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Risk-Return Trade-Offs to Complete Educational Paths: Vocational, Academic and Mixed

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Risk-Return Trade-Offs to Complete Educational Paths: Vocational, Academic and Mixed*

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June 2008

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. To study the labor market outcome we compare earnings and calculate net return rates as well as risk measures to investigate whether different educational paths are characterized by different risk-return trade-offs. We use Lazear's jack-of-all-trades theory on entrepreneurship to derive testable predictions about the labour market outcome of different combinations of education for entrepreneurs and employees. Our empirical results are based on the Swiss Labor Force Survey (SLFS) and demonstrate that mixed educational paths are well rewarded in the labor market. However, a high return is also associated with a high income variance which is driven by those who end up as entrepreneurs.

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1. Introduction

Although it has been shown repeatedly that the type and highest 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 include only the highest educational degree, nor is it adequate to ignore different types of paths an individual can take to receive his complete bundle of educational degrees and knowledge. In our study, we therefore compare the labor market value of different types of educational paths, and, in particular, we include mixed educational paths (i.e., the above-mentioned combinations of both types of education). The question in which we are primarily interested is whether mixed educational paths are a detour or whether they are rewarded in the labor market? This is of particular importance given that, in many countries, the first educational decisions have to be made at a very early age, which may induce an interest or a need for corrections in later stages. Consequently, this is an especially important policy issue for countries with early tracking.

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 of which we are aware¹: 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 into account the years of study, an educational path leading to higher-level vocational qualifications compares favorably to a purely academic curriculum.

To study the labor market value of different types of educational paths, we compare earnings. This allows us to analyze the labor market valuation of various combinations of qualifications and to find out if people who switch between the two sides of the educational system are rewarded for the additional qualification. In addition, we study lifetime net earnings of different educational paths because this is what is crucial for the individual educational decisions. Therefore, we consider not only the benefits but also the costs associated with each type of educational path. To compare which of the educational paths is more profitable, we

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).

calculate the internal rate of return which is standard in traditional human capital literature. Since the internal rate of return is not beyond dispute in the finance or accounting literatures, we alternatively calculate another measure known as the Baldwin rate of return which is standard in finance and accounting. This is one innovation of our paper because, to the best of our knowledge, Baldwin rates of return have never been calculated before.

Finally, we also investigate whether different educational paths are characterized by different risk-return trade-offs. A few studies have already shown that individuals have to be compensated for risk associated with their educational decision (see, e.g., Hartog 2007, Hartog/Vijverberg 2007a). Some studies have analyzed the risk-return properties focusing on the level of general education (Palacios-Huerta 2003), on the level and field of education (Christiansen et al. 2007), or on labor market skills (Hartog/Vijverberg 2007b). However, the question of whether there are systematic differences in the risk-return trade-off of vocational and academic education or a combination thereof has not been analyzed. Since entrepreneurs are typically found to have a higher risk tolerance (e.g., Cramer et al. 2002, Ekelund et al. 2005, Caliendo et al. 2006), we additionally distinguish employees from entrepreneurs. We use Lazear's jack-of-all-trades theory (Lazear 2005) on entrepreneurship to derive hypotheses about the labor market outcome attached to different educational paths dependent on whether the individual is an entrepreneur or an employee. This is another innovation of our paper because traditional literature on educational returns has not theoretically distinguished between entrepreneurial and employee investments in human capital.

In our paper, we use these implications to study the labor market outcome of different types of educational paths, i.e., purely vocational, purely 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 that our empirical results are consistent with almost all of our hypotheses.

As a whole, our study is innovative in at least three ways. First, it focuses on complete educational careers and not just the highest educational degree. We are thereby able to analyze the labour market value of various combinations of different types of education. Secondly, we use an alternative measure, namely, the Baldwin rate of return, to assess the profitability attached to various types of educational paths. This measure does not rely on the strong assumption that (human) capital can be reinvested at the internal rate of return. Third,

we calculate the risk associated with each educational path and present a theoretical framework that predicts a labor market premium attached to certain combinations of vocational and academic education under well-specifiable conditions. Thereby, the study goes beyond the existing evidence on the jack-of-all-trades theory² by applying it to different types of educational paths and by analyzing their returns according to the jack-of-all-trades theory. The paper proceeds as follows: we first briefly describe the Swiss school system in order to characterize the different types of educational paths. In the subsequent sections, we present the main theoretical considerations and analyze empirically whether there are differences in the return to education that are consistent with our hypotheses. 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-thirds 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 skilled workers within their occupational fields at the companies where they were trained or in new companies. 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 and training school” or a “university of applied sciences”.³ We will call this the *purely vocational educational path*. 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.

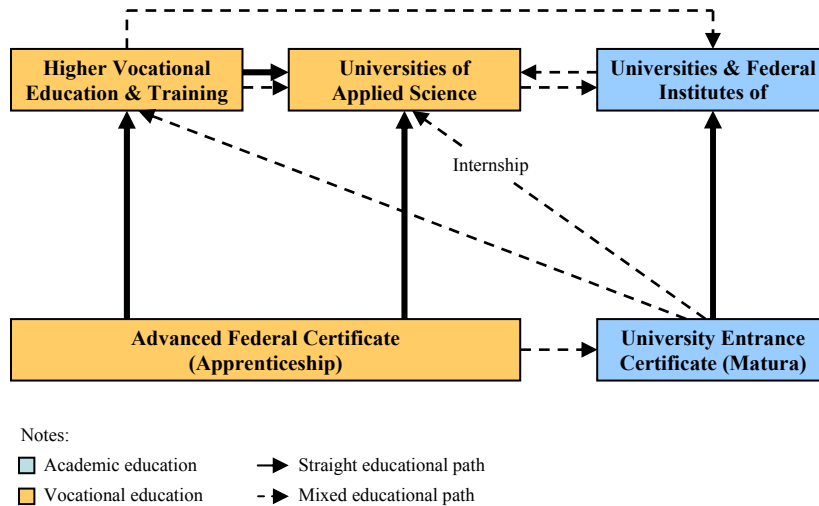
Another alternative for students after compulsory education is to stay in the school system, attend gymnasium and obtain a “Matura” which grants them access to *higher academic education*, i.e., to all universities and to the prestigious federal institutes of technology. We will call this the *purely academic educational path*. After gymnasium students may alternatively choose to switch to the vocational side of the educational system, thereby

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.

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 sections.

combining 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

Figure 1: Swiss educational system



3. Theoretical analyses of different types of educational paths

3.1 The labor market outcome and risk-return trade-offs

As already pointed out by Becker (1964), investments in human capital improve skills and knowledge and thereby increase earnings. Moreover, the skills acquired in different schools vary in terms of the level of specialization and diversification. Thus, we expect the labor market outcome to depend on the type of education, namely, vocational or academic education, as well as on the level of education. Although Becker (1964) does not consider the difference between vocational and academic education, we expect any additional qualification (of either type) to have additional returns on the labor market because they increase productivity (in various ways):

H1: Additional education of all types leads to higher earnings. (1)

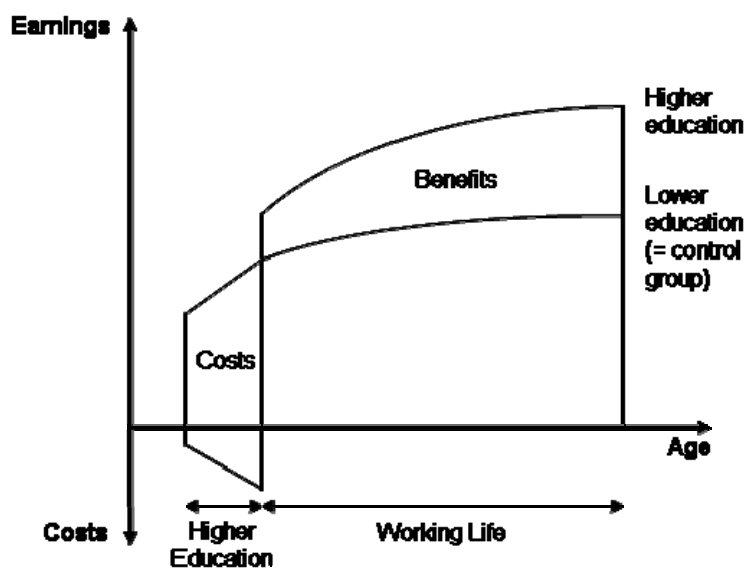
Thus, not only the highest level of education but complete educational paths matter for labor market outcomes. This sounds trivial but has never been studied due to the typical design of empirical studies.

However, for individual educational choices, we expect lifetime earnings to be the crucial determinant. Therefore, we use the cost-benefit model presented in Psacharopoulos (1987, 1995) to consider costs and benefits associated with each type of educational path. Because

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

we are interested in the private rates of return (as opposed to social rates of return), we 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 that 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.⁵ 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 profiles for individuals with higher education compared to those with the next lower level of education who form the control group.

Figure 2: The cost-benefit model



Source: Diagram modified from 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:

⁵ 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.

$$\sum_{t=k}^T \frac{(W_t^{HE} - W_t^{LE})}{(1+r)^t} = \sum_{t=0}^k \frac{(W_t^{LE} + C_t^{HE})}{(1+r)^t} \quad (2)$$

where $(W_{HE}-W_{LE})$ is the wage premium for higher education (*HE*), namely, the difference between the wage of those who completed higher education 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 ($t=k$) until retirement (T). The right-hand side of equation (4) represents the direct costs C_{HE} as well as opportunity costs W_{LE} . Costs are incurred during completion of higher education (starting at $t=0$ and ending at $t=k$). 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. Thus, this internal rate of return indicates the profitability of an investment in education.⁶ The higher the internal rate is, the more profitable the investment is.

This method of calculating the internal rate of return, although standard in traditional human capital literature, is not beyond dispute in finance and accounting literature. One of the major criticisms concerning the internal rate of return measure is that we implicitly assume that the (human) capital can be reinvested at the internal rate of return.⁷ This, however, does not have to be the case. Therefore, we alternatively calculate the so-called Baldwin rate of return (Baldwin 1959): while benefits are compounded to the time of retirement such that the final value of an investment is calculated, costs are discounted to the starting point, i.e., the point at which we evaluate the profitability of an investment. It should be noted that one should use the rate at which the (human) capital could be reinvested. In a second step, we then calculate the Baldwin rate of return corresponding to the rate at which the discounted final value and the discounted investment equalize.

Two important facts about the educational system analyzed in this study must be mentioned: on the one hand, vocational education is usually associated with a lower full-time equivalent of study than academic education. On the other hand, individuals who switch between the two sides of the educational system have to catch up on some “qualifications” (schooling or labor market experience) beforehand. Therefore, as soon as costs and benefits are considered, we expect educational paths with vocational education only to compare favorably to educational paths with academic education only; moreover, we expect that the profitability of mixed educational paths compared to straight educational paths is reduced.

⁶ 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).

⁷ This, of course, can contrary be seen as an advantage, because the internal rate of return can be calculated before knowing what the appropriate interest rate is.

Since human capital investments not only involve differences in average income and rates of return 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.⁸ Theoretically, one would expect higher income variance to be accompanied by higher average earnings, which prompts us to test the following hypothesis:

H2: Generally, the higher the rate of return is, the higher the risk associated with a certain type of educational path is. (3)

Since entrepreneurs are typically assumed to have a higher risk tolerance, we expect systematic differences between various types of educational paths dependent on whether they are a (necessary) prerequisite for successful entrepreneurship or whether they satisfy the job requirements for employees. Thus, in the next section, we first analyze which educational backgrounds consist of the qualifications necessary to be a successful entrepreneur and which educational background provides the specialist qualification needed as an employee. Lazear's (2005) jack-of-all-trades theory on entrepreneurship offers testable predications about the labor market outcome attached to different combinations of education dependent on the professional status.

3.2 Lazear's Jack-of-all-trades theory

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:

$$\text{Specialist income} = \max [x_1, x_2] \quad (4)$$

⁸ 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.

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 that 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)⁹:

$$\text{Balanced income} = \lambda \min[x_1, x_2] \quad (5)$$

In sum, an individual chooses to become an entrepreneur if and only if:

$$\lambda \min[x_1, x_2] > \max [x_1, x_2] \quad (6)$$

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 purely 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, hairdressers 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 ($x_2=0$).¹⁰ The condition to become an entrepreneur is not met:

$$\lambda x_2 = \lambda 0 < x_1 \quad (7)$$

Individuals with a purely vocational path are, therefore, expected to choose to become an employee receiving an income that is determined by their highest vocational degree. Secondly, we have the case of a purely academic educational path. We assume that academic education is typically not occupation specific but that it consists of know-how that is easily transferable to different types of occupations and job requirements. Academic education largely consists of general analytical skills that 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, we categorize individuals with a purely academic educational path as non-specialized. They are more likely to become an entrepreneur because

$$\lambda x_1 > x_2 \quad (8)$$

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

⁹ 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).

¹⁰ The knowledge imparted in vocational education is, of course, not limited to one specific skill. In this simplified framework, however, it has a comparatively high level of specialization as its main advantage.

portfolio is high but supply of this particular skill portfolio is low, the entrepreneurial premium λ is larger. In contrast, if demand for a particular portfolio is low but supply is high, the entrepreneurial premium λ is low. In the educational system that we analyze, i.e., the Swiss educational system, the availability of academic skills is rather scarce. For example, in the year 2002, approximately only 10% of the population had a university degree, so we expect a rather large entrepreneurial premium for individuals with an academic degree.

Third, we look at combinations of academic and vocational qualifications. Given that mixed educational paths consist of a high variety of skills, as they consist of academic and vocational education, the probability to become an entrepreneur and the resulting income are expected to be higher for entrepreneurs than for employees.

In a next step, we then consider income risk but distinguish educational paths consisting of a broad educational background from educational paths consisting of a specialized educational background (as the educational decision is made first). Within those educational paths that are predicted to be associated with a higher level of earnings for entrepreneurs than for employees, we expect to observe a higher variance of income among entrepreneurs (all else being equal) associated with a high average income. Concerning educational pathways that largely consist of specialized knowledge and are, therefore, predicted to be better for employees, it is not clear what we should expect a priori. One could either argue that individuals with a specialized educational background should face lower risk as entrepreneurs than as employees given the lower return or one could still expect entrepreneurs to accept a higher risk given that they are less risk averse. Thus, the last hypotheses to be tested can be stated as follows (and does not include the latter type of educational paths for the reasons stated before):

H3: Individuals with a broad educational background (i.e., a purely academic educational path or a mixed educational path) are better off as entrepreneurs than as employees, whereas individuals with a specialized educational background (i.e., a purely vocational educational path) earn more as employees than as entrepreneurs. (9)

H4: Individuals with a broad educational background get a higher rate of return as entrepreneurs, but they also face a higher income risk than employees. (10)

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 first estimate a simple Mincer earnings function. Based on this estimation, we calculate internal rates of return and Baldwin 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 paths and investigate the respective differences in the risk-return trade-off, and we additionally distinguish entrepreneurs from employees.

4.1 Empirical analysis of rates of return to different skill bundles

To study earnings differences of various types of educational paths, we include 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 estimate can be written as:

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

We estimate an ordinary least square regression using the natural logarithm of earnings as the 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 the independent variables. In addition, we include interaction terms for education variables and experience as the experience-earnings profiles are assumed to vary by educational pathway.¹¹

Equation (11) shows that our set of independent variables is strongly restricted to education and experience variables 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 shown, for example, in a study by Dearden (1999): the effect of omitted ability and family background completely cancels out the bias associated with measurement error and composition bias.¹²

Since we are also interested in net returns, we cannot ignore that different educational paths differ in length and, as a result, in opportunity costs. Thus, we use the cost-benefit model presented in the previous section (3.1) to calculate net rates of return. We start with estimating the above mentioned earnings function (11). In a second step, we then predict, based on the

¹¹ 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.

¹² 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 are expected to be associated with a downward bias.

estimated coefficients, the age-earnings profiles for each educational path. In order to take into account opportunity costs, the earnings function is 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 predict age-earnings profiles for the control group. Following Psacharopoulos (1995: 8), we smooth out the age-earnings profiles by moving averages and adjusting the estimated age-earnings profiles to anticipated real growth in earnings and unemployment. In a third step, we calculate the internal rates of return (IRR) based on the adjusted age-earnings profiles for each educational path. 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. Alternatively, we calculate the Baldwin rate of return (BRR) that corresponds to the rate at which the discounted final value and the discounted investments equalize.

Recently, the Mincer specification has come under criticism (see, e.g., Heckman et al. 2008).¹³ It has been 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 using locally weighted regression (Cleveland 1979); in the specification that additionally considers the professional status, we perform separate estimations for each educational path and by professional status. This procedure does not require the specification of a global function but smoothes the scatterplot of experience and earnings.

4.2 Empirical analyses of income risk 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 that measures the risk by the variations in relation to the respective level of income (because the same amount of variation has more severe consequences for small incomes than for large incomes). This risk measure is calculated as follows:

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

¹³ Besides showing that it is important to allow the earnings-schooling-experience relationship to be estimated flexibly (by using nonparametric methods), the authors also raise concerns about other (strong) assumptions of the Mincer method, some of which we can consider: while we explicitly take into account that additional schooling years are associated with loss of working life and use net earnings, we do not have information about the psychic costs of education.

That is, it uses the average squared ratio of the standard deviation (true earnings (Y) minus predicted earnings (\hat{Y})) to the predicted earnings (\hat{Y}).

As has been emphasized in the previous section, entrepreneurs and employees can be assumed to (strongly) differ in their degree of risk aversion as well as in their educational backgrounds. In order to separate these two factors, we additionally perform all the empirical analyses described above separately for entrepreneurs and employees (denoted as specification (2) in the following).

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

The Swiss Labor Force Survey has been conducted annually since 1991, and it 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 that, although the panel structure cannot be used in the present study¹⁴, we have to control for the fact that people stay in the survey for several consecutive years. The fact that we use cross section data does not seem to be a disadvantage for our study: as has been shown by Schweri et al. (2007), individuals use contemporaneous market data to build their wage expectations.

The present study focuses on people who have completed higher tertiary education, be it vocational or academic.¹⁵ 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.

¹⁴ The fraction of people who can be identified before and after having completed some education is far too small to be used for an empirical analysis.

¹⁵ 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

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

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

Although straight educational paths constitute the vast majority, mixed educational paths are not an unusual phenomenon: a considerable number of people combine academic and vocational qualifications. Among those with a higher tertiary education, more than 10% completed academic and vocational qualifications during their education (Typ II and III). This can be interpreted as a first indication of the permeability of the educational system. Approximately 12% of individuals who hold a higher vocational degree started with an academic education, and approximately 15% of individuals with an academic exit have started with an initial vocational education. Interestingly, educational paths with repeated loops through both types of education are very rare and are thus not included in our analyses.¹⁶

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 section, predicted age-earnings profiles are adjusted by unemployment rate and a real growth rate.¹⁷

¹⁶ 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' completing an apprenticeships before starting university, which is well-known from Germany (a country with a similar education system).

¹⁷ 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 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

In regards 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 more important costs because there is no tuition for initial academic or vocational education (as both types of education are publicly funded or, in the case of an apprenticeship, provided by the companies free of charge). Thus, the profitability of an educational strategy depends crucially on opportunity costs, measured by earnings of individuals who stopped one step earlier on their educational pathway. Therefore, it is important to acquire information that is as detailed 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 his or her 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.¹⁸ As the vast majority of individuals retire at the age of 65 independent of their affiliation with one of the four educational groups and also independent of their 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 Swiss¹⁹ 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. The average self-employment rate in Switzerland is about 14%, whereas individuals with a tertiary educational degree have a significant higher probability (of about one-third) of being self-employed (BfS 2006). For definitions and descriptive statistics of all the variables used see Table A2 in the Appendix.

6. Results: labor market outcomes to different educational paths

6.1 Estimating labor market outcomes and risk-return trade-offs

As described in section 4 we start with the estimation of an “extended” Mincer earnings function. The results are shown in Table 2 for specification 1 (according to equation (11)).

Table 2: “Extended” Mincer earnings function

for each educational path and by professional status, observations with earnings above the 99th percentile or below the 1st percentile are dropped so that the results are not determined by outliers.

¹⁸ These numbers are offered by the Swiss Federal Statistical Office. See

<http://www.bfs.admin.ch/bfs/portal/en/index.html>.

¹⁹ Including foreigners would not ensure comparability among the various educations completed.

Net yearly earnings	Spec. (1)
Purely academic	Reference
Mixed with vocational entry & academic exit	0.2793*** [0.0488]
Purely vocational	-0.0060 [0.0293]
Mixed with academic entry & vocational exit	0.1195** [0.0499]
Experience (exp)	0.0312*** [0.0035]
Experience squared (expsq)	-0.0006*** [0.0001]
Mixed with vocational entry & academic exit * exp	-0.0276*** [0.0103]
Mixed with vocational entry & academic exit * expsq	0.0005 [0.0004]
Purely vocational * exp	-0.0223*** [0.0041]
Purely vocational * expsq	0.0005*** [0.0001]
Mixed with academic entry & vocational exit * exp	-0.0158** [0.0071]
Mixed with academic entry & vocational exit * expsq	0.0003 [0.0002]
_cons	11.2580*** [0.0266]
Prob > F	0.0000
R ²	0.10
N	10606

Notes: The test for joint significance of separate experience profiles by educational path can be rejected. 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 those of individuals with straight educational paths. For example, individuals with a mixed educational path with vocational entry earn a 32% earnings premium compared to individuals with a purely academic educational path.²⁰ The labor market obviously rewards the additional qualification(s) that individuals gather while switching between the two sides of the educational system. Thus, individuals who decide to change their initial educational path are not just taking a detour: they 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. The results support hypothesis (*H1*), which states that additional qualifications – independent of whether they are of the same or of the other type – yield higher earnings. Our findings even indicate that there might exist

²⁰ Calculated as e^{β} , where β is the coefficient of the dummy variables indicating educational paths (see equation (8)).

some complementarities between the two types of education. However, a detailed analysis of this presumption is not within the scope of this paper. Moreover, we interpret our results as evidence against the argument that switching between the two sides of the educational system only represents an adjustment of an initially false decision (e.g., individuals find out about their comparative advantage only later). If this were the case we would not expect such a high income premium attached to mixed educational paths.

Given the result from Table 2, there is still one puzzle to be solved: why are mixed educational paths, which have the highest earnings outcomes, chosen only by a minority of the workforce? We argue that the puzzle might be solved by taking into account the different costs associated with different types of educational paths. Therefore, 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 and the Baldwin rate of return respectively for each educational path to account for different costs associated with different educational paths.

We calculate the rates of return based on Mincer earnings functions and alternatively based on earnings functions from a nonparametric approach. Results are given in Table 3.²¹

²¹ Detailed results of the calculation of the internal rates of return (IRR) and the Baldwin rates of return (BRR) are reported in Tables A3 and A4 in the appendix.

Table 3: Internal rates of return(IRR) and Baldwin rate of return (BRR) by educational path

	Spec. (1)			
	IRR		BRR	
	Based on Mincer earnings function	Based on non-parametric approach	Based on Mincer earnings function	Based on non-parametric approach
Purely academic	10.91%	10.30%	6.00%	5.88%
Mixed with vocational entry & academic exit	8.62%	8.45%	4.92%	4.88%
Purely vocational	13.96%	13.34%	6.11%	6.05%
Mixed with academic entry & vocational exit	18.37%	17.79%	6.99%	6.88%

Source: Own calculations based on SLFS 1999-2005.

We start by looking at the internal rates of return (IRR) and find that the picture is different from the one that we found by comparing incomes only after education is finished. As soon as lifetime earnings are considered, a purely vocational path compares very favorably to a purely academic path (due to a shorter duration in full-time education and a lower foregone income associated with a purely vocational path). These results are in line with Wolter/Weber (1999a), who report rates of return by highest educational degree for Switzerland. This might help to explain why, in Switzerland, the fraction of a youth cohort starting its non-compulsory education within the vocational system is quite stable over time and why with two-thirds of the cohort on a very high level. Regarding mixed educational paths, we find that educational paths with an academic entry and a vocational exit are still a 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 comparatively high incomes due to the academic education that they finished in the first stage of their education. Moreover, most of these individuals directly switch to the vocational side of the educational system right after their first academic education. In contrast, mixed educational paths with a vocational entry and an academic exit are the least favorable paths. 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.

Turning to the alternative measure of rates of return, the Baldwin rate of return, a relative comparison between the different types of educational paths confirms the results obtained by comparing internal rates of return, with the only difference being that BRR are about half the IRR. The latter is mainly due to our choice of a 3% interest rate for reinvestments, which is a realistic long-term interest for Switzerland. Since we are primarily interested in the relative profitability of various types of educational paths (and thus a comparison among the educational paths described above), it does not really matter in our analyses which profitability measure we use. However, for general policy issues, it might be more accurate to use the Baldwin rate of return to compare different types of investments.

In sum, as soon as costs and benefits are considered, purely vocational educational paths compare very favorably to purely academic educational paths, and the profitability of mixed educational paths compared to straight educational path is reduced. However, there is still a puzzle to be solved: why do people choose educational paths with strongly unfavorable rates of return and why do not all choose the educational path with the highest return? 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 conclusively solve the puzzle and better understand educational decision.

To study the risk-return trade-offs we calculate the income risk associated with each educational path. The risk measures are reported in Table 4.

Table 4: Income risk by educational path

	Spec. (1)	
	Based on Mincer earnings function	Based on non-parametric approach
Purely academic	0.14	0.15
Mixed with vocational entry & academic exit	0.17	0.17
Purely vocational	0.13	0.13
Mixed with academic entry & vocational exit	0.25	0.25

Source: Own calculations based on SLFS 1999-2005.

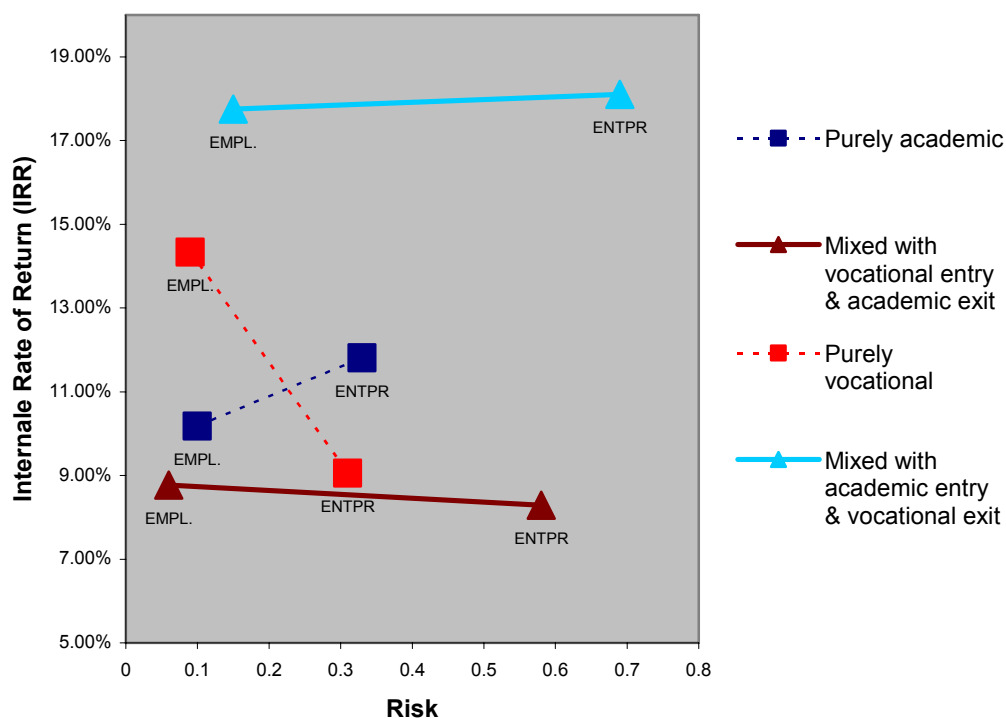
Generally, mixed educational paths are associated with a (substantially) higher income risk than straight educational paths and, thus, hypothesis *H2* cannot be confirmed. The exceptionally high risk attached to mixed educational paths with academic entry might be an important cause why these mixed educational path are chosen only by a minority: there is a lot of uncertainty attached to taking a mixed educational path with academic entry. However, the picture still does not fully fit: why do some people choose a mixed educational path with

vocational entry (i.e., the educational path with the lowest return and a high income risk)? As already mentioned before, we would expect entrepreneurs to differ from employees.

6.2 Estimating risk-return trade-offs for entrepreneurs and employees

Henceforth, we perform all our analysis for entrepreneurs and employees separately (see Table A4 in the appendix). The internal rates of return (IRR) and risk measures from Table A5 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.

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 that we assume following Lazear (2005). 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 in terms of the internal rates of return (y-axis), we find evidence in favor of the jack-of-all-trades theory and, thus, hypothesis *H3*: 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 acquisition of a

broader set of skills pays only for entrepreneurs but not for employees. Secondly, we also find an entrepreneurial premium for purely academic paths, which 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 lose 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 (slightly) 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 pays only for employees but not for entrepreneurs who are paid depending on their weakest skill anyway. But then, of course, the question arises why we observe employees or entrepreneurs in those educational paths that are not the most favorable to them at all. 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.

If we now 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 employees in general are faced with a lower income risk than entrepreneurs. Within the group of employees, mixed educational paths with vocational entry have the lowest income risk explaining why people with these educational paths accept the lowest rate of return.

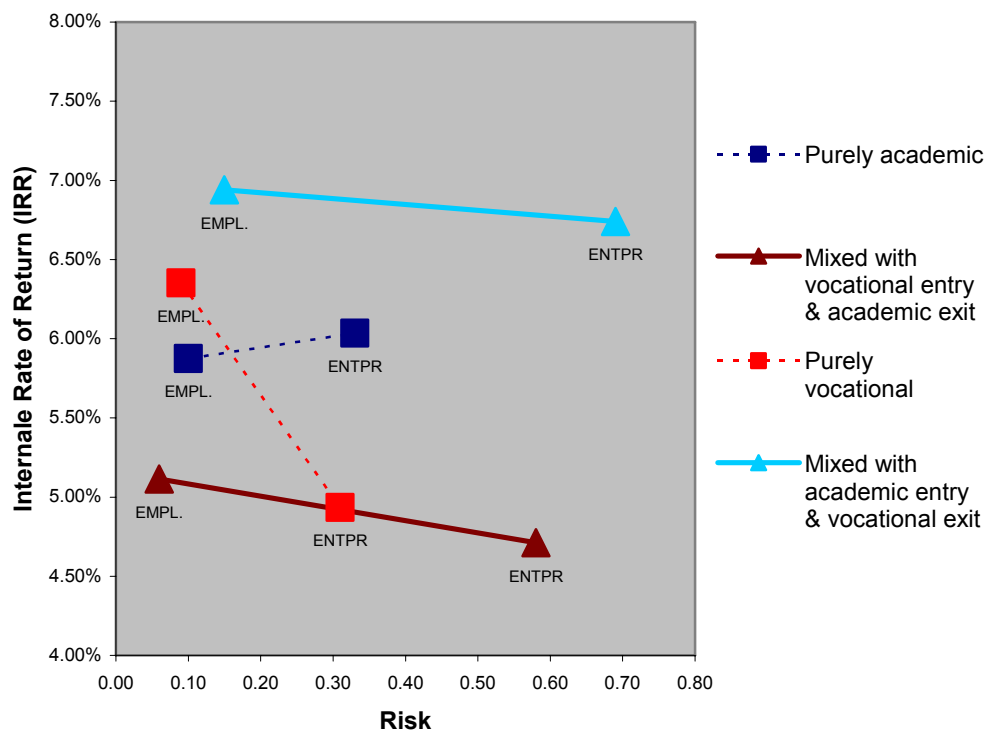
If we then look at the axis indicating return (y-axis) again, we also find that the higher risk of entrepreneurs is compensated by a higher income, except for entrepreneurs with a vocational entry (i.e., with a purely vocational educational path or a mixed path with vocational entry and academic exit). 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. Another reason could be that the difference between gross and net income of entrepreneurs and employees is systematically different. In contrast, 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.

In summary, the results show that there is some evidence for risk-return trade-offs for individuals with a broad educational background as stated in hypothesis *H4*, but, for educational paths with vocational entry, this does not apply.

Alternatively, we can use Baldwin rates of return (BRR) instead of internal rates of return (IRR). This, however, does not change the main results, as can be seen in Figure 4.

Figure 4: Baldwin rate of return (BRR) and risk by educational path and professional status



Source: Own calculations based on SLFS 1999-2005.

7. Conclusion

In this paper we have examined the rates of return and the risks to complete educational paths with different combinations of academic and vocational education. We have distinguished a purely academic educational path from a purely vocational path and a mixed path with loops through both systems. Our results demonstrate that it is important to consider complete

pathways instead of simply using the highest educational degree: the labor market rewards the additional qualifications that individuals gather while switching between the two sides of the educational system. Secondly, using the Baldwin rate of return instead of the internal rate of return substantially reduces the profitability of different educational paths. This, however, does not have an impact on the main conclusion in terms of a relative comparison among the various combinations of academic and vocational education. Thirdly, we find that analyses of rates of return to complete educational paths without additional consideration of income risk would be misleading, as individuals seem to care not only about rates of return but also about risk associated with a certain type of educational path. Finally, analyses of investments in human capital should distinguish entrepreneurs from employees.

Not surprisingly, the relative profitability of mixed educational paths is (substantially) reduced as soon as rates of return, instead of earnings, are compared providing an explanation why mixed educational paths are chosen only by a minority. As already noted, the organization of the educational system could be a cause for this phenomenon. In any case, it should be emphasized that complementarities between academic and vocational education seem to exist. Further research on mixed educational paths might provide an insight into the presumed relationship between the two types of education.

The importance of considering the fact that human capital investments involve differences not only in rates of return but also in income variance or risk, should not be underestimated. Risk-averse individuals might not take a mixed educational path because these combinations of the different types of education are associated with a high uncertainty about future income. Using Lazear's jack-of-all-trades theory, we find that this result is mainly driven by the group of entrepreneurs (thus, it seems to be important to analyze the educational decision in combination with the occupational decision). On the one hand, the prospect of an exceptionally high return might lead these individuals to choose mixed educational paths. On the other hand, different combinations of education within the group of mixed educational paths might also differ in terms of the breadth of their educational background and, thus, their entrepreneurial premium.

Finally, our analysis reveals implications not only 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-declaration²². We suppose that there might be some

²² See http://www.bmbf.de/pub/bologna_deu.pdf.

value to increasing the permeability of the educational system and especially to facilitating the change between the two sides of the educational system. This would reduce the time loss associated with following a mixed educational pathway.

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Appendix

Table A1: Benefits and costs by educational paths

	Unemployment rates			Age at latest education completed
	Full Sample	Entrepreneur	Employee	
Purely academic	1.71	0.69	1.98	26
Mixed with vocational entry & academic exit	1.01	0.00	1.30	29
Purely vocational	1.05	0.40	1.26	25
Mixed with academic entry & vocational exit	3.15	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 rates of return (IRR)

	Spec. (1): IRR					
	Based on Mincer earnings function			Based on non-parametric approach		
		& unempl. risk	& real growth rate		& unempl. risk	& real growth rate
Purely academic	10.36%	10.36%	10.91%	9.74%	9.75%	10.30%
Mixed with vocational entry & academic exit	7.85%	8.08%	8.62%	7.68%	7.91%	8.45%
Purely vocational	12.87%	13.39%	13.96%	12.27%	12.78%	13.34%
Mixed with academic entry & vocational exit	20.06%	17.78%	18.37%	19.39%	17.20%	17.79%

Source: Own calculations based on SLFS 1999-2005.

Table A4: Baldwin rates of return (BRR)

	Spec. (1): BRR					
	Based on Mincer earnings function			Based on non-parametric approach		
		& unempl. risk	&real growth rate		& unempl. risk	&real growth rate
Purely academic	5.74%	5.75%	6.00%	5.62%	5.63%	5.88%
Mixed with vocational entry & academic exit	4.65%	4.72%	4.92%	4.60%	4.67%	4.88%
Purely vocational	5.79%	5.89%	6.11%	5.72%	5.83%	6.05%
Mixed with academic entry & vocational exit	6.93%	6.78%	6.99%	6.83%	6.67%	6.88%

Source: Own calculations based on SLFS 1999-2005.

Table A5: Internal rates of return, Baldwin rates of return and income risk by educational path and professional status

	Spec. (2)											
	Based on Mincer earnings function						Based on nonparametric approach					
	Employee			Entrepreneur			Employee			Entrepreneur		
	IRR	BRR	Risk	IRR	BRR	Risk	IRR	BRR	Risk	IRR	BRR	Risk
Purely academic	10.92%	6.00%	0.09	10.80%	5.97%	0.34	10.18%	5.87%	0.10	11.81%	6.03%	0.33
Mixed with vocational entry & academic exit	8.65%	4.94%	0.07	8.51%	4.90%	0.58	8.77%	5.11%	0.06	8.29%	4.71%	0.58
Purely vocational	15.25%	6.45%	0.09	8.05%	4.79%	0.32	14.33%	6.35%	0.09	9.05%	4.93%	0.31
Mixed with academic entry & vocational exit	18.50%	7.04%	0.14	17.29%	6.84%	0.68	17.75%	6.94%	0.15	18.10%	6.74%	0.69

Source: Own calculations based on SLFS 1999-2005.