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Risk-return trade-offs to different educational paths: vocational, academic and mixed[1]

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Abstract: Purpose – This paper investigates the rates of return and the risks of different types of educational paths – all leading to a tertiary educational degree. We distinguish a purely academic educational path from a purely vocational path and a mixed path with loops through both systems.

Design/methodology/approach – 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 additionally separate entrepreneurs from employees in order to examine whether for the same combination of education the labour market outcomes differ between the two groups.

Findings – The 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, for entrepreneurs a high return is also associated with a high income variance.

Research limitations/implications – Our findings provide evidence for the existence of complementarities between vocational and academic education. Further research on mixed educational paths might provide more insight into this presumed relationship.

Practical implications – Since the results indicate that mixed educational paths are a worthwhile strategy, the permeability of a national education system is a very important educational policy issue.

Originality/value – The study is innovative in three ways: first, it focuses on complete educational *paths* and not just the highest educational degree. Second, an alternative measure, the Baldwin rate of return, is used to assess the profitability attached to different educational paths. Third, we calculate the income risk associated with each educational path.

Keywords: risk-return trade-off, complete educational paths, occupational choice

Paper Type: Research paper

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., combinations of both types of education). The question that primarily interests us 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 educational 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 aware [i]: 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 most profitable, we 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 literature,

we alternatively calculate the Baldwin rate of return which is more 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 for returns on education.

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 and 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 and 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 separate employees from entrepreneurs. The latter are often excluded from studies analyzing rates of return to education (because of difficulties attached to measuring earnings of self-employed persons). Hence, the knowledge concerning the relationship between education, professional status and earnings is very limited.

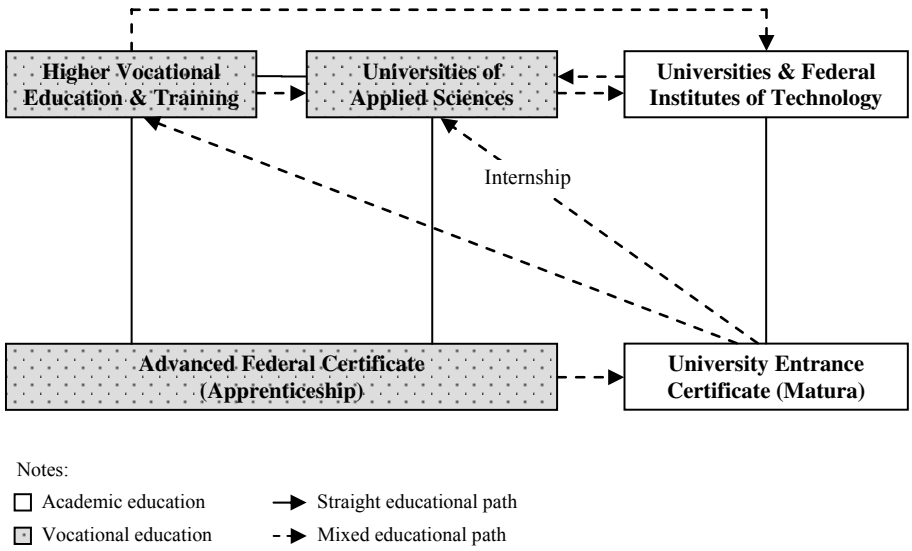
In our paper, we start from the well-known human capital model in order to study the labor market outcomes of different types of educational paths, i.e. purely vocational, purely academic or mixed vocational and academic. We test our theoretical implications based on the Swiss Labor Force Survey (SLFS), 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 mixed educational paths are well rewarded in the labor market.

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.

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 nine 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 (cf. Figure 1, which gives a simplified diagram of the Swiss educational system [ii]).

Figure 1: Swiss educational system



They may choose to go into *higher vocational education* and attend a "higher vocational education and training school" or a "university of applied sciences".[iii] In this case, they also end up with a tertiary educational degree that is as well recognized as other tertiary degrees in Switzerland. In our study we will call this the *purely vocational educational path*. On the other hand, students who finish an apprenticeship 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 option for students after compulsory education is staying in the school system by attending gymnasium and obtaining a "Matura" which grants them access to *higher academic education*, i.e., to all universities. We will call this the *purely academic educational path*.

These students also have the option to switch to the vocational side of the educational system after they finished gymnasium, thereby combining academic and vocational education, denoted as a *mixed educational path*, but with a vocational tertiary degree as the highest educational outcome.

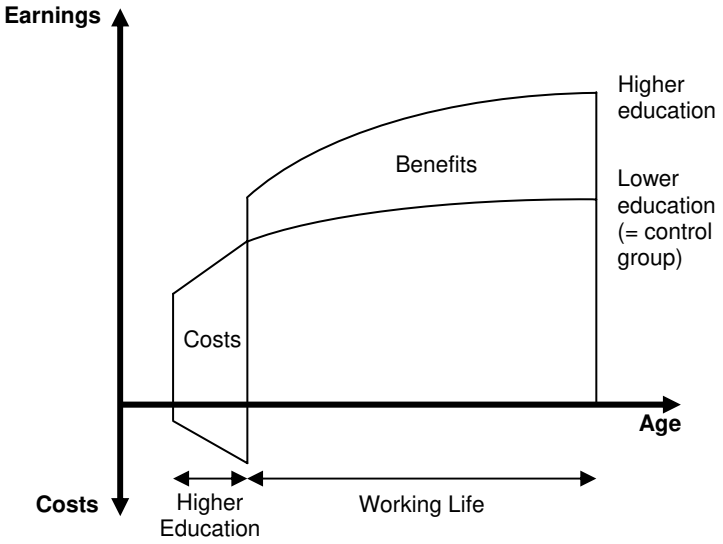
Theoretical analyses of different types of educational paths

As already pointed out by Becker (1964), investments in human capital improve skills and knowledge and thereby increase earnings. Since the skills acquired in different schools vary in terms of the level of specialization and diversification 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. We expect any additional qualification of either type to have additional returns on the labor market because they all increase productivity in various ways:
H1: Additional education of all types leads to higher earnings.

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 not only returns to be important but lifetime net 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 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. Taking another educational degree typically leads to foregone earnings during that time. These are the costs we concentrate on although there are obviously also direct costs related to education, such as tuition fees. But compared to foregone earnings, direct costs in the Swiss educational system are substantially lower and for most educational degrees almost negligible.[iv] While the costs of education arise during a short time period at the beginning, the benefits are expected over the whole life-cycle. The benefits consist mainly 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 are used as a 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:

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

where $(W^{HE}\text{-}W^{LE})$ 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 (1) 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.[v] The higher the internal rate is, the more profitable is the investment.

This method of calculating the internal rate of return, although standard in traditional human capital literature, is not beyond dispute in the finance and accounting literature. One of the major criticisms concerning the internal rate of return measure is the implicit assumption that all returns can be reinvested at the rate of return being calculated for the initial investment (cf. e.g., Kierulff, 2008).[vi] This, however, does not have to be the case in reality. Since workers

might hardly make the exact same investment again, but rather invest the returns in another project, using different rates of return might be more appropriate. In our context of human capital investments workers might only be able to invest in education at a specific time in life. After that they have to choose, at least partly, another form of investment, for example investments on the financial market that have a different rate of return. 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 return to the human capital (i.e., earnings) 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: firstly, vocational education is usually associated with a lower full-time equivalent of study than academic education. Secondly, 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.

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 depending on the educational path chosen.[vii] 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 is the rate of return, the higher is the risk associated with a certain type of educational path.

As entrepreneurs are typically assumed to have a higher risk tolerance than employees (see e.g., Kihlstrom and Laffont, 1979) we expect the former to go for higher earnings by tolerating a higher level of risk. Therefore, it seems important to take account of these potential differences by distinguishing entrepreneurs from employees in our empirical analyses.

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:

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

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.[viii]

Equation (2) 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 and 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), they are not a problem in our analysis because we are only interested in the so-called treatment effect on the treated (i.e. the return of those who have chosen a certain educational path in comparison to those who have chosen a different educational path) and not in the treatment effect on the

untreated (i.e. the return of a particular educational path to those who have actually chosen a different path).[2]

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 to calculate net rates of return. We start with estimating the above mentioned earnings function (2). In a second step, we then predict, based on the 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, p.8), we smooth out the age-earnings profiles by moving averages. 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).[ix] It has been shown that the relationship between experience and earnings cannot simply be represented by a quadratic function (see, e.g., Murphy and 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. This procedure does not require the specification of a global function but smoothes the scatterplot of experience and earnings.

4.2 Empirical analysis of income risk to different types of educational paths

To measure the income risk of an education decision, Hartog and 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:

[2] However, Dearden (1999) also shows that the two biases may cancel out each other: in their study the effect of omitted ability and family background completely canceled out the bias associated with measurement error and composition bias.

$$R_j = \frac{1}{N_j}\sum_{i=1}^{N_j}\left(\frac{Y_{ij} - \hat{Y}_{ij}}{\hat{Y}_{ij}}\right)^2 \qquad (3)$$

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. In order to separate the impact of such other factors, we additionally perform all the empirical analyses described above separately for entrepreneurs and employees (denoted as specification (2) in the following).

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 study [x], 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.* (2008), 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.[xi] 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.

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

Exit / Entry	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 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.[xii]

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. Net incomes (compared to real incomes) are net of social security contributions but still represent income before taxes.[xiii]

In regards to the costs associated with a particular educational path, there are direct costs as well as opportunity costs. In order to correctly assign costs over an individual's life cycle it is important to acquire information that is as detailed as possible about the length of study, the direct costs per year of study and the age of entry into the labor market. Table A1 in the Appendix gives an overview over this information separately for each type of education and

educational path respectively. As individuals in the SLFS are neither asked to report how long they have been studying nor about the expenses associated with their education we gather this information from two external sources: on the one hand, we assign an average length of study to each type of education based on data from the Swiss Federal Statistical Office. On the other hand, we rely on Weber (2003, p.416) who provides several useful indicators concerning the Swiss educational system, among them one indicator representing the average private expenses associated with various types of education. Concerning the age at which an individual has completed his or her latest education, the SLFS provides valuable information: each individual in the survey is asked to report the year he or she has finished the latest education. In our empirical analyses the mode is used as the typical age of entry into the labor market in order to calculate average age-earnings profiles. 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. Finally, we have to consider opportunity costs, which, in Switzerland, are by far the most important costs because there is basically 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. In order to ensure comparability individuals with a secondary educational degree in form of an advanced federal certificate (apprenticeship) – which represent the largest educational group – are used as control group for all educational paths leading to a tertiary educational degree. The estimation results underlying the calculation of the opportunity costs are presented in Table A2 in the Appendix.

Based on these data, we are now able to compare discounted benefits and discounted costs for each educational path. Basically, predicted age-earnings profiles should be adjusted for inflation and by unemployment rate. Since 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) we do not use additional adjustment here to simplify the analysis.[xiv] Concerning inflation of incomes we make an adjustment using the average annual long-term consumer price index for Switzerland which was 0.5%.[xv]

For our analyses, we select Swiss [xvi] 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 and hardly varies between the different educational paths. The average self-employment rate in Switzerland is about 14%, whereas individuals with a tertiary educational degree have a significantly higher probability (of about one-third) of being self-employed (BfS, 2006). It should be noted that our definition of entrepreneur includes both those who employ workers and those who have no employees and just work for themselves. Unfortunately, we cannot separate these two groups in our analysis due to data restrictions. However, these differences within the group of entrepreneurs should be kept in mind when comparing the estimation results with those for employees. For the group of entrepreneurs without employees the fact that entrepreneurship holds fringe benefits as independence or flexibility of time consumption might be even more important than the resulting monetary earnings. For definitions and descriptive statistics of all the variables used see Table A3 in the Appendix.

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 (2)).

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[i] Sociological research on complete educational paths concentrates on the impact of social inequality (e.g., see Hillmert and 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).

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

[iii] 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.

[iv] 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. This support, however, is not evenly distributed among the various types of education. For this reason we (all the same) consider direct costs.

[v] 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).

[vi] This, of course, can contrarily be seen as an advantage, because the internal rate of return can be calculated before knowing what the appropriate interest rate is.

[vii] Besides, there is also the risk of dropping out of school and the risk of becoming unemployed (see e.g. Wolter and Weber, 1999a; Wolter and Weber, 1999b). The latter will be addressed in the empirical part of the paper. 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.

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

[ix] 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.

[x] 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.

[xi] 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.

[xii] This also holds true for the prevalent and extensively analyzed (see, e.g., Büchel and Hellberger, 1995; Lewin *et al.*, 1996) phenomenon of high school graduates completing an apprenticeship before starting university, which is well-known from Germany (a country with a similar education system).

[xiii] Zero earnings are always a potential indication of misreporting for which reason they are generally not included in our analyses. Nevertheless, this is only the case for 0.005% of the entrepreneurs and for none of the employees in the sample analyzed. Moreover, separately 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.

[xiv] However, robust checks show – as expected – that our results are stable when considering unemployment risk.

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

[xvi] Including foreigners would not ensure comparability among the various educations completed.

Table 2: "Extended" Mincer earnings function

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)
Constant	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.[xvii] 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 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.[xviii]

Table 3: Internal rates of return (IRR) and Baldwin rates 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 (N=2412)	10.63%	10.03%	5.91%	5.79%
Mixed with vocational entry & academic exit (N=441)	8.01%	7.85%	4.74%	4.70%
Purely vocational (N=6842)	12.55%	12.01%	5.83%	5.77%
Mixed with academic entry & vocational exit (N=911)	19.38%	18.76%	6.97%	6.87%

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 and 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 it is on a very high level with two-thirds of the cohort. 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 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, measured as the earnings variation in relation to the respective level of income (see section 4.2), 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 (N=2412)	0.14	0.15
Mixed with vocational entry & academic exit (N=441)	0.17	0.17
Purely vocational (N=6842)	0.13	0.13
Mixed with academic entry & vocational exit (N=911)	0.25	0.25

Source: Own calculations based on SLFS 1999-2005.

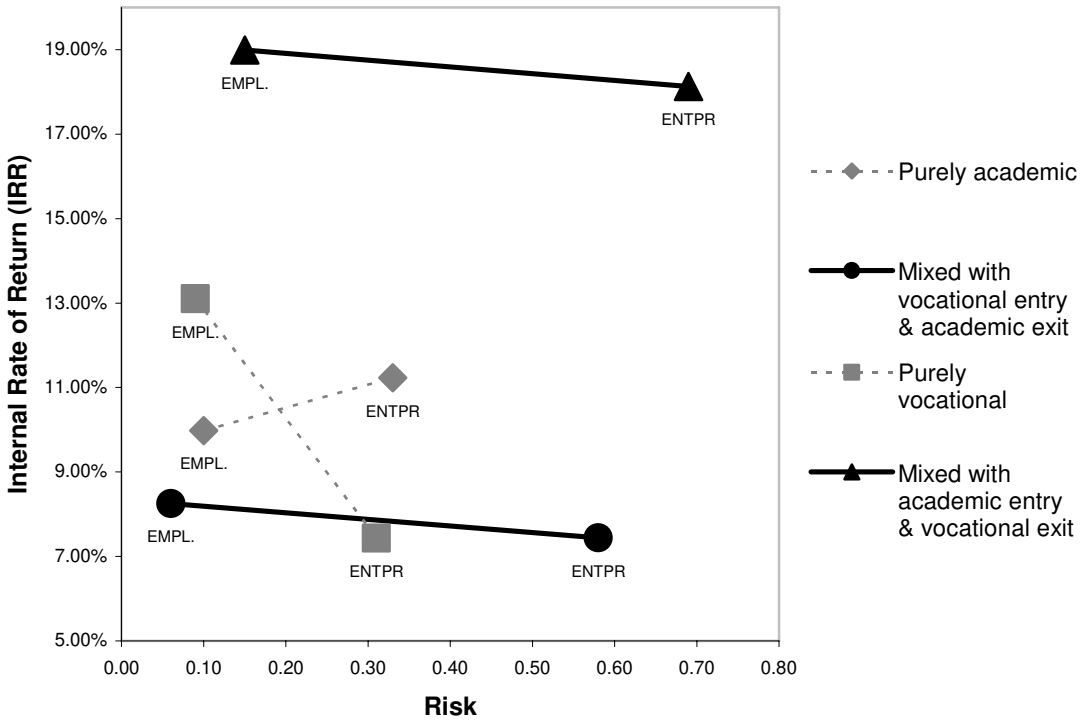
Generally, mixed educational paths are associated with a (substantially) higher income risk than straight educational paths and, thus, hypothesis (*H2)* cannot be confirmed. The exceptionally high risk attached to mixed educational paths with academic entry might be an important cause why these mixed educational paths 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

To detect potential differences between entrepreneurs and employees we perform in the following all our analyses separately for the two groups. The estimation results of the extended Mincer earnings function are described in Table A6 in the Appendix. Similar to specification (1) we still find a significant positive impact on the level of earnings for combining academic and vocational education compared to choosing a straight educational path. The variables indicating entrepreneurship turn out to be insignificant with the exception of a variable representing entrepreneurs with a purely vocational educational background. Workers with a purely vocational educational path earn significantly less if they belong to the group of entrepreneurs than if they are employed.

The internal rates of return (IRR) and risk measures are displayed in Figure 3 (for detailed results see Table A7 in the Appendix).

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. The assumption is supported by the fact that the internal rate of return results of the two estimation methods differ the most for entrepreneurs.

If we look at the structure of the results in terms of the internal rates of return (y-axis), we find an entrepreneurial premium for purely academic educational paths. In contrast, purely vocational educational paths have a higher internal rate of return for employees than for entrepreneurs. Hence, the skills acquired by taking a purely academic educational path seem to be a better prerequisite for entrepreneurship than those skills associated with a purely vocational educational path. As regards mixed educational paths there is also some evidence for lower average returns attached to entrepreneurship. However, the return differences between entrepreneurs and employees are very small and presumably even negligible. This indicates that switching between the two sides of the educational system does not restrict the occupational choice but rather extends it: mixed educational paths pay off both for entrepreneurs and employees.

But then, of course, the question arises why we observe employees or entrepreneurs in those educational paths that are not - at least in terms internal rates of return - 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 there is some evidence for a risk-return trade-off: mixed educational paths with vocational entry have the lowest income risk providing a possible explanation why people with these educational paths accept the lowest rate of return. In contrast, mixed educational paths with academic entry have the highest rate of return but are also associated with the highest income risk. The numbers for straight educational paths lie in-between. However, although employees with purely vocational educational paths have higher average returns than employees with purely academic educational paths, they face (slightly) lower income risk. As regards the group of entrepreneurs we find that the income risk is twice as high for mixed educational paths as for straight educational paths. Thus, combining both types of education does not reduce but rather substantially increases uncertainty about future incomes.

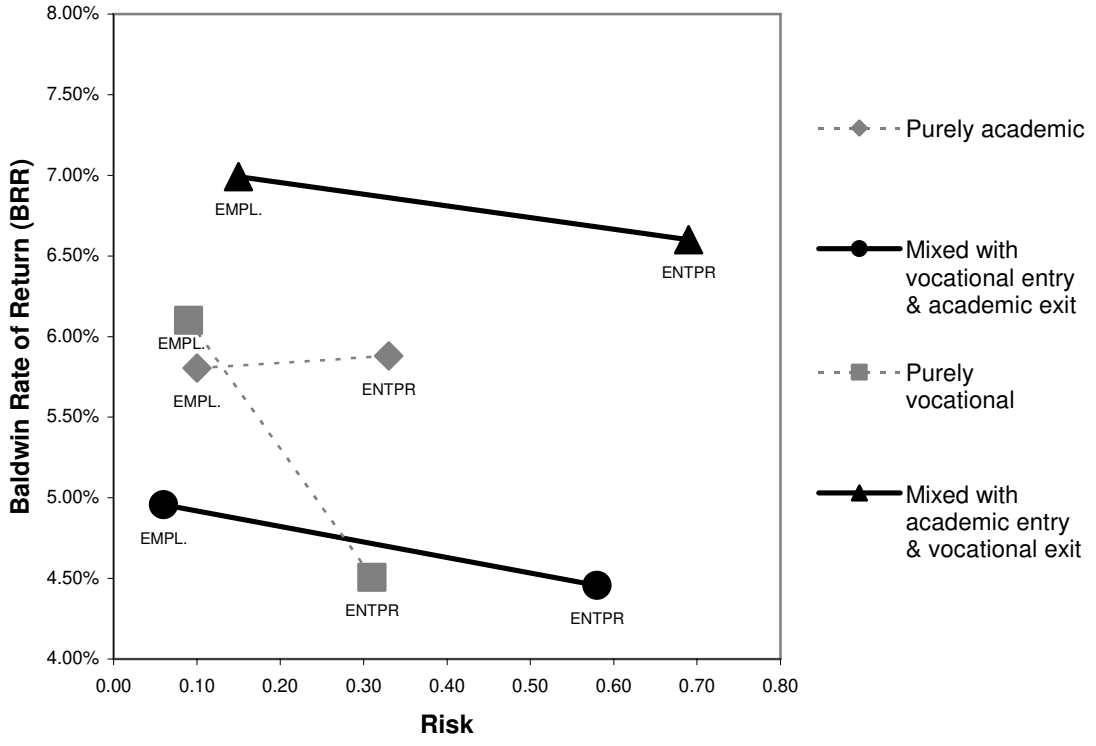
In summary, entrepreneurs face a considerable higher uncertainty about future income streams, which is on average not compensated by a higher rate of return, but rather the opposite is the case. The fact that entrepreneurs are less risk averse might not explain the sharp difference: in all educational groups (with the exception of purely academic educational paths) entrepreneurs accept a higher risk despite a slightly lower average income. Hence, entrepreneurs seem to benefit from other factors associated with entrepreneurship. For example Benz and Frey (2008) argue that they have a strong preference for being independent and being their own boss, which compensates them for the loss in income. This might especially hold for those entrepreneurs who have no employees. As already mentioned, the latter are assumed to have lower earnings than entrepreneurs with employees which could explain our results. Further research should possibly narrow the definition of entrepreneurs. This, however, would need new datasets with a larger number of entrepreneurs. Another explanation for the results could be that the differences are caused by measurement problems attached to earnings of entrepreneurs. On the one hand, in our data set earnings are measured by income before taxes. Income after taxes might be systematically different for entrepreneurs

and employees. Due to higher tax reductions, the latter might pay fewer taxes and, thus, comparing net incomes we underestimate the returns for entrepreneurs. On the other hand, some individuals indicating to be self-employed might in fact be unemployed. As they fear a bad reputation they misreport their employment status. This then leads to a bias in our risk measure: leaving out this group of pretended self-employed persons the variance is expected to be considerable lower. Unfortunately, there is no possibility to identify such cases in our dataset. Thus, we have to keep in mind that workers might in fact have a better guess about their position in the income distribution than we as a researcher observe for each educational group, which may also explain why our results seem not rational at first sight.

Finally, in contrast with the other educational paths, entrepreneurs with academic entry have (slightly) higher average returns than employees; however, they also face a considerably higher income risk. The latter makes entrepreneurship 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.

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. Basically, the only differences are that BRR are about half the IRR (or even lower) and that the income gap between entrepreneurs and employees is increased.

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



Source: Own calculations based on SLFS 1999-2005.

Our findings provide evidence, that the occupational choice might be strongly related to the educational background. Lazear's jack-of-all-trades theory (Lazear, 2005), which analyzes the occupational choice to become an entrepreneur as opposed to becoming an employee, might be useful in explaining the educational patterns that we find. The 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. The question to be answered then is, who has a broad and who has a specialized educational background. We argue that persons who acquire vocational education are assumed to specialize in one type of skill and are therefore expected to be better off as employees than as entrepreneurs. In contrast, we think that mixed educational paths consist of a high variety of skills, as vocational and academic educations are combined. Thus, these educational paths are expected to be associated with a broad educational background, which is a good prerequisite for entrepreneurship. The same is true for purely academic educational paths: academic education is assumed to be easily transferable to different types of occupations and job requirements. We do find some evidence for these propositions. However, this issue should be the focus of future research.

Conclusions

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. This might provide a possible explanation why mixed educational paths are chosen only by a minority. As already noted, the organization of the educational system could also 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. There is some evidence for risk-return trade-offs within the group of employees, but for entrepreneurs, this does not apply. Moreover, our findings indicate that the level of risk aversion is related to the occupational choice. Finally, uncertainty about future incomes might also play a role in educational decisions. Although this cannot be tested in our study, at least the results indicate the existence of such an effect: risk-averse individuals might not take mixed educational paths because these combinations of different types of educations are on average associated with a high uncertainty about future income. The latter result is mainly driven by the group of entrepreneurs. Though, as concerns the group of entrepreneurs, the results should generally be interpreted with some caution given the difficulty of measuring entrepreneurial income after taxes and the differences between various types of entrepreneurs such as those who employ workers and those who just work for themselves. However different combinations of education within the group of mixed educational paths might anyway differ in terms of the usefulness of the bundle of skills acquired for entrepreneurial occupations and should possibly be distinguished in future research.

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-declaration [xix]. We suppose that there might be some value to increasing the permeability of the educational system and especially to facilitating transitions between the two sides of the educational system. This would reduce the time loss associated with following a mixed educational pathway and might take the educational system a step forward towards an optimal allocation of students.

[xvii] Calculated as e^{β}, where β is the coefficient of the dummy variables indicating educational paths (see equation (2)).

[xviii] Detailed results of the calculation of the internal rates of return (IRR) and the Baldwin rates of return (BRR) are reported in Tables A4 and A5 in the appendix.

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

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Appendix

Table A1: Overview over the information used for calculation of age-earnings profiles

	Unemployment rates[A]	Age at latest education completed[A]
Purely academic	1.71	26
Mixed with vocational entry & academic exit	1.01	29
Purely vocational	1.05	25
Mixed with academic entry & vocational exit	3.15	28
	Length of (full-time) study[B]	Direct costs
Advanced Federal Certificate (Apprenticeship)	3.5	-6000
University Entrance Certificate (Matura)	4	1200
Higher Vocational Education & Training	2	6500
Universities of Applied Sciences	3	2000
Universities & Federal Institute of Technology	4.5	2000

Note: The information for higher vocational education is composed of the numbers for Higher Vocational Education & Training and Universities of Applied Sciences.

Source: [A]Based on SLFS 1999-2005; [B]Weber (2003: 416); [C]Swiss Federal Statistical Office (http://www.bfs.admin.ch/bfs/portal/en/index.html)

Table A2: "Extended" Mincer earnings function for control group

Net yearly earnings	
Advanced Federal Certificate (Apprenticeship)	Reference
University Entrance Certificate	-0.0002 (0.0516)
Experience (exp)	0.0183*** (0.0011)
Experience squared (expsq)	-0.0003*** (0.0000)
University Entrance Certificate * exp	0.0104* (0.0057)
University Entrance Certificate * expsq	-0.0001 (0.0001)
Constant	10.8594*** (0.0101)
Prob > F	0.0000
R^2	0.09
N	16391

Notes: While the control group solely consists of individuals with an advanced federal certificate as highest educational degree, the estimation results for workers with a university entrance certificate are used to calculate the age-earnings profiles for individuals with an academic entry; *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.

Table A3: 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 A4: Internal rates of return (IRR)

	Spec. (1): **IRR**			
	Based on Mincer earnings function		Based on non-parametric approach	
		& adjustment for inflation		& adjustment for inflation
Purely academic (N=2412)	10.07%	10.63%	9.48%	10.03%
Mixed with vocational entry & academic exit (N=441)	7.46%	8.01%	7.31%	7.85%
Purely vocational (N=6842)	11.98%	12.55%	11.44%	12.01%
Mixed with academic entry & vocational exit (N=911)	18.75%	19.38%	18.14%	18.76%

Source: Own calculations based on SLFS 1999-2005.

Table A5: Baldwin rates of return (BRR)

	Spec. (1): **BRR**			
	Based on Mincer earnings function		Based on non-parametric approach	
		& adjustment for inflation		& adjustment for inflation
Purely academic (N=2412)	5.66%	5.91%	5.54%	5.79%
Mixed with vocational entry & academic exit (N=441)	4.53%	4.74%	4.49%	4.70%
Purely vocational (N=6842)	5.61%	5.83%	5.54%	5.77%
Mixed with academic entry & vocational exit (N=911)	6.75%	6.97%	6.65%	6.87%

Source: Own calculations based on SLFS 1999-2005.

Table A6: "Extended" Mincer earnings function with distinction between entrepreneurs and employees

Net yearly earnings	Spec. (2)
Purely academic	Reference
Mixed with vocational entry & academic exit	0.2791***
	(0.0487)
Purely vocational	0.0071
	(0.0293)
Mixed with academic entry & vocational exit	0.1266**
	(0.0493)
Entrepreneur	-0.0181
	(0.0333)
Mixed with vocational entry & academic exit * entrepreneur	-0.0015
	(0.0932)
Purely vocational * entrepreneur	-0.1340***
	(0.0378)
Mixed with academic entry & vocational exit * entrepreneur	-0.0346
	(0.0689)
Experience (exp)	0.0315***
	(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	-0.0200***
	(0.0040)
Purely vocational * expsq	0.0004***
	(0.0001)
Mixed with academic entry & vocational exit * exp	-0.0161**
	(0.0071)
Mixed with academic entry & vocational exit * expsq	0.0003
	(0.0002)
Constant	11.2592***
	(0.0267)
Prob > F	0.0000
R^2	0.12
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.

Table A7: 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 (N= 1945, 467)	10.69%	5.93%	0.09	10.26%	5.81%	0.34	9.98%	5.80%	0.10	11.23%	5.88%	0.33
Mixed with vocational entry & academic exit (N= 348, 93)	8.10%	4.78%	0.07	7.68%	4.65%	0.58	8.25%	4.96%	0.06	7.44%	4.46%	0.58
Purely vocational (N= 5279, 1563)	13.92%	6.20%	0.09	6.59%	4.34%	0.32	13.11%	6.10%	0.09	7.43%	4.51%	0.31
Mixed with academic entry & vocational exit (N= 716, 195)	19.82%	7.05%	0.14	17.23%	6.67%	0.68	18.99%	6.99%	0.15	18.12%	6.60%	0.69

Note: N (number of observations employees, number of observations entrepreneurs).

Source: Own calculations based on SLFS 1999-2005.