Zeitschrift: Schweizerische Zeitschrift für Soziologie = Revue suisse de sociologie = Swiss journal of sociology

Herausgeber: Schweizerische Gesellschaft für Soziologie

Band: 38 (2012)

Heft: 2

Artikel: Parental background, upper secondary transitions and schooling inequality in Switzerland

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DOI: https://doi.org/10.5169/seals-815118

Parental Background, Upper Secondary Transitions and Schooling Inequality in Switzerland

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1 Introduction

Correlations between parents and children with respect to educational outcomes are generally found to be high, especially in Switzerland as shown in OECD (2009). A large part of the sociological literature on intergenerational mobility tends to focus on highest educational attainment, whereas parents may influence their children's choices at earlier stages of the educational process. This is relevant in the Swiss context as students choose between distinct tracks at various points of their educational career. Bauer and Riphahn (2006) show that the age of tracking is a key factor shaping schooling inequality in Switzerland. Yet, schooling is a cumulative process in which the probability of pursuing education heavily depends on previous transitions. Thus, the inequality of outcomes measured by differences in highest educational attainment is the product of inequalities occurring at different stages of the educational process.

The literature on intergenerational mobility in education usually fails to move beyond the difficult task of measuring intergenerational links in educational achievement. This is especially the case for studies focusing on intermediate school achievements. The importance of intergenerational correlations measured at age 15 depends on the mobility within the schooling system and on the returns to education. Dustmann (2004) has shown that intergenerational correlation in upper secondary educational attainment turns into large income differences on the German labour market. Performing a similar study, Falter et al. (2011) have shown that the impact of parental background on incomes, which is channeled through upper secondary education, is smaller in Switzerland. They further show that these differences are explained by lower returns to tertiary education in Switzerland rather than by differences in intergenerational correlation in education. Another issue

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I would like to thank the Transitions from Education to Employment Survey (TREE) consortium for the kind permission to use the data. I acknowledge financial support from the Federal Office for Professional Education and Technology. I also wish to thank the editors, three anonymous referees and participants at the following conferences: 6th International Conference of Panel Data Users in Switzerland and the 2nd VET conference in Bern for helpful comments. All the remaining errors are the author's responsibility.

is when and on what variable one should attempt to measure intergenerational correlations. The economic literature has greatly relied on samples of students from international surveys, which measure literacy achievements at age 13 or 15. As shown by Brunello and Checchi (2007), the impact of educational policies on inequality of opportunities greatly depends on ages and outcomes (literacy scores or labour market outcomes).

In this paper, our goal is twofold. First, we want to measure the impact of parental background variables across transitions. Do parental background variables matter more at age 15 or at age 19? This question will be answered by means of a sequential logit model estimated at various stages within the Swiss schooling system. In a second step, we investigate the relevance of the estimated parental background effect on educational inequality. For instance, observing large parental background effects at age 15 may only matter if individuals subsequently end up with different levels of education. This is especially important in Switzerland as the recent introduction of the so-called vocational matura in 1996 and the expansion of the universities of applied sciences (i. e. tertiary vocational education) may have mitigated the impact of upper secondary transitions on educational inequality.

The importance of intergenerational links with respect to upper secondary educational attainment in Switzerland is analyzed by means of microdata from the *Transitions to Education and Employment Survey* (TREE), which is a follow-up of PISA 2000. It contains information on individual ability as well as a wealth of family background information. This enables us to analyze the effect of parental background variables for different ability levels.

The remainder of the paper is organized as follows: Section 2 briefly discusses the Swiss education system and the main differences existing between cantons, Section 3 describes the data and provides a descriptive analysis of the sample. Section 4 reviews the methodological choices while Section 5 presents the results. Finally, Section 6 provides concluding comments.

2 The Swiss Educational System

A brief description of the Swiss schooling system is useful to understand our approach. Education in Switzerland is not shaped at the federal level. Instead, each canton has its own schooling system, leading to some important differences. Yet, despite their differences, the various cantonal schooling systems share some important components. Compulsory schooling begins at age 6 and ends at age 15.[1] Depending on the cantons, some tracking occurs between the age of 11 and 14. The number of

1 Policy steps are currently being taken in order to introduce compulsory schooling from the age of 4 years throughout Switzerland ("Harmos concordat"). The same plan currently being discussed at cantonal levels plans to raise the age of selection at the age of 13 years throughout the country.

tracks as well as the type of tracking is not consistent throughout the country, as it may consist in grouping students in different types of schooling (specialized schools vs. pre-gymnasial) or different types of teaching (low ability vs. high ability classes). This stage is important as transitions towards upper secondary education will be the product of this institutional feature along other variables such as schooling ability, social stratification, values and individual preferences.

At age 15, young individuals face the transition towards upper secondary education. At the upper secondary level, a youth can choose from a large array of school types. In this paper, we distinguish five main tracks. One first option is to drop out of school and leave the schooling system. The second possibility is to choose a dual apprenticeship training which implies working part-time in a firm and spending 1 or 2 days per week at school. Thirdly, one may enter full-time vocational school. Vocational education and training (VET) degrees do not give access to tertiary education. An important factor related to our research is the introduction of the so-called vocational matura in 1996. This degree can be obtained parrallel or after obtaining an upper secondary vocational degree. In both cases, it is an extension of the basic VET certificate. This diploma gives access to tertiary education. A fourth choice is represented by general knowledge schools and other specialized middle schools that do not lead to a degree giving direct access to college. We call this track "intermediate education". Finally, we consider college bound education, which gives access to universities and other forms of tertiary education (Maturity or A-level). Transitions to upper secondary school are based partly on schooling performance and teachers' advice, but may also ultimately reflect values of the family, social values and, of course, economic incentives. One has to bear in mind that school choices are seldom based on standardized tests or exams, which may explain the importance of socio-economic factors on upper secondary school choices.

The transition to tertiary education is obviously dependent on upper secondary school achievement. Vocational education may lead to tertiary education as one can pursue education in tertiary vocational school, the so-called "Universities of applied sciences". This type of school has been expanding recently in Switzerland in order to improve higher education opportunities for those who choose vocational education. Students mainly access Universities of applied sciences through the vocational matura.

3 Data and descriptive statistics

We use data from the *Transitions to Education and Employment Survey* (TREE), a follow-up of the Swiss PISA 2000 sample, which surveyed students at age 15. This is a unique database as it combines variables available in the standard PISA survey with longitudinal information. PISA enables us to gather information on parental

background and provides us with a measure of ability i. e. the PISA test score. In this paper, we focus on reading scores as this is the only measure covering all students in the data.

Our key variable is the diploma obtained. As a consequence, we only focus on successful transitions and we disregard incomplete paths. For instance, a person who first entered college bound education and then switched to an apprenticeship will be solely considered as an apprentice. We consider all upper secondary diplomas obtained until 2007, which is seven years after the end of the lower secondary education. For the sake of simplification, some degrees have been grouped. We end up with five types of upper secondary educational attainment. The bottom outcome is not (yet) having achieved any diploma after seven years. The second and third group consist of people having obtained a VET degree. As vocational training is quite heterogeneous, we split VET into two groups which we call low-skill VET and high-skill VET. This distinction is based on Stalder (2011), who establishes a classification of 105 apprenticeships according to their intellectual requirements. For the sake of simplicity and to avoid too detailed a classification, we consider VET classified as level 5 and 6 according to Stalder as being high-skilled and the levels 1 to 4 as low skilled.[2] One should also note that we do not distinguish between people who obtained their degree through a full-time vocational school or followed dual apprenticeship training. The primary motive is practical as it reduces the number of degrees. But it may also serve an additional purpose: apprenticeship training is constrained by the availability of apprenticeship positions, thus the observed "choices" heavily depend on firms' demand. By merging full-time vocational school and apprenticeship training in a single category, we may mitigate this issue.[3] The next outcome includes graduates of general knowledge schools and specialized middle schools, which we call throughout the paper "Intermediate education". The last outcome is a "matura", which is the highest upper secondary achievement in Switzerland. This degree can either be obtained by following a vocational track ("vocational matura") or through a gymnasial school.

The set of explanatory variables is taken from the original PISA data and can be divided into three categories: family background variables, individual characteristics and institutional aspects. We include the highest parental educational attainment (either the father or the mother, whichever is the highest) and the number of books in the household. This latter variable is often used as a substitute to parental education. It may also better reflect values towards education. Finally, as the information are reported by individuals aged 15, it may be more reliable

2 Bertschy et al. (2009) proceed in a similar fashion with the same dataset.

3 This argument is valid if apprenticeship training and full-time vocational schools are substitute. Evidence from Germany provides some support to this claim, as apprenticeship positions vacancies is negatively correlated to enrollment in full-time vocational schools (Parey 2009). Yet, as shown by Hupka-Brunner et al. (2010), these two forms of VET attract different populations. But as long as the substitution effects affect individuals at the margin, our argument is still valid.

than parental education. We assume that parental background variables play an important role in explaining the transitions towards upper secondary education. Yet, the exact mechanism is unkown as it may reflect economic inequalities, values towards education and ability.

We include the PISA reading-scores measured in 2000. We use exclusively the reading scores, since the results of other tests, such as mathematics, are only available for a smaller number of students. This variable enables us to control for ability, which reduces the potential ability bias of intergenerational links. Indeed, more educated parents may give birth to more able children, thus intergenerational correlation may be explained by nature rather than by nurture. The reading score also enables us to estimate the effect of parental background variables for different levels of competences. It is indeed important to know whether social stratification affects all individuals, regardless of their level of ability.

Among the other control variables, we introduce a dummy variable identifying first generation migrants. Additionally we include some geographic control variables for the non-German part of Switzerland, which is supposed to capture differences

Table 1 Descriptive statistics, women

	(1)	(2)	(3)	(4)	(5)	(6)	Total
Reading score	441.32	484.06	581.71	539.8	480.03	544.99	500.19
	[86.79]	[69.93]	[66.11]	[65.17]	[80.57]	[61.99]	[90.45]
Age in 2000 (months)	191.31	188.32	185.94	186.32	188.93	187.98	188.51
	[8.53]	[6.46]	[6.65]	[10.03]	[6.57]	[7.27]	[7.66]
Parents with intermediate education	34%	38%	39%	38%	42%	45%	39%
Parents with high education	11%	14%	47%	34%	9%	23%	21%
Canton with university	60%	53%	57%	54%	62%	60%	58%
Swiss born	78%	91%	94%	91%	83%	97%	87%
Other national	6%	6%	4%	5%	9%	2%	6%
Foreign language	26%	11%	9%	10%	17%	8%	15%
French speaking	18%	14%	27%	26%	20%	13%	20%
Italian speaking	2%		05%	5%	4%	0.03%	3%
51–249 books at home	29%	44%	35%	44%	44%	0.55%	39%
> 250 books at home	18%	23%	55%	35%	13%	0.28%	27%
Early selection*	30%	20%	24%	29%	24%	0.21%	25%
Share	23%	20%	20%	8%	24%	0.05%	100%

Between brackets: standard errors. Weighted statistics. N = 2 213.
(1): Drop out; (2): Low skill VET (vocational education and training); (3): Academic (4) Intermediate
(5): High skill VET; (6) Vocational Matura.
* Tracking at age 11.

Data: TREE 2001–2007.

Table 2 Descriptive statistics, men

	(1)	(2)	(3)	(4)	(5)	(6)	Total
Reading score	411.14	438.54	568.92	503.83	497.75	537.45	469.64
	[85.49]	[81.10]	[69.79]	[69.58]	[72.66]	[66.29]	[94.25]
Age in 2000 (months)	191.55	190.89	187.51	188.47	190.37	187.77	190.15
	[8.60]	[7.43]	[8.06]	[7.36]	[8.28]	[7.01]	[7.99]
Parents with intermediate education	20%	36%	31%	41%	46%	47%	35%
Parents with high education	25%	16%	60%	33%	25%	38%	27%
Canton with university	71%	57%	56%	71%	58%	58%	61%
Swiss born	64%	88%	92%	84%	82%	90%	83%
Other national	7%	3%	2%	2%	6%	8%	5%
Foreign language	37%	17%	6%	10%	23%	7%	20%
French speaking	37%	12%	19%	30%	19%	12%	20%
Italian speaking	6%	3%	7%	5%	2%	4%	4%
51–249 books at home	44%	42%	31%	31%	42%	57%	42%
>250 books at home	14%	16%	55%	53%	23%	26%	24%
Early selection*	20%	22%	18%	48%	40%	31%	26%
Share	22%	37%	12%	4%	16%	10%	100%

Between brackets: standard errors. Weighted statistics. N = 1 717.
(1): Drop out; (2): Low skill VET (vocational education and training); (3): Academic (4) Intermediate (5): High skill VET; (6) Vocational Matura.
* Tracking at age 11.

Data: TREE 2001–2007.

in attitudes across linguistic regions towards VET. We additionnaly include institutional variables such as early tracking or cantons with a university.

The original PISA sample available in TREE includes 6 343 students, while reliable information on the obtained diploma and control variables is only available for 3 930 students (2 213 women, 1 717 men). Compared to the original PISA sample, individuals still available for our research show higher ability levels and higher socio-economic background. This pattern is more acute for males than for females. Table 1 and 2 provide weighted statistics of our sample for women and men.[4] Differences between genders are quite important. Women show a much greater probability of choosing the academic track than men, while men go more often in low-skill VET. Women and men have a similar propensity to choose high skill VET (columns 5 and 6), yet men tend to pursue their education towards vocational matura more often than women. With respect to high parental education, young men going into either academic education or high skill VET seem to have a more favorable family background than their female counterparts. Taking the number of

4 We use sample weights provided by TREE.

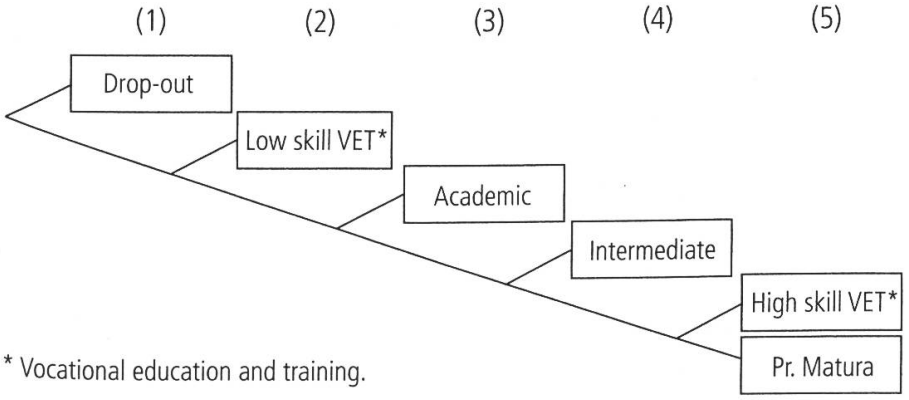
books instead of parental education somewhat blurs the picture as the pattern is not the same. Finally, the relatively high percentage of school drop-out is worth noting. This comes from the fact that our variable of interest is obtained diplomas. Later "catch-ups" are likely to occur, thus reducing the number of drop-outs.

4 Methodology

4.1 Description of the transition structure

Schooling is a cumulative process as the probability of pursuing education heavily depends on previous transitions. In order to capture the cumulative nature of educational outcomes, we break down educational paths into strings of binary choices. We focus on the path towards vocational matura i. e. the highest upper secondary achievement obtainable through the VET track. The reasons for focusing on the path to vocational matura are many. First, the introduction of the vocational matura may have improved access to higher education for individuals from lower socio-economic background. Second, as the vocational matura provides an improved access to higher education for individuals entering VET, the school choices made at age 15 may have little impact on economic outcomes.

Figure 1 Educational path



* Vocational education and training.

We decompose this path in five stages as shown in Figure 1. Each knot is better explained by describing the exit. The first knot describes the probability of dropping out of school, or more accurately of not having achieved a degree at age 22. The second knot describes the probability of choosing low-skill VET. The rationale is that this form of education is clearly distinct from the others. One should keep in mind that students choosing this branch of the tree can still pursue education towards a vocational matura. As such, we model an incomplete path. The third

step is choosing college bound education. This degree is the one offering the highest return among upper secondary qualifications. The fourth transition describes the exit towards "Intermediate education". Finally, the fifth step describes the binary choice between high skill VET and vocational matura.

4.2 Discussion of the tree structure

The tree structure makes important assumptions about the sequence of choices. It is highly debatable whether young individuals go through a set of binary choices, especially since most of these choices are simultaneous. Moreover, the string of knots could be altered by assuming, for instance, that individuals choose first between vocational and general education. Our tree structure should then be taken as a descriptive representation of the schooling system. The purpose of this tree structure is to assess how some transitions in the schooling system may affect educational inequality. Decomposing schooling outcomes into a string of binary choices allows us to measure the weight of these transitions by means of a relatively straightforward methodology.

The tree structure makes implicit behavioral assumptions. We assume a sequence of transitions towards the vocational matura, but the choice to go into this type of education could have been taken at an earlier age i. e. at the end of lower secondary education. This point has been raised by Cameron and Heckman (1998) who found little evidence supporting the sequential choice model with American data. Yet, we think that a sequential model may be more relevant in the Swiss context. The transitions observed at age 15 towards upper secondary education are determined not only by individual choices but also by external factors such as tracking. Moreover, as tracking takes place quite early, Universities of applied sciences offer a second chance to individuals who may have gone into higher education in a less selective system. The capacity to grab this opportunity may well depend on family background variables.[5]

Besides the sequential feature of educational choices, we do not make strong assumptions about the driving forces explaining educational choices. We will later refer to monetary returns to education in order to compare different educational outcomes. Yet, the benefits of schooling go well beyond pecuniary benefits, especially for women (see Oreopoulos and Salvanes 2011). Moreover, social values or gender role may affect individual choices independently of future income.

In this paper, our main interest lies in the impact of parental background variables on each of the above transitions. For some of the transitions, the sign of the coefficients cannot be determined beforehand. This is especially true for the

5 The fact that vocational matura may be obtained parallel to the basic VET certificate is more in line with the Cameron and Heckman critique. Yet, the rationale for estimating a sequential model lies more in the initial tracking which takes place quite early than on the decision observed at age 15.

transitions to vocational matura. Indeed, this degree may actually help reducing inequalities of opportunities in the educational system. This could typically happen if tracking at age 15 or earlier heavily depended on socio-economic background. By increasing mobility between types of schooling, the vocational matura may also mitigate the impact of early tracking on the inequality of school outcomes.

One may first think that the tree structure described above is a somewhat narrow view of the schooling system as it describes the path towards vocational matura. This is definitely not the case. Transition (1) is dropping out of school, which is definitely an important outcome for social and economic policy. The alternative to transition (3) is obtaining a matura, the second most important upper secondary degree in Switzerland and the main access to tertiary education. Therefore, only the alternatives of transition (2) and transition (4) do not describe an entire path as for both low skill VET and intermediate education the possibility remains of subsequently obtaining a matura. For the sake of brevity, we do not report the estimates describing the transition to matura from either low-skill VET or intermediate education.

4.3 Estimation framework

In order to estimate the educational path described above, we make use of a sequential logit model also known as a sequential response model (Maddala 1983). This model consists in estimating a logit model on a subset of the population that faces a transition at each knot described in Figure 1. One issue with this kind of model is the presence of unobserved heterogeneity (see Cameron and Heckman 1998). Unobserved heterogeneity raises two sorts of problems. First, as it could leave out confounding factors that are correlated with our variables of interest, it would be difficult to infer causality from the estimated effects. In case of intergenerational correlation, one may think of ability bias. This would happen if children of highly educated parents were more likely to pursue education for reasons unrelated to socio-economic background. In such cases, our estimates would overstate the extent of social stratification. The inclusion of ability test score may reduce this problem, but it doesn't solve it. If one is interested in population average effects, this issue is not troublesome. As such, the model is mostly descriptive. More importantly, estimated coefficients may be biased downwards even when unobserved variables are not confounding factors. The problem lies first in the properties of the logistic functions, as non-linearities in the estimated probabilities tend to lower the estimated coefficients (see a discussion of Cameron and Heckman 1998). Second, there is little reason to believe that the impact of unobserved heterogeneity may be stable across transitions. For instance, if one assumes that unobserved heterogeneity does not have any impact on the first transition, this is quite unlikely to be true for subsequent transitions as the distribution of unobserved attributes will change. As unobserved heterogeneity is indeed unobserved, adequately modeling this latent variable is a

nearly impossible feat. We tackle this issue by running robustness checks. We estimate the model with various scenarios about the presence of an unobserved latent variable across transitions. More specifically, we follow the footsteps of Buis (2011). We assume that the unobserved variable follows a standard distribution whose effect is equal to 2 across transitions. This means that a standard deviation increase in unobserved heterogeneity increases the odds of passing of a factor approximately equal to 7.[6] We also assume that our unobserved variable is not correlated to the independent variable at the first transition. This model is estimated using maximum likelihood. The inclusion of this latent variable does have a small impact on the size of the coefficients. This is especially true for those related to parental education as they become somewhat bigger with controls for unobserved heterogeneity. While such pattern is consistent with expectations, the conclusions of our research do not depend on unobserved heterogeneity.[7]

Our goal is twofold. First, we want to assess the impact of parental background variables across transitions. Do parental background variables matter more at age 15 or at age 19? This question will be answered by means of the logit estimates, which will provide an indication of the inequality of educational opportunities *(IOP)* at each transition.[8] In a second step, we investigate the impact of transitions on educational inequality. The probability of reaching an educational outcome can be considered as the conditional probability of passing a transition weighted by the importance of this transition. Following the sociological model proposed by Mare (1981), it can be shown that inequality of educational outcomes *(IOUT)* is a weighted average of inequalities of opportunities *(IOP)*, captured by the logit coefficients at transitions t:

$$IOUT = \sum_{t=1}^{T} (weight_t * IOP_t)$$

The weight depends on the population at risk (the proportion of the population confronted with a given transition), the variance of the indicator variable indicating who passed and who failed ($P_t * (1 - P_t)$ with P_t the probability of passing transition t) and the expected gain of passing a transition. Thus, the weight of a transition

6 These effects are large but conservative according to the literature. Kloosterman et al. (2009) and Erikson et al. (2005) for respectively the Netherlands and the United Kingdom found effects approximately equal to 2.5.

7 For the sake of brevity, we report only one set of results, although the impact of unobserved heterogeneity will be discussed. Results obtained with alternative specifications are available upon request.

8 We label these intergenerational correlations as "inequality of opportunities" as we refer to the seminal paper of Mare (1981). If one refers to the economic literature and more specifically to Becker (1964), the estimated IOP would rather be the cumulative impact of inequality opportunities and inequality of abilities. Notice that we do not attempt to establish whether the estimated correlations are due to ability or social inequalities, though we include an ability variable in our estimations.

will be greater if the probability of passing is close to 0.5 and if the population at risk is large. The weights and their components will be different for each individual as they depend on personal characteristics and the logit estimates. With respect to policy implications, it is important to understand the link between *IOP* and *IOUT*. Thus, our analysis focuses not only on the coefficients but also on the weight of each transition.[9]

Our empirical model relies on the computation of expected gain of passing a transition. Thus, one has to provide cardinal values for each educational outcome. We use the returns to upper secondary education estimated by Falter et al. (2011). Their estimates have been computed on a representative sample of the adult population drawn from the Swiss household panel survey between 1999 and 2006. This approach takes into account two broad types of qualification, vocational and matura diplomas. The returns to upper secondary vocational school are equal to 12.7% for women (12.8% for men) and the returns to a matura are equal to 33.6% for women (35.0% for men).[10]

5 Results

5.1 Inequality of opportunities

Table 3 and 4 report the odds-ratios of transitions for the main variables in our model for women and men respectively.[11] The model produces five sets of coefficients, one for each knot described in Figure 1. A positive effect (odds-ratio above 1) means that the explanatory variable increases the probability of pursuing the educational path and reduces the probability of exiting. The first exit is dropping out of school, which is the reference category of column 1. As expected, the PISA test score in reading is positively correlated to a degree at age 22 (vs. no qualifications) for both men and women. Interestingly, family background variables fail to produce statistically significant effects, except for the number of books in the women sample. One should keep in mind that we measure family background effects independently from observed ability. Thus, family background variables still have an impact on this transition through the PISA test score, which is highly correlated to socio-economic background. We also observe some male specific effects as dropping out of school

9 To compute the weights of transitions, we make use of a Stata routine developed by Buis (2010).

10 The wage information in TREE does not allow estimating the lifetime earnings gain from education as we observe only labor market entrants. Moreover, as a large share of the sample is still studying while interviewed, it does not allow estimating accurate returns to education.

11 We discuss only differences between genders that are statistically significant at the 10% level. Statistical significance was assessed by running a fully interacted model on the whole sample. Detailed results are available upon request.

Table 3 Odds-ratio: educational path to vocational matura, women

	(1)	(2)	(3)	(4)	(5)
Reading test score	1.015***	1.016***	0.985***	0.990***	1.014***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Parents with intermediate education	1.009	1.221	0.517	0.958	1.276
	(0.985)	(0.632)	(0.116)	(0.923)	(0.564)
Parents with high education	2.287	2.963*	0.193***	0.180***	3.469**
	(0.206)	(0.055)	(0.006)	(0.000)	(0.0431)
51–249 books at home	2.243*	1.440	0.590	0.731	1.980
	(0.093)	(0.441)	(0.293)	(0.491)	(0.211)
≥250 books at home	1.506	1.215	0.179***	0.219***	1.830
	(0.504)	(0.727)	(0.001)	(0.005)	(0.315)
Cantons with university	1.121	2.412**	1.407	1.823	1.659
	(0.768)	(0.020)	(0.342)	(0.152)	(0.267)
French speaking	1.089	1.986	0.436**	0.461*	0.421*
	(0.858)	(0.227)	(0.042)	(0.080)	(0.075)
Born in Switzerland	0.871	0.614	0.662	1.100	3.200
	(0.852)	(0.532)	(0.446)	(0.887)	(0.301)
Tracking at age 11	0.590	1.597	1.258	0.938	0.975
	(0.266)	(0.275)	(0.611)	(0.879)	(0.962)
Observations			2213		
χ^2			72.39		

Method of estimation: sequential logit model. Robust p-values in parentheses.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$. Not reported: Italian speaking, language at home, age.
(1): Drop-out vs. having achieved a diploma (2): Low skill VET (vocational education and training) vs. other diplomas; (3): Academic vs. Intermediate & High skill VET (4): Intermediate vs. High skill VET
(5): High skill VET vs: Vocational matura.

Data: TREE 2001–2007.

is positively correlated with French speaking cantons (odds-ratios below one) while early tracking increases the probability to achieve an upper secondary degree.

The second exit is low-skill VET (column 2), which is once again the reference group. The reported estimates are the odds of having achieved a degree other than low-skill VET, arguably higher forms of education. Now parental education is unambiguously positively correlated to higher education. Once again, early tracking seems to matter only for men as the coefficient attached to this institutional feature is positive, while it fails to be statistically significant for women. Interestingly, the positive impact of ability is significantly smaller for women than for men. Greater ability sorting among men may be due to occupational segregation in VET. Most

Table 4 Odds-ratio: educational path to vocational matura, men

	(1)	(2)	(3)	(4)	(5)
Reading test score	1.011***	1.026***	0.993**	1.010**	1.014***
	(0.000)	(0.000)	(0.011)	(0.028)	(0.000)
Parents with intermediate education	2.796*	2.603**	1.226	1.872	2.138
	(0.065)	(0.021)	(0.681)	(0.322)	(0.240)
Parents with high education	2.317	5.222***	0.388*	2.024	4.685**
	(0.175)	(0.000)	(0.0739)	(0.323)	(0.011)
51–249 books at home	0.486	1.119	1.219	0.678	2.076
	(0.162)	(0.781)	(0.706)	(0.550)	(0.175)
≥250 books at home	0.686	1.822	0.539	0.139***	0.601
	(0.511)	(0.209)	(0.242)	(0.003)	(0.418)
Cantons with university	0.887	1.429	1.823	0.608	0.977
	(0.815)	(0.354)	(0.182)	(0.408)	(0.966)
French speaking	0.096***	0.774	0.341**	0.271**	0.439
	(0.000)	(0.528)	(0.019)	(0.043)	(0.167)
Born in Switzerland	3.132*	0.466	0.759	1.295	0.668
	(0.093)	(0.241)	(0.681)	(0.797)	(0.743)
Tracking at age 11	2.707*	4.990***	7.147***	1.485	1.049
	(0.097)	(0.000)	(0.000)	(0.465)	(0.932)
Observations			1 717		
χ^2			86.98		

Method of estimation: sequential logit model. Robust p-values in parentheses.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$. Not reported: Italian speaking, language at home, age.
(1): Drop-out vs. having achieved a diploma (2): Low skill VET (vocational education and training) vs. other diplomas; (3): Academic vs. Intermediate & High skill VET (4): Intermediate vs. High skill VET
(5): High skill VET vs: Vocational matura.
Data: TREE 2001–2007.

of the occupations in VET are either male or female dominated, and lower female transitions in VET may be due to less attractive occupations for females (see Falter and Wendelspiess 2011). This may explain differences in ability sorting between males and females.

The third exit is college bound education (column 3), individuals that get a matura without having achieved any other forms of upper secondary education. The probability to go into academic education is positively correlated to the PISA test score and hence negatively to our educational path. The impact of ability is statistically different between genders as the odds-ratio is smaller among females. This means that ability has a greater positive impact on choosing academic educa-

tion for women than for men. Parental education variables produce the expected signs as having parents with higher education increases the probability to choose the academic track. It is worth noting that individuals living in French speaking Switzerland have a higher propensity to go into academic education, which may indicate cultural differences. Finally, we observe once again a statistically significant effect of early tracking in the men sample.

In the fourth column, we report the parameters describing the exit to intermediate education vs. choosing high skill VET. Differences between genders are quite important. For women, high skill VET is negatively correlated to parental education, while the reverse is true for men (though the effects are not statistically significant). Nevertheless, it is worth noting that the impact of parental background variables are somewhat ambiguous for men as the number of books is negatively correlated to choosing high skill VET. A diverging pattern between genders is also found for the ability test score, as we observe a negative impact on choosing high skill VET for women and a positive sign for men. These estimates seem to indicate that VET is less attractive for females than for males.

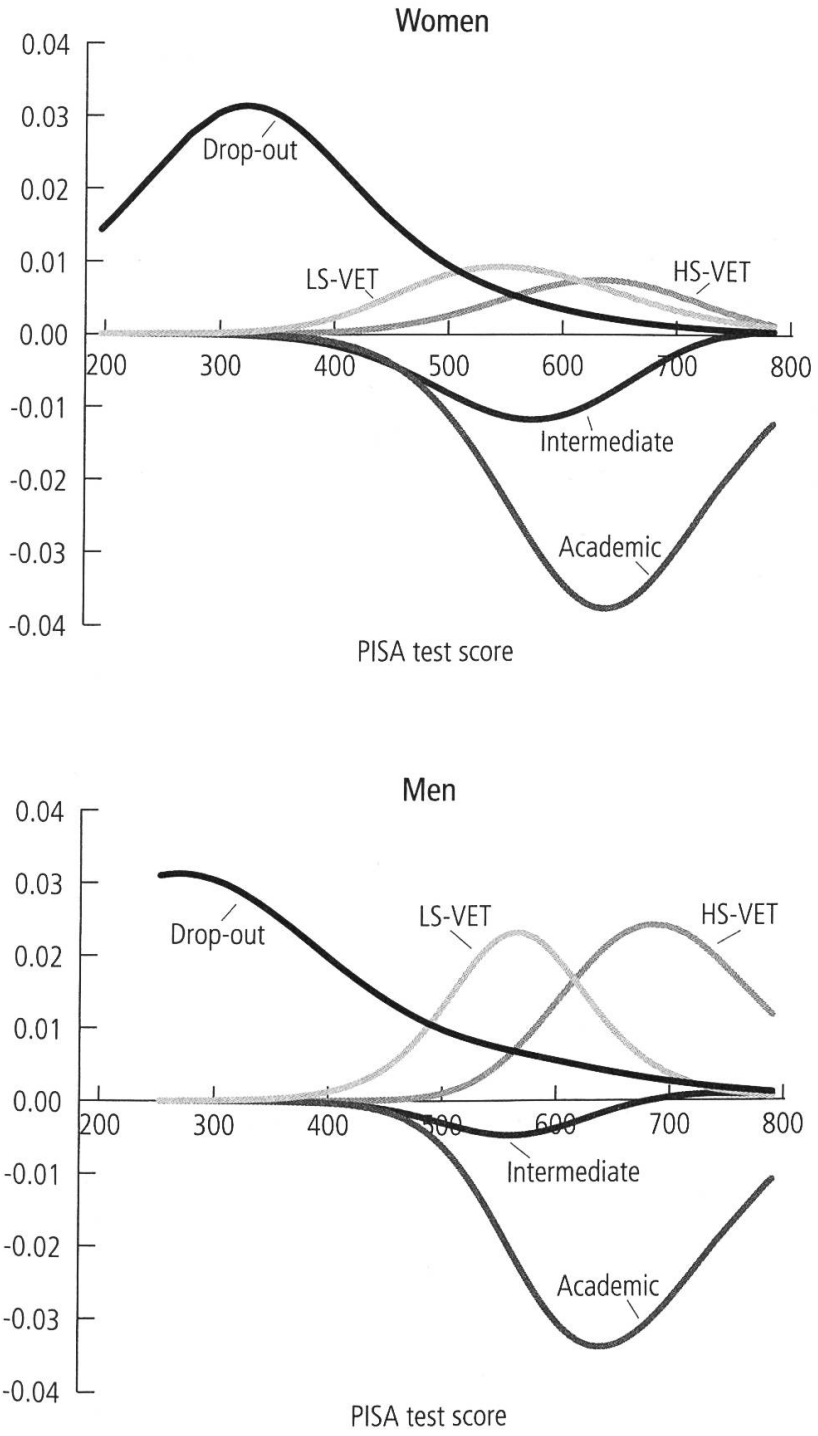
Finally, column 5 reports the results pertaining to the transitions from high-skill VET to the vocational matura. In our model of educational choices, it is the only choice that is unambiguously subsequent to the previous one, as individuals have to get first an upper secondary degree. Our results are quite consistent between genders. Higher ability score still have an impact on further transitions. We also observe strong and significant impacts of parental education on the choice of pursuing towards the vocational matura. Finally, our French speaking canton dummy still shows some important differences as French speakers are less likely to get a tertiary vocational matura. All the other variables in our model fail to be statistically significant.

5.2 From inequality of educational opportunities to inequality of outcomes

The odds-ratios discussed above are interpreted as inequality of opportunities at different stages of the educational path. These estimates will only matter for educational inequality if they were to translate into differences in outcomes. As previously mentioned, inequality of outcomes is the weighted average of inequality of opportunities. These weights are the product of the population at risk, the expected gain of passing a transition and the variance of the variable indicating who passed or who failed a transition. From the above estimates, it is possible to compute these weights for each individual in the sample. We perform this exercise for a hypothetical person having the modal characteristics in our sample and low educated parents. We compute these weights by allowing our ability variable, the PISA 2000 reading tests score, to vary.

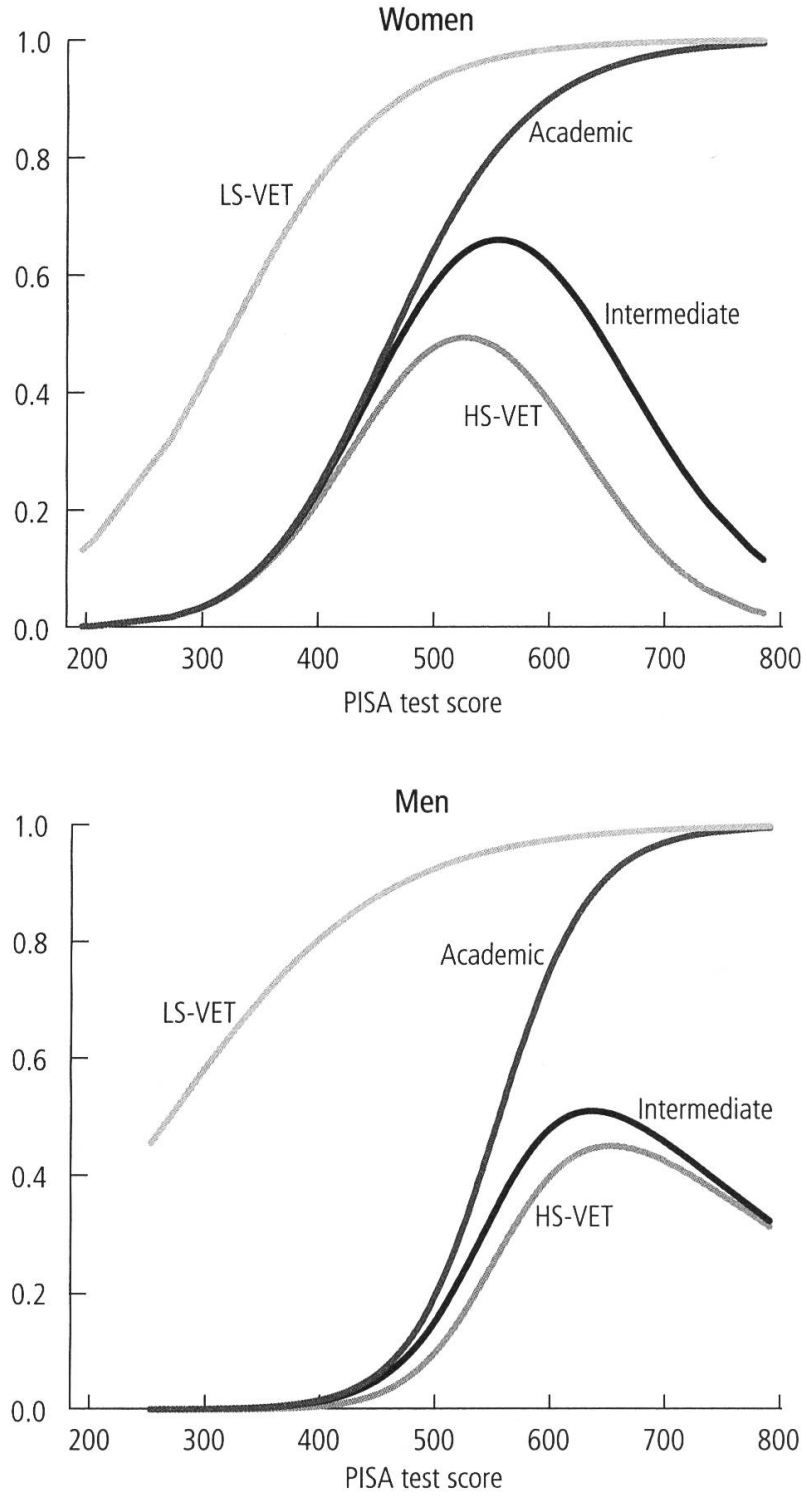
In Figure 2, we show the weights of transition for women and men. The weights can be either positive or negative, depending on whether passing a transi-

Figure 2 Weights of transitions, by exits



Notes: Individuals have the following characteristics: Swiss German, 15.75 years at time of PISA 2000, lives in a canton with a university, normal tracking, 51–249 books in the hh, parents with basic education. Weights are defined as: population at risk*expected gain of transition*variance at transition.

Figure 3 Population at risk, by exits



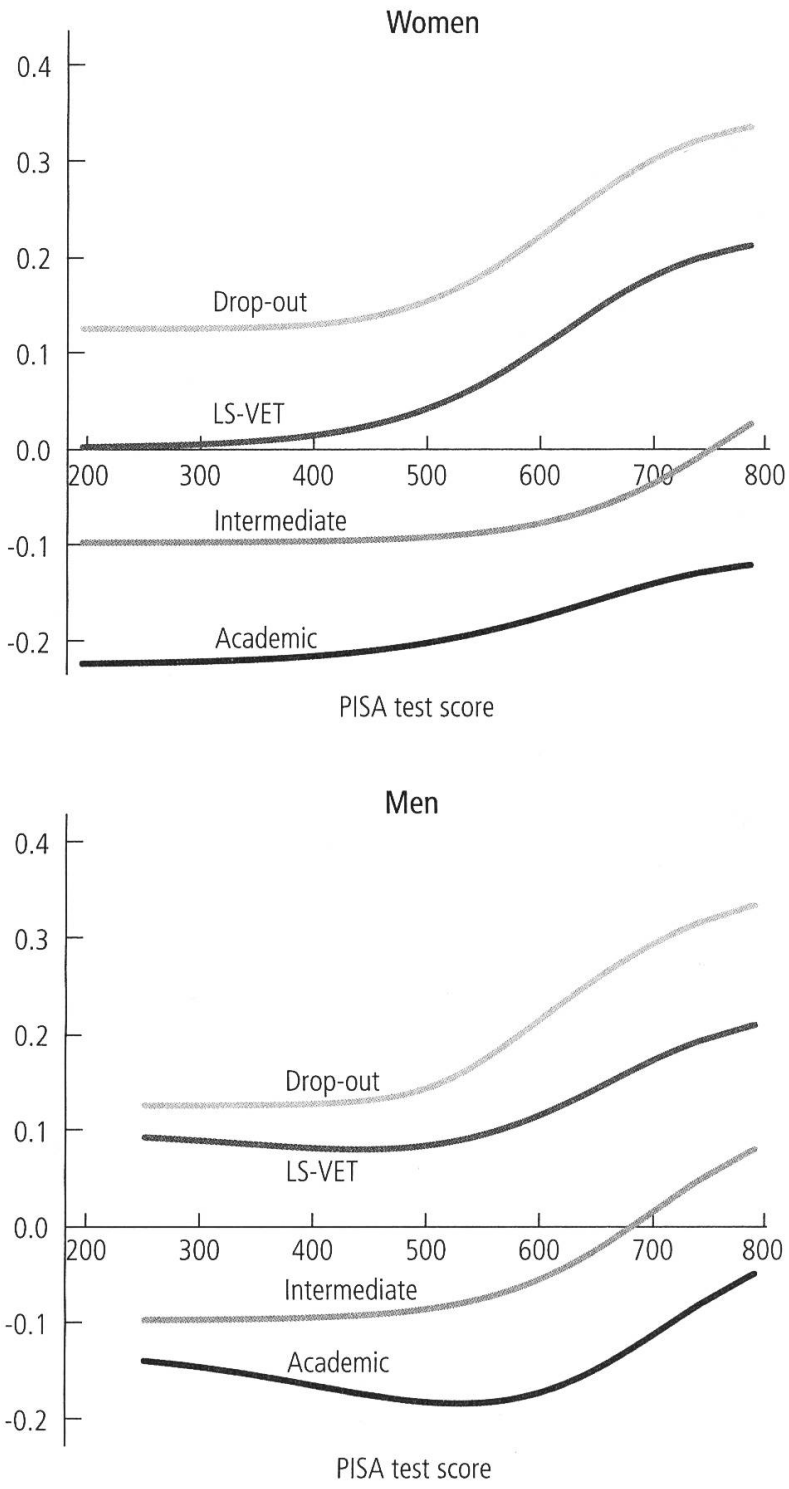
Notes: Individuals have the following characteristics: Swiss German, 15.75 years at time of PISA 2000, lives in a canton with a university, normal tracking, 51–249 books in the hh, parents with basic education.

tion increases or decreases one's income. For instance, pursuing the path towards the vocational matura instead of exiting towards the academic track lowers one's income. This means that the weights for this transition are negative. For both men and women, the weights of dropping out of school are large for low skills individuals, and decrease with ability. On the other hand, we observe large weights in absolute values for the transitions towards academic education for relatively high ability people. With respect to the transition to vocational matura, the weights are relatively small for women while they are relatively large for high skilled men. This means that the parental effects reported for women with respect to this transition are unlikely to matter for educational inequality.

One interesting feature is to decompose the weights in their components. We will discuss the pattern of the population at risk and the expected gain of passing a transition. We first start with the population facing a transition (Figure 3). The first transition i. e. dropping out of school is left out of the graphic as every individual in the sample faces it. With respect to the next two transitions, i. e. low skill VET and academic education, we observe that virtually all high ability individuals face this transition as they are quite unlikely to either drop out or choose low-skill VET. Regarding the exit versus intermediate education or high skill VET, the curves have a bell shape, as low and high ability individuals are quite unlikely to face this choice. Low ability individuals have either dropped out or gone into low-skill VET, while high ability students end up in the academic track. It is worth noting that the drop in the population at risk is much sharper among women than men, which indicates that high skilled women are much more likely to pursue the academic track than high skilled men.

One important component is the gain associated to a transition. We use the monetary returns to education computed by Falter et al (2011) for upper secondary education in Switzerland to provide cardinal values to educational attainment. Falter et al. (2011) estimate only returns to broad types of qualification, i. e. vocational and matura diplomas. This means that the difference between low and high-skill VET comes from the lower transition rates towards vocational matura for individuals choosing low-skill VET. This probably under (over) estimates the true returns to high-skill (low-skill) VET. In Figure 4, we observe that the expected gains depend greatly on ability. Low skills individuals tend to gain little from not dropping out of school or avoiding low skill VET, as they have a small probability to pursue education towards a matura anyway. Of course, this conclusion greatly depends on the returns to education, which are relatively low. Any increase in the returns to upper secondary education may dramatically change the picture. With respect to academic education, the gains are negative as one would earn more by choosing this track instead of going into either intermediate education or high skill VET. The loss becomes smaller for high ability individuals, which is explained by

Figure 4 Expected gain of transitions, by exits



Notes: Individuals have the following characteristics: Swiss German, 15.75 years at time of PISA 2000, lives in a canton with a university, normal tracking, 51–249 books in the hh, parents with basic education.

the fact that high ability people tend to end up with the highest degree, whichever track they choose.

We do not report the last component of the weights, i. e. the variance of transition which is defined $P_t * (1 - P_t)$ with P_t the probability of passing transition t. We only mention that the variances depend on ability. For each transition, the variance first increases with ability until reaching its maximum value (around 0.25) and then decreases with ability.[12] This maximum values are also obtained for different levels of ability depending on the transitions. This relationship between the variance of passing and the PISA test score indicates that the effect of parental background variables depends on ability. This is not always the case as shown by Checchi and Flabbi (2007) in Italy, where parental background effects are mostly independent from ability level.

To summarize, the computation of weights and their decomposition show that the most important transitions are still the ones giving access to academic education and dropping out of school. Nevertheless, these weights depend crucially on ability level. It is worth noting that for high ability individuals, parental background variables seem to play a small role on educational outcomes. This is played out through two mechanisms. First, high ability individuals tend to overwhelmingly choose the academic track. Second, access to higher education is still possible through the vocational matura. For low ability individuals, the weights regarding dropping out of school are relatively large. Yet, the logit estimates attached to parental education are relatively small concerning this transition. Therefore, these weights reflect the fact that dropping out of school is relatively costly in Switzerland. However, they do not indicate that parental education shapes inequalities at this stage of the educational process.

5.3 Sensitivity of the results

The results reported in this paper have been obtained by a method which attempts to control for unobserved heterogeneity. As explained earlier, one has to make bold assumptions about the functional forms and the behavior of unobserved heterogeneity. The sensitivity of our results to our assumptions is assessed by running the model without controls for unobserved variables and also with alternative scenarios describing the behavior of unobserved heterogeneity. While we do not report the results obtained with these alternative choices, we briefly discuss the impact of unobserved heterogeneity on our results.[13]

When estimating the model naively i. e. without trying to control for unobserved heterogeneity, we find relatively similar odds-ratios as those reported in the results section. For women, the most important differences are found in the transition towards low-skill VET as coefficients become smaller and fail to be statistically

12 The exception being school drop-out for men as the variance is always decreasing with ability.
13 The descriptive statistics of the unobserved variable are available upon request.

significant. For men, we also observe the largest differences from the results presented previously for the exit towards low skill VET. For both women and men, the size of the odds-ratios is somewhat smaller for transitions 2 to 5. This was to be expected as failing to account for unobserved heterogeneity may mechanically reduce the size of the coefficient due to non-linearities in the logistic function.

The weights of the transitions on the inequality of outcomes and their components are derived from the estimated coefficients. Thus, running naive estimations alter the shape of the graph. This is especially true with respect to exits towards drop-out, as the weights become larger for any ability level. Yet, the discussion in the previous section remains valid, notwithstanding the choice with regard to accounting for unobserved heterogeneity.

The weights and their components do not depend only on the estimated coefficients but also on the cardinal values attached to educational outcomes. We make use of estimates of returns to upper secondary education that have been computed on the overall adult population. These returns may be driven by older cohorts, thus they may not be suited for individuals on the verge of entering the labour market. Due to rising returns to skills, the returns to maturas may rise for the youngest generations. Higher returns to tertiary education would put a greater weight on both dropping out of school and choosing academic education. Yet, the gains from education are not the sole driving force behind the computed weights.

6 Conclusion

In this paper, we investigate intergenerational mobility with respect to educational attainment in Switzerland. We make use of data from TREE, a follow-up of PISA 2000, which combines information on ability at age 15 and longitudinal information. Our goal is to analyze the cumulative feature of education as we estimate a sequential logit model. We are particularly interested in transitions leading to the vocational matura, as this new qualification may provide new opportunities for individuals following the vocational track. Subsequently, we endeavor to measure whether inequality of educational opportunities measured at various transitions points implies inequality of educational outcomes.

Our results show that parental background variables matter for most transitions. This is especially true with respect to the transition towards the vocational matura, which takes place approximately at age 19 or later. Our results also point to important gender effects. Parental education and reading test score coefficients are positively correlated with choosing the vocational matura for men, while the reverse is true for women. This could be explained by the fact that VET is relatively less attractive for women, due to the type of occupations in which this type of training takes place.

When we turn to the link between these intergenerational correlations and inequality of educational outcomes, our results show that the effects of parental background heavily depend on the skill level of individuals. Inequality of outcomes is a weighted mean of inequality of opportunities. The weights depend on the population facing transition, the expected gains and the variance of passing a transition. For low ability students, parental background variables have an impact on inequality of outcomes only with respect to dropping out of school. This is explained by the fact that low ability students are quite unlikely to face transitions towards higher education. Parental background variables also have limited impacts on high ability children as they are sorted into higher forms of education, independently of their social characteristics. With respect to transitions to vocational matura, our results show that parental education increases the probability of pursuing education for both women and men. Yet, it only has an impact on the inequality of educational outcomes for the latter as the weight of this transition is small for women.

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