999 to 2005. It should be mentioned that the SLFS is a rotating panel and, although the panel structure cannot be used in the present study[12], we have to control for the fact that people stay in the survey for several consecutive years.

The present study focuses on people who have completed higher tertiary education, be it vocational or academic.[13] We start by identifying the main educational paths leading to a tertiary educational degree. The most frequently used educational paths are presented in Table 1. To keep matters simple, we distinguish four groups of educational paths depending on whether the entrance was vocational or academic and whether the last educational step (the exit) was vocational or academic.

[12] The fraction of people that can be identified before and after having completed some education is far too small to be used for an empirical analysis.

[13] As there is no vocational equivalent to writing a dissertation after higher academic education, individuals with a doctoral degree are not included in our analyses.

Table 1: Educational paths categorized by type and order of educational degrees

Entry \ Exit	Vocational	Academic
Vocational	**Typ I, purely vocational (64 %)** *Advanced Federal Certificate (Apprenticeship) + Higher Vocational Education & Training/ Universities of Applied Sciences*	**Typ II, mixed, with vocational entry (4 %)** *Advanced Federal Certificate (Apprenticeship) + University Entrance Certificate (Matura) + Universities & Federal Institutes of Technology* *Advanced Federal Certificate (Apprenticeship) + Higher Vocational Education & Training/ Universities of Applied Sciences + Universities & Federal Institutes of Technology*
Academic	**Typ III, mixed, with academic entry (9 %)** *University Entrance Certificate (Matura) + Higher Vocational Education & Training/ Universities of Applied Sciences* *University Entrance Certificate (Matura) + Universities & Federal Institutes of Technology + Higher Vocational Education & Training/ Universities of Applied Sciences*	**Typ IV, purely academic (23 %)** *University Entrance Certificate (Matura) + Universities & Federal Institutes of Technology*

Note: The percentages add to 100% and therefore solely refer to the sample of Swiss full-time employed males with one of the above described well-defined educational paths.

Although straight educational paths constitute the vast majority, mixed educational paths are not an unusual phenomenon; there is a considerable number of people who combine academic and vocational qualifications. Among those with a higher tertiary education more than 10 % completed academic and vocational qualifications somewhen along their educational pathway (Typ II and III). This can be interpreted as a first indication for the permeability of the educational system. Approximately 12% of individuals who hold a higher vocational educational degree started with an academic education and app. 15% of individuals with an academic exit have started with an initial vocational education. Interestingly, educational paths with repeated loops through both types of educations are very rare and are thus not included in our analyses.[14]

In order to assess the labor market outcomes of various educational paths we analyze net returns, more precisely the level of earnings as well as the rates of return, for these four groups. As explained in the previous chapter predicted age-earnings profiles are adjusted by unemployment rate and a real growth rate.[15]

[14] This also holds true for the prevalent and extensively analyzed (see e.g. Büchel/Hellberger 1995 or Lewin et al. 1996) phenomenon of high school graduates to complete an apprenticeship before starting university, well known from Germany (a country with a similar education system).

[15] Switzerland has a comparatively low average unemployment rate with around 3.5% in 2007 and individuals with tertiary education have a lower than average risk of unemployment (see Table A1 in the Appendix). The

Turning to the costs associated with a particular educational path there are direct costs as well as opportunity costs. In Switzerland the latter are by far the most important costs because there is no tuition for initial academic or vocational education (as both types of education are public funded or in case of apprenticeship provided by the companies free of charge). Thus, the profitability of an educational strategy crucially depends on opportunity costs, measured by earnings of individuals who stopped one step earlier on their educational pathway. It is therefore important to get as detailed information as possible about the length of study and the age of entry into the labor market. Our data provide information on the age at which an individual has completed its latest education. The mode is used as the typical age of entry into the labor market in order to calculate average age-earnings profiles. Additionally, we assign an average length of study to each type of education based on data from the Swiss Federal Statistical Office.[16] As the vast majority of individuals retire at the age of 65, independently from the affiliation to one of the four educational groups and also independent from the professional status, we decided to use the same retirement age for the whole sample analyzed. Based on these data we are now able to compare discounted benefits and discounted costs for each educational path.

For our analyses we select Swiss[17] full-time employed males between 20 and 64 years of age. This leaves us with 10606 observations. We categorize individuals who report to be self-employed or employed at their own company as entrepreneurs. This applies to approximately 22 % of persons analyzed in this study. For definitions and descriptive statistics of all variables used see Table A2 in the Appendix.

6. Results: labor market outcomes to different educational paths

6.1 Earnings

As described in Chapter 4 we start with the estimation of an "extended" Mincer earnings function. The results are shown in Table 2 separately for specification 1 (according to equation (10)) and specification 2 (according to equation (11)).

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average annual long-term real growth rate of wages in Switzerland was 0.5%. Detailed numbers are offered by the Swiss Federal Statistical Office. See http://www.bfs.admin.ch/bfs/portal/en/index.html. Finally, separately for each educational path and by professional status observations with earnings above the 99% percentile or below the 1% percentile are dropped in order that the results are not determined by outliers.

[16] These numbers are offered by the Swiss Federal Statistical Office. See http://www.bfs.admin.ch/bfs/portal/en/index.html.

[17] Including foreigners would not ensure comparability between the various educations completed.

Table 2: "Extended" Mincer earnings function

Net yearly earnings	Spec. (1)	Spec. (2)
Purely academic	Reference	Reference
Mixed with vocational entry & academic exit	0.2793***	0.2791***
	[0.0488]	[0.0487]
Purely vocational	-0.0060	0.0071
	[0.0293]	[0.0293]
Mixed with academic entry & vocational exit	0.1195**	0.1266**
	[0.0499]	[0.0493]
Entrepreneur (entpr.)		-0.0181
		[0.0333]
Mixed with vocational entry & academic exit * entpr.		-0.0015
		[0.0932]
Purely vocational * entpr.		-0.1340***
		[0.0378]
Mixed with academic entry & vocational exit * entpr.		-0.0346
		[0.0689]
Experience (exp)	0.0312***	0.0315***
	[0.0035]	[0.0035]
Experience squared (expsq)	-0.0006***	-0.0006***
	[0.0001]	[0.0001]
Mixed with vocational entry & academic exit * exp	-0.0276***	-0.0276***
	[0.0103]	[0.0103]
Mixed with vocational entry & academic exit * expsq	0.0005	0.0005
	[0.0004]	[0.0004]
Purely vocational * exp	-0.0223***	-0.0200***
	[0.0041]	[0.0040]
Purely vocational * expsq	0.0005***	0.0004***
	[0.0001]	[0.0001]
Mixed with academic entry & vocational exit * exp	-0.0158**	-0.0161**
	[0.0071]	[0.0071]
Mixed with academic entry & vocational exit * expsq	0.0003	0.0003
	[0.0002]	[0.0002]
_cons	11.2580***	11.2592***
	[0.0266]	[0.0267]
Prob > F	0.0000	0.0000
R^2	0.10	0.12
N	10606	10606

Notes: The test for joint significance of separate experience profiles by educational path can be rejected in both specifications. Cluster-robust std.errors are in parentheses. *Statistically significant at the 0.10 level; **at the 0.05 level; ***at the 0.01 level.

Source: Own calculations based on SLFS 1999-2005.

We find that among all educational paths ending with a tertiary degree, the mixed educational paths are associated with the highest level of earnings: earnings of individuals with mixed educational paths are significantly higher than with straight educational paths. The labor market obviously rewards the additional qualification(s) individuals gather while switching between the two sides of the educational system. Thus, individuals who decide to change the educational path taken initially are not just taken a detour but are rewarded by a higher income. The income premium compared to a purely academic educational path decreases over time which supports the importance of our empirical model that allows the experience-earnings profiles to differ by educational paths. Including a dummy variable for entrepreneurs

and interaction terms between this variable and the variables indicating different educational paths does not change the main findings of the pure education variables: earnings with mixed educational paths are higher than earnings with a straight educational path. If we look at the results for the interaction variables we find that a purely vocational educational path is associated with a significant income "penalty" for entrepreneurs. For all other interaction variables there are no significant results. These results are in line with the jack-of-all-trades theory arguing that a strong specialization in one type of skill only pays for employees but not for entrepreneurs whose earnings are based on their weakest skill. Thus our results strongly support hypothesis *H1*.

However, given the results from Table 2, there is one puzzle to be solved still, i.e. why mixed educational path which have the highest earnings outcomes are only chosen by a minority of the workforce and not by almost all if they pay so much? We argue that the puzzle can be solved by taking into account the different costs associated with different types of educational paths. Therefore, in the next section, we go one step further than the standard approach measuring labor market outcomes by Mincer earnings functions. We estimate and compare the internal rate of return for each educational path to additionally account for different costs associated with different educational paths.

6.2 Estimating rates of return to different types of educational paths

We calculate the internal rate of return based on Mincer earnings functions and alternatively based on earnings functions from a nonparametric approach. According to our theoretical model we also distinguish the internal rate of return for employees (empl.) and entrepreneurs (entpr.). Results are given in Table 3.

Table 3: Internal rates of return by educational path (and professional status)

	Spec. (1)		Spec. (2)			
	Based on Mincer earnings function	Based on non-parametric approach	Based on Mincer earnings function		Based on nonparametric approach	
			Empl.	Entpr.	Empl.	Entpr.
Purely academic	10.91%	10.30%	10.92 %	10.80 %	10.18 %	11.81 %
Mixed with vocational entry & academic exit	8.62%	8.45%	8.65 %	8.51 %	8.77 %	8.29 %
Purely vocational	13.96%	13.34%	15.25 %	8.05 %	14.33 %	9.05 %
Mixed with academic entry & vocational exit	18.37%	17.79%	18.50 %	17.29 %	17.75 %	18.10 %

Source: Own calculations based on SLFS 1999-2005.

We find that the picture for internal rates of return is different from the one we found comparing incomes. As soon as lifetime earnings are considered, a straight vocational path all of a sudden compares strongly favorably to a straight academic path (due to a shorter duration in full-time education and a lower foregone income associated with a straight vocational path). This helps to explain why in Switzerland a large fraction of a youth cohort decides to start their non-compulsory education within the vocational system. Regarding mixed educational paths we find that educational paths with an academic entry and a vocational exit are still the more profitable choice than straight educational paths. Although individuals with these mixed educational paths also suffer from foregone income while they start their education in the full-time academic system, they do not suffer severely from foregone income in the second phase of vocational education. In this phase they earn already comparatively high incomes due to the academic education they finished in the first part. In contrast, mixed educational paths with vocational entry and academic exit are the least favorable ones. The problem is that these educational paths mostly involve a change into full-time education in a later stage (i.e. after higher vocational education) in which individuals could have earned comparatively high incomes already. Thus, these individuals give up comparatively high potential earnings going back into full time academic education in a second stage. Although the estimation results using a nonparametric approach are somewhat different from the ones using the extended Mincer earnings function the general pattern remains the same. So overall, our results strongly support hypothesis *H2*: as soon as lifetime earnings are considered, purely vocational educational paths compare favorably to purely academic educational paths.

For the interpretation of differences between entrepreneurs and employees we focus on the estimation results based on the nonparametric approach: in this approach we allow age-earnings profiles to be different for entrepreneurs and employees, which we think is necessary given the very different income generating production functions we assume according to Lazear. The assumption is supported by the fact that the internal rate of return results of the two estimation methods differ most for entrepreneurs. If we look at the structure of the results we again find evidence in favor of the jack-of-all-trades theory: first, mixed educational paths with academic entry and vocational exit have a higher internal rate of return for entrepreneurs than for employees. This is in line with the jack-of-all-trades argument that the collection of a broader set of skills only pays for entrepreneurs but not for employees. Secondly, we also find an entrepreneurial premium for purely academic paths which confirms our results from the previous chapter and is again consistent with the jack-of-all-trades argument. For a purely

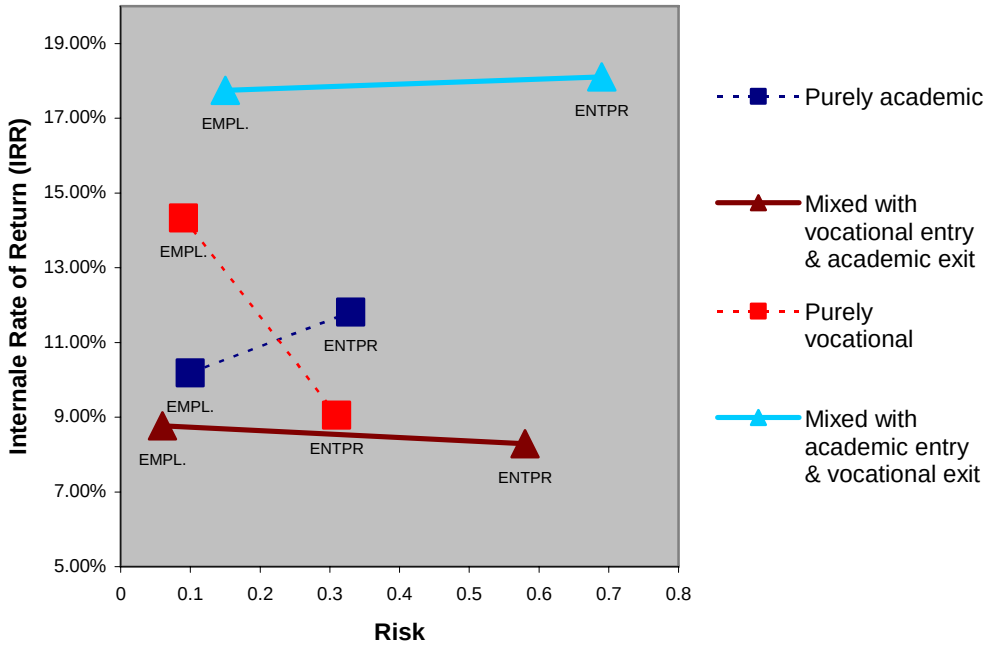
academic educational path the entrepreneurial premium is even higher than for a mixed path with an academic entry.

This indicates that the switch from an academic education in the first stage to a vocational education in a later stage of an educational path is also accompanied by a higher level of specialization. Hence, specialists are comparatively well off by being compensated based on their specialty and at the same time entrepreneurs gain comparatively small amounts by being compensated by an entrepreneurial premium on their weakest skill (they loose too much in their strongest skill, i.e. the vocationally specialized skill). This effect is even stronger in mixed educational paths with a vocational entry and an academic exit; here, the internal rate of return is even higher for employees than for entrepreneurs. Finally, as expected, a purely vocational educational path provides a significantly larger internal rate of return for employees than for entrepreneurs. This is exactly what we expect according to Lazear's jack-of-all-trades model: a strong specialization only pays for employees but not for entrepreneurs who are paid depending on their weakest skill anyway. But then, of course, the question arises why at all we do observe employees or entrepreneurs in those educational paths which are not the most favorable to them. Thus, there is still a puzzle that has to be resolved. We argue that in addition to the average return to an educational path, one also has to look at the risks associated with different paths in order to solve the puzzle and better understand the educational decision in combination with the occupational choice.

6.3 Estimating risks and returns associated with different types of educational paths

To study the risk-return trade-offs we calculate the income risk associated with each educational path and again distinguish between entrepreneurs and specialists (cf. Table A3 in the Appendix). The internal rates of return (IRR) and risk measures from Table A3 are displayed in Figure 3.

Figure 3: Internal rate of return (IRR) and risk by educational path and professional status



Source: Own calculations based on SLFS 1999-2005.

If we first look at the four entrepreneurial markings in comparison to the four employee markings and concentrate on the axis indicating risk (x-axis), we find that entrepreneurs in general are faced with a higher income risk than employees. If we then look at the axis indicating return (y-axis), we also find that the higher risk of entrepreneurs is compensated for by a higher income, except for entrepreneurs with a vocational entry (i.e. with a purely vocational educational path or a mixed path with vocational entry and academic exit). The latter accept a higher risk despite a lower average income, so they seem to have a very strong preference for being independent and being their own boss as argued by Frey/Benz (2008), which compensates them for the loss in income. Secondly, if we look at the x-axis again, we find that there is only a very small income risk for employees and virtually no differences in the risk associated with different types of educational paths. Thirdly, as already noted, entrepreneurs with academic entry have (slightly) higher average returns than employees; however, these educational paths also have a considerably higher income risk. The latter makes them obviously less attractive for individuals with high risk aversion so that highly risk averse individuals decide to become employees and accept a lower income with a lower risk. Summarizing the results, there is some evidence for risk-return trade-offs as stated in hypothesis *H3*, but for educational paths with vocational entry this does not apply.

7. Conclusion

In this paper we have examined the rates of return and the risks to complete educational paths. We distinguished a purely academic educational path from a purely vocational path and a mixed path with loops through both systems. We used Lazear's jack-of-all-trades theory on entrepreneurship to derive hypotheses about the labor market outcome attached to these different types of educational paths. Our results reveal that it is important to consider complete pathways instead of simply using the highest educational degree: a mixed educational path is ceteris paribus associated with higher earnings than a straight educational path leading to the same tertiary education. Secondly, we find our empirical results to be consistent with Lazear's jack-of-all-trades theory on entrepreneurship: a broader educational background pays for individuals who become entrepreneurs while individuals with strongly specialized educational backgrounds are better off becoming employees. Thirdly, we demonstrate that analyses of rates of return to complete educational paths without additionally considering income risk would be misleading. In order to understand the educational choice in combination with the occupational choice one has to take account of the fact that individuals differ in their risk preferences.

Our findings contrast the evidence of Dearden et al. (2002) for UK. On the one hand, they have demonstrated that combinations of academic and vocational qualifications do not yield an exceptionally high wage premium; on the other hand, they have shown that the returns to academic qualifications are generally higher. Both findings are in sharp contrast to our results for Switzerland. The reason could be that the vocational educational systems are quite different in both countries, whereas vocational education is much more important in Switzerland. In any case, it seems important to consider all qualifications held by an individual and avoid defining a rank order of educations (i.e. particularly of academic versus vocational educations).

Considering the educational decision in combination with the occupational decision and particularly using Lazear's jack-of-all-trades theory on entrepreneurship we are able to explain the labor market value attached to mixed educational paths. Interestingly, the fact that educational paths combining academic and vocational education are not a priori highly specific to a certain professional status seems to be an advantage: mixed educational paths are not only competitive with straight educational paths; rather the additional qualification is rewarded in the labor market. Nevertheless, taking into account costs associated with various educational decisions significantly reduces the relative profitability of mixed educational strategies and might explain why – despite the at first glance high profitability of mixed

educational paths – a lot of individuals still prefer straight educational paths. In sum, we consider Lazear's framework as a useful (maybe even necessary) starting point for analyses of complete educational paths.

It should be mentioned that our findings are in contrast to Benz (2006) who claims that entrepreneurship generally does not pay in monetary terms: individuals with academic entry obtain a higher income as entrepreneur than as employee. Moreover, we argue that it is not only the average return but also the prospect of an exceptionally high return and thus still a monetary incentive that leads individuals to choose to become an entrepreneur.

Finally, our analysis not only reveals implications for individuals' educational decisions but also for the organization of the educational system. Since our results indicate that mixed educational paths are a worthwhile strategy, the permeability of a national education system becomes an important aspect in its evaluation. This is a point of discussion that has been rightfully intensified since the Bologna-declaration[18]. We suppose that there might be some scope of increasing the permeability of the educational system and especially facilitating the change between the two sides of the educational system. This would reduce the time loss associated with following a mixed educational pathway.

[18] See http://www.bmbf.de/pub/bologna_deu.pdf.

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Appendix

Table A1: Benefits and costs by educational paths

	Unemployment rates		Age at latest education completed
	Entrepreneur	Employee	
Purely academic	0.69	1.98	26
Mixed with vocational entry & academic exit	0.00	1.30	29
Purely vocational	0.40	1.26	25
Mixed with academic entry & vocational exit	1.18	3.73	28

Source: Own calculations based on SLFS 1999-2005.

Table A2: Definitions and descriptives of variables

Variable	**Definition**	**Mean**	**(Std. Dev.)**
Net yearly earnings	Net yearly earnings (log.)	95525.70	(36371.53)
Purely academic	1 if individual has taken a purely academic educational path (Typ IV, Table 1), 0 otherwise	0.2274	(0.4192)
Mixed with vocational entry & academic exit	1 if individual has taken a mixed educational path with vocational entry (Typ II, Table 1), 0 otherwise	0.0416	(0.1996)
Purely vocational	1 if individual has taken a purely vocational educational path (Typ I, Table 1), 0 otherwise	0.6451	(0.4785)
Mixed with academic entry & vocational exit	1 if individual has taken a mixed educational path with academic entry (Typ III, Table 1), 0 otherwise	0.0859	(0.2802)
Entrepreneur (entpr.)	1 if individual is self-employed or employed at the own company, 0 otherwise	0.2186	(0.4133)
Experience (exp)	Actual age minus age at graduation, measured in years	13.5395	(10.1530)

Source: Own calculations based on SLFS 1999-2005.

Table A3: Internal rate of return and income risk by educational path and professional status

	Based on Mincer earnings function				Based on nonparametric approach			
	Employee		Entrepreneur		Employee		Entrepreneur	
	IRR	Risk	IRR	Risk	IRR	Risk	IRR	Risk
Purely academic	10.92 %	0.09	10.80 %	0.34	10.18 %	0.10	11.81 %	0.33
Mixed with vocational entry & academic exit	8.65 %	0.07	8.51 %	0.58	8.77 %	0.06	8.29 %	0.58
Purely vocational	15.25 %	0.09	8.05 %	0.32	14.33 %	0.09	9.05 %	0.31
Mixed with academic entry & vocational exit	18.50 %	0.14	17.29 %	0.68	17.75 %	0.15	18.10 %	0.69

Source: Own calculations based on SLFS 1999-2005.