Upper secondary school transitions: an empirical analysis

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Upper secondary school transitions: an empirical analysis

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Abstract

This thesis proposes an empirical analysis of upper secondary school transitions, using exhaustive registry data for a single Swiss Canton, Geneva. Educational choices made by 15 year olds represent a high stake moment in the Swiss highly differentiated tracked school system. Moreover, the persistence in educational pathways implies that making the "right choice" will have important consequences in structuring the future set of opportunities, whether within the educational system or directly on the labor market.

The four main chapters assembled here each deals with a particular aspect of those transitions. Chapter 3 takes an encompassing view and examines the first upper secondary school transition of all 15 cohorts of students and assesses how transition opportunities are affected (and constrained) by social capital endowments and migration background; a focus especially relevant, given the heterogeneous nature of the student population in Geneva. Social capital is found to be an important determinant of first upper secondary school transitions, with heterogeneous impacts across middle school tracks and migrant groups.

Chapter 4 looks at the impact of the age at first tracking on the smoothness of upper secondary school transitions and examines if a one-year delay in middle school tracking influences the probability of route changes at the upper secondary level. Thanks to a natural experiment in Geneva, whereby a group of middle schools tracked their students a year later than the majority of schools, and because selection into treatment is independent of potential outcome, the average treatment effect can be identified through a regression design. Results suggest a small positive ATE, implying a negative impact of delayed middle school tracking on the smoothness of subsequent school transitions. Effects are heterogeneous along the ability distribution, with low achievers more negatively affected.

Chapter 5 focuses on transitions to apprenticeship training and examines apprentices' pathways, studying how the latter might be related to past school outcomes. Pathways are assessed over two dimensions: a more quantitative one, looking at the pure accumulation of years of training, and a more qualitative one, looking at the smoothness of vocational pathways, i.e., whether or not apprentices change occupations over the years. Using zero inflated models, results show that, although middle school low track students are much more likely to engage in apprenticeship training, they are less successful in accumulating years of training than their high track counterparts. In addition, the former are less likely than the latter to achieve a smooth occupational pathway within apprenticeship training. Additionally controlling for grades and non cognitive skills yields a similar pattern. High achievers thus have an absolute advantage in both types of education.

Permeability of vocational systems has only recently been identified as key

challenge for traditional apprenticeship countries and chapter 6 thus focuses on transitions across modes of training within vocational education and training, examining the impact of changing modes of training on the qualification probability on the one hand, and on the number of years necessary to qualify on the other. The impact of changing modes of training is estimated for commercial vocational students, the largest field of vocational education at both the country and Cantonal levels, and the field in which the share of exclusively school based students is the largest. Allowing unobserved heterogeneity to be correlated with the regressors, the results show that transitioning from full time to dual vocational education and training increases students' probability to qualify. Due to an obvious lack of permeability between modes of education, this type of transition is however associated with an extended delay towards qualification.

Résumé

Cette thèse propose une analyse empirique des transitions scolaires vers le secondaire supérieur reposant sur une base de données administratives et exhaustives pour le canton de Genève (Suisse). Dans un système scolaire fortement différencié, les choix éducationnels des adolescents de 15 ans sont cruciaux pour la suite de leurs parcours, aussi bien au sein du système éducatif que sur le marché du travail.

Les quatre principaux chapitres assemblés ici traitent chacun d'une problématique particulière concernant ces transitions. Le chapitre 3 adopte une approche globale et examine la première transition des 15 cohortes d'étudiants contenues dans les données sous l'angle du capital social. En particulier, ce chapitre s'intéresse à la manière dont ce dernier conditionne les opportunités au moment de la transition d'une part, et des possibles différenciations en fonction de l'origine migratoire d'autre part; un sujet particulièrement important pour Genève, vu la forte hétérogénéité de la population d'élèves. Les dotations en capital social jouent un rôle important au moment de la transition, avec un impact différencié en fonction de la section du secondaire inférieur et de l'origine migratoire.

Le chapitre 4 s'intéresse à l'impact de l'âge de la sélection (*tracking*) sur la linéarité des transitions au postobligatoire. Grâce à une expérience naturelle dans le canton de Genève, où un groupe d'écoles du secondaire inférieur retarde la sélection d'une année, et parce que la sélection entre groupe traité et groupe de contrôle est indépendante des résultats potentiels, l'effet moyen du traitement peut être identifié par régression. Les résultats suggèrent un effet de traitement moyen faible : retarder la sélection d'une année a un effet négatif sur la linéarité des transitions subséquentes. Les effets sont hétérogènes en fonction de la performance des élèves; les élèves les plus faibles sont les plus négativement affectés.

Le chapitre 5 se concentre sur les transitions vers l'apprentissage et examine le parcours des apprentis. Ces parcours sont examinés à la fois sous un angle quantitatif, en se concentrant l'accumulation d'années de formation, et qualitatif, en étudiant la linéarité vocationnelle des parcours professionnels, i.e., les changements de profession durant l'apprentissage. Grâce à des modèles dits à inflation de zéros, les résultats montrent que la participation à la formation duale est plus importante chez les élèves du regroupement à exigences moindres. Néanmoins, ces élèves accumulent moins d'années de formation que les élèves du regroupement à exigences étendues. Les premiers accomplissent également des trajectoires vocationnelles moins linéaires que les derniers. La prise en compte des performances scolaires et des capacités non cognitives ne modifie pas les résultats. Les élèves à fort potentiel semblent ainsi avoir un avantage absolu tant dans l'académique que le vocationnel.

La perméabilité des systèmes de formation professionnelle a récemment été

identifiée comme l'un des défis majeurs à relever. Le chapitre 6 s'intéresse ainsi aux transitions à l'intérieur de la formation professionnelle, entre l'apprentissage et la formation exclusivement en école et à leurs impacts, d'une part sur la probabilité d'obtenir un diplôme secondaire et, d'autre part, sur le nombre d'années nécessaire à l'obtention de ce diplôme. Cet impact est estimé pour les étudiants en formation commerciale, la voie professionnelle la plus importante, tant au niveau cantonal qu'au niveau suisse, et où le plus d'étudiants sont exclusivement basés dans une école professionnelle. En prenant en compte la corrélation entre l'hétérogénéité non observée et les variables de contrôle, une transition de la formation professionnelle en école à la formation duale augmente les chances d'obtenir un diplôme secondaire. Du fait du manque de perméabilité du système professionnel, cette transition entraîne en revanche un délai supplémentaire à l'obtention du diplôme.

1. Introduction

One of the goals of education systems in Western and OECD countries has been (and still is) to provide equal opportunities to all children in giving them free and universal education from a young age. To a large extent, stylized facts support this latter statement: educational participation and attainment have been steadily rising over the last fifty years. For example, access to primary and lower secondary education is now universal in all OECD countries and, in 2013, 40% of non studying adults have achieved a higher education level than their parents (OECD, 2014a). In addition, over the last decade, many countries have managed to improve the effectiveness of their educational system and to increase their PISA scores over the successive test waves (OECD, 2014b). Based on these pieces of evidence, it is somehow safe to say that, overall, the objective has been achieved.

Nonetheless and perhaps unsurprisingly, over the last five decades, researchers and policy makers have become more and more concerned with the failures of current educational systems, as it appeared that some groups were getting systematically less favorable outcomes than others, seriously challenging the equal opportunity principle. This suspicion precisely motivated the commission of the Coleman report (1966) during the mid 1960s in the US. Among many other things, the Coleman report highlighted that one could not rely on the education system to provide equal opportunity to all children, and worse, the system was even aggraveting pre-existing differences. Needless to say, had those differences in outcomes been related to objective differences in, say, ability or preferences, then none of these should have been a real concern, at least from an economist's perspective. However, it turned out that differences in outcomes were strongly related to differences in terms of socioeconomic status or ethnic background.

Although this report was of course dated, revealing social and political concerns of the 1960 America, findings were probably relevant for other countries, but it would take some more time for these themes to come up in the political agenda in Western Europe. Towards the end of the 1980s, policy makers and, to some extent, society in general could not ignore those issues any more. Whether it was because social preferences had evolved, with equity and fairness having become

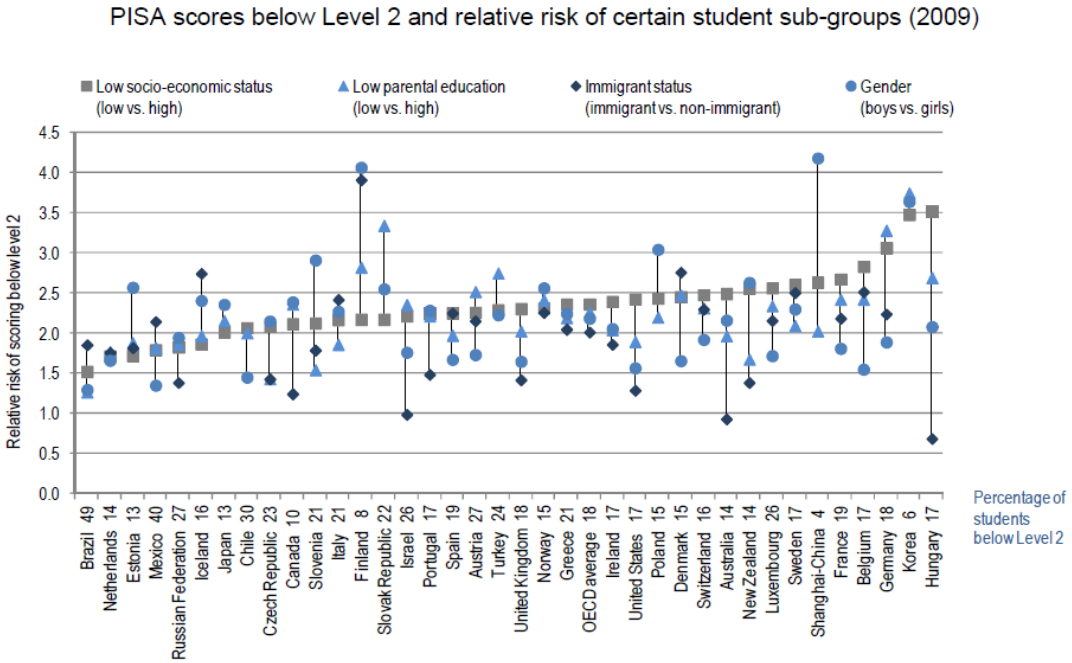
much more of a concern, or because the sometimes violent manifestations of those inequities, such as the 1992 LA riots or the 2005 French Banlieue riots, simply became unbearable; a cure, or more modestly a fix, had to be found rapidly.

Countless large scale public policies were then implemented to remediate some of those disadvantages: early on in the US at the beginning of the 1970s, following the publication of the Coleman report, with the busing of black students to different schools (so called "desegregation busing") and the head start program; later on in Europe with, for example, the French ZEP (standing for "Zone d'Education Prioritaire") program at the beginning of the 1980s or the 2006 REP (standing for "Réseau d'Education Prioritaire") initiative in Geneva. Occurring with a slight delay, the question of the effectiveness of those programs in attaining their original goals crept up; impact studies revealed that some programs did a pretty good job and some others did not, but for certain, much more remained to be done, as systematic disadvantages were still a by-product of most Western school systems. Figure 1.1, reproduced form the OECD (2012b) report on equity within school systems, links the impact of socioeconomic background, migration status, gender and parental education with the risk of performing below level 2 in the PISA reading proficiency scale, a level denoting the lack of basic reading skills. Point estimates greater than one suggest that a particular factor increases the probability that the student performs below level 2. In all OECD countries, point estimates for at least one such factor (and usually for all of them) are indeed higher than one.

Although there isn't a single explanation as to why school systems perform so poorly in leveling inequalities, a useful framework to think about those issues is the Effectively Maintained Inequality (EMI) hypothesis: "The effectively maintained hypothesis posits that socioeconomically advantaged actors secure for themselves and their children some degree of advantage, wherever advantages are commonly possible. On the one hand, if quantitative differences are common, the socioeconomically advantaged will obtain quantitative advantage; on the other hand if qualitative differences are common, the socioeconomically advantaged will obtain qualitative advantage" (p.1652, Lucas, 2001). The EMI implies that closing quantitative gaps, in achieving for example a certain nearly universal education level, is probably a necessary but not sufficient condition to get rid of inequality, as qualitative advantages will replace quantitative ones, effectively maintaining inequality.

This simple framework highlights that fighting inequality within a school system is a very complex task, since so many possible aspects might ultimately

Figure 1.1: Students at risk of low performance in OECD countries



Source: p.17, OECD (2012b).

count as "qualitative differences", such as a better teacher, better peers or even simply more attention from a given teacher, to only cite a few. Even if only small qualitative differences might be observed at some stages, provided that they can be accumulated over a full school career, resulting differences might, then, very well be large. Moreover, the diverging nature of individuals' school experience from an early stage in their life can also be regarded as a stepping stone towards the increased heterogeneity (e.g., in social status or health) that is generally observed between members of a given cohort at a later stage, as developed in the concept of cumulative dis/avantage proposed by Dannefer (2005).

In this context, each piece of research examining a specific feature of a school system is thus valuable in itself, because it provides us with more information on the mechanisms at stake and can, hopefully, help us identify ways of correcting those systemic and systematic disadvantages.

The choice of outcome is not neutral and understandably, the outcomes picked first in the literature were the most obvious and easily measured ones, such as years of schooling or graduation, whether from high school or from college. For the latter two outcomes, what was considered as desirable was also clearly defined. Human capital theory provided a consistent framework in which additional years of education were beneficial in terms of wage, while the signaling theory justified a positive and significant sheepskin effect, the wage premium associated with formal

diploma holding, conditional on the years of schooling.

In a highly differentiated upper secondary school system and in the absence of a formal theory, defining what a desirable upper secondary school transition looks like is more subjective and this is one of the explanations as to why this topic has been relatively neglected in the literature so far. There are at least two additional reasons. First, due to the rather unified structure of the US upper secondary school system, studying transitions made little sense. Second, in countries where these transitions were a high stake moment in a child' life, i.e., in countries with highly differentiated upper secondary school systems, such as Germany and Switzerland, up until very recently, resulting outcomes appeared so favorable that probably, very few scholars and policy makers sensed a pressing issue. With glowing records of low youth unemployment rates and successful school to work transitions, those countries relied heavily on vocational education and the apprenticeship system as a warrant of nearly universal smooth transitions, the latter being regarded as a sufficiently favorable outcome for considering the whole system "successful".

In the light of recent evidence, such a prior is starting to get seriously challenged. A second look at Figure 1.1 reveals that out of the four traditional apprenticeship countries, Denmark, Austria, Germany and Switzerland, three of them score well above the OECD average in terms of socioeconomic background impact, with Germany among the most unequal countries in that regard. In addition, as presented in appendix figure A.1, this inequality of opportunity is not associated with particularly high levels of average attainment, as Germany and Denmark score just above the OECD average, while Switzerland seems to perform slightly better in that regard. Given that the ranking presented in figure 1.1 is based on PISA data, it is assessing 15 year old students, the same set just about the make (or right after, depending on the sampling) their first upper secondary school transition in Switzerland.

If inherited factors such as parental education or migration background have such a large impact on the acquisition of basic literacy skills, assessing, first, the set of possible transition options and second, the future and present costs and benefits tied to each of them is likely to be also heavily dependent on the same set of factors. The persistence in educational pathways moreover implies that making the "right choice" (whatever this means) will have important consequences in structuring the future set of opportunities, whether within the educational system or directly on the labor market. Although bridges across education types certainly exist, they are effort intensive and costly, as, most of the time, additional years of schooling have to be accepted. In a life course perspective, these transitions have thus to be viewed

as both "turning points" in indviduals' life, as they potentially determine a whole new set of future trajectories, and vectors of social mobility, as the chosen path will affect individuals' social status in the long run (Levy et al., 2009).

For all these reasons, this thesis intends to shed some light on the educational choices of 15 year olds and to study their upper secondary school transitions, a high stakes moment (or in life course terms, a critical event) in the Swiss highly differentiated school system. The four main chapters assembled here each deals with a particular aspect of those transitions, from a general and encompassing view proposed in chapter 3 to a very specific problematic examined in chapter 6. In addition to a common theme, all empirical analyzes in this thesis rely on the same dataset: high quality registry data for the Canton of Geneva, Switzerland. This means that data are Canton specific but presents the advantage of being exhaustive, including information on all students. On the internal-external validity trade-off, we thus stand closer to the internal pole, while external validity appears more challenging. This concern is addressed in each chapter, relating the particular setting and topic to a broader picture and institutional elements presented in chapter 2 moreover help interpreting the following empirical results adequately in the Swiss perspective.

More specifically, chapter 2 is purely descriptive and presents the important institutional features of secondary education in both Switzerland and Geneva, alongside descriptive statistics to compare and to contextualized Geneva within the Swiss context. The chapter then moves on to introduce and to discuss the concept of "smoothness of transitions", a concept further used in the remaining empirical chapters.

In chapter 3, we look at first upper secondary school transitions of all 15 cohorts of students contained in the data. In particular, we assess how transition opportunities are affected (and constrained) by social capital endowments and migration background; a focus well in line with the previous considerations and especially relevant given the heterogeneous nature of the student population in Geneva, where more than one third of all students are not Swiss nationals. We find social capital to be an important determinant of first upper secondary school transitions, with heterogeneous impacts across middle school tracks and migrant groups. Social capital endowments especially matter for high track students and impact particularly transitions to the academic route. Low track students' transitions are generally less affected by their social capital endowments with the notable exception of their dropout probability, the latter being around 60% larger for low social capital students. This polarized impact of social capital at the two extremes of the school system is well in line with the classical literature on social capital. Moreover, con-

cerning transitions to the academic route on the one hand and to transitory solutions on the other, at equal levels of social capital, natives are generally in a more advantageous position than migrants and across migrant groups, students belonging to the most recent migration waves, such as from Turkey or the Balkans are in the least favorable position.

Chapter 4 examines the impact of the age at first tracking on the smoothness of upper secondary school transitions. In international comparison, pupils are tracked rather early in Switzerland, around the age of 12, with differences across Cantons. More interestingly, differences in the age of tracking also exist within Cantons, as has been the case in Geneva for almost 50 years. This duality within the tracking system, with a group of schools tracking its students a year later than the majority, can be used as an exogenous source of variation to identify the causal impact of a one year delay in middle school tracking on the smoothness of upper secondary school transitions. Although, there exists evidence, on the one hand, on the effects of tracking on "classical" outcomes, essentially students' achievement, and, on the other hand, on the smoothness of transitions, we are the first to link these two outputs of the school system and go a step further than a simple correlation. In line with the literature on the effects of tracking, we find a small average effect of two percentage points and heterogeneous effects along the ability distribution, with low achievers more affected than high achievers. Unlike most of the previous literature, we find that low achievers are actually hurt by a later tracking, with respect to the smoothness of their upper secondary school transitions. Estimates suggest that for this group of students, a delayed middle school tracking increases their chances of having unsmooth upper secondary school transitions by about 12 percentage points. These results are robust to a variety of specifications and checks. We discuss the possible channels and provide several plausible explanation for this result, differences in educational aspirations being one of them.

The following two chapters both deal with vocational education and training. Chapter 5 focuses on transitions to apprenticeship training and examines apprentices' pathways over the three years following the end of compulsory school, studying how these pathways might be related to past school outcomes. In this context, the selection of students in apprenticeship can inform us on the attractiveness of this type of education, which is one of the many possible routes at the upper secondary level. Even in traditional VET countries, given declining cohort sizes and other structural changes, such the evolution of preferences towards general and academic education, apprenticeship training must increasingly compete for students with other types of education. Moreover, the local context combining both

the well established structural features of apprenticeship training and a heavily tertiarized economy constitutes an interesting framework to study these questions, as both types of education, academic and vocational, are well established routes. We start by providing descriptive evidence as to who are the students engaging in apprenticeship training and then move on to examine apprenticeship pathways. We innovate in assessing the latter over two dimensions: a more quantitative one, the pure accumulation of years of training, and a more qualitative one, the smoothness of vocational pathways, i.e., whether or not apprentices change occupations over the years. In both cases, we use zero inflated models, a specific type of two part simultaneous model which, simply put, in addition to accounting for the large prevalence of zeros in the data, enables us to account for a differential impact of the covariates on the participation probability on the one hand and on the outcome intensity on the other. Our results show that, while low track and low achieving students are more likely to participate in apprenticeship training, they get less favorable outcomes than comparable high track and high achieving students– a pattern consistent across both outcomes. These results are robust to the use of a variety of performance indicators, including PISA scores, and to the inclusion of non cognitive skills in the model. We interpret these results as indicating an absolute advantage of high achievers in both types of education, academic and vocational.

Chapter 6 focuses on transitions across modes of training within vocational education and training and is, to the best of our knowledge, the first study to quantitatively examine the impact of changing modes of training on the qualification probability on the one hand, and on the number of years necessary to qualify on the other. Permeability of VET systems has only recently been identified as key challenge for traditional apprenticeship countries, the idea being that transitions across modes of training, whether entirely school based or dual (combining firm- and school- based training), and across occupations should be facilitated by a system of credit transfers, whereby (already) certified competences would be recognized across modes and occupations, thus allowing true flexible pathways. Most notably, Germany is now moving in this direction since the launch of the DECVET initiative in 2007. The shifting focus towards the permeability of VET systems can be rooted into three main phenomena: first, the ever increasing number of youngsters in transitory solutions, both in Germany and Switzerland; second the difficulty of matching supply and demand on the apprenticeship market; third, the resulting increase of entirely school based vocational education and training as an attractive solution to the two previous issues. Adding an important parallel vocational pathway alongside apprenticeship training leads quite naturally to the question of

transitions across both parts of the system and to its permeability. The impact of changing modes of training is estimated for commercial vocational students, the largest field of vocational education at both the country and Cantonal levels, and the field in which the share of exclusively school based students is the largest. Allowing unobserved heterogeneity to be correlated with the regressors, the results show that transitioning from full time to dual vocational education and training increases students' probability to qualify. Due to an obvious lack of permeability between modes of education, this type of transition is, however, associated with an extended delay towards qualification.

The concluding section zooms out and identifies two cross cutting themes; their interrelation is then discussed.

2. Secondary education in Switzerland: is Geneva really a special case?

The purpose of this short descriptive chapter is threefold. First, useful general features of the Swiss secondary education system are described, so as to offer an appropriate background for the next chapters of this thesis: section 2.1 deals with lower secondary education, while section 2.2 takes a closer look at upper secondary education. Second, across both sections, Geneva is compared to the rest of the country and its commonalities and differences are highlighted. Finally, section 2.3 presents the current policy issues at the upper secondary level and contextualizes the concept of "smoothness of transitions", which will be further used in the remainder of this thesis, and in particular in chapters 4, 5 and 6.

For an encompassing and extensive review of the Swiss education system, the Swiss Education Report yearly produced by the Swiss Coordination Center for Research in Education (SKBF, 2014) is the absolute reference. As such, in what follows, and except when otherwise specified, all facts are drawn from this source.

2.1. Lower secondary education

As Switzerland is a federal union, the subsidiarity principle implies that education is primarily handled by Cantons. Up until upper secondary education, i.e., for the full length of compulsory education, each Canton is entirely responsible for the structure and form of its educational system, which implies that education systems may differ both across and within the 26 Cantons. Nevertheless, since 2006, in addition to providing the general boundaries in terms of quality and accessibility, the Swiss Constitution additionally requires Cantons to harmonize the important features of their school systems, "such as school entry age and compulsory schooling, the duration and objectives of the different levels of education, the transition from one level to another and the recognition of qualifications" (p.41, SKBF, 2014). The 2007

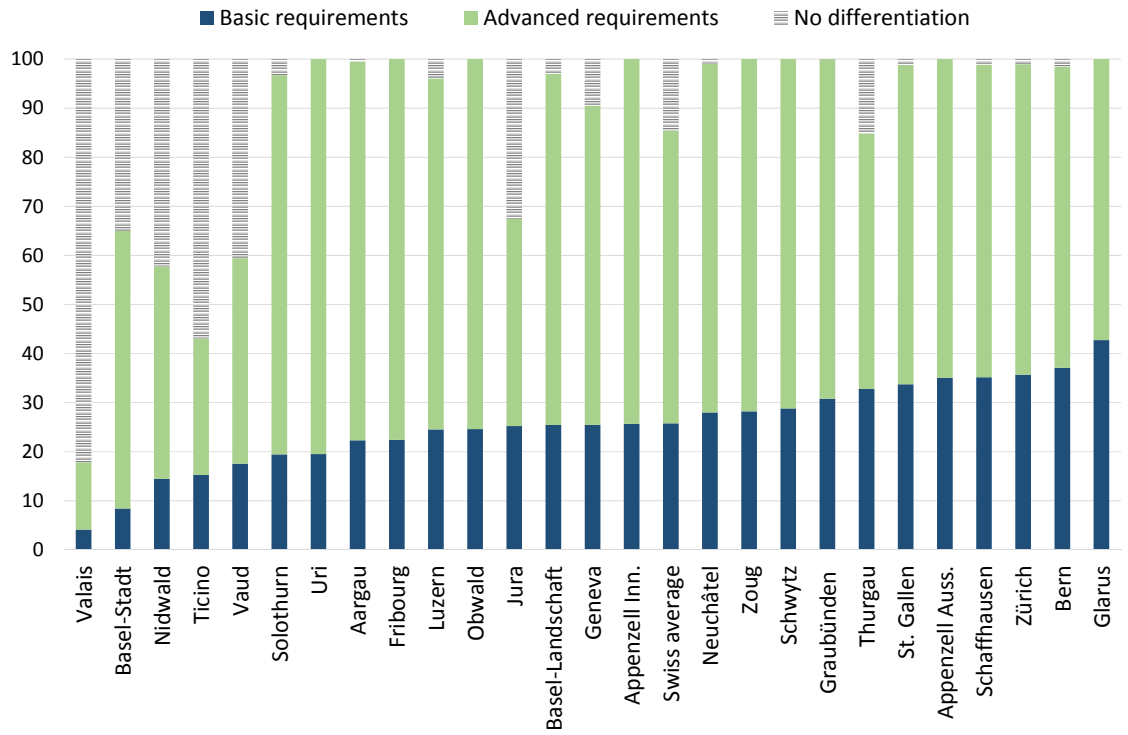
inter-Cantonal HarmoS agreement thus intends to harmonize structures (duration of each education cycle in particular) and curricula across participating Cantons, in accordance with the new constitutional requirements. Fifteen Cantons are part of this process, including all French speaking Cantons. The agreement came into force in 2009 and foresees a six year implementation period, which will end in July 2015.

With respect to secondary education, HarmoS only deals with lower secondary education, the compulsory part, setting its length uniformly to three years (out of the required eleven years of compulsory schooling) across all participating Cantons. Concerning Geneva, this is not much of a change, since lower secondary education already lasted three years, for students aged 12 to 15.

The structure of lower secondary education, and especially the amount of tracking taking place at this stage, varies greatly both across and within Cantons, from a fully integrated model (i.e., no tracking) in the Cantons of Jura and of Ticino, to a tracked system at the school level in the Canton of Schwyz for example. Concerning Geneva, tracking takes place at the classroom level so that differently tracked pupils share a common school building and two broad types of track exist, a track with advanced requirements and another with only basic ones. As will be further explained in chapter 4, the structure of tracking over the period covered by our data (1993-2007) differed across two groups of schools, with a group tracking students a year later. Due to a popular initiative and to the implementation of the HarmoS agreement, the tracking system at the lower secondary level changed in 2011 and was harmonized at the Cantonal level, with all schools now tracking students in a similar fashion from the age of 12.

To get a sense of the diversity and the selectivity of lower secondary school systems across Cantons, figure 2.1, displays the percentages of all lower secondary pupils by track requirement and by Canton. The data are sorted in ascending order according to the percentage of pupils in the basic requirement track. Almost all French-speaking Cantons, including Geneva, display proportions of low track pupils smaller than the Swiss average, only Neuchâtel is right above. One should, however, be cautious when interpreting such data, as these percentages not only reflect structural differences across Cantons but also diverse compositions of their students' populations, in particular with respect to the proportion of students with a migration background.

Figure 2.1: Percentages of lower secondary pupils by track requirement and Canton (2011-2012)



Data source: Swiss Federal Statistical Office (2014e).

2.2. Upper secondary education

2.2.1. Structure

Broadly speaking, upper secondary education is organized around two types of route: general education and vocational education and training (VET).

General education is subdivided into, on the one hand, academic education in Gymnasien (baccalaureate schools) leading to an automatic University admission and, on the other hand, a lower level general education in general schools whose task is "both to provide a more in-depth general education and to prepare students for the vocational fields associated with social work, information and communication, design and art, music and theatre, applied psychology or education science" (p. 160, SKBF, 2014), in the corresponding Universities of Applied Sciences. In both routes, students may obtain a Matura, either academic in Gymnasien or specialized in general schools. Although all Maturas are recognized at the Federal level, both types of general education are handled at the Cantonal level.

Vocational education and training is, however, primarily steered at the Fed-

eral level in a tripartite fashion, involving the Swiss Confederation, the Cantons, and craft and professional associations. Cantons are responsible for implementing the Federal law, namely the Federal Act on Vocational and Professional Education and Training, and the corresponding ordinances.

Vocational education can be undertook either in a dual mode of training, i.e., through an apprenticeship, which combines on-the-job learning at a firm and training at a vocational school, or through full time studies at a vocational school. Both routes lead to a three year federal VET certificate and, optionally, to a vocational Matura, when adding an extra year to the curriculum. Vocational Matura holders can automatically access a University of applied sciences and, provided that they pass an admission exam, University is also an option.

To be extensive, recent developments in vocational education and training have leaned towards a better inclusion of young people on the lower hand of the achievement distribution and, to that goal, a two year VET diploma has been introduced in 2002 in a selected number of occupations. This two year diploma intends to provide a suitable qualification to those who could not have completed an apprenticeship training and to channel some of its holders into further training to obtain a three year VET certificate (for more information, see Kammermann et al., 2011).

2.2.2. Patterns of participation

While student track allocation varies at the lower secondary level, the pattern of participation in upper secondary education is even more differentiated across Cantons, mainly due to the diversity of both education systems and students' populations.

At the country level, vocational education, and apprenticeship in particular, is the most popular type of upper secondary education concerning, on average, two thirds of each cohort. Despite this fact, French-speaking Switzerland is consistently more oriented towards general and academic education.

Figure 2.2 provides a snapshot of the percentages of students by type of education during the school year 2012-2013 by Canton, for only two types of education, initial vocational education and training and general education (percentages do not sum to one as there are other types of upper secondary education such as remedial and transitory solutions that are not reported in the chart). Cantons are displayed in descending order as to the proportion of students in initial VET.

Geneva stands on the far right, with both, and by far, the lowest percentage of students in initial VET and the largest percentage in general education. Nevertheless, when thinking about the external validity of the results presented in the following chapters, and although Geneva certainly stands out as an outlier, there are

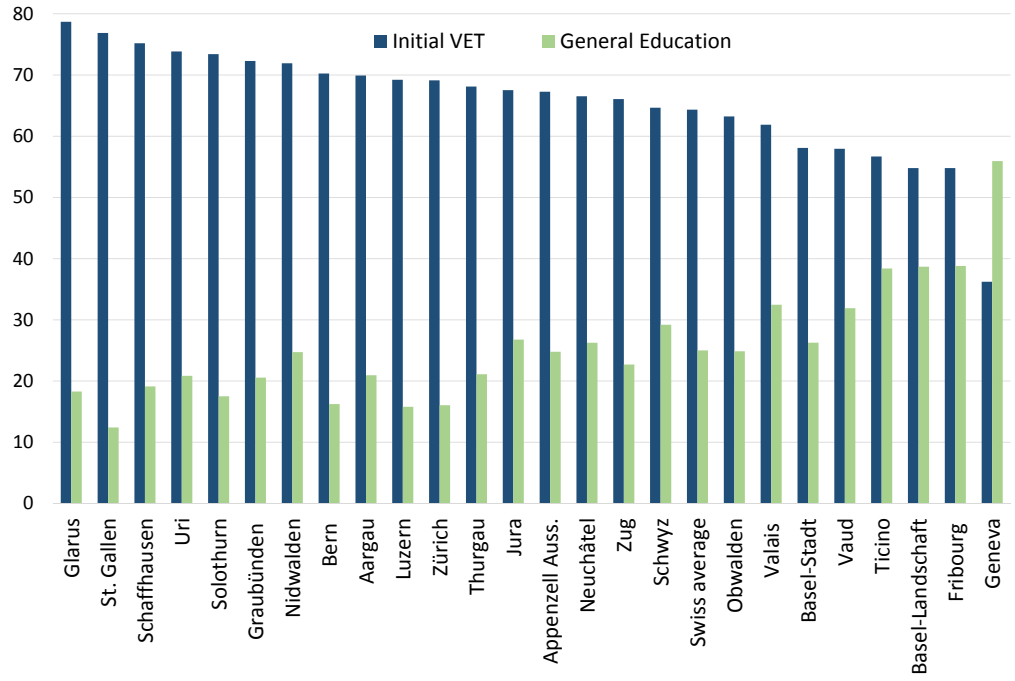
other Cantons that do not appear dramatically different, such as Fribourg, Basel or Ticino. At the same time, upcoming empirical results may not be relevant for Cantons such as Glarus, St. Gallen or Uri. However, given the high level of heterogeneity observed across Cantons in terms of language, culture, demography, geography or economic structure, finding a result readily applicable to the whole country is rather rare. Despite this high current level of heterogeneity, some structural factors, such as the heterogeneity of the students' population or the weight of the tertiary sector in the local economy, are rather converging than diverging across (most) Cantons, which implies that results concerning Geneva may not yet be relevant for certain Cantons but may apply in the near future. Finally, one should point out that results obtained through nationally representative samples might not be of any use to Cantonal policy makers, in particular when concerning domains that are primarily handled at the Cantonal level, such as education, so that external validity may sometimes come at the cost of applicability. These considerations further imply that much could be learned from doing an in depth comparative analysis between a given set of Cantons, an exercise that has, so far, been precluded by the lack of data.

Concerning the differences observed in transition patterns, one should highlight that they reflect the interacting effects of both students' (and families') preferences and institutional constraints. Access to academic upper secondary education indeed suffers from rationing in certain (mostly German speaking) Cantons, so that not all potentially suitable pupils are able to transition to such a route and are mostly channeled to apprenticeship training instead (Ryan et al., 2013).

In contrast in Geneva, and this may also explain the dominance of the academic route, there is no such rationing or shortage of places in Gymnasium (or in any other upper secondary school): provided that they meet the formal admission requirements and that they apply, students are automatically admitted. Admission requirements to all upper secondary exclusively school-based options (i.e., apart from apprenticeship training) only depend on students' lower secondary track and grades, without any teacher recommendation system, and, although grades requirements are track specific (with Gymnasium being the most selective route), students from both tracks may gain access. This specific setting, in which institutional constraints do exist but are rather light in comparison with other Cantons, justifies that, in the remainder of this thesis, upper secondary school transitions are often referred to as resulting predominantly from choices made by both students and their families.

When looking at vocational education, the pattern of participation can be examined under two angles, the type of diploma pursued and the mode of training,

Figure 2.2: Percentages of upper secondary students by Canton and education type in 2012-2013



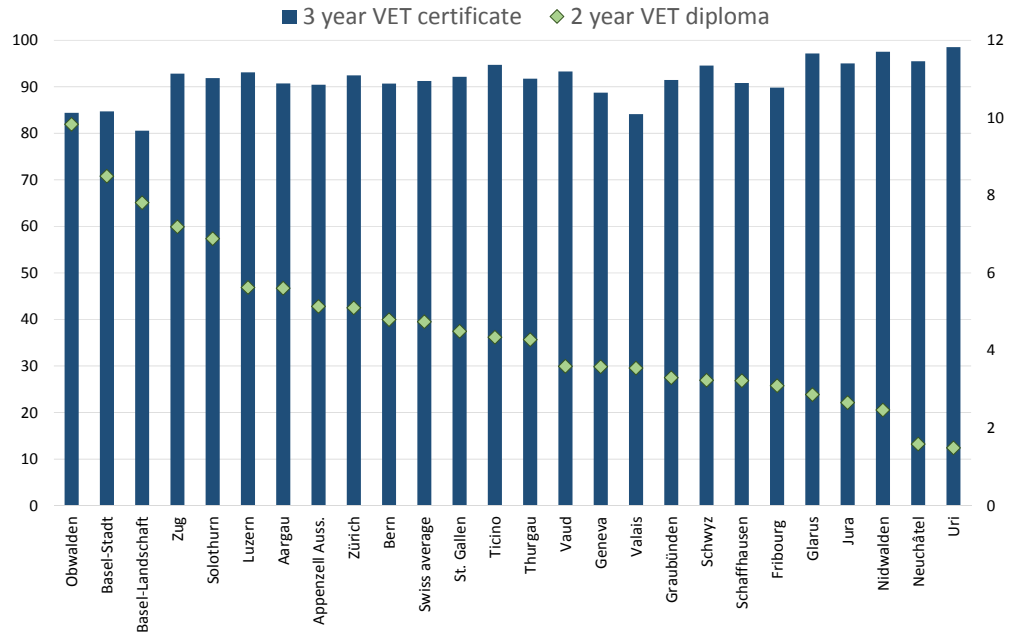
Data source: Swiss Federal Statistical Office (2014b).
Note: Data for Appenzell Innerrhoden are excluded from the figure as, due to its small size, the Canton does not have any initial VET students.

whether dual or full time. First, Figure 2.3 displays the breakdown of initial VET students by the type of diploma pursued, whether the traditional three year Federal VET certificate or the more basic two year VET diploma, for the year 2012-213. Cantons are sorted in descending order so as to the percentage of students engaged in a two year diploma, which can be read on the right-hand side axis. Note that these percentages do not sum to 100, as there are other (quite minor) categories of diploma, such as non Federally recognized vocational certifications (which can be obtained in private vocational colleges for example), the non certifying so-called basic vocational education that only concerns less than 1% of all students in most Cantons (0.7% for the Swiss average and 0.03% in Geneva) and students engaged in commercial or IT schools but not pursuing a 2 or 3 year diploma (3% for the Swiss average and 4% in Geneva).

Figure 2.3 highlights that a large majority of initial VET students in all Canton aims at obtaining a three year Federal VET diploma and Geneva is not an exception in that regard, with a rate of 89%, close to the Swiss average of 91%. Concerning participation in two year programs, it is relatively more heterogeneous across Cantons with the highest rate of 10% observed in Obwalden. The 3.5% rate

for Geneva is rather low and quite in line with the rates observed in other French speaking Cantons.

Figure 2.3: Percentages of initial VET students by Canton and by diploma pursued in 2012-2013

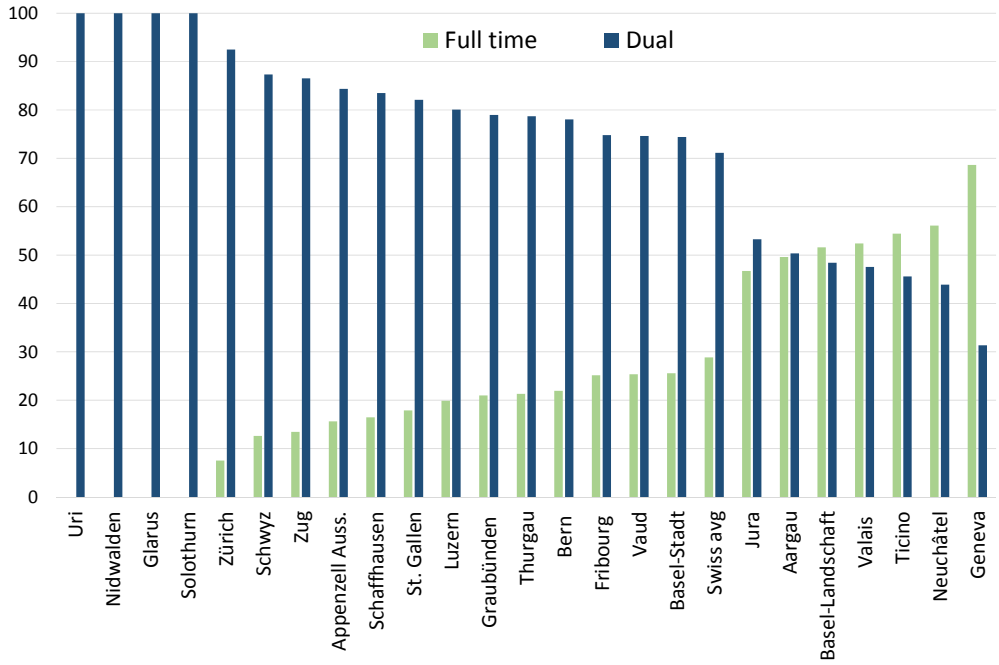


Data source: Swiss Federal Statistical Office (2014b).
Note: Percentages of students pursuing a 2 year VET diploma are reported on the right-hand side axis. Data for Appenzell Innerrhoden are excluded from the figure as, due to its small size, the Canton does not have any initial VET students.

Second, concerning the pattern of VET participation by mode of training, either dual with training both at school and on the job (i.e., apprenticeship training) or through full time schooling at a vocational school, it differs significantly across Cantons and linguistic regions. In French speaking Cantons, entirely school-based vocational education represents around a quarter of all vocational students, whereas the latter are only around 11% in the German speaking part (SERI, 2014a). Unfortunately, there are no comprehensive data that would allow a breakdown of this proportion by Canton but based on our own data for Geneva, around half of vocational students are exclusively school based, most probably the highest rate in the country. We could nevertheless access this type of data for a single occupation, commercial training, which will be the focus of chapter 6. Proportions of students for the year 2012 and by Canton are displayed in figure 2.4, in descending order as

to the proportion of students in apprenticeship training. Unsurprisingly, Geneva is again on the far right, with both the largest proportion of full time VET students and the smallest proportion of dual VET students.

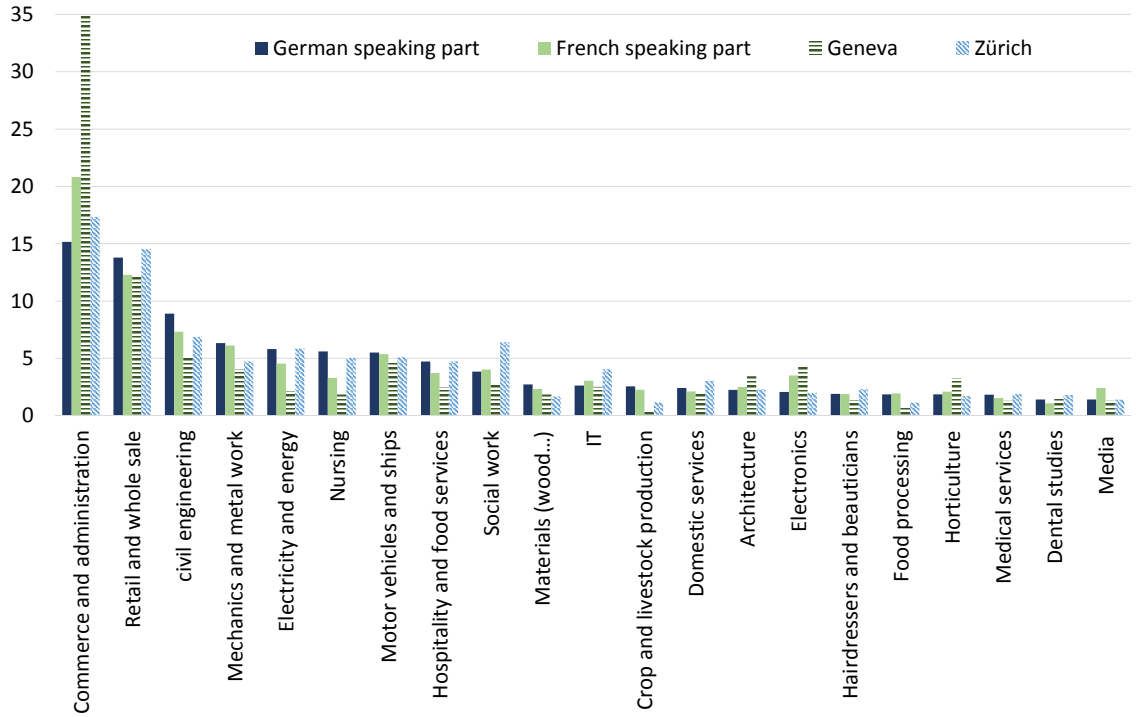
Figure 2.4: Shares of full time and dual VET students in commercial training by Canton in 2012 (in percent)



Data source: Swiss Federal Statistical Office (2014c).

Although the type of diploma pursued by initial VET students does not differ much between Geneva and other Cantons, according to the two other indicators (respectively participation in general vs vocational education and, within VET, participation by mode of training), it seems that Geneva stands quite apart from the rest of the country. Fortunately, this is not the end of the story, as a closer look at the structure of vocational education reveals that Geneva is in fact not so different from the rest of Switzerland. Figure 2.5 displays the proportion of newly concluded apprenticeship contracts by type of occupation, for German and French speaking Switzerland, as well as for the Cantons of Zürich and of Geneva in 2013. I chose to present these four entities for comparison purposes, with, on the one side, the linguistic regions and, on the other, two densely populated urban Cantons. Data are sorted in descending order according to the Swiss German proportion of new apprenticeship contracts in a given occupation.

Figure 2.5: Shares of all newly concluded apprenticeship contracts by occupation and location in 2013 (in percent)



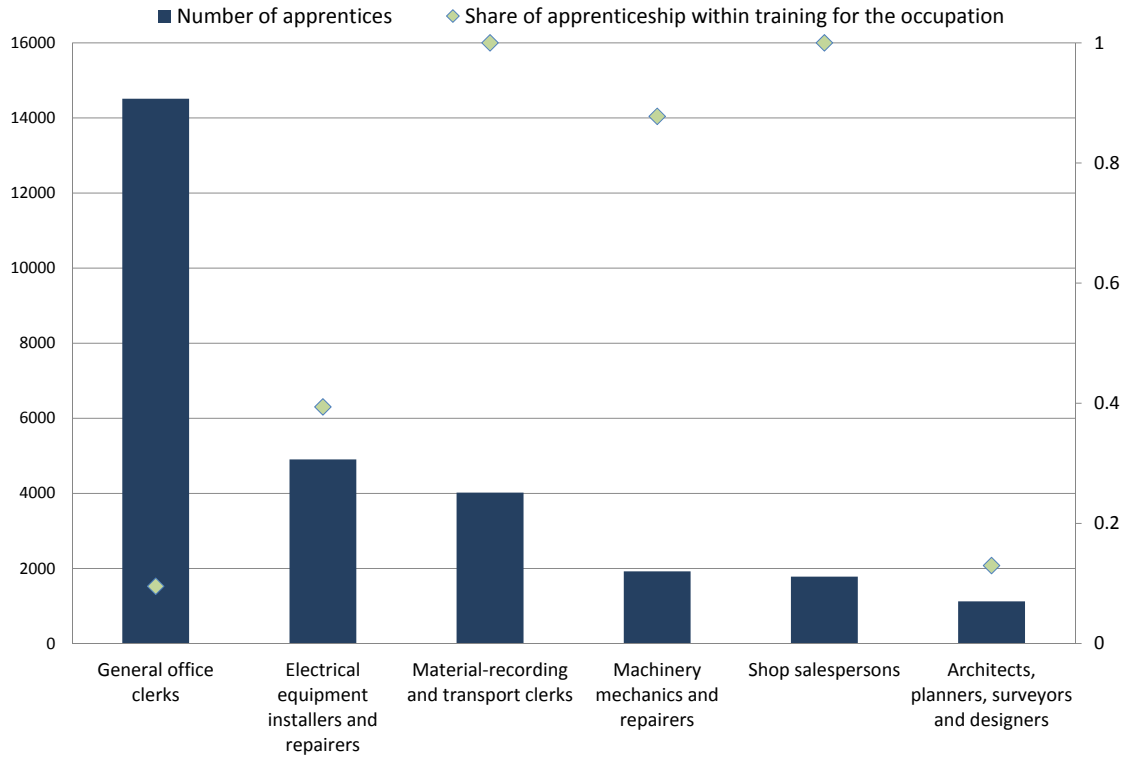
Data source: Swiss Federal Statistical Office (2014a).
Note: Occupations in which the proportion of contracts in the German speaking part is less than 1.4 % are not shown in the figure.

Across all regions, the occupation in which the most apprenticeship contracts were concluded is commercial vocational education and training. With respect to other occupations, one can see that proportions across regions and Cantons are not so different, although there are of course variations due, essentially, either to the differential importance of school based VET, as is the case for nursing for example, or to differences in the economic structure (e.g., the electricity and energy production sector is pretty small in Geneva, compared to, say, the Canton of Valais). The main point of this chart is thus to highlight that, although Geneva can be seen as an extreme case in terms of vocational education and training, the occupational structure of apprenticeship training is not dramatically different from the rest of the country.

As a final point, as the Geneva schooling database was matched with International Standard Classification of Occupations (ISCO) three digit codes for nearly all types of vocational training, as will be further developed in chapters 5 and 6, one can compare the proportion of full time and dual VET students for each occupation

and these are displayed on figures 2.6 and 2.7. For the sake of readability, the first figure only reports occupations with more than a 1000 apprentices and all other (non marginal) occupations, i.e., with more than a 100 apprentices, are displayed on figure 2.7. As a technical clarification, the first three transitions of all students in the GSD database are used to obtain those numbers and the count is done in a cross sectional manner, with each count taking into account all individuals in a given year in a given occupation.

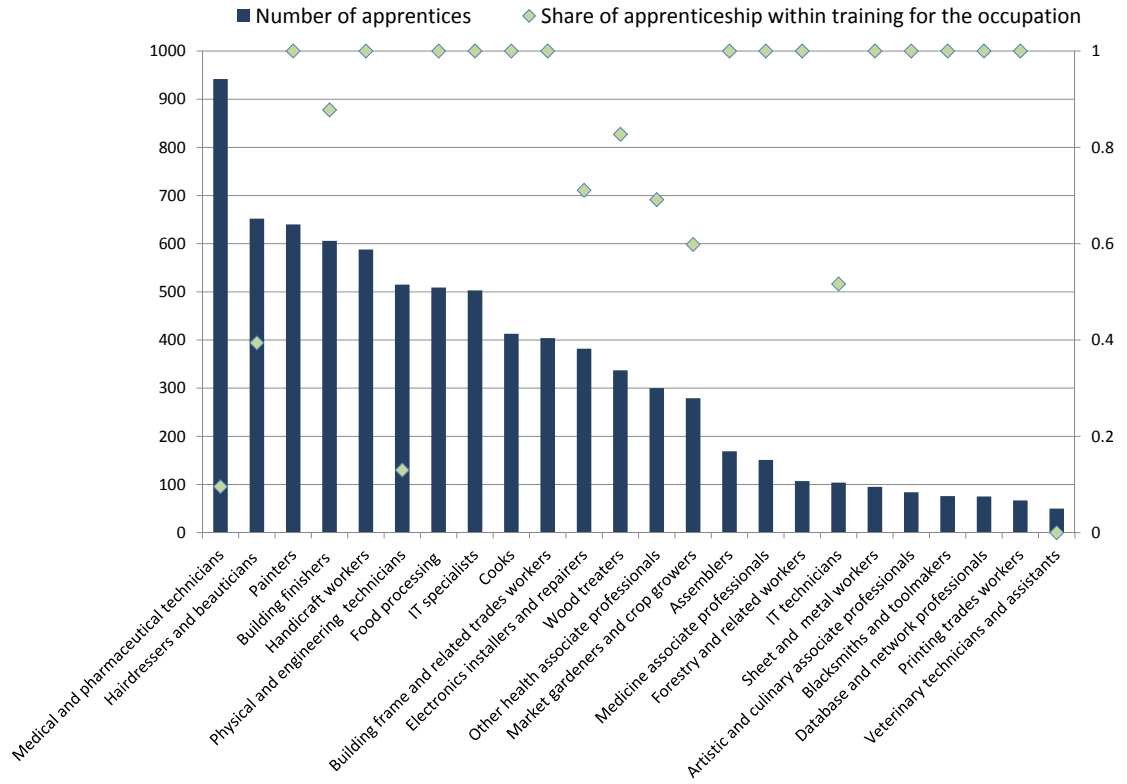
Figure 2.6: Number of apprentices and proportions of apprenticeship within training for ISCO three digit occupations in Geneva, 1993-2007, 6 largest occupations



Data source: Geneva schooling database (1993-2007).
Note: Only occupations with more than 1000 apprentices are shown in the figure.

A first interesting feature is that although commercial training (which is classified in the three digit ISCO occupation under "General office clerks") accounts for the largest number of apprentices, school based training represents around 90% of the pool of commercial vocational students. Note that this proportion decreases

Figure 2.7: Number of apprentices and proportions of apprenticeship within training for medium sized and small ISCO three digit occupations in Geneva, 1993-2007



Data source: Geneva schooling database (1993-2007).
Note: Occupations with less than 100 apprentices are not shown in the figure.

as more transitions are taken into account, as shown in chapter 6, with, for the 2003 cohort, a proportion of commercial diploma delivered by full time commercial schools of around 70%.

Second, in many occupations, apprenticeship training is either the sole or predominant mode of training, suggesting that in addition to a similar structure of vocational domains, apprenticeship training in Geneva is well established where it "needs to be": just as in the rest of Switzerland, painters are trained through both firm and school based training. These very contrasted proportions could also suggest that some trades can be learned trough school based education, while some others simply cannot. The skill content of an occupation is thus likely to play an important role in the development of training modes. Finally, the apparently high overall percentage of school based vocational training is, in fact, largely driven by commercial training and does not therefore reflect a (more) uniform distribution across occupations.

To sum up on participation to vocational education and training, the apparent dissimilarities observed in Geneva, such as the lowest rate of participation in

initial VET, hide in fact many similarities at the occupational and sectoral levels. The relative importance of apprenticeship to school based VET differs across occupations but for a majority of occupations, apprenticeship is the sole or predominant mode of training.

2.3. Policy issues

As mentioned previously, compulsory education stops after eleven years of primary and lower secondary education, when students are aged 15. Nevertheless, the national policy goal is that, by 2015, 95% of young people obtain an upper secondary qualification (EDK, 2011), the latter regarded as determinant for their chances of success on the labor market (OECD, 2010b). At the national level in 2010, the rate of youngsters obtaining an upper secondary qualification was around 92.4% (SKBF, 2014); using more recent data, Hrizi et al. (2014) estimate this rate to be currently around 90% in Geneva. Those numbers indicate that, although we stand close to the target rate, closing up the remaining gap might not be an easy task and may require additional structures and policies to help young people in precarious situation get back on track. Remedial education and bridge courses were certainly designed with this specific goal in mind: "at the interface between compulsory and upper secondary education"(p.110, SKBF, 2014), they are designed for individuals not managing a direct transition to a certifying upper secondary education.

During the last decade, the importance of remedial education has been growing, although heterogeneously across Cantons (SKBF, 2014): in Geneva, this type of first transition only concerned 7% of students in 1999, while this rate is now around 14% (Hrizi et al., 2014). At the country level, this type of (first) transition concerns on average 15% of students. Unfortunately for the time being, there are no comprehensive data allowing an accurate comparison of this rate across Cantons[1]; one can only compare the percentages of upper secondary students engaged in this type of education, as presented in appendix figure B.1, but only limited insight can be gained from such data.

Institutionally speaking, transitory options can be seen as a response to the increasing difficulty of some youngsters to manage a direct and smooth transition to a certifying upper secondary route. In this context, a relevant question is whether or not remedial education actually helps young people obtain an upper secondary

[1]For two reasons: first, the precise definition of remedial education varies across Cantons and, second, so does the statistical definition between certain Cantons and the Federal statistical office, so that numbers for a given Canton might differ if taken from the Cantonal statistical source or from the Federal statistical office (SKBF, 2014).

qualification. Relatively few studies exist on this question, but descriptively for Geneva and when looking at true transitory options (i.e., excluding propaedeutic years to designated schools), after a year, only half of students enroll in a certifying upper secondary route and a quarter drops out without any certification (Hrizi et al., 2014). Keeping in mind the 95% target rate, these dropouts are precisely those who need to be kept within the system for the goal to be achieved.

From a public policy perspective, transitory solutions probably represent a second best policy response to the increasingly complex and not always successful nature of upper secondary pathways, a phenomenon moreover observed in several OECD countries, such as Germany, Denmark or the Netherlands for example (OECD, 2014a). A first best policy choice would be to directly target the smoothness and the certifying nature of upper secondary school transitions, helping students, not only, to choose the best suited educational route in providing sufficient (and unbiased) counseling, but also to offer them adequate support ensuring success. For any educational system, achieving such a goal would ensure both fairness and efficiency, as all individuals would be supported and pushed to the best of their abilities. Educational choices would also be less dependent on socioeconomic background, thus improving equity. Incentives to achieve such an objective are probably aligned between both the public and private sides of the educational system, as longer and more uncertain pathways represent risks and costs beared by both individuals and the education system.

When considering this first best perspective, smoothness is a desirable outcome, for both the system and individuals and, most often in the remainder of the thesis, this first best situation will be our counterfactual for the following reason: absent any data on more long term outcomes, such as wage or happiness for example, we cannot rank second best alternatives. In other words, we know for certain that the best match is the best outcome, while we don't know if a broken match is better than a continued bad match, and we thus have to assume that continued matches are the good ones. We, of course, acknowledge that there may be second best improvements in breaking a bad match for a better alternative but with the data at hand, we simply have no way of assessing this relative ranking of second best alternatives.

As a closely related point, although the definition of the first best alternative, i.e., the smooth transition, is relatively straightforward, they are several possible definitions of the unsmooth alternative, and which one is used should depend on the particular focus of the study. Again, longer term outcomes would also be useful at this stage, as they would provide a way to assess which type of

unsmooth transition pathway should be looked at in priority, depending on their relatively larger detrimental impact in the long run.

The previous considerations also imply that, first, a definite statement on whether or not an unsmooth pathway is an actual undesirable feature can only be assessed in the long run; something we are, unfortunately, not able to do in this thesis. Second, not all unsmooth transitions are alike, something quite obviously implied from the two previous points, and, most likely, not all unsmooth transitions are alike for all individuals, i.e., there may very well be heterogeneous effects of irregular pathways, which may depend on both the bundle of cognitive and non cognitive skills possessed by individuals (and possibly in an interactive manner).

Finally, the issue of permeability deserves a few words at this point. In international comparison, the Swiss school system is usually scoring well in terms of permeability, since no educational route is considered as a dead end; many bridges across routes exist at various levels. As mentioned already, a vocational Matura holder can enter university after successfully passing an exam, as does an academic Matura holder who would like to enroll in a University of applied sciences. However, at the moment, the concept of permeability is mostly envisioned as bridges between routes at the interface of major cycles, i.e., between lower and upper secondary education on the one hand, and between upper secondary and tertiary education on the other hand. Permeability within cycles and, in particular, during upper secondary education, is far less institutionalized and mostly operated on a case by case basis. In the context of interest here, this means that entry into any upper secondary route is possible (although not equally easy) for both middle school tracks, high and low; finishing middle school in the low track does not per se close any doors. In this sense, the upper secondary education system is relatively open. However, within upper secondary education, institutional bridges across routes seldom exist and students most often loose years when they change routes. In this perspective, within cycles, the system expects individuals to stay and qualify in a given route, i.e., to manage a smooth and well defined pathway.

Within the framework laid out in this discussion, several chapters of this thesis, namely chapters 4, 5 and 6, open up the research agenda on the smoothness of upper secondary pathways. Each chapter uses a different angle, i.e., a different definition of the unsmooth outcome in a given context. More precisely, in chapter 4, we (causally) investigate the impact of a later tracking age on the smoothness of transitions and look at the impact of an institutional feature of the school system on upper secondary pathways. Chapter 5 deals with the relationship between outputs of the school system, such as lower secondary track or grade on the vocational

smoothness of apprentices, looking at changes of occupation within apprenticeship training. In chapter 6, we examine a within occupation definition of smoothness, looking at changes across modes of training within commercial training. In this latter chapter, we study the impact of unsmooth pathways on short term outcomes (upper secondary qualification probability and time to qualify) and put forward several factors that could justify such a moove at the individual level. All three chapters somehow complement each other, as two of them look at the impact of past inputs on the smoothness of transitions, i.e., using "smoothness" as an outcome variable, while the last chapter uses a smoothness indicator as an independent variable. Both approaches appear necessary to get an encompassing view of the topic, as, to use an analogy, not only do we want to know the determinants of human capital accumulation but also its effect on wages.

3. Migrant integration in a VET-oriented school system: A ladder hard to climb[1]

This paper proposes a measure of social capital endowments in a school context characterized by early tracking and oriented towards vocational education and training, and discusses migrant integration into the Swiss school system from this perspective. Using administrative data, we look at the first upper secondary school transition of fifteen cohorts and examine how the latter are affected by social capital. Results confirm that social capital endowments matter for all students independently from parental socioeconomic status, but with clear differences between natives and migrants, and between several groups of migrants. Relative impacts of social capital are heterogeneous across transition outcomes and middle school tracks.

Keywords: migrant integration; school transitions; social capital; tracking.

JEL classification: I24; I28; J15.

3.1. Introduction

The relevant literature has identified several factors influencing the integration process of migrant children into school systems. For instance, cross-country evidence (mainly) using PISA data confirms the idea that early tracking during compulsory school increases inequality between natives and migrants (Hanushek and Woessmann, 2006; Schnepf, 2007; Schneeweis, 2011; Cobb-Clark et al., 2012; Luedemann and Schwerdt, 2013); a result even more pronounced for children from lower socioeconomic backgrounds (Dustmann, 2004; Meghir and Palme 2005; OECD, PISA, 2007; Pekkarinen, Uusitalo and Kerr, 2009; Dustmann et al., 2012). In this paper,

[1]This chapter is a modified version of the similarly entitled paper and is a joint work with José V. Ramirez. This work profited from useful comments from Jennifer Hunt, Eric Verdier, Philippe Méhaut, Jacques Amos, François Rastoldo, Michel Oris, Rainer Winkelmann and Paul Ryan. It was presented at the conference for Junior Researchers of EARLI in Regensburg (2012), at the Congrès annuel de la Société Suisse pour la Recherche en Education in Bern (2012), during the Séminaire de recherche du SRED in Geneva (2012), at the VET Research Congress in Zollikofen, Bern (2013) and during the Rencontres scientifiques du SFM in Neuchâtel (2013). Remaining errors are naturally ours.

we focus on migrant integration into the Swiss school system, as expressed by their first post-compulsory school transition, and examine how the latter are affected by social capital endowments.

Upper secondary school transitions have been relatively sparingly studied in the literature, though choices, and in particular the first one of them, made at this point have long-lasting implications in terms of both future educational attainments and subsequent labor market outcomes. Recent contributions have begun to bridge this gap: a few studies specifically examine the impact of socioeconomic background, generally finding a strong association between parental background and upper secondary track choice (see, for Germany, Dustmann, 2004 and Tieben, de Graaf and de Graaf, 2010 for the Netherlands). In Norway, Brinch, Bratsberg and Raaum (2012) look at the impact of a reform which entitled each student to a spot in an upper secondary school, alleviating previous capacity constraints. They find that the reform increased migrant students' educational attainment and reduced native-migrant differences, in especially increasing migrant educational participation. Using a similar empirical framework to ours, Mocetti (2012) examines the determinants of upper secondary track choices in Italy. He finds that grade repetition during middle school and parental education are strong predictors of upper secondary school outcomes. Finally, for Switzerland, Falter (2012) follows a single cohort up to tertiary education, focusing on the determinants of access to tertiary vocational education. He finds that, in addition to parental background, gender is a strong determinant of such a transition. Our analysis is thus well integrated into this strand of literature and, to our knowledge, the first one to look at Swiss post-compulsory school transitions in a comprehensive way.

Broadly defined as "the ability of actors to secure benefits by virtue of membership in social networks or other social structures" (p.6, Portes, 1998), social capital has been presupposed to play an important role in human capital formation from a very early stage (Bourdieu, 1986; Coleman, 1988). Further empirical studies highlighted that social capital could affect educational outcomes in a positive way, with higher amounts of social capital associated with higher educational attainments. Dika and Singh (2002) provide a useful review of the literature in this field and outcomes related to school choices are usually the following: high school graduation, college enrollment and dropout probabilities. Interestingly, out of the 35 studies reviewed by Dika and Singh (2002), none of them look at school choices in a comprehensive way and only one paper uses a methodology comparable to ours but deals with outside school activities of dropout students (White and Glick, 2000).

Extending the notion of social capital in the context of migrants, Rumbaut

(1998) and, subsequently, Portes and Rumbaut (2006), provide us with an encompassing sociological framework. Rumbaut's typology of migrants relies on the fact that any migrant can be characterized by a distinct set of resources and vulnerabilities, both linked to the individual and to the community he belongs to: social class resources (financial and human capital); legal status in the destination country (what Rumbaut calls "political capital") and social network, family structure, and cohesiveness, i.e., social capital. Obviously, social capital also covers access to information channels (Coleman, 1988) and, in the context of education, information about the functioning of the school system. Access to such information is expected to be more difficult for more culturally distant groups of migrants (see Zhou and Kim, 2006), which means, in particular, that past and future implications of school choices might be imperfectly evaluated by migrant families, putting them at a disadvantage compared to natives.

With respect to Switzerland, in addition to having to deal with one of the most heterogeneous population among OECD countries (in 2013, around 35% of the permanently residing population has a migration background, Swiss Federal Statistical Office, 2014d), the Swiss secondary school system is characterized by early tracking at the lower level (with an age at first tracking varying between 10 and 13 depending on the Canton), and by a strong orientation toward dual vocational education and training (VET) at the upper secondary level, with around two third of each cohort in the apprenticeship system. In such a tracked school system, upper secondary track or route choices heavily depend on middle school grades and tracks, as both factors formally condition transition opportunities. However the choice process certainly involves students, families and middle schools, as teachers may provide (nonbinding) advice. In this context, it is sensible to view first upper secondary school transitions as the result of a tripartite decision making, which implies that opportunities and constraints faced by students and families, including strategies they may adopt to reach a desired transition outcome, depend on their human and social capital endowments.

In terms of equality of opportunity, the Swiss school system is not scoring well in international comparison. First, the impact of socioeconomic status and migrant background is stronger than in other OECD countries (Fuentes, 2011; Liebig, Kohls and Krause, 2012). Second, this positive correlation between educational outcomes and socioeconomic background is exacerbated by early tracking during compulsory school (Vellacott and Wolter, 2005; Bauer and Riphahn, 2006). Descriptively, in 2010, while migrant students represent around 21% of all middle school pupils in the country, they are only 15% of students in the high track

and around one third of low track students (Swiss Federal Statistical Office, 2012). Third, a recent report from the advisory board of the Swiss government in terms of education policy, documented the existence of a structural gap between natives and migrants at the end of compulsory school: at equal school performance levels, natives are four times more likely than migrants to find a firm offering them an apprenticeship contract (EDK, 2011).

Moreover, over the last ten years the structure of educational choices at the upper secondary level has evolved along diverging directions. As in many Western countries, the number of students opting for academic and general education has increased (e.g., Leslie and Drinkwater, 1999) and, as in Germany (Hoeckel and Schwartz, 2010), the number of youngsters engaging in remedial education or transitory solutions has been steadily rising (SKBF, 2014), a growing concern for policy makers (EDK, 2011).

Our case study is Geneva, a dense urban Canton with, on the one hand, the highest share of foreign-born inhabitants in the country (around 40%, Cantonal Statistical Office, 2011b) and, on the other hand, a local economy heavily oriented towards services. The combination of those factors resulted in an ever increasing polarization of transitions within the school system, with, on the one hand, a historical predominance of academic transitions and, on the other hand, a recent substantial increase of transitions to remedial education. Although these two tendencies are observed in other Swiss Cantons, the above mentioned specificities of Geneva imply that the two of them are locally stronger. Thanks to an exhaustive administrative database, we are able to look at the first upper secondary school transition of 15 cohorts (1993-2007).

Our results confirm that, when tracked during middle school, inequality between natives and migrants at the end of compulsory school is important, and that social capital endowments matter independently from parental socioeconomic status. As captured by family structure, language spoken at home, country of provenance, nationality (which is associated with a given wave of migration), and "tenure" within the local school system, social capital plays an important role in explaining first upper secondary school transitions. Relative impacts of social capital are heterogeneous across both upper secondary outcomes and middle school tracks. Moreover, we find that, irrespectively of their social capital endowments, socioeconomic status and middle school track, recent migrants most often end up in non-certifying remedial education, rather than directly benefiting from vocational education, which would help them climb up the socioeconomic ladder.

The rest of this paper is structured as follows: the next section briefly

describes the school system in the Canton of Geneva and section 3.3 presents the data and the variables used for the empirical analysis. Section 3.4 exposes our empirical findings and section 3.5 concludes.

3.2. The local school system

In Geneva, students are first tracked (in a common school building) at the beginning of middle school, when aged 12. Track allocation depends on students' grades obtained during the previous year and can be either high or low. A majority of the students (around 70%) finishes middle school in the high track[2]. Compulsory school ends three years later, when the student is normally aged 15.

For those pursuing further education inside the public system, the upper secondary level revolves around five broad types of tracks or routes. The first one, college-bound high school, the equivalent of the British grammar school or the German Gymnasium, is the most popular choice with, on average, 48% of students choosing this route and its diploma (the academic Matura, the equivalent of the German Abitur) grants an automatic access to university. It is worth mentioning here that the predominance of this route is a specific feature of French-speaking Switzerland, as the German-speaking part is consistently more oriented towards Vocational Education and Training (VET).

General school is the second type of route and, perhaps unsurprisingly, delivers lower level general knowledge. The four year general school diploma (a specialized Matura) allows students to enroll in selected universities of applied sciences. In our data, this route concerns around 11% of students.

Vocational education is divided into two routes: apprenticeship training (dual VET) and full time vocational schools. Apprentices divide their time between a vocational school and on-the-job training in a firm, while full time VET students study exclusively at a vocational school. Whether through dual of full-time vocational education, students may acquire first a federal VET certificate, a three year diploma, and optionally a vocational Matura (a more advanced vocational degree) granting them access to universities of applied science. In our data, around 17% of the students selected full time vocational education and only 8% of the pupils directly moved on to an apprenticeship.

"Remedial education" groups all preparatory years to various schools and special structures, designed for students that do not meet the other route require-

[2]In our sample, more than 87% of students graduating from the high track started middle school in this very same track. This points to a certain degree of systemic inertia, as the initial track placement decisions are only rarely modified later on.

ments. It can be seen as an (or even two) additional noncertifying year(s) to a regular curriculum but, at the same time, as a catch up opportunity. Students encountering difficulties are given a last chance to access a formal (and certifying) upper secondary education. On average, over the period, 9% of students have transitioned to a remedial route.

Finally, we also take dropouts into account and consider that students drop out of the public school system if they transition to a private school or when they simply "disappear" from the database. Several reasons may explain such a disappearance, for example a return migration, a voluntary gap year or the impossibility to continue school for irregular migrants[3].

When successfully completing middle school, high track students find themselves in a favorable position, as they are automatically admitted to all above listed schools. The only exception is dual apprenticeship that, regardless of middle school grades and track, requires a contract between a firm and an apprentice. For low track students, the situation is more complicated: only remedial education offers an automatic admission (though up until 2003 general school did as well). Both full time vocational education and college-bound high school have set admission requirements based on middle school grades (latest cumulative GPA), with the academic route being highly selective. Nevertheless, one should highlight that only lower secondary track and grades formally condition admission to the various upper secondary schools and, in Geneva, there is no rationing of access to any school: provided that the student meet the admission requirement and apply, a spot is guaranteed. This situation differs from other (mostly German speaking) Cantons in Switzerland, that are known to restrict access to the academic route (see Ryan et al., 2013 for further details). Moreover, the dominance the academic path might also stem from the fact that pupils are rather encouraged to make such a first transition for two main reasons: first, this is the route that is the most socially valued in the Canton, the school norm. Second, the academic route leaves all subsequent transition options opened[4] and is thus the less constraining option in the case where individuals have not completely made up their mind (Rastoldo, Kaiser and Alliata, 2005).

Transition average percentages, by track, are presented in Table 3.1. High

[3]Though public compulsory schools have a legal obligation to enroll all children, irrespectively of their political status, this obligation stops at the upper secondary level.

[4]As no formal bridges exist within upper secondary education, situations are assessed on a case by case basis. In this context, when switching tracks and provided that they completed their first year reasonably well, students coming from the academic route have the best chances to be allowed to transition directly to the second year curriculum in the incoming school, thus loosing no or only a minimal amount of time in the process; other schools *usually* view a successfully completed year of college-bound high school as, at least, equivalent to a year completed in their own school.

track students markedly (are able to) favor the academic route, while low track students tend to move more often to vocational education.

Table 3.1: Transitions from lower to upper secondary level by middle school track

		Academic route	General School	Full Time VET	Dual VET	Remedial	Drop Out	Total
High track	N	20'955	1'464	4'951	1'174	539	1'450	30'533
	Percent	68.63	4.79	16.22	3.85	1.77	4.75	100
	Std. dev.	0.70	2.26	1.76	1.20	2.34	1.02	
Low track	N	263	3'335	2'428	2'269	3'341	1'792	13'428
	Percent	1.96	24.84	18.08	16.90	24.88	13.35	100
	Std dev.	2.78	2.71	2.34	1.83	2.41	0.79	
Total	N	21'218	4'799	7'379	3'443	3'880	3'242	43'961
	Percent	48.27	10.92	16.79	7.83	8.83	7.37	100
	Std dev.	0.71	1.49	1.59	1.34	2.00	0.73	

Data source: Geneva Schooling Database (1993-2007).
Note: respective standard deviations are computed for transition percentages.

3.3. Data and variables

The database used in this paper is the Geneva Schooling Database (GSD), compiled and yearly updated by the Cantonal school administration. The GSD records every child who goes to public and private school in Geneva, from primary to upper secondary education. We could access data from 1993 up to 2007. Our dependent variable thus records transitions of regular public students from their last year of public middle school[5] to their fist year in any public upper secondary school, including dropouts. Note that this definition excludes repeating cases, as only first transitions are taken into account. In total, our dependent variable records around 44,000 transitions, from seventeen different middle schools, and covers fifteen cohorts.

Concerning our independent variables, basic controls are gender and whether or not the student repeated a grade during middle school, which is used a as proxy for performance, since we do not have information on students' grades for the complete cohort population. For a subsample of four cohorts, we nevertheless could match GSD data with middle school grades, and this information will be used in the study to test the robustness of our substantive conclusions. In all estimations, we also take into account cohort and middle school fixed effects.

In addition to traditional controls, our choice of independent variables aims at capturing the impact of social capital endowments and social class resources and

[5]This implies that lower secondary private students are not taken into account (less than 10%) and that (public) special classes designed for newly arrived migrants are, for example, excluded from the analysis for comparability reasons (only less than 2% of all students).

the latter are proxied by parental socioeconomic or occupational status, with the contrast category defined as white collar workers. Although this measure may seem rather limited, it is worth noting that it used by Cantonal authorities to assess whether a school is considered disadvantaged or not (especially at the primary level, where disadvantaged schools get additional resources) and is therefore accurately and carefully constructed to reflect the family socioeconomic status of each student.

Social capital endowments are captured, or at least proxied, by a set of variables. Portes (p.9, 2000) distinguishes three basic functions of social capital: "(a) as a source of social control; (b) as a source of family support; (c) as a source of benefits through extra-familial networks", so that our variables will try to reflect at least two of these dimensions, as, unfortunately, we don't have any variable reflecting social control. We highlight at this point that, in this study, our approach to the concept of social capital will be endowment oriented. High social capital endowments will thus be assumed to facilitate (i.e., lower the cost of) access to both family support and benefits through networks. Obviously, as researchers, we do not observe whether or not individuals actually mobilize these resources, but a cost benefit analysis framework would suggest that if, ceteris paribus, costs to access resources decreased (thereby increasing net benefits), use of these resources would rise.

First, two variables reflect the notion of family support: family structure and language spoken at home. The family structure is taken into account because, as postulated by Coleman (1988) and shown by Heckman (2011), single parent families are able to provide less social capital for their children. For simplicity, we only control for the best case scenario with the "lives with both parents" dummy variable. Family support can play a greater role if the language spoken at home and in the destination country coincide (Rumbaut, 1998), a concept that has been empirically supported by the literature examining the migrant-native achievement gap, with language spoken at home one of the largest factor explaining achievement gaps during compulsory school (Dustmann et al., 2010; Dustmann et al. 2012). To account for this fact, we add a dummy "non French-speaker" to our model.

Second, benefits through networks are proxied by: age at arrival inside the school system, nationality group and the foreign country of provenance dummy. The age at arrival inside the school system reflects the idea that the more time spent within the school system, the easier the integration and assimilation (Hirschman, 2001; van Ours and Veenman, 2006). In parallel, long-time migrants usually have a better and more extended social network, i.e., more social capital. We split the continuum of possible ages at arrival into five different categories: the first group

contains all students either born in Geneva or who arrived before the beginning of preschool (i.e., children who arrived before or at four years of age). The second category encompasses all children who arrived between the ages of five and six which, in fact, corresponds to the beginning of primary school. Pupils who arrived during primary school are split into two groups: those who arrived between the ages of seven and eight and those who arrived up until the age of twelve. The rationale behind this splitting is that, formally, primary school is divided into two cycles: elementary and intermediate. Our last category regroups students who arrived during middle school. Children who spent all their school years in Geneva are the reference group[6].

Integration into the local school system at a later age can be hard for some children, especially if they do not speak the tuition language (French, in our case), as supported by the recent study of Cobb-Clark et al. (2012). In order to capture this phenomenon, we interact our "non French-speaker" variable with the dummies reflecting the age at arrival, allowing the effect to be modified for each age group, depending on the language spoken. We expect French speakers to possess a higher amount of social capital, or, at least, to be able to acquire some more easily, as both students and their family can access information networks and, therefore, might be less affected by having arrived at a later stage.

Our sevenfold nationality grouping, with Swiss nationals as the contrast group, follows the different migration waves and, therefore, reflects as well the amount of political capital accumulated by migrants, since more years of residence allow individuals to apply for more stable permits. Over the last fifty years, the migrant population in Switzerland has been deeply affected by a labor-market oriented migration policy (see Mahnig and Piguet (2003) for a complete review). From the end of World War II to the beginning of the 1990s, the government applied the so called "guest worker policy", a policy aimed at recruiting unskilled male workers in southwestern European countries for short term contracts (from Italy first, then from Spain, and subsequently from Portugal). This resulted in a massive wave of Mediterranean migrants, generally assigned to unstable low paid jobs. However, many of them found their way into the economic system and managed to secure a stable position and, consequently, benefit from the family reunion clause. To differentiate effects among this first group of migrants, we consider two subgroups: first, students from either Italy or Spain, and, as they represent the most important migrant community, Portuguese migrants are singled out. Due to their early arrival, Mediterranean migrants usually enjoy a stable political status (and often an auto-

[6]Note that the age at arrival does not directly determine the type of residence permit a child will get upon arrival, as when benefiting from the family reunion clause, a child will receive the same permit as the parent actioning the clause.

matically renewed permanent residence permit), i.e., from our perspective, a high amount of political capital.

Since the middle of the 1990s, the Swiss government has reoriented its policy towards bilateral agreements with the European Union (EU). The agreement on the Free Movement of Persons, which came into force in 2002, intended to attract more highly skilled migrants and, at the same time, to limit the arrival of relatively unskilled migrants. Thanks to this new favorable legislation, EU27 (and EFTA) nationals have enjoyed a comfortable political situation and they constitute our fourth nationality group ("Rest of EU27").

While certainly attracting highly skilled professionals from all over Western Europe, the agreement on the Free Movement of Persons did not prevent an influx of low skilled workers and political refugees due to, respectively, ongoing family reunions and conflicts in the Balkan region. Note that for the purpose of this analysis and the remainder of this thesis, "the Balkans" refer to the following countries: Albania, Bosnia-Herzegovina, Croatia, Kosovo, Macedonia, Montenegro, and Serbia. Essentially arrived during the 1990s, Balkan and Turkish nationals are nowadays the fourth largest group of migrants, and the ones who have managed to stay (essentially managing to switch from temporary refugee status to another, more stable, permit), enjoy now a fairly stable political status. However, during the period of analysis, their legal status was obviously more precarious: except for Turkish nationals, a large part of the migrants from the Balkans only had a temporary permit. Consequently, we expect this group to possess a smaller amount of political capital than migrants from Southwestern Europe.

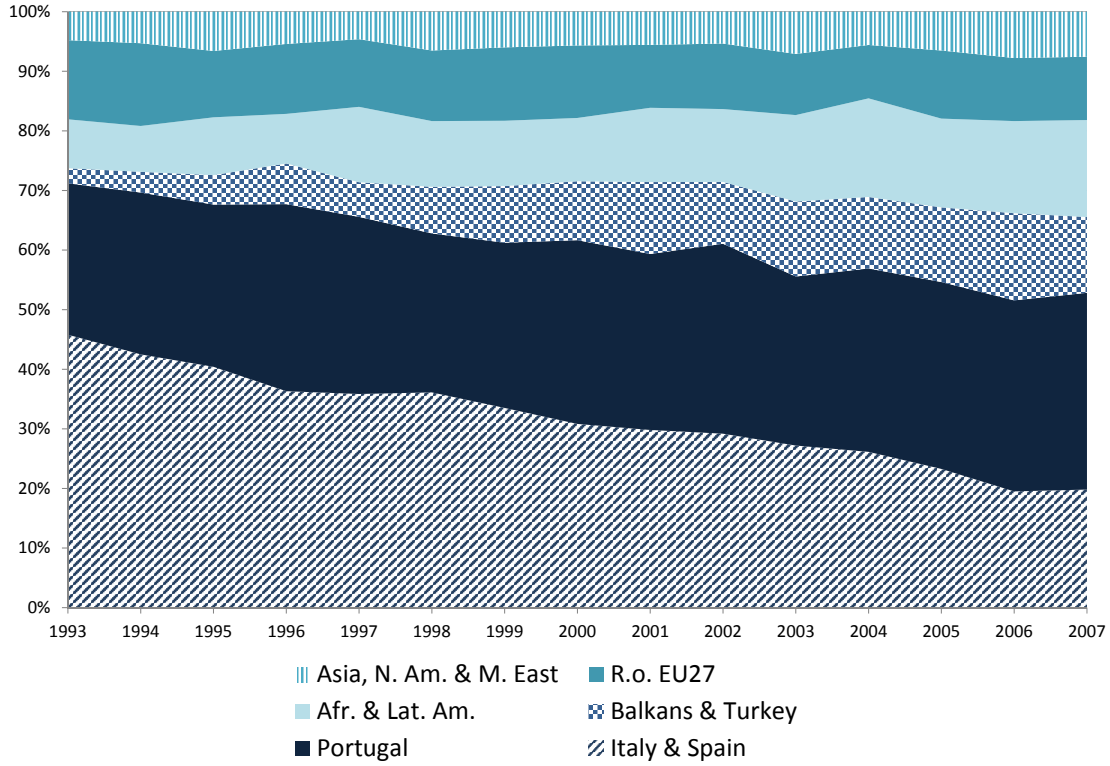
All other nationalities are sorted into the last two groups. Students from Africa and Latin America are grouped together, and North American, Asian, and Middle Eastern students constitute the last group. With respect to political status, on average, only one-third of the nationals belonging to either of these groups possesses a permanent residence permit (Swiss Federal Statistical Office, 2011).

Our nationality grouping implies that students who acquired the Swiss nationality before their last year of middle school are logically grouped with Swiss students. However, over the period 1993–2007, the average naturalization rate has only been around 2.5% (Cantonal Statistical Office, 2011a). Finally, as a clarification, in the remainder of this article, we will use the term "migrant" to mean that the student is not Swiss national. Given that the laws governing the attribution of the Swiss nationality follow a *jus sanguinis* principle, this definition implies that both parents have to be foreign nationals, even if the child is born in Switzerland.

Figure 3.1 displays the composition of the foreign student population over

time (i.e., by cohort) and illustrates well the structural impact of the successive migration waves. At the beginning of the period, Mediterranean and other European children represents more than 80% of foreign pupils, indicating an overall relatively high homogeneity among foreign students. In comparison, in 2007, around four foreign children out of ten come from non-European countries and Africans and Latin Americans make up the third largest group of students. In less than 15 years, the share of nationals from the Balkans and Turkey has almost quadrupled. As a result, the overall mix of students appears clearly more heterogeneous in the recent years and, on average, culturally more distant.

Figure 3.1: Composition of the foreign student population by cohort



Data source: Geneva Schooling Database (1993-2007).

While we can fully control for students nationality with the grouping aforementioned, due to data constraints we only introduce a dummy "foreign country of provenance" as an additional control. This variable takes the value one for all students coming from abroad, indicating only whether the country of provenance is Switzerland or not[7]. This variable controls for the fact that incoming students may, in fact, arrive from another Swiss Canton. In about 78% of the cases, however, the country of provenance and nationality coincide.

[7]Note that this case also includes Swiss students coming from abroad.

Table 3.2 presents selected descriptive statistics for all of our independent variables (by middle school track) and it appears that student populations are clearly different between tracks. One striking, and unsurprising, fact is that migrants make up a higher proportion of the low track students, as do blue collar workers. Conversely, natives and managerial workers make up a larger proportion of the high track students. In addition, variables reflecting social capital all suggest that low track students possess, on average, less social capital.

Table 3.2: Descriptive statistics

		High track		Low track	
		proportion	N	proportion	N
All		*30'533*		*13'428*	
Gender	girl	52.28	15'963	43.98	5'905
Grade retention	repeater	8.67	2'648	10.08	1'354
Age at arrival	arrival: before school	88.55	27'036	72.89	9'787
	arrival: preschool	2.96	905	5.60	752
	arrival: primary school I	2.35	719	5.67	762
	arrival: primary school II	4.65	1'420	11.82	1'587
	arrival: middle school	1.48	453	4.02	540
Family structure	lives with both parents	75.34	23'005	66.96	8'992
Language spoken at home	non-French speaker	29.29	8'944	51.55	6'922
Country of origin	arriving from a foreign country	15.05	4'596	33.30	4'472
Nationality groups	Switzerland	72.87	22'250	46.56	6'252
	Italy & Spain	9.02	2'754	15.21	2'043
	Portugal	6.20	1'892	19.73	2'649
	Balkans & Turkey	1.93	590	6.46	867
	Africa & Lat. America	3.10	947	7.59	1'019
	R. o. EU 27	4.38	1'337	3.04	408
	Asia, N. America & M. East	2.50	763	1.41	190
Family SES	white collars	41.95	12'808	31.27	4'199
(occupational status)	managerial workers	25.12	7'669	6.13	823
	self employed	5.88	1'795	6.79	912
	blue collars	24.14	7'371	48.05	6'452
	misc. /NA	2.91	890	7.76	1042

Data Source: Geneva Schooling Database (1993-2007).

To conclude this section, one should highlight the limitations of our approach. First, our operationalization of social capital is, of course, not perfect, as some important dimensions cannot be accounted for in this study, such as a measure of social control or, in the case of the family structure, the gender composition of a child's siblings and the rank occupied by the child among them (Bader and Fibbi, 2012). These drawbacks come from the fact that our dataset was designed to pilot a school system, not to measure social capital. Second, our definition might, therefore, not readily compare with previous studies, especially those done in the US on a common dataset (mainly the 1988 National Educational Longitudinal Survey data), that all used a (relatively) comparable definition of social capital (e.g., Mc-

Neal, 1999; Muller and Ellison, 2001, and see Dika and Singh, 2002, for a complete review). Third, one could, of course, criticize the concept of social capital, as has been done in the literature: "One problem with the analysis of social capital is that it is ill-defined, with different authors attributing different meanings to the concept" (Durlauf 1999, as quoted in Manski, 2000, on p.122); a critique certainly relevant for our study.

Nevertheless, we believe that embedding our work within the framework of social capital is helpful for several reasons. First, previous studies on this topic help us conceptualize and organize our empirical analysis serving as a benchmark on the variables to include and on their expected sign, as has been discussed for each component. Second, as pointed out by Durlauf, in the absence of a unified operationalization of the concept of social capital, all empirical research use their own (empirical) definition of the concept, as appears obvious when looking at the meta analysis performed by Dika and Singh (2002). In this context, we are no different and certainly profit from the theoretical umbrella of social capital and adapt its empirical definition to our specific setting. Finally, although our measure is not perfect, it has the advantage of being available for all pupils, allowing a relatively fine decomposition and comparison across meaningfully defined groups, such as the different groups of migrants (heterogeneous effects). On the contrary, self collected (and especially qualitative) data, while measuring the concept more precisely, often suffer from sampling limits which, in turn, may compromise their external validity.

3.4. Empirical findings

3.4.1. Main findings

Although the use of a multinomial logit model can be microfounded through a random utility framework, assuming that, even conditional on their middle school track, individuals choose freely their upper secondary track is a strong assumption. Choices are made under constraints, most notably grades, that unfortunately we cannot account for for all cohorts. Therefore, we propose our approach to be viewed as a reduced form estimation without any assumption about the underlying behavior or preferences. Nevertheless, the consistency of multinomial logit estimates rely on the independence of irrelevant alternative assumption (IIA), which states that the odds between existing choices will not be modified if a new alternative is added to the set of possible choices. The strong dissimilarity across the six types of upper secondary routes makes this latter assumption plausible. Additionally, as the structure of the

school system is built upon those six routes, our dependent variable thus reflects non substitutable institutional alternatives[8].

As admission requirements to upper secondary schools vary by middle school track, all estimations are performed on high track and low track students separately, and the different forms of capital are introduced successively. To avoid confusion, we present all results as either marginal effects (at the mean) or conditional probabilities.

Before analyzing the results concerning social capital, we examined the impact of the sole control variables and those results are reported in appendix table C.1. Gender is highly significant for both middle school tracks and has expected signs: in both middle school tracks, girls are more likely to choose an academic or general education over a vocational route, probably reflecting differences in aspirations between boys and girls (Gilbert et al., 2010). Repeating a year during middle school has an important effect on transition patterns of high track students (but does not seem to affect low track students) and impacts can be fairly substantial, as it reduces chances of access to the academic route by almost 30 percentage points.

Our second specification includes controls, socioeconomic status and all variables reflecting social capital endowments; results are displayed in Table 3.3. The total impact of social capital endowments will be discussed subsequently, so for now, we will only look at the individual impact of each component[9]. For both tracks, family structure appears significant: a two parent family increases transition probabilities to the academic route for high track students and to full time VET for low track students.

Not being a native French speaker influences significantly almost all transition probabilities. Strongest effects are observed on college-bound high school for high track students, indicating that, ceteris paribus, multilingualism can be beneficial to some children (see Portes and Rumbaut, 2006); and on remedial education for low track students, reflecting here that lacking language skills can be burdening.

When considering the impact of nationality groups (compared to natives) effects vary depending on middle school track. However, in both middle school tracks, latest-generation migrants exhibit singular transition patterns: except for nationals from the Balkans and Turkey, all other students belonging to more recent migration waves transition more often to the academic route than Swiss students, with the highest effect observed for Asian, North American, and Middle Eastern

[8] Thus no empirical test for the validity of the IIA assumption is presented.

[9] A more parsimonious model including only controls and social capital components has also been estimated and, reassuringly, qualitative conclusions do not change. This set of marginal effects is reported in appendix table C.2.

pupils. This may reflect a cultural orientation towards academic studies, as has often been demonstrated for Asian students in the US (Zhou and Kim, 2006; Sue and Okazaki, 2009; Peng and Wright, 1994). Another type of explanation would relate to a strong preference for academic studies, seen as the route offering these students the best chances in terms of future labor market outcomes (Latina and Ramirez, 2012).

All substantive conclusions drawn from the by component analysis of social capital are robust to the inclusion of grades in the model. In other terms, controlling for performance does not affect the substance of our results. Appendix tables C.3 and C.4 present such results by track for the subsample of students (four cohorts) for which we also possess this kind of information. Unsurprisingly, compared to the full dataset, the smaller sample size renders many marginal effects insignificant (lack of precision). However, the accurate comparison is between estimations performed on the same subsample once including and once not including grades: nearly all marginal effects stay in a comparable range, once performance is accounted for.

After having examined the impacts of each component, we are now interested in apprehending the total impact of social capital endowments. To this goal, we estimate two models including all independent variables (i.e., including controls and parental socioeconomic status) and then use them to compute conditional transition probabilities to all six routes by middle school track, level of social capital and type of migrant. The resulting probabilities are presented in Table 3.4. A high (low) social capital endowment is defined as a (non) native-speaking student from a two (single) parent family, and either born in Geneva or having arrived before preschool (having arrived during middle school) from another Swiss canton (abroad). To capture the sole impact of social capital more closely, we set the socioeconomic status to the reference group (white collar workers) for both profiles. Nationality groups are set according to the type of migrant we are interested in. Specifically, we chose to examine the five groups of students representing the main communities among pupils: natives, first-wave Italians and Spaniards, second-wave Portugueses, more recent migrants either from Turkey or the Balkans, and the group made of Africans and Latin Americans. This typology will allow us to examine whether the impact of social capital on schooling decisions differs between natives and various types of migrants, and to compare if belonging to a more established migrant community such as Italian and Spanish nationals makes any difference. All other variables in the model are held at their sample means.

Conditional probabilities enable us to compare levels of access to the six transition options across groups. Let us focus on migrant-native differentials con-

Table 3.3: Marginal effects of social capital components by track

		Academic	Gen.School	FT VET	Dual VET	Remedial	Drop Out
	dependent var. mean	*68.6*	*4.8*	*16.2*	*3.9*	*1.8*	*4.8*
High	non-French speaker	4.84***	-1.83***	-1.83***	-1.22***	-0.29*	0.34
track	lives w. both parents	4.73***	-0.96***	-1.61***	-0.20	-0.39**	-1.57***
	from a foreign country	-1.31	0.08	0.05	-0.22	-0.03	1.43***
	Spain and Italy	-8.64***	1.56***	5.21***	-0.68**	1.27***	1.28**
	Portugal	-13.56***	3.28***	3.84***	0.98*	1.56***	3.89***
	Balkans & Turkey	-6.25***	0.26	6.87***	-1.08*	1.17*	-0.97
	Africa & Lat. America	1.05	-0.32	-2.02*	-2.57***	2.04***	1.82**
	R. o. EU 27	2.82**	-0.05	-2.09**	-1.78***	-0.14	1.24**
	Asia, N. America & M.East	4.30**	-1.27**	-3.80***	-2.47***	-0.11	3.35***
	arrival: 5-6 y. o.	1.14	-0.99	-0.68	-1.07*	-0.15	1.75*
	arrival: 7-8 y. o.	-0.74	0.90	-1.87	0.34	-0.57	1.94*
	arrival: 9-12 y. o.	-5.24***	0.01	1.14	0.25	0.49	3.36***
	arrival: 13-15 y. o.	-13.12***	2.21	-2.26	2.51	0.02	10.65***
	N			30'244			
	Percent correctly predicted			69.0			
	dependent var. mean	*2.0*	*24.8*	*18.1*	*16.9*	*24.9*	*13.4*
Low	non-French speaker	0.65**	-2.98**	2.53**	-2.57**	4.25***	-1.88*
track	lives w. both parents	-0.16	0.88	4.19***	1.04	-1.45	-4.51***
	from a foreign country	-0.56**	2.74*	-0.64	0.16	-2.03	0.33
	Spain and Italy	-0.16	-1.56	-3.67***	0.09	4.26***	1.04
	Portugal	0.17	0.27	-3.87***	-0.90	2.17	2.15
	Balkans & Turkey	0.84	-5.43***	2.23	-5.46***	10.41***	-2.58*
	Africa & Lat. America	2.00***	-0.78	1.03	-13.79***	12.74***	-1.21
	EU 27	1.21*	-0.27	0.70	-6.05***	0.93	3.47*
	Asia, N. America & M. East	3.98**	-5.60*	4.72	-15.34***	13.02***	-0.78
	arrival: 5-6 y. o.	-0.01	-4.02	-4.46*	-1.36	6.95**	2.90
	arrival: 7-8 y. o.	0.06	-4.90*	-2.51	0.16	-1.39	8.57***
	arrival: 9-12 y. o.	-0.55	-1.51	-4.61***	0.16	2.72	3.78**
	arrival: 13-15 y. o.	0.15	-2.92	-2.11	0.77	-4.01	8.11***
	N			13'282			
	Percent correctly predicted			35.2			
	controls			yes			

Legend: * 0.10 ** 0.05 *** 0.01

Notes: Multinomial logit with transition choice as the dependent variable. Are included in the model: an interaction between all the categories of the "age at arrival" variable and the non-French speaker dummy.
Controls are "gender", "repeater", SES, year and school dummies. Standard errors are computed using the delta method. All variables are held at their sample average and factor variables handled consistently.

cerning low track students and their transition probabilities to apprenticeship training and remedial education. Looking at those two transition alternatives makes sense for low track students, since dual vocational education and remedial education are the only two options with no formal grade requirements. For a given amount of social capital, it clearly appears that, somehow, the school system puts natives in a better position: they have the highest probability to transition to an apprenticeship and the lowest one to enter a remedial education. However, for migrant students the situation is clearly less favorable and gets more precarious as students belong to more recent waves of migrants. The systemic disadvantage is the most acute for pupils either from the Balkans and Turkey or from Africa and Latin America, with a transition probability to an apprenticeship three to nine times smaller than a

transition to remedial education. This worrying result is well in line with Vellacott and Wolters's (p.46, 2005) findings: "a lack of social capital, coming on top of cultural differences, is a further cause exacerbating the chances for young people with a migration background of being accepted into an apprenticeship". In addition, a study conducted by Fibbi et al. (2003) found empirical evidence of discrimination against nationals from the Balkans and Turkey, as their chances of getting an interview for a first job after completing an apprenticeship were reduced by at least a half, compared to native applicants. Their results could shed some light on our findings, as it is plausible to believe that the same structure of discrimination could prevail when hiring apprentices.

To further synthesize the display of our results, we now present conditional probabilities as conditional risk ratios, which will allow us to compare the relative impacts of both social capital and middle school tracking. First, Table 3.5 presents corresponding risk ratios of students belonging to the same middle school track but with different amounts of social capital. In our specific context, a ratio greater than one implies that a high endowment of social capital has a positive impact on the relevant transition probability.

Relative ratios suggest that social capital matters heterogeneously across transition outcomes and middle school tracks. For all nationality groups, the largest ratio for high track students concerns the transition to the academic route, with a high social capital increasing the chances of access from 25% on average to over 46% in the case of Portuguese students. One explanation could be the relatively large impact of the "hidden curriculum" (Driessen, 2001), which refers to non explicit but binding requirements that only children with a high social capital are aware of (and can thus comply with).

High social capital endowments also substantially increase chances of access to the academic route for low track students, although it plays an even greater role in increasing transition probabilities to general school and vocational routes. Transitions to apprenticeship training are particularly sensitive to social capital if students complete middle school in the low track but is not so important for high track students, as ratios are close to one for all groups.

Across both tracks and all groups, relative risk ratios to remedial education are close to one, suggesting that other factors might be at play. Moreover, although relative impacts of social capital on this transition option are relatively homogeneous, there are substantial probability differences in levels, as discussed earlier. Finally, as expected, dropout risk ratios are close to zero for all groups and middle school tracks. Consistently with previous findings in the literature (e.g., Ream and

Rumberger, 2008; Croninger and Lee, 2001), students with low endowments of social capital are far more likely to dropout. Social capital plays, therefore, the biggest role at the two extremes of the school system (the academic route on the one side and dropouts on the other), reflecting a polarization of the system, despite the many educational opportunities it offers.

To examine how middle school tracking might affect different groups of students and transition options, table 3.6 presents risk ratios across middle school tracks at given levels of social capital. The main result emerging is that two transition outcomes are heavily dependent on middle school track: transitions to the academic route on the one hand, with comparable low track students having almost no chances of access and, on the other hand, transitions to remedial education with corresponding ratios reflecting that high track students almost always manage to avoid this outcome. Furthermore, ratios to the academic route decrease as students belong to more recent migration waves, suggesting that middle school tracking impacts differently the various groups of migrants considered and generates greater differences for natives and first wave migrants. Possible explanations for this result would be the path dependence of the tracking system, that initially had to deal with only some specific and relatively homogeneous groups of students: as a result native and Mediterranean migrants all exhibit ratios of the same order of magnitude. Said differently, the middle school tracking system at stake sorts students more selectively when they belong to "well known" groups.

3.4.2. Further results

The goal of this section is to further assess the differential effect of social capital across migrant groups. Our first model specification, without interaction term, was a necessary first step but could not fully answer the question at stake. As multinomial logit models are computationally and parametrically intensive, an interaction term between each migration group and each single component of social capital is a dead end strategy. We thus adopt a different approach and compute a social capital score for each individual, defined as the addition of each individual component of social capital. More precisely, as all components of social capital are qualitative variables, we attributed a score of one to each dummy variable, with one representing the lowest level of social capital (i.e., being a non-french speaker, not living with both parents, coming from a foreign country are each worth a point). For the age at arrival, starting from a score of one for children arrived between 5 and 6 years of age, each successive modality is credited with an additional point, up to four points for children arrived during middle school. The total score for each individual is then

the sum of the value taken by each component and varies between zero and seven.

Appendix table C.5 presents summary statistics of this score broken down by track. As before, low track students have on average less social capital (higher score) than their high track counterpart. Based on this score sample mean, we define a dummy indicating a high social capital for all individuals below the mean (as a higher score corresponds to less social capital). Only this dummy is then interacted with the six migrant groups.

This method relies on the underlying assumption that each component contributes linearly and equally to the individual score, so that the impact of each component is lost and only a global effect is estimated; nevertheless, since we could examine the (unrestricted) individual impact of each variable in the previous section, this simplification is not problematic at this point.

We will focus the discussion on the relative risk ratios within tracks displayed in table 3.7, but for the sake of completeness, appendix table C.6 presents conditional probabilities for each track, group of migrants and dichotomized level of social capital and appendix table C.7 presents the conditional risk ratios between tracks.

As expected, compared to the first by-component specification without interactions, differences in conditional risk ratios across groups of migrants are more marked for all transition options. However, largest differences are observed for transitions to general school, to apprenticeship training and for dropouts. Concerning transitions to general school, a high social capital seems to play a bigger role, and especially so for high track Swiss and Spanish and Italian students. Compared to the previous specification, high track student relative risk ratios concerning transitions to apprenticeship training are now below one for Portuguese and Balkanian students, suggesting that a high social capital actually decreases their transition probability to this particular option. The pattern for low track students is fairly different, with ratios above unity for Swiss and first wave migrants, as before, but now, all other groups exhibit ratios close (or just below) unity. For these latter groups, this suggests that social capital does not play an important role in determining transition probabilities to apprenticeship training. Finally, high track student risk ratios for dropouts are all larger than previously, with the largest increase for Portuguese students, pointing toward a relatively larger impact of a high social capital in avoiding this issue. The distribution of dropout risk ratios for low track students is also more heterogeneous across groups, with a large increase of this ratio for students from Turkey and the Balkans: a high social capital reduces their chances of dropping out by around 60%.

Table 3.4: Impacts of social capital endowments on conditional transition probabilities by track and group of migrants

		Acad.route	Gen.School	FT VET	Dual VET	Remedial	Drop Out
				High social capital			
	Swiss stdt	74.30	3.93	14.33	3.57	1.14	2.72
	std. error	*0.48*	*0.20*	*0.38*	*0.20*	*0.10*	*0.16*
High track	Italian/Spanish stdt	65.76	5.77	19.70	2.79	2.35	3.63
	std. error	*1.30*	*0.64*	*1.08*	*0.39*	*0.40*	*0.44*
	Portuguese stdt	61.00	7.81	18.33	4.73	2.65	5.48
	std. error	*1.66*	*0.98*	*1.25*	*0.72*	*0.55*	*0.71*
	Balkanian stdt	67.87	4.23	21.31	2.31	2.25	2.03
	std. error	*2.30*	*0.88*	*2.02*	*0.66*	*0.67*	*0.47*
	African stdt	76.23	3.60	12.40	0.59	3.13	4.05
	std. error	*1.64*	*0.64*	*1.27*	*0.25*	*0.70*	*0.59*
				Low social capital			
	Swiss stdt	59.34	8.44	16.51	3.39	1.28	11.04
	std. error	*3.34*	*1.82*	*2.51*	*1.36*	*0.51*	*1.99*
High track	Italian/Spanish stdt	48.81	11.50	21.09	2.45	2.47	13.67
	std. error	*3.57*	*2.50*	*3.11*	*1.01*	*1.00*	*2.59*
	Portuguese stdt	41.90	14.41	18.17	3.86	2.57	19.09
	std. error	*3.44*	*2.88*	*2.75*	*1.51*	*1.02*	*3.25*
	Balkanian stdt	53.78	9.00	24.36	2.17	2.52	8.17
	std. error	*4.00*	*2.29*	*3.69*	*1.00*	*1.12*	*2.09*
	African stdt	58.88	7.48	13.82	0.54	3.41	15.87
	std. error	*3.38*	*1.68*	*2.25*	*0.30*	*1.30*	*2.65*
				High social capital			
	Swiss stdt	1.26	25.68	20.34	19.19	21.10	12.44
	std. error	*0.20*	*0.94*	*0.86*	*0.86*	*0.83*	*0.67*
Low track	Italian/Spanish stdt	1.10	24.18	16.68	19.40	25.18	13.47
	std. error	*0.30*	*1.64*	*1.34*	*1.57*	*1.62*	*1.27*
	Portuguese stdt	1.45	26.09	16.46	18.32	23.22	14.47
	std. error	*0.40*	*1.87*	*1.42*	*1.68*	*1.64*	*1.45*
	Balkanian stdt	2.15	20.18	22.88	13.54	31.05	10.20
	std. error	*0.72*	*2.04*	*2.23*	*1.74*	*2.36*	*1.43*
	African stdt	3.40	25.29	21.76	4.60	33.41	11.53
	std. error	*0.93*	*2.13*	*2.04*	*0.83*	*2.31*	*1.37*
				Low social capital			
	Swiss stdt	1.02	19.99	16.00	14.19	23.04	25.76
	std. error	*0.42*	*2.48*	*2.28*	*2.50*	*2.57*	*3.19*
Low track	Italian/Spanish stdt	0.87	18.36	12.80	13.99	26.80	27.19
	std. error	*0.38*	*2.38*	*1.96*	*2.49*	*2.94*	*3.41*
	Portuguese stdt	1.13	19.67	12.53	13.12	24.54	29.01
	std. error	*0.46*	*2.31*	*1.82*	*2.21*	*2.60*	*3.22*
	Balkanians stdt	1.73	15.63	17.92	9.96	33.74	21.02
	std. error	*0.75*	*2.15*	*2.59*	*1.89*	*3.32*	*3.02*
	African stdt	2.66	19.06	16.57	3.29	35.30	23.12
	std. error	*0.96*	*2.28*	*2.23*	*0.75*	*3.06*	*2.74*

Notes: All numbers are in percent. Conditional probabilities are computed
using a multinomial logit model with transition choice as the dependent variable. Controls, financial and social capital are included in the model. Except for the following variables: age at arrival (either before school or during middle school), lives w. both parents (either 0 or 1), from a foreign country (either 0 or 1), and non-French speaker (either 0 or 1),
nationality group and SES (white collars), all other variables are held at their sample mean.

Table 3.5: Social capital endowments: conditional risk ratios within tracks

		Acad.route	Gen.School	FT VET	D.VET	Remedial	Drop Out
Swiss	High track	1.25	0.47	0.87	1.06	0.89	0.25
	Low track	1.24	1.28	1.27	1.35	0.92	0.48
Italians & Spaniards	High track	1.35	0.50	0.93	1.14	0.95	0.27
	Low track	1.27	1.32	1.30	1.39	0.94	0.50
Portugueses	High track	1.46	0.54	1.01	1.23	1.03	0.29
	Low track	1.28	1.33	1.31	1.40	0.95	0.50
Balkanians & Turks	High track	1.26	0.47	0.87	1.06	0.89	0.25
	Low track	1.24	1.29	1.28	1.36	0.92	0.49
Africans & Lat. Americans	High track	1.29	0.48	0.90	1.09	0.92	0.26
	Low track	1.28	1.33	1.31	1.40	0.95	0.50

Note: Conditional risk ratios are computed using conditional probabilities from two multinomial logit models. The relevant exposed group has a high amount of social capital while the relevant non-exposed group has a only a low amount of social capital, all other things equal.

Table 3.6: Social capital endowments: conditional risk ratios between tracks

		Acad.route	Gen.School	FT VET	D.VET	Remedial	Drop Out
Swiss	High social K	58.83	0.15	0.70	0.19	0.05	0.22
	Low social K	58.08	0.42	1.03	0.24	0.06	0.43
Italians & Spaniards	High social K	59.72	0.24	1.18	0.14	0.09	0.27
	Low social K	56.20	0.63	1.65	0.18	0.09	0.50
Portugueses	High social K	42.09	0.30	1.11	0.26	0.11	0.38
	Low social K	36.92	0.73	1.45	0.29	0.10	0.66
Balkanians & Turks	High social K	31.50	0.21	0.93	0.17	0.07	0.20
	Low social K	31.01	0.58	1.36	0.22	0.07	0.39
Africans & Lat. Americans	High social K	22.45	0.14	0.57	0.13	0.09	0.35
	Low social K	22.15	0.39	0.83	0.16	0.10	0.69

Note: Conditional risk ratios are computed using conditional probabilities from two multinomial logit models. The relevant exposed group has a high amount of social capital while the relevant non-exposed group has a only a low amount of social capital, all other things equal.

Table 3.7: Dichotomized social capital endowments: conditional risk ratios within tracks

		Acad.route	Gen.School	FT VET	D.VET	Remedial	Drop Out
Swiss	High track	1.01	1.21	1.09	1.23	0.87	0.47
	Low track	0.68	1.17	1.04	1.51	0.85	0.69
Italians & Spaniards	High track	1.01	1.29	1.09	1.24	1.19	0.52
	Low track	1.30	0.83	1.38	1.18	1.15	0.60
Portugueses	High track	1.16	0.71	0.88	0.60	1.04	0.67
	Low track	1.39	0.99	1.56	0.77	0.91	0.90
Balkanians & Turks	High track	1.14	0.46	0.86	0.22	0.77	0.47
	Low track	1.09	0.71	0.94	0.99	0.97	1.68
Africans & Lat. Americans	High track	1.13	0.83	0.64	2.77	1.31	0.54
	Low track	1.67	0.98	1.07	0.98	1.00	0.85

Note: Conditional risk ratios are computed using conditional probabilities from two multinomial logit models; social capital is interacted with nationality groups. The relevant exposed group has a high amount of social capital while the relevant non-exposed group has a only a low amount of social capital, all other things equal.

3.5. Conclusion

In this paper, we have examined migrant integration into the Swiss school system, as expressed by their choice of route at the upper secondary level, using data for Geneva over the period 1993–2007, and estimated a series of multinomial logit models by middle school track, since the track constrains the transition options. Results confirm that social capital matters for all types of students and differences in social capital endowments have the largest impact at the extremes of the school system, strikingly influencing dropouts and transitions to the academic route. Relative impacts of social capital are heterogeneous across groups of migrants, upper secondary outcomes and middle school tracks. Moreover, concerning transitions to the academic route on the one hand and to transitory solutions on the other, at equal levels of social capital, natives are generally in a more advantageous position than migrants and across migrant groups, students belonging to the most recent migration waves, such as from Turkey or the Balkans are in the least favorable position.

If the school system is supposed to level out the playing field across sociodemographic groups, these results suggest that it is not doing a very good job. More importantly, the leveling effect is differentiated across groups, so that the school trajectory of certain groups (first wave Mediterranean migrants) is kept close to natives', while the trajectories experienced by other groups (recent migrants) are rather diverging.

The underlying causes of such mechanisms are, however, not observable and may be of diverse nature, rooted in both preferences (or aspirations) and school related differential treatment. However, when considering clearly unfavorable outcomes, such as remedial education, one can more easily rule out aspirations and point towards school related factors. Moreover, those diverging experiences most likely shape individuals' perception of the system. If natives and the main communities of migrants share a globally positive vision of the system, this has two main implications: first, no major reform on the questionable equity of the system is going to be high on the political agenda, as a majority is content with the status quo and, second, teaching vocations will probably be unevenly distributed within the population, occurring more frequently within the favored groups. Both factors contribute to a fairly high degree of inertia. However, the status of the well known migration groups gives us a hint that systemic learning has been taking pace along the way, although at a probably slow pace.

While non adaptability was an acceptable and logic feature in a relatively closed and static world, such as during the second part of the twentieth century, increased openness and heterogeneity, as observed over the last decades, should

start challenging this premise.

4. Age of tracking and the smoothness of upper secondary school transitions[1]

In this article, we examine if a one-year delay in middle school tracking influences the probability of route changes at the upper secondary level. We take advantage of a natural experiment in Geneva (Switzerland), whereby a group of middle schools tracked their students a year later than the majority of schools. Because of specific conditions, we argue that selection into treatment is independent of potential outcome and, therefore, use a regression design to identify the average treatment effect (ATE). We find a small positive ATE implying a negative impact of delayed middle school tracking on the smoothness of upper secondary school transitions. Effects are heterogeneous along the ability distribution with low achievers more negatively affected.

Keywords: age at first tracking; average treatment effect; efficiency; upper secondary route changes.

JEL classification: I20; I21; I28.

4.1. Introduction

Tracking is a common feature of many countries' school systems, though the intensity and the age at first tracking vary greatly. From ability streaming in US high schools to German early school tracking, a wide range of institutional features exist and a natural question arises as to how exactly tracking impacts students, with regards to their educational choices, achievement or interaction with their peers. A closely related question is to examine how placement into a particular track is influenced by other factors than students achievement, such as family background or parental education and how they further interact with tracking. This paper is well in line

[1]This paper is co-authored with José V. Ramirez. This work profited from useful comments from Michele Pellizzari, Jennifer Hunt, Martin Carnoy, Rainer Winkelmann and Paul Ryan. It was presented at the VET research congress in Biel (2012), at the Second Lisbon Research Workshop on Economics, Statistics and Econometrics of Education in Lisbon (2013) and at the XXVIII AIEL Conference of Labour Economics in Rome (2013).

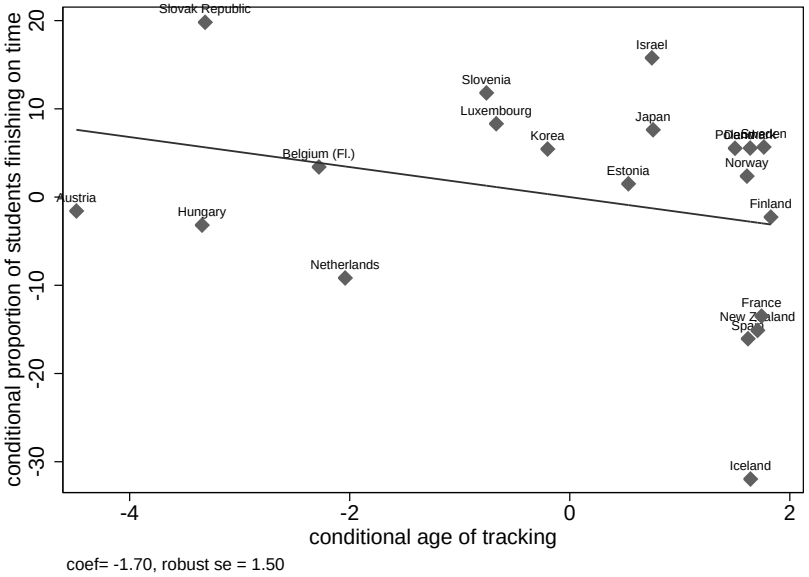
with the former strand of literature, and deals specifically with the impact of the age of middle school tracking on the smoothness of post-compulsory school transitions. We examine, in particular, how delayed tracking might impact the probability of track or route changes during upper secondary studies.

There are three main reasons why one should look at the smoothness of upper secondary school transitions. First, the OECD report *Education at a glance* (OECD, 2012a) highlights that, over the 25 countries for which they have data, on average, 70% of students complete the (upper secondary) program they entered "on time", i.e., within the theoretical duration of the program. This rate rises to 85% when adding two years to the theoretical duration, to take into account grade repetition and changes of programs. Both numbers point out that route changes at this stage are common and worth examining. Interestingly, combining this smoothness indicator with PISA data (OECD,2014b), one can compute a simple cross country correlation between the age at first tracking and the percentage of students completing general programs on time, while controlling for average nation-wide PISA score, expenditure per students, the proportion of 15-year-olds with an immigrant background and GDP per capita. The resulting association is small and negative, as displayed on figure 4.1, suggesting that an early tracking is negatively related with the smoothness of upper secondary school transitions. Obviously, this correlation exercise is very rough and only (tentatively) descriptive but still informative.

Second, from a public policy perspective, as pathways become increasingly complex, larger resources have to be invested in upper secondary school systems. It goes without saying that, in addition to public costs, individuals also support a private cost in foregone earnings associated with longer years spent studying, and this is especially true if those additional years do not have any positive impact on future school transitions and labor market outcomes. In the short run, smoother upper secondary transitions appear economically desirable, both from a public and private perspectives. However, in the long run, the impact of non smooth transitions can be either negative or positive, depending on the quality of the "rematches", i.e., depending on both the quality of newly selected route and the perspectives it may bring. In addition, a certain degree of permeability is a desirable feature of school systems: in allowing individuals to make mistakes or simply change their minds, permeability can improve both fairness and efficiency.

The third argument is of a different nature and relates to the consistency of our modeling strategy. As noted in many empirical studies (see, for example, Betts, 2011), examining the impact of tracking on student performance is an empirically difficult question, because disentangling the two phenomena is hard (reverse causal-

Figure 4.1: Age of tracking and the proportion of students finishing general upper secondary programs on time



Notes: Added variable plot. Other controls are average 2012 PISA math score, expenditure per student, proportion of 15-year-olds with an immigrant background, GDP per capita.

ity issues). Another strategy is to tackle the impact of tracking through another educational output and use as dependent variables less co-varying indicators, such as tertiary degree completion (e.g., Malamud and Pop-Eleches, 2011) or, as in our case, the smoothness of upper secondary school transitions.

The impact of the age of tracking has received substantial attention recently and, generally speaking, results suggest that a later tracking is beneficial to least-favored students. Most studies look at the impact of the age of tracking on test scores and the most comprehensive analysis in this field has been done by Hanushek and Woessmann (2006). Thanks to a relatively large sample of countries they are able to use a difference-in-difference approach. Their results indicate that early tracking increases educational inequality and tends to reduce mean performance. In addition, numerous case studies have tried to identify the impact of tracking using natural experiments. For Sweden, Meghir and Palme (2005) exploit a major educational reform from the late 1940s that, among others, postponed tracking from age 12 to 13. One of their main results is that "the reform led to an increase in schooling beyond the new compulsory level for individuals with higher ability and unskilled fathers" (p. 422). Using regression analysis on German data for the State of Hessen, where in addition to regular tracking at 10, parents can choose to postpone tracking by two years, Muehlenweg (2007) finds that delaying tracking had no negative effect

on test score mean, while positive effects are found for pupils with less favorable family backgrounds. A recent study by Piopiunik (2014) examines the impact of a policy reform that anticipated tracking by two years (from age 10 to 8) on students performance, in Bavaria (Germany). Using PISA data along with double and triple difference estimations, he finds that early tracking reduces the performance of 15-year-old students. Koerselman (2013) brings to our attention incentive effects that may arise in tracked systems, leading forward-looking students to anticipate track allocation in increasing their effort, a mechanism empirically supported by his UK data and a credible explanation as to why we observe a widening early test score gap (grades 3 and 4) between early and late tracking countries.

Other studies look at the impact of the age of tracking on different educational outcomes. For Romania, Malamud and Pop-Eleches (2011) highlight that a later secondary school tracking (from 8 to 10 years of general schooling) increases the number of disadvantaged students applying for University but has no effect upon degree completion, because the number of available University slots had not evolved. In a context relatively similar to ours, van Elk et al. (2011) study the impact of a delayed tracking (from 12 to 13 or even 14 years old) on higher education completion, using Dutch data. Both their OLS and IV estimates suggest that delayed tracking is beneficial to students at the margin of engaging in higher education, as it increases their probability of completing a degree by 5 percentage points. No detrimental effect is found on high achieving pupils. Hall (2012) identifies the impact of delayed tracking in Sweden, thanks to a reform at the upper secondary level that harmonized curriculum content and duration between academic and vocational tracks during the 1990s. She finds that introducing more academic content in vocational tracks increases vocational student educational attainment but has no effect on their tertiary educational attainment nor labor market income. Lowest achievers are even hurt by the reform, as it increases their probability of dropping out. Finally, for Switzerland, Bauer and Riphahn (2006) use a difference-in-difference estimation on a cross-sectional census dataset and find that early tracking is relatively beneficial to students with highly educated parents, as it increases their educational mobility.

Our case study, Geneva, a dense urban Swiss Canton, has witnessed the coexistence of two different (within) middle school tracking systems during an extended period of time (1971-2011), with one system tracking students a year earlier than the other. Because assignment to either one of the tracking regimes is based only on observables, we can identify an average treatment effect (ATE). While the literature points out that early tracking tends to increase school performance inequality, our results suggest that delaying tracking can reduce the smoothness of

subsequent school transitions and particularly so for low ability students. This result is consistent with low achieving students' higher probability to make improper educational decisions regarding upper secondary schooling when tracked a year later.

The remainder of this paper is structured as follows: the next section exposes our identification strategy while describing the lower-secondary school system and the third one details our empirical framework. Section 4.4 presents the results we discuss in section 4.5. The last section concludes.

4.2. Variation in the timing of tracking

During the period covered by our data, 1993–2007, two different tracking systems prevailed in the Canton of Geneva. While the majority of middle schools tracked their students from the beginning, i.e., at the age of twelve, a group of three middle schools (representing around 16% of all students) only started tracking students at the age of thirteen, i.e., a year later. Although we will simply use the term "tracking" in this paper, what we are referring to is within-school "streaming", as students are allocated to different tracks within a common school building (Brunello and Checchi, 2007). In our context, this means that within a given middle school, tracks are differentiated at the classroom level, so that classroom peers are track specific. Furthermore, track allocation criteria are defined at the Cantonal level so that, within a given tracking system, all schools have the same structure.

The coexistence of a two-tier tracking system finds its origin at the beginning of the 1970s (1971–1972). In a thorough historical review, Bain et al. (2004) explain that, at that time, the recently created (1962) unified lower secondary (tracked) school system was already subject to concerns. Politicians and pedagogists questioned the functioning of the system and, in particular, its ability to correctly direct students to the various upper secondary routes, as well as its high degree of selectivity, perceived then as too elitist. Inspired by the UK comprehensive school model, decision makers sensed that introducing more heterogeneity, at least during the first year of lower secondary school, could mitigate (if not solve) those issues, effectively delaying tracking by a year.

In this view, the director of lower secondary education assigned the pilot school principal the elaboration of a reform package, which was then implemented in 1972. Two other schools joined the pilot group in 1973 and 1975 respectively. Several reasons help understand this extension: first, because the two additional schools were just about to open, they did not necessitate any transition period, facilitating the adoption of the reform. Second, as the next school was located close

to the initial pilot school decision makers considered important that all students attending the same pool of upper secondary schools, i.e., those located in the common area, emerged from a unified secondary system. However, the third participating school was located on the far side of the Canton, forcing decision makers to formally acknowledge the equivalence between the two tracking systems.

After a successful trial period and favorable expert recommendations, the project was, however, not generalized to the whole Canton. The reform was supposed to be extended to all middle schools in September 1980, but in May, lacking a general consensus on implementation details and probably sensing that imposing such a reform would cause more harm than good, the government changed gears and backed up. The three treated establishments were, nevertheless, enthusiastic about the delayed tracking system, as they felt that the new system was successful in providing more social heterogeneity and in leading to a higher degree of social integration, being especially beneficial to low-achieving and average students (Bain et al., 2004). Thanks to the relative autonomy granted to middle schools in the Canton, the three schools were allowed to keep it. This systemic difference subsisted until very recently (2011), when only a supra-Cantonal curriculum harmonization was a strong enough factor of change.

It is important to note that the treated middle schools had not much in common, except for their delayed tracking system: different directors and school policies, different locations across the Canton and, therefore, potentially different compositions of their student population. Indeed, in Geneva, students are allocated to a given middle school on the sole basis of their home address and rules are strict: it is not possible for parents to request a particular middle school for their children. In addition, the local housing market is extremely tight, as the vacancy rate is one of the lowest in Switzerland, with a local average vacancy rate of 0.8% over the period and annual values consistently below this level since 2000 (Cantonal Office of Statistics, 2011c), thus rendering strategic moves highly unlikely and, in all cases, very costly (as new leases imply substantial rent increases). The combination of those factors makes the cost of self-selection very high. On the other hand, the benefit from any self-selection is likely to be very small, since the public system is generally perceived as equivalent (and more importantly, equivalently good) across all middle schools[2]. Finally, the allocation of primary students to a specific middle

[2]Teacher mobility between the different schools (both within and between the two tracking systems) is very low and greatly due to the dynamic of retirement-induced vacancies. Moreover, teacher's salary is set at the Cantonal level and there aren't any wage incentives, regarding, for example, students' performance, at the class and/or at the school level. Furthermore, comprehensive school rankings do not exist (including for managerial purposes) and the only information available to practitioners is a yearly Cantonal school ranking solely based on (school

school may vary from one year to another, making middle school targeting trough neighborhood selection only approximate.

The crucial point we make here, is that selection into treatment is dependent only on the home address and though, arguably, there exist compositional differences related to the population of a particular neighborhood, they will be accounted for by the model (i.e., it is a case of selection on observables). Most importantly, assignment to treatment is independent of potential outcomes, since students (and their parents) do not self-select themselves into a particular tracking system based on their chances of accomplishing smooth upper secondary studies and given these specific conditions, it is quite difficult to think of an omitted variable that would both influence the choice of neighborhood and the smoothness of subsequent school transitions. Therefore, conditional on a large set of covariates, the average treatment effect of the age of tracking on the smoothness of upper secondary transitions can be reasonably well identified using a regression design.

4.3. Empirical framework

4.3.1. Data

The database used in this paper is the Geneva Schooling Database (GSD), compiled and yearly updated by the Cantonal schooling administration. The GSD records every child who goes to either public or private school in Geneva, from primary to upper secondary level. We could access data from 1993 up to 2007, i.e., data for twelve cohorts of public students. For two cohorts, the latest ones (i.e., in their first year of upper secondary education in 2003 and 2004, respectively), we also possess information on students' middle school grades. In addition, for our empirical strategy to be consistent, we only run the analysis on students who stayed in the same tracking system during all their middle school years; thus, about 2% of all observations were dropped.

4.3.2. Variables

As previously mentioned, the idea here is to examine the smoothness of upper secondary school transitions, and by this, we mean looking at route changes during the first three years of upper secondary schooling[3]. Specifically, all possible up-

average) scores at a standardized test.

[3]While our data would have allowed us to consider four, we only took three years of post-compulsory education into account, because labor-market exiting may arise after the completion of an apprenticeship training (which is possible in three years) and our data do not allow us to

per secondary choices are grouped into six main routes reflecting the diversity of the Swiss upper secondary school system: college-bound high school (the academic route), general school (that delivers lower-level general knowledge), full time vocational education (professional schools), dual vocational education and training (i.e., the apprenticeship system, whereby apprentices divide their time between a professional school and on-the-job training), remedial education (this covers all preparatory years to various schools and special structures, designed for students that do not meet other route requirements) and dropouts[4]. A change of route is then simply defined as a switch between routes over a period of any two consecutive years. Including remedial education and dropouts as route "choices" imply that students transitioning to either one of those routes are bound to change route subsequently when engaging in certifying upper secondary education. However, when examining the smoothness of transitions, one needs to take those cases into account since they always increase the number of years before getting any diploma and are part of the educational system.

This definition of smoothness implies that we keep a neutral standpoint, as we take any route changes into account, whether going upward or downward. Once again, from our perspective, in the short run, any route change means additional costs, both at the private and public levels.

Table 4.1 presents the distribution of transition options in the sample by first, second and third transition, and by age of tracking. Additionally, p-values resulting from corresponding t tests across sub-sample means are reported, so as to check whether transition patterns differ between students tracked at 12 and at 13. While there appear to be differences in the general pattern of the first transition between the two types of students, these differences seem to fade over time, except for transitions to apprenticeship training that attracts greater percentages of students tracked at 12 at each point in time.

As we take into account the first three years of upper secondary schooling, the maximum number of observed route changes for a given individual is two (between the first and second year, and/or between the second and the third one). Table 4.2 presents basic summary statistics for our dependent variable and it highlights that, for our sample of around 42,000 individuals, route changes occur both across individuals (between variation) and over time for a given individual (within

identify those cases.

[4]A thorough explanation of the Swiss school system can be found in a report by the Swiss Coordination Center for Research in Education (SKBF, 2014).

Table 4.1: First, second and third transitions by age of tracking

	1st transition			2nd transition			3rd transition		
	12	13		12	13		12	13	
	percent	percent	p-val	percent	percent	p-val	percent	percent	p-val
Academic route	50.90	52.67	0.006	45.02	45.80	0.230	40.53	40.71	0.780
General School	11.75	10.04	0.000	10.99	10.99	0.997	10.66	10.51	0.706
Professional schools	17.24	17.65	0.413	19.00	20.30	0.013	17.05	18.37	0.009
Apprenticeship	8.67	6.46	0.000	16.41	13.78	0.000	19.34	16.80	0.000
Remedial	8.42	10.28	0.000	0.54	0.59	0.577	0.14	0.16	0.691
Drop out	3.02	2.89	0.561	8.03	8.53	0.166	12.28	13.46	0.008

Data source: Geneva Schooling Database for 12 cohorts of students (1993-2007).

Notes: p-values report results from the t-test on the equality of means. A 100% is 41,901 for each transition

variation). Table 4.3 illustrates that route changes are more frequent between the first and second year of post-compulsory school, suggesting that, on average, re-orientations tend to intervene at earlier stages. Moreover, table 4.3 highlights that, unconditionally, route changes are significantly more frequent among delayed tracking students.

Table 4.2: Route changes: summary statistics

	Mean	Std.Dev.	Observations
overall	0.225	0.418	N = 83,802
between		0.315	n = 41,901
within		0.274	T = 2

Data source: Geneva Schooling Database for 12 cohorts of students (1993-2007).

Table 4.3: Proportions of route changes by age of tracking and transition node

	1st node	2nd node	Total
Tracked at 12	27.2%	17.2%	34,812
Tracked at 13	29.4%	18.7%	7,089
p-val	0.000	0.003	

Data source: Geneva Schooling Database for 12 cohorts of students (1993-2007).

Notes: p-values report results from the t-test on the equality of means across the two sub-samples.

The idea behind our choice of independent variables, aside, of course, from our dummy of interest reflecting the age of tracking, is to control for as many individual characteristics as possible. As a set of controls we have: an indicator of middle school performance based on (middle school) grade repetition, gender, socioeconomic (occupational) status, nationality group, a dummy indicating whether or not the country of provenance is different from Switzerland, language spoken at home, age at arrival inside the school system and family structure. Time dummies are also added to control for year-specific factors. A complete description of all independent variables can be found in table 4.4 and a table of summary statistics, by age of tracking, is available in appendix table D.1. The third column of table D.1 reports p-values resulting from corresponding t tests across sub-sample means. Even though most of the means appear significantly different between the sub-samples, it is still worth noticing that the (raw) proportions of all variables remain in a very comparable distributional range across both tracking systems. Finally, we will also use middle school level proportions of all independent variables to further strengthen our results.

Table 4.4: Description of independent variables

name	description
tracked at 13	dummy referring to the age at first tracking; is 1 for students tracked at the age of 13. The reference group is tracked at 12.
repeater	dummy to control for grade repetition during middle school.
age at arrival	reflects the age at arrival inside the school system with a grouping based on the different cycles of compulsory school in Geneva. Five groups are made: all students either born in Geneva or arrived before the beginning of kindergarten (before 4; reference category); all children arrived during kindergarten (i.e. between 4 and 6 years of age); those arrived during the first part of primary school (i.e., between 7 and 8 years of age); those arrived during the second part of primary school (i.e., between 9 and 12 years of age) and those arrived during middle school (i.e., between 13 and 15 years of age).
girl	zero for boys.
family structure	one if the students lives with both parents.
non-French speaker	one if the home language of the student is not French.
foreign country of provenance	one if the incoming country is different from Switzerland, i.e., the student does not arrive from another Swiss Canton.
nationality groups	seven dummies grouping nationalities based on the incoming migration waves to Switzerland since the 1950s. "Swiss" is the contrast group and the other groups are: Spain and Italy; Portugal; Balkans & Turkey; Extra European countries; R.o. EU 27 and EFTA; Asia, North America & Middle East.
socioeconomic status	occupation based parental socioeconomic status. Categories are: managerial workers; blue collars; self employed and miscellaneous/NA. The reference group is white collar workers.

4.3.3. Modeling

As we assume independence between treatment and outcome, our estimation strategy is to compare estimations performed using panel data modeling (that allows to correct for both heteroskedasticity and auto-correlation in the error term), and linear probability models, that permit to estimate the average treatment effect (e.g., Blundell and Costa Dias 2000; Imbens and Wooldridge 2009; Angrist and Pishke, 2009). Comparable results across estimations would support the robustness of our findings.

For the simple OLS case, we estimate the following equation:

$$y_{it} = \mathbf{x'}_{it}\boldsymbol{\beta} + \gamma T_i + \varepsilon_{it} \tag{4.1}$$

where y_{it} denotes the probability to change route for individual i at time t, $\mathbf{x}_{it}$ is a vector of individual controls as described in the previous subsection and T is our dummy of interest reflecting the age of tracking.

Concerning panel data modeling, we use a population-average model, which, in the case of a dichotomous dependent variable, allows an estimation of marginal effects. Specifically, we use a population average logit model, defining the probability to change route for an individual i at time t as:

$$Pr(y_{it} = 1 \mid \mathbf{x}_{it}, \boldsymbol{\beta}, \alpha_i) = \Lambda(\alpha_i + \gamma T_i + \mathbf{x'}_{it}\boldsymbol{\beta}) \tag{4.2}$$

with $\alpha_i = \alpha$ and $\Lambda(.)$, the logistic conditional distribution function, where $\Lambda(z) = \frac{e^z}{(1+e^z)}$. In both cases, this implies that educational outputs, including the tracking regime and grades, are considered as given past outcomes, and that we examine their influence on a subsequent outcome of a different nature, namely transition smoothness.

4.4. Results

4.4.1. Baseline results

We first report estimation results of our baseline set of specifications in table 4.5. Depending on the variables added to the model, we classify specifications into a first, a second and a third set but all sets present results obtained using a population average (PA) logit model and a simple linear probability model. The first set only controls for individual characteristics, as discussed in section 4.3.2; the second set, however, also includes nationality and socioeconomic status groups but considered

at the school level, which enables us to explicitly take into account any compositional effect due to differences in middle school populations. Furthermore, adding school level controls allows us to estimate the impact of delayed middle school tracking more precisely, since the model now accounts for school-specific factors. Finally, for the sake of completeness the last two columns of table 4.5 present the third set of specifications where the time-variying school level proportions of all independent variables are added[5].

Table 4.5: The impact of delayed tracking on upper secondary route changes: baseline results

	OLS	OLS	PA	OLS	PA	OLS	PA
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
tracked at 13	0.018***	0.022***	0.022***	0.021***	0.022***	0.022***	0.022***
repeater		0.107***	0.105***	0.108***	0.106***	0.110***	0.108***
arrival: 5-6 y. o.		0.015*	0.014*	0.016*	0.015*	0.018**	0.018**
arrival: 7-8 y. o.		0.031***	0.027***	0.032***	0.028***	0.032***	0.029***
arrival: 9-12 y. o.		0.025***	0.019**	0.027***	0.021***	0.027***	0.020***
arrival: 13-15 y. o.		0.028**	0.019	0.029**	0.020*	0.029**	0.020*
girl		-0.030***	-0.031***	-0.030***	-0.031***	-0.030***	-0.031***
lives w. both parents		-0.067***	-0.067***	-0.067***	-0.067***	-0.066***	-0.066***
non-French speaker		-0.015***	-0.015***	-0.017***	-0.017***	-0.017***	-0.017***
from a foreign country		0.025***	0.024***	0.025***	0.024***	0.026***	0.026***
Spain and Italy		0.048***	0.049***	0.050***	0.050***	0.050***	0.051***
Portugal		0.080***	0.078***	0.079***	0.076***	0.078***	0.075***
Balkans & Turkey		0.084***	0.082***	0.079***	0.076***	0.078***	0.075***
Africa & Lat. America		0.100***	0.094***	0.097***	0.090***	0.096***	0.089***
R. o. EU 27		0.017**	0.019**	0.019**	0.021***	0.019**	0.021***
Asia, N. America & Middle East		0.019*	0.024**	0.018	0.022*	0.017	0.021*
managerial workers		-0.048***	-0.053***	-0.042***	-0.048***	-0.042***	-0.048***
self employed		0.038***	0.039***	0.039***	0.039***	0.038***	0.039***
blue collar workers		0.045***	0.045***	0.043***	0.043***	0.043***	0.043***
misc. /NA		0.069***	0.062***	0.067***	0.060***	0.067***	0.061***
school population controls	no	no		SES & nationality		All	
Number of observations	83,802	83,074					
Number of ids	41,901	41,537					

Legend: * 0.10 ** 0.05 *** 0.01

Note: Dependent variable is the probability to change route. Variance is robust and year dummies are included. For population average (PA) estimations, the correlation term is only constrained to be the same across individuals and only marginal effects are reported. School controls include school level proportions of all nationality and socioeconomic groups in the second set and the proportions of all independent variables in the third one.

Results are remarkably similar across specifications, and our dummy of interest reflecting the age of tracking, appears very significant and positive, indicating that, ceteris paribus, a later middle school tracking tends to increase the probability

[5]Moreover, identification does not seem to be driven by a particular treated middle school, re-estimating the model dropping one school at a time yields comparable results, the dummy appears significant at conventional levels in two cases and significant at 12% in the last case. Results are reported in appendix table D.2.

of route changes during upper secondary studies by 2 percentage points[6]. As previously mentioned, given our specific setting, this effect can be interpreted as the average treatment effect.

As discussed in section 4.2 and as supported by the stability of our findings so far, we believe that our empirical framework allows us to identify the effect of delayed tracking. Nevertheless, a further support to this statement is provided by the results obtained through a two-stage estimation strategy: in a first stage we estimate propensity scores using (time-varying) school level proportions of nationality groups and socioeconomic categories as determinants of the probability to receive treatment. That is, we try to proxy housing choices, i.e., neighborhood selection, using the socioeconomic and ethnic composition of the area, as reflected by the middle school attached to it. In a second stage, propensity scores are used as sample weights to re-estimate our baseline model with a complete set of individual characteristics (Freedman and Berk, 2008; Caliendo and Kopeinig, 2008; Imbens, 2004). In both OLS and PA regressions, our dummy of interest appears significant at 1% and of a very comparable magnitude (0.030 and 0.031 respectively)[7].

4.4.2. Further results

To further verify the robustness of our results, we investigate if our main result holds under alternative specifications and on different sub-samples. We first examine if the impact of delayed tracking is different across transition nodes, i.e., we check if the total effect is not, in fact, driven by a large effect at the first node and no further effect at the second one. OLS estimations by transition nodes are presented in table 4.6. Our dummy of interest stays significant at both nodes and decreases slightly in magnitude, suggesting that the effect of delayed tracking fades but still persists over time.

Second, one potential drawback of our modeling strategy is that our estimates may, in fact, still suffer from an omitted variable bias. Specifically, if, say, the educational quality of children sent to the three treated middle schools were to differ significantly in comparison to all other middleschoolers, and if educational

[6] As mentioned previously, results are robust to the exclusion from the sample of students transitioning to either remedial education or (temporarily) dropping out as first transition option. The delayed tracking dummy appears significant at 1% and of a a slightly lower magnitude, between 0.011 and 0.016 depending on the controls. Complete results are reported in appendix table D.5.

[7] Complete second stage results of those estimations are reported in appendix table D.6.

Table 4.6: The impact of delayed tracking on upper secondary route change: results by transition node

	1st node		2nd node	
	(1)	(2)	(3)	(4)
Tracked at 13	0.026***	0.030***	0.017***	0.017***
R-squared	0.059	0.061	0.023	0.024
individual controls	yes	yes	yes	yes
school population controls	no	yes	no	yes

Data source: Geneva Schooling Database for 12 cohorts of students (1993-2007).

Notes: OLS estimation on the probability to change route with robust variance on 12 cohorts. In all estimations, N is 41,537.

quality were actually correlated with the probability of route changes at the upper secondary level, then, when only partially controlling for school performance (i.e., educational quality), our estimates could be biased. In this case, even signing the bias would be hazardous. Therefore, we try to overcome this limitation by using a twofold strategy: first, we will perform estimations dividing students according to their first transition choice, and second, we will use information on middle school grades, that, as previously mentioned, we only possess for two cohorts.

Our first goal is to perform estimations on sub-samples of more homogeneous students, defining our sub-samples using ex-post information on students' first transition choice, thereby creating six groups. The idea behind this splitting is that all students attending a particular upper secondary route have to meet route-specific grade requirements upon admission. This guarantees that, for example, all students attending the academic route during their first year of upper secondary schooling had to meet an admission requirement of a cumulative grade point average of 4 out of 6[8]. This second round of results is presented in appendix table D.3, and estimates suggest that only students choosing the academic route are more at risk of changing routes subsequently. Moreover, results are robust to the inclusion of school level controls in the model: the delayed tracking dummy stays at a magnitude of 2 percentage points (significant at 1%) for students choosing the academic route and a 3 percentage point effect appears on students choosing apprenticeship. At this point, we would like to emphasize two elements: first, we are performing our estimations on the complete population of students and consequently, there should be, in principle, no sampling errors. Therefore, all point estimates are worth looking at, and

[8]The only meaningful exception to this rule is apprenticeship training (the second being dropouts), that only requires a match between a student and a firm willing to hire an apprentice; firms are absolutely free to chose whomever they see fit.

the relatively narrow range of coefficient magnitudes for our dummy of interest is a reassuring sign. Second, a legitimate question is to ask if the two groups of middle schools exhibit different patterns in sending students to the six upper secondary routes.

As reported in table 4.1, on average over the whole period, the two groups of schools did not differ much in the percentages of students transitioning to the academic track in their first transition. This is particularly interesting for our purpose, because this suggests that our result is unlikely to be driven by other omitted factors, such as, for example, a better job performed by a particular group of middle schools in sending students more often to the most socially valued (academic) route[9].

In addition, one could also wonder if some upper secondary route specific factors could affect students' decision to move or to stay. For example, the high demands of the academic route might be discouraging while professional schools could excel at keeping their students. To account for those upper secondary route specific factors, we (conservatively) add three sets of secondary route dummies, one for each transition. Our dummy of interest resists here as well and we obtain a 0.8 percentage point effect significant at 5%.

Our second approach to control for educational quality is to use information on grades obtained during the last year of middle school for the 2003 and 2004 cohorts (i.e., students in their last grade of middle school in 2003 and 2004, respectively). The idea here is that, by using grades, we are able to control for the educational quality of students more precisely than just dividing the sample using their first transition choice. A debatable question, is, however, which indicator of educational quality to use, so as to reflect the true educational quality. Attempting to answer this question with the data at hand, is clearly not the object of this paper, so we will keep a neutral standpoint and present results for two indicators: the cumulative grade point average (GPA)[10] and the standardized test score in mathematics. For both performance indicators we use two different empirical specifications. In the first one, we divide the population of students by quartile, and re-estimate separately

[9] Additionally, the overall negative effect is not driven by high SES students wrongly channeled to the academic route, as their exclusion from the sample does not modify the results, in both the baseline model (2.23 p.p. effect, significant at 1%) and the by-first-transition-choice model (2.5 p.p. effect, significant at 1% for students choosing the academic route as first transition).

[10] Defined as the average of the math, German and French annual GPAs, which are the three subjects used by secondary schools to set admission requirements. We additionally highlight that the upper secondary route choice process predominantly happens during the last year of middle school and teachers only play a minor role, in the sense that there isn't any "teacher recommendation system". Only grades and middle school track formally condition upper secondary route placements.

the same model for each quartile, including in all four regressions the complete set of individual controls. In the second specification, we only run one regression on the complete sample but add dummies for each quartile, as well as an interaction term between the delayed tracking dummy and quartile dummies. Results of the first specification by quartile are presented in table 4.7, where only the estimated values of our dummy of interest are reported.

Table 4.7: The impact of delayed tracking on upper secondary route changes: results by level of performance

Grouping by\ quartile	1st	2nd	3rd	4th
cumulative GPA	0.117***	0.036*	0.037**	0.001
Obs.	*3,180*	*3,430*	*3,556*	*3,664*
stdzed math score	0.052**	-0.009	-0.002	-0.039***
Obs.	*2,846*	*2,712*	*2,804*	*5,468*[a]
indiv. controls	yes	yes	yes	yes

Legend: * 0.10 ** 0.05 *** 0.01

Notes: OLS estimation on the probability to change route with robust variance on 2 cohorts (2003 & 2004).

[a]The high number of students in the last quartile is due to a peak in the distribution at the threshold value.

Two striking results appear: first, whichever indicator of educational quality is used, the probability to change route of the highest performing students is never negatively affected by the age of middle school tracking: both performance indicators suggest that a later tracking is actually beneficial for high achievers, in reducing their subsequent probability to change route but only significantly when considering standardized math scores. Second, the lower end of the ability distribution seems consistently negatively affected by the age of tracking: the dummy denoting delayed tracking appears positive and significant for the first quartile in both models. Results concerning the middle range of the ability distribution are less clear cut, as signs vary across performance indicators; although the strong significance of coefficients related to GPA partitioning tends to point towards a negative effect on those students as well. When looking at the magnitude of the point estimates, effects on the first quartile suggest an increase in the probability to change route from 5 to 12 percentage points[11], while the negative impact of delayed tracking decreases when

[11]Tests on the equality of coefficients across GPA quartiles (using the first quartile as base), are all significant at (at least) 5%. When performing the same set of tests using math scores, effects on the second and fourth quartiles are significantly different from the first one at 5% and the third one is only significantly different at 10%.

moving up in the performance distribution. These results all point out that the group "at risk", i.e., the most negatively affected by a delayed tracking, comprises, perhaps unsurprisingly, students on the lower end of the achievement distribution.

Table 4.8 presents results for the second specification, where the regression is now run on the complete two cohort sample. Results appear very similar to our previous specifications. When tracked at 12, the probability to change route at the upper secondary level decreases significantly along each quartile of the GPA distribution. Furthermore, this probability decreases as the level of performance increases, irrespectively of the tracking system and the performance indicator. However, when looking only at the cumulative GPA, distributional effects are larger for students tracked at 13, as indicated by the higher magnitude of the estimated interaction effects.

Table 4.8: The impact of delayed tracking on upper secondary route changes: specification with interaction terms between age at first tracking and performance quartile

	cumulative GPA	stdzed math score
tracked at 13	0.120***	0.054**
q2	-0.060***	-0.059***
q3	-0.153***	-0.104***
q4	-0.257***	-0.164***
tracked at 13*q2	-0.081**	-0.057*
tracked at 13*q3	-0.089***	-0.054*
tracked at 13*q4	-0.125***	-0.095***
Obs.	13,830	13,830
R-squared	0.112	0.084
indiv. controls	yes	yes

Legend: * 0.10 ** 0.05 *** 0.01

Notes: OLS estimation on the probability to change route with robust variance on 2 cohorts.

As a final check, we combine both approaches and use the first transition choice as well as grades to create different sub-samples of both cohorts. In this case, we first split students by their initial transition choice and then divide them according to their position relative to the median score of their upper secondary route: either above or below. We then re-estimate the model for each sub-group, and the results of those twelve estimations are presented in appendix table D.4. This final set of results confirms, once again, that only low-performing students are

negatively affected by a later tracking[12]. In addition, a new result emerging is that delayed tracking also impacts the first half of the distribution of students (i.e., below the median) choosing professional schools significant at 5%. Professional schools are, on average, the second most-demanding upper secondary route (after the academic route) and, for this reason, finding a significant effect is not surprising.

4.5. Discussion

After examining the robustness of our empirical findings, what remains is to make actual sense out of them. Our main result suggests that delaying middle school tracking by a year does not help students accomplish smooth upper secondary school transitions, which at first glance might appear in contradiction with the general literature on the effects of tracking. However, one should first point out that the main outcome examined in both the theoretical and the empirical literature is skill formation, i.e. academic performance, in an educational production setting. In this framework, from a theoretical point of view, both tracking and detracking can be efficient, as shown by Arnott and Rowse (1987). In their model, the aversion for skill inequality plays an important role in determining the effective level of streaming in the classroom. When aversion for skill inequality is strong, their model predicts a very low level of streaming, i.e., no tracking. This inequitable aspect of tracking has been supported by many empirical studies that find large negative performance effects on low achieving students, while high achieving students are generally much less affected. Depending on the relative magnitudes of each effect, the resulting average effect is typically small and can be either positive or negative.

At this point, it is worth highlighting the contextual framework of much of the previous tracking literature: the deterministic educational production function. As pointed out by Wilson (2001), school characteristics, such as tracking, are "inputs in the process of being schooled (...) and these studies view the relationship between school (and family) characteristics and educational attainment as deterministic. If an input changes, then the educational attainment of the individual will change by an amount determined by the technology and the level of the other inputs. The

[12] We also performed this estimation further dividing the sample by transition node, leading to a total of 24 regressions (2 nodes times 6 upper secondary routes times 2 performance groups). Results are robust and significant effects are found on the first transition node for the group below the median going to the academic route (effects of 0.12 significant at 1%). Other effects are observed on the first transition node of students below the median transitioning to professional schools (0.11, significant at 10%), as well as on the first node of low achieving students transitioning to an apprenticeship (0.21 significant at 5%). All results are reported in appendix table D.7.

individual is not viewed as a decision maker who is choosing a level of education, nor do the returns to education play an explicit role within this framework" (p. 521). In other words, the educational production function literature has been relatively blind to the human capital literature. Now, more closely related to our topic, when examining the effect of tracking on students' upper secondary transitions, we are considering the institutional effects of a school system on individual choices, situating ourselves at the junction between the two literatures; a sub-field initiated in the early nineties by Card and Krueger (1992)[13]. Given these considerations, the effect(s) of tracking on students' choice and educational match is not a priori defined and is left to the data.

Nevertheless, this is not to say that we cannot relate to the previous literature on tracking. First, the pattern of the effect is similar to what is usually found when looking at performance: a small average effect and a large heterogeneity along the ability distribution. Second, the study closest to ours is Van Elk et al. (2011)'s study on the impact of the age of tracking on higher education graduation probability[14]. They do find a detrimental effect of early tracking on higher education completion, comparing essentially the situation of a relatively low ability student being taught in either a low tracked class or in a comprehensive one. It is not impossible that even if later tracking means less smooth transitions for low achieving students, some of them might actually manage to get a tertiary degree in relatively larger proportions than their early tracked counterparts, implying that both findings are not necessarily in contradiction.

From a substantive point of view, the exact channel through which delayed tracking affects school transitions is unobservable. However, given that in essence tracking implies a change in the peer composition, we think that the theory of social contrast can shed some light on this process.

The theory of social contrast states that humans tend to assess their individual characteristics relatively to the set of characteristics possessed by others surrounding them, whether it relates to their physical attractiveness (e.g. Wade and Abetz, 1997) or to their educational quality, as showed by the seminal work of Davis (1966). Since then, in the context of education, the social contrast mechanism is usually called the "big-fish-little-pond" effect, whereby "students compare their own academic achievements with the academic achievement of their peers and

[13]They initially examined the influence of school quality on earnings. In the same vein, recent attention has been paid to the influence of the school system on health outcomes (e.g., Frisvold and Golberstein, 2011).

[14]To a certain extent, one could also consider the article by Malamud and Pop-Eleches (2011) on access to higher education but the latter mostly look at the impact of the reform on the socioeconomic composition of university applicants.

use this social comparison impression as one basis for forming their academic self-concept" (p.366, Marsh and Hau, 2003). These authors provide solid evidence that this effect is valid across a wide sample of countries and can therefore, be reasonably well considered as an established empirical fact.

Taking this idea one step further, Jonsson and Mood (2008) examine the impact of peers achievement on educational choice formation and, among others, they find that: "The tendency to make a high-aspiring choice at upper secondary school is less for those who go to school with high-achieving peers" (p.759). When looking at the negative effect of delayed tracking on students transitioning to the academic route, this statement makes particular sense. Given that the academic route is the most demanding upper secondary route, our result would thus be consistent with an overall higher degree of scholarly ambition among delayed tracking students, affecting particularly low achievers, who are, ceteris paribus, more re-orientation prone.

A second possible explanation can be found in the status characteristics theory, as developed in and supported by Correll (2004): individuals self-assess their own competence while constrained by cultural or societal beliefs, resulting in double standards of assessment. Correll cites the example of the common belief that men are better at math. Due to this, at equal performance levels (e.g., equal test scores), men will use a more lenient standard than women when assessing their own task competence, leading "men to overestimate and women to underestimate their actual task ability" (p.98). Individuals then form aspirations based on their perceived abilities, implying that those with higher perceived task abilities will further aspire to activities involving this particular competence, e.g, men will engage more often in advanced math classes or choose math-oriented college majors. In our specific context, it is likely that the assignment of students to tracks creates a (systemic) belief concerning their expected school performances, impacting their self-assessment of academic abilities. Given that the negative impact of delayed tracking is the strongest on low achievers, it is consistent with a detrimental impact of a low track allocation on students' perceived abilities and subsequent academic aspirations. In other words, as in the men-women example, low achieving students exposed to three years of tracking, i.e., highly exposed to a negative systemic belief, tend to underestimate their own scholastic ability while students only tracked for two years, i.e., less exposed to the belief, tend to overestimate it. At equal performance levels, theses differences in performance assessment lead to diverging educational aspirations, the latter being more academically eager than the former. This explanation would thus also be consistent with the negative effect of early tracking on higher education

completion found by Van Elk et al. (2011).

4.6. Conclusion

A rough cross-country correlation suggests that early tracking is negatively associated with the proportion of students finishing their general upper secondary program on time. In this paper, taking advantage of a natural experiment to identify the impact of a one-year delay in middle school tracking on the probability to change route at the upper secondary level, we find a similar pattern. Our main result suggests that students tracked at a later stage are more likely to change route during upper secondary studies. When splitting students by performance level, results suggest that students on the lower end of the ability distribution might well be significantly more affected, with estimates ranging from 5 to 12 percentage points, depending on the performance indicator used. In addition, we find that quartile differentials are larger for students tracked at 13 than students tracked at 12, suggesting that the inequality in terms of route change probability (at the upper secondary level) is higher in the delayed tracking system.

Although the average effect of two percentage points seems small, a quick back of the envelope calculation reveals that it may still prove economically significant. In 2012, the average public cost per student was around 22,869 Swiss Francs (SRED, 2014) and in our data, the average cohort size is around 3,223 students. Conservatively assuming that over three years of upper secondary school, students tracked later on spend just one additional year in upper secondary education, they would represent an extra cost amounting to 1% of the annual public upper secondary education budget. Additionally taking into account that this system has been running for over 38 years, we believe our result to be relevant for decision makers.

This calculation highlights that when considering short run students' choice, tracking seems more efficient in addition to being more equitable, since least able students find a better educational match when tracked younger. However, the question remains as to, whether or not, unsmooth transitions might, in the end, be beneficial to students. Are re-matches efficiency enhancing? Do they lead to better outcomes, such as better chances of getting a diploma or simply to higher student satisfaction with the newly chosen route? Or are non resilient students negatively affected in their self confidence and educational ambition? And, as always, are these effects heterogeneous across student types? These are the kinds of questions further research on transition smoothness should address.

Finally, the results presented here do not, and by far, end the debate on the benefits and disadvantages of tracking as, for instance, its negative effect on low achieving students performance might offset the benefit in terms of smoothness in the short run. In the vein of Meier and Schütz (2007), a more comprehensive analysis of the costs and benefits of tracking seems a desirable next step to get a more accurate idea about the desirability of tracking. Ultimately, tracking remains a choice variable and as such, its desirability will vary according to societal preferences.

5. How far can you go? An analysis of transitions to apprenticeship training[1]

In this paper, we focus on transitions to apprenticeship training. We examine apprentices' pathways and study how the latter might be related to past school outcomes, such as track and grades. We innovate in assessing these pathways over two dimensions: a more quantitative one, looking at the pure accumulation of years of training, and a more qualitative one, looking at the smoothness of vocational pathways, i.e., whether or not apprentices change occupations over the years. Using administrative panel data from a Swiss Canton spanning 12 cohorts, we estimate a series of zero inflated models and find that, although middle school low track students are much more likely to engage in apprenticeship training, they are less successful in accumulating years of training than their high track counterparts. In addition, the former are less likely than the latter to achieve a smooth occupational pathway within apprenticeship training. Additionally controlling for grades and non cognitive skills yields a similar pattern. High achievers thus have an absolute advantage in both types of education.

Keywords: apprenticeship training; school transitions; vocational smoothness; zero inflated models.

JEL classification: I20; I21; I28.

5.1. Introduction

Broadly speaking, upper secondary school systems in OECD countries can be classified into two types: those emphasizing general and academic education (e.g., France) and those more oriented towards vocational education and training (VET) (e.g., Germany). However, vocational education exists at some level in most countries but

[1]This paper is co-authored with José V. Ramirez. We are grateful to Michele Pellizzari, Rainer Winkelmann and Paul Ryan for useful comments and to Mark Harris and William Greene for their help with the estimation of ZIOP models. This paper was presented at the LIVES doctoriales in Lausanne (2014), at the VET research congress in Bern (2014), at the "School-to-work transitions, pathways and hurdles" workshop in Geneva (2014) and at the EALE conference in Ljubljana (2014). Any remaining error is ours.

vocational students' outcomes markedly differ between VET and non VET countries, i.e., whether or not they can benefit from a highly structured and recognized vocational system (OECD, 2009).

In countries where vocational education is not common, it is most often seen as a "dead end", attracting only low achieving students (OECD, 2010b). In contrast, in traditional VET countries, vocational education is usually the educational norm, as a majority of students follows this path. However, even in those countries, VET systems are currently under pressure for three main reasons (OECD, 2010a): first, to provide accurate and up-to-date training, vocational education needs to keep up with the pace of technological change and to constantly adapt. Second, the current evolution of OECD economies, specializing towards high value added services requires highly skilled jobs with a high level of general human capital, usually acquired through university education. Last, demographic trends (such as aging and population shrinking) combined with the widely observed phenomenon of upper secondary choice converging towards academic education, imply that VET faces a fierce competition, since even if it remains as attractive as today, fewer students will engage in vocational education in the future.

In this context, it becomes relevant to examine who are exactly the students choosing vocational education, and we do so in a traditional VET country, Switzerland. In particular, we study apprentices' pathways in a both quantitative (looking at the years of training accumulated) and qualitative (looking at the smoothness of vocational pathways) manner, and examine how those pathways are affected by middle school track and grades. Looking at these two outcomes allows us to examine the selection into apprenticeship at the local level and to investigate whether or not it attracts high achievers.

The attractiveness of the dual VET system depends on many factors. One of its main strength is to offer apprentices good chances in terms of wage and employment perspectives (Wolter and Ryan, 2011) with, for example, comparatively low youth unemployment rates, as observed in Switzerland or Germany, resulting from smooth school-to-work transitions. In Switzerland, while the most commonly held diploma among the workforce is delivered at the upper secondary vocational level (Swiss Federal Statistical Office, 2012), the attractiveness of the system nonetheless depends on the tertiary perspectives available, as well as on the different bridges between vocational and general education, so as to provide flexible pathways (OECD, 2009).

An additional important factor is the retention rate of vocational education. At an international level, relatively scarce evidence is available on the topic, though

the OECD average suggests that while 77% of students complete general programs within their theoretical duration, they are only 61% to do the same in vocational programs (p.57, OECD, 2012a). However, compared to exclusively school based vocational programs, apprenticeship training might be able to retain apprentices more effectively, as well as to re-attract former dropouts into the educational system (p.87, OECD, 2012b; Reile and Crump, 2002).

This combination of factors explains why a majority of students (still) follows this path at the upper secondary level in countries traditionally oriented towards VET, as is the case in Switzerland with two thirds of each cohort making such a choice, the highest rate among OECD countries (OECD, 2013), suggesting indeed a high overall attractiveness of the dual system. Completing this picture, based on PISA 2006, the OECD report "Off to a good start? Jobs for youth" (OECD, 2010b, p.73) finds a small conditional performance advantage of Swiss fifteen-year-old vocational students over general track students, suggesting that the VET system appears attractive to high achieving students as well.

Dual vocational education appears thus well positioned in the Swiss educational system. However, some indicators tell a slightly different story. First, the number of direct transitions from compulsory school to vocational education has decreased over time, while the number of first transitions to general education has increased over the last ten years and is expected to keep increasing in the future (Swiss Federal Statistical Office, 2013). This suggests that even if two thirds of students end up in vocational education, a significant proportion of them try a general education first. Second, on average, even if only a third of each cohort chooses a highly demanding academic education at the upper secondary level[2], this proportion hides substantial variation at the regional and Cantonal level, reflecting the high degree of heterogeneity of the Swiss educational system.

In addition, although the average national difference in PISA scores suggests a slightly better performance of students sorted into vocational tracks, it is worth noticing that in all other traditional apprenticeship countries (Germany, Austria and Denmark), this difference is markedly negative: students in the academic track outperform those in the vocational track (OECD, 2010b, p.73). It is possible that this 2006 favorable picture has changed, evolving along similar lines but one can only guess. However, this average better performance of vocational students at the national level does certainly not reflect the heterogeneity across Swiss Cantons, as is the case with the pattern of transitions. Furthermore, two other factors suggest

[2] A relatively low proportion that is also explained by the rationing of access to academic education, which is common in certain Cantons (see Ryan et al., 2013) but which is not in Geneva.

that the educational quality of apprentices may be relatively dispersed: first, access to apprenticeship training is not subject to formal grade requirements (the hiring decision is entirely up to the firm), as opposed to admissions in other upper secondary schools. Second, at the lower secondary level, vocational tracks are usually less scholarly demanding than the academic track, which implies that students sorted into vocational tracks are theoretically not expected to be on the high end of the achievement distribution. Additional support has been found by Hupka and Stalder (2006): using a Swiss nationally representative panel, they found that indeed high achievers tended to choose exclusively school based vocational education as opposed to apprenticeship training. Using a subsample of TREE data, Mueller and Wolter (2014) find that among aspiring apprentices, school grades are an important predictive factor when looking at a successful entry into apprenticeship training and that underachievers are more likely to experience problems in apprenticeship training, such as dropping out, repeating a year of failing the external exam. Siegenthaler (2011) looks at the predictive power of externalized achievement tests on vocational outcomes on a subset of apprentices in the retail sector, and find that lower secondary school track and GPA provide more reliable information than external test results in predicting vocational outcomes.

Summing up, although general indicators paint a fairly rosy picture of dual vocational education in Switzerland when comparing it to other countries, some other pointers suggest that things are evolving. Therefore, to get a more definite idea, one needs to look not only at the outcome but at the process as well: Who are exactly students engaging in dual VET and what kind of pathways do they undertake? How are years of dual vocational education accumulated? Who achieves smoother vocational pathways? These questions are examined in this paper using (administrative) panel data for the Canton of Geneva, a densely populated urban Canton on the French speaking side of Switzerland. The local economy is heavily oriented towards high value added services, explaining, in part, why the school system has been historically more oriented towards academic and general education than vocational education and training. This local setting is especially interesting to study the attractiveness of apprenticeship training, since it combines features of both traditional and non traditional VET systems: a strong preference for academic education, along with a well developed apprenticeship system and an early within school tracking. In this context, our results show that although middle school low track students are much more likely to engage in apprenticeship training, they are less successful in accumulating years of training than their high track counterparts. In addition, the former are less likely than the latter to achieve a smooth occupa-

tional pathway within apprenticeship training. Additionally controlling for grades and non cognitive skills yields a similar pattern. We interpret these results as an indication that high achievers have an absolute advantage in both types of education.

The remainder of this paper is structured as follows: the next section introduces our empirical framework, detailing first the modeling strategy and then describing the data and variables used for the analysis. Section 5.3 presents our results and section 5.4 concludes.

5.2. Empirical framework

5.2.1. Modeling strategy

To better understand how performance at the end of compulsory school influences dual VET outcomes, our strategy is twofold: first we look at apprentices' pathway in a quantitative manner, examining the accumulation of years of apprenticeship training and second, we focus on a more qualitative outcome and study the smoothness of pathways within dual VET.

The first part of the analysis is intended to shade some light on the characteristics relevant in the selection process of individuals to apprenticeship training on the one hand, and on the mechanisms driving the accumulation of years of apprenticeship training on the other. To answer these two questions simultaneously, we estimate a zero-inflated Poisson (ZIP) regression, which accounts for the excess of zeros in the data, as first proposed by Lambert (1992).

Compared to other fields, such as health economics (e.g., Fuemeller et al.,2013), accident modeling (e.g., Li et al., 2008) or ecological economics (e.g., Kuhnert et al., 2011), zero inflated models have been relatively sparingly used when dealing with educational outcomes. A few noteworthy examples are: Roebuck, French and Dennis (2004), who looked at the link between marijuana use, high school dropouts and truancy outcomes using as zero inflated negative binomial model; and Temple and Reynold (2007), who looked at the effectiveness of preschool participation on years of special education and on the number of arrests, using a zero inflated negative binomial model.

The first stage of the model is a simple binary logit dealing with the selection of individuals into two (latent) groups: a possibly positive outcome group and an always zero outcome group. The second part then uses a Poisson regression to model the count of years for individual belonging to the group that may have a positive outcome.

This model structure has two main implications: first, in a zero-inflated model, an individual crossing "the hurdle" may still get a null realization, contrary to hurdle models, as zero counts are generated by two distinct processes, either from the logit part (strategic zeros) or through the Poisson regression (incidental zeros) (Zorn, 1998). Relating this modeling feature to our specific setting, strategic zeros would concern people who chose another upper secondary route, e.g. academic education, and who never intended to start an apprenticeship. Incidental zeros, could refer to people who looked for an apprenticeship at a later stage, typically after doing something else for the first two years, and could not find one, for example because of the scarcity of training places that exists in some sectors. This latter explanation makes sense since we observe transitions to apprenticeship training to increase with the number of years spent in upper secondary education.

Second, and this is a corollary of the double nature of zeros, the model accounts for overdispertion, contrary to a simple Poisson regression (Greene, 1994). Formally (and omitting subscripts), the model density can be written as a mix between a degenerate distribution at zero and a Poisson distribution (Garay et al., 2011) such as :

$$f(y) = \begin{cases} f_1(0) + \{1 - f_1(0)\}\ f_2(0) & \text{if } y = 0 \\ \{1 - f_1(0)\}\ f_2(y) & \text{if } y \geq 1 \end{cases} \tag{5.1}$$

with $f_1(.) = \frac{\exp(\mathbf{x}'\boldsymbol{\delta})}{1+\exp(\mathbf{x}'\boldsymbol{\delta})}$ the logistic density and $f_2(.) = \frac{\exp(\lambda)\lambda^y}{y!}$ the Poisson density, with $\lambda(\mathbf{x}) = \exp(\mathbf{x}'\boldsymbol{\beta})$ and $\mathbf{x}$ a vector of covariates. The corresponding conditional expectation function (CEF) is then given by 5.2.

$$E(y|\mathbf{x}) = (1 - f_1(\mathbf{x}))\lambda(\mathbf{x}) = \frac{\exp(\mathbf{x}'\boldsymbol{\beta})}{1 + \exp(\mathbf{x}'\boldsymbol{\delta})} \tag{5.2}$$

In the second part, we examine transition pathways inside the apprenticeship training system by looking at the smoothness of those transitions at the occupational level, using an ISCO three-digit level of disaggregation. Since the smoothest transitions are theoretically the most desirable outcomes, i.e, those that would provide individuals with the highest levels of utility, we will use a zero inflated ordered probit (ZIOP) model, as was first proposed by Harris and Zhao (2007)[3].

The structure of the model is relatively similar to the zero inflated Poisson. However, in this case, the first stage is a probit selection equation while the second is an ordered probit. Similarly, the zeros are then jointly explained by the two mechanisms, whether or not to participate and then, conditional on participation, the level

[3] A recent application can be found in Downward, Lera-Lopez and Rasciute (2011) who modeled sport participation.

of participation (which could be zero) is selected. The propensity to participate and the level decision are modeled as latent variables with both structural models linear in the parameters.

Formally and rather concisely, using Harris and Zao (2007)'s notation and assuming that covariates explaining participation and levels are identical (as will be the case in the empirical analysis), the model is basically composed of the following two equations, one for the latent propensity to participate, (5.3) and, conditionally on participation, another one for the latent level decision (5.4):

$$r* = \mathbf{x}'\boldsymbol{\eta} + \varepsilon \tag{5.3}$$

$$\widetilde{y}* = \mathbf{x}'\boldsymbol{\gamma} + u \tag{5.4}$$

Only the realizations of $r*$, noted r, and of $\widetilde{y}*$, noted $\widetilde{y}$, are observed; ε and u, are two normally distributed error terms. The probability of participation is given by (5.5), which is a standard probit model generated through the latent variable $r*$. Symmetrically, the probabilities of the observed levels are given by (5.6), denoting an ordered probit model generated by the latent variable $\widetilde{y}^*$.

$$P(r = 1|\,\mathbf{x}) = P(r* > 0|\,\mathbf{x}) = \Phi(\mathbf{x}'\boldsymbol{\eta}) \tag{5.5}$$

$$P(\widetilde{y}) = \begin{cases} P(\widetilde{y} = 0|\,\mathbf{x},\, r = 1) = \Phi(-\mathbf{x}'\boldsymbol{\gamma}) \\ P(\widetilde{y} = j|\,\mathbf{x},\, r = 1) = \Phi(\mu_{\mathbf{j}} - \mathbf{x}'\boldsymbol{\gamma}) - \Phi(\mu_{\mathbf{j-1}} - \mathbf{x}'\boldsymbol{\gamma}) \;\; j = 1, ..., J-1 \\ P(\widetilde{y} = J|\,\mathbf{x},\, r = 1) = 1 - \Phi(\mu_{\mathbf{J-1}} - \mathbf{x}'\boldsymbol{\gamma}) \end{cases} \tag{5.6}$$

with $\Phi(.)$ the cumulative distribution function of the univariate standard normal distribution function. Defining the mapping such as $y = r\widetilde{y}$ and assuming that ε and u are iid, the probabilities are finally given by (5.7).

$$f(y) = P(y) = \begin{cases} P(y = 0|\,\mathbf{x}) = [1 - \Phi(\mathbf{x}'\boldsymbol{\eta})] + \Phi(\mathbf{x}'\boldsymbol{\eta})\Phi(-\mathbf{x}'\boldsymbol{\gamma}) \\ P(y = j|\,\mathbf{x}) = \Phi(\mathbf{x}'\boldsymbol{\eta})\,[\Phi(\mu_{\mathbf{j}} - \mathbf{x}'\boldsymbol{\gamma}) - \Phi(\mu_{\mathbf{j-1}} - \mathbf{x}'\boldsymbol{\gamma})] \;\; j = 1, ..., J-1 \\ P(y = J|\,\mathbf{x}) = \Phi(\mathbf{x}'\boldsymbol{\eta})\,[1 - \Phi(\mu_{\mathbf{J-1}} - \mathbf{x}'\boldsymbol{\gamma})] \end{cases} \tag{5.7}$$

As in the ZIP model, the observed level decision can therefore result either from the selection equation or from the level decision, effectively inflating the

proportion of zeros.

5.2.2. Data and variables

We rely on the Geneva Schooling Database (GSD), an exhaustive administrative dataset recording all pupils in the Canton for the period 1997-2003. Upper secondary outcomes are examined for the first three years of (public) schooling, so as to avoid labor market exiting. In addition, for the latest two cohorts of students, we could access information on their grades obtained during the last year of lower secondary education. Finally, we complemented the database by matching apprenticeship descriptions with three-digit ISCO codes, using the ISCO 2008 nomenclature[4].

In the first part of the analysis, we look at the (gross) number of years spent in apprenticeship training accumulated by individuals by the end of three years of upper secondary schooling, which implies that all individuals in the data are covered. Table 5.1 presents the distribution of such a count for our panel of 42'880 individuals. Around a quarter of all students totalize at least a year of dual VET and, consequently, one can notice the large prevalence of zero counts in the data. However, this general picture hides a specific pattern of transitions to apprenticeship training, as presented in table 5.2: the proportion of students transitioning to an apprenticeship increases with the number of years spent in upper secondary education. This suggests that, as observed at the national level, some individuals choose another route before, somehow, converging to apprenticeship training. This confirms as well that, even in a local setting highly oriented toward academic education, in which no rationing takes place, apprenticeship training manages to attract students.

Table 5.1: Distribution of the number of years of apprenticeship training

N. of years	N	Percent
0	33'221	77.47
1	3'293	7.68
2	3'698	8.62
3	2'668	6.22
Total	42'880	100.0

Data source: Geneva Schooling Database for 12 cohorts, 1993-2007.

[4]This implies that for some cases (less than 2%), no match could be found and a missing value was, therefore, imputed.

Table 5.2: Transitions by year of upper secondary schooling

	1st trans.		2nd trans.		3rd trans.	
	N	percent	N	percent	N	percent
Academic	21'752	50.7	19'161	44.7	17'201	40.1
Apprenticeship	3'582	8.4	6'930	16.2	8'181	19.1
Others	17'546	40.9	16'789	39.2	17'498	40.8
Total	42'880	100.0	42'880	100.0	42'880	100.0

Data source: Geneva Schooling Database for 12 cohorts, 1993-2007.
Note: The first transition happens between the end of compulsory school and the first year upper secondary education. The second (third) transition happens between the first and second (second and third) year of upper secondary education. The category "others", groups all other possible types of transitions, i.e., lower level general education, full time VET, remedial education and dropouts.

In the second part, we examine the smoothness of transitions to dual vocational education. Conducting a fine-grained analysis requires a trade off between a high level of disaggregation, where no general conclusions can be reached, and a too general picture, where some information would be lost. We chose a somewhat mezzo level of disaggregation, classifying apprenticeships at the ISCO three-digit level. Based on this, we could then define what a smooth transition would look like.

We grouped all transitions into four groups, depending on the number of years spent in training and whether or not those years were spent in a given ISCO occupation. The smoothest outcome corresponds to a direct and permanent transition from middle school to apprenticeship training in a given ISCO occupation. The second smoothest outcome encompasses all cases, where over the three years considered, a student manages two consecutive years of training in a given occupation. Note that, in a two year period, an apprentice could theoretically obtain the lowest of all VET qualifications, the VET diploma (for more details, see Kammermann et al., 2011).

In theory, and since we cannot control for the type of diploma pursued, defining vocational smoothness in this way could potentially bias the effect of the track and the grade upwards, as only low achievers engage in 2 year programs and, from our perspective, those individuals would never be able to achieve the smoothest outcome. However, in our data only 12% of individuals who total 2 years of apprenticeship do so during their first and second year of upper secondary schooling, and

an additional 5% of these individuals transition to another route during their third year. Note that, since we have no information on the diploma pursued, these people could simply drop out from their 3 year apprenticeship training program. A plausible story given that, descriptively, the percentage of individuals effectively engaged in a two year apprenticeship is low, around 4% of all VET students (Swiss Federal Statistical Office, 2014b), and that Hrizi et al. (2014), show that the mean age at entry into a 2 year vocational training program in Geneva is 19 years old, and that, more importantly, practically noone starts a 2 year qualification right after compulsory school.

The least smooth outcome is assigned to all apprentices totalling either two or three years of training, but changing ISCO sectors. Finally, for students either having only a year of dual VET or for those who never undertook any apprenticeship training, our measure of smoothness equals zero. The dependent variable takes, therefore, four different modalities and the distribution of those outcomes is presented in table 5.3.

Less than a quarter of apprentices manage to accomplish the smoothest outcome, and one more third of students enter a stable apprenticeship during their second year of upper secondary schooling. Note that we fully recognize that changes of occupation may be efficiency enhancing in the long run, as some students may break a bad match for a better alternative, for example increasing their overall life satisfaction. However, in the short run, which is the type of temporal horizon we consider in this paper, all changes are costly in terms of foregone earnings and especially so, if we compare individuals who change occupation with their counterparts in the first best alternative, i.e., students who have found their best match from the beginning.

Table 5.3: A smoothness measure of apprenticeship transitions

Description	y	N	Percent
3 years of dual VET within the same ISCO	3	2'226	5.2
2 years of dual VET within the same ISCO	2	3'255	7.6
2 or 3 years of dual VET in different ISCOs	1	706	1.7
No measure of VET smoothness	0	36'693	85.6
Total		42'880	100.0

Data source: Geneva Schooling Database for 12 cohorts, 1993-2007.

The list of independent variables is essentially the same across both parts of the empirical analysis and exploits the information contained in the GSD data. A

complete list of individual characteristics taken into account is presented in table 5.4. Table 5.5 presents some descriptive statistics for the two relevant samples: first, for the whole population and then, for the sub-population of students totalling, at least, a year in dual VET. Descriptives show that the population of dual VET students is indeed quite different from the whole population and generally social-economically less advantaged. Students from the low track are strongly over represented, as are children from blue collar families. On the opposite, Swiss are under represented among apprentices.

Table 5.4: Description of independent variables

name	description
middle school track	set of three dummy variables reflecting the middle school track during the last year of compulsory school: high track (reference group), low track or delayed tracking system.
repeater	controls for grade repetition during middle school.
girl	zero for boys.
family structure	one if the students does not live with both parents ("broken" family).
non-French speaker	one if the home language of the student is not French.
foreign country of provenance	one if the incoming country is different from Switzerland, i.e., the student does not arrive from another Swiss Canton.
nationality groups	set of seven dummies grouping nationalities based on the incoming migration waves to Switzerland since the 1950s. "Swiss" is the contrast group and the other groups are: Spain and Italy; Portugal; Balkans & Turkey; Extra European countries; R.o. EU 27 and EFTA..
socioeconomic status	parental socioeconomic status. Categories are: managerial workers; blue collars; self employed and miscellaneous/NA. The reference group is white-collar workers.
religion groups	set of dummies taking into account the main religions (at the local level): Protestant, Catholic, Muslim and "other". The reference group is made of Catholic students.
age	controls for potential age effects.
grades	two indicators: either the annual cumulative GPA in the last year of middle school obtained averaging annual grades in Maths, French and German; or the standardized math test score result of a standardized test in math taken during the same year. Information available only for the two most recent cohorts.
PISA score in maths	Information available for the GSD 2002 cohort (which corresponds to the 2003 PISA wave).
ISCO three-digit code	used only in the second part of the analysis. Classification of all apprenticeships according to the ISCO 2008 nomenclature.

Table 5.5: Descriptive statistics in percent by subsample

	Whole population	d. VET sample
N	*42'880*	*9'659*
high track	58.13	29.42
low track	24.62	54.89
delayed tracking	17.24	15.68
repeater	11.20	16.77
girl	49.83	37.66
"broken" family	28.55	32.33
non French-speaker	36.08	42.23
from a foreign country	20.83	26.00
Swiss	67.45	59.86
Spain and Italy	10.91	14.82
Portugal	9.30	15.93
Balkans and Turkey	2.78	3.93
extra European countries	5.74	3.07
R. of EU 27	3.82	2.38
white collars	39.50	35.43
managerial workers	19.33	7.45
self employed	6.04	7.37
blue collars	30.59	44.19
misc. /NA	4.54	5.56
other religion	24.81	17.51
Protestant	18.04	16.84
Catholic	50.82	59.59
Muslim	6.33	6.06
age (in years)	16.95	17.24

Source: Geneva Schooling Database for 12 cohorts, 1993-2007.

Notes: "d. VET" refers to the subsample of students totalilng at least a year of apprenticeship training over three years of upper secondary education.

As previously mentioned, we had access to middle school grades of the two most recent cohorts. In our analysis, we will use two different indicators: the cumulative (normalized) GPA (obtained as an average of three annual grades: French, Math and German) and a central exam test score in math. Moreover, a subsample of the 2002 cohort took part in the 2003 PISA study. We could match their scores to our database and will, therefore, exploit this information as well. Table 5.6 presents the distribution of the GPA and math test score for each of the two cohort subsamples and the available information on PISA scores. All show that students with at least a year of dual VET did not perform as well as others during their last year of middle school. Moreover, when using grades, apprentices form a more homogeneous

group than the whole relevant population, as indicated by the lower standard deviations. These results stand in sharp contrast with the slight performance advantage found at the national level for the 2006 PISA cohort (OECD, 2010b): at the local level, apprentices clearly perform below the mean. We highlight that, in country as heterogeneous as Switzerland, in terms of education system, students' preferences, and economic structure, finding that a country level result is not replicated at the Cantonal level is perfectly fine, especially in a domain such as apprenticeship training, which is certainly perceived rather differently across regions. Even if it does not hold for Geneva, the PISA performance advantage might however be readily replicated in other Swiss Cantons, such as Uri or Glarus that are much more oriented towards vocational education and training (see Chapter 2 for more details).

When considering other types of less academic subjects, such as history or geography, where perhaps, performance of potential apprentices could be more comparable to other students, the picture is very similar: lower overall performance and lower standard deviation around their group mean[5].

Table 5.6: Grade distribution by subsample

	2 cohort population			d. VET students		
	mean	std dev.	N	mean	std. dev.	N
GPA	0.00	1.00	6'960[a]	-0.67	0.77	1'114
Stdzd Math score	0.00	1.00	6'942	-0.46	0.84	1'182
2003 PISA score in math	0.00	1.00	1561[b]	-0.01	1.38	270

Data source: Geneva Schooling Database. [a]2 cohorts, 2003-2004.
[b]All students tested in Geneva by PISA 2003. Pisa scores have been normalized on our sample.
"d. VET" stands for dual VET. Grades have been normalized on the 2 cohort sample
to have zero mean and a standard deviation of 1,

[5]Comparison using other clearly non academic subjects, such as cooking classes for example, is made difficult by the fact that they are track specific and not part of the high track curriculum.

5.3. Results

5.3.1. Accumulating years of apprenticeship training

First, we estimate a zero inflated Poisson regression model[6] on the whole subsample, i.e., without grades. Results of this estimation are shown in table 5.7. The two part structure of the model is reflected in the results, as we present coefficients for the zero (inflate) equation as well as those for the Poisson equation. Coefficients from the zero equation indicate the effect of a characteristic on the likelihood of being in the latent group getting a definitive zero outcome (as opposed to the other group where a positive outcome is possible). This means, in particular, that variables changing signs across equations are not a worrying sign.

In the third and fourth columns, we additionally present overall marginal effects, which are to be interpreted as the influence of a given characteristic on the expected number of years of training achieved. Given the non linear setting, we report both marginal effects at the mean (MEM) of all covariates, as well as average marginal effects (AME). For continuous variables, the standard marginal effect is reported, while for the discrete ones, the first difference is reported instead.

Looking first at logit coefficients, middle school track dummies imply that students sorted into the low track are much more likely to get a potentially positive number of years of apprenticeship training, as are students who repeated (at least) a year during middle school. Those first two results seem to hint towards an overall lower educational quality of students engaging in dual VET. Also worthy of note, are the effects of the different nationality groups; the three main migrant groups (Italians and Spaniards, Portugueses, as well as Turks and students from the Balkans) are equally likely than natives to get a positive count. Children from the highest socioeconomic status have a higher probability of never engaging in dual vocational education.

Concerning marginal effects, AME and MEM are in a comparable range and only two variables change significance level in becoming significant at 10 percent (effects related to being from the Balkans and being Protestant). Overall, marginal effects confirm that low track students have a higher expected count than high track students, with the difference amounting to around two third of a year. This is the largest marginal effect we find. Having repeated a grade during middle school has a positive effect on the overall count, of around a quarter of a year. Girls on the other

[6]Specification tests (BIC and AIC criteria and the Vuong test) have been performed and all are favoring ZIP modeling over simple Poisson and negative binomial regressions. A zero inflated negative binomial model could not be fitted to our data since no convergence could be achieved. Detailed test results are available in appendix table E.1.

hand markedly accumulate fewer years of training than comparable boys, with a marginal effect of a fifth of a year.

Table 5.7: Zero inflated Poisson regression on the count of years of apprenticeship training

	Poisson part	Logistic part	MEM	AME
low track	-0.075***	-2.232***	0.611***	0.575***
delayed tracking	-0.124***	-0.821***	0.143***	0.143***
repeater	-0.102***	-0.577***	0.119***	0.078***
girl	-0.167***	0.550***	-0.199***	-0.188***
“broken” family	-0.097***	-0.388***	0.068***	0.039***
non French-speaker	-0.025	0.264***	-0.075***	-0.065***
from a foreign country	-0.031	-0.073	0.008	0.002
Spain and Italy	-0.028	-0.087	0.013	0.006
Portugal	0.004	-0.127	0.037*	0.030
Balkans and Turkey	0.149**	0.073	0.036	0.054
extra European countries	-0.470***	1.016***	-0.267***	-0.289***
R. of EU 27	-0.150**	0.450***	-0.145***	-0.143***
managerial worker	-0.103***	0.658***	-0.157***	-0.155***
self employed	0.065**	-0.333***	0.120***	0.107***
blue collar	0.062***	-0.420***	0.146***	0.128***
misc. /NA	-0.079*	-0.286***	0.047**	0.028
other	-0.034	0.347***	-0.097***	-0.086***
Protestant	0.061***	0.021	0.017	0.024*
Muslim	-0.241***	0.245**	-0.129***	-0.140***
age	0.018	-0.567***	0.152***	0.128***
N		42,463		
year dummies		yes		

Legend: * 0.10 ** 0.05 *** 0.01

Note: three years of upper secondary schooling are considered. Variance is robust.

MEM stands for marginal effect at the mean and AME stands for average marginal effect.

In a second time, we exploit the information on grades and PISA scores (available, respectively, for the two most recent cohorts and a subsample of the 2002 cohort) and re-estimate the model including each performance indicator separately. Table 5.8 presents results for our variables of interest. For each of the grades used, the first column corresponds to the exact same specification as before, while the second only differs in the addition of an interaction term between the middle school track and the relevant grade. The reason for doing this, is that grades can be partially track specific, as standards of assessment may differ between tracks.

First, reassuringly, results are consistent across all perfomance indicators[7]. The overall picture suggests that higher performers achieve fewer years of apprenticeship training and, therefore, as a corollary, more years of exclusively school based education. However, provided that they do choose apprenticeship training, higher performers accumulate more years of training. This fine grained analysis is made possible by the two part structure of our model, as either a simple Poisson or a negative Binomial model both estimate a negative impact of the grade on the expected count, and a large positive impact of being in the low track, both results due to the comparatively large magnitude of the negative selection into apprenticeship training[8].

Concerning the effect of the track, as before, we find this variable to have the largest impact (around half a year) on the expected count. Adding an interaction term generally reinforces the impact of both the track and the grade, a result consistent across all performance indicators.

To deepen the analysis, we also examined the evolution of track marginal effects (on the expected count) at different values of the covariates, and, especially, at different performance levels. More specifically, we computed, for each track, the relevant marginal effect at the different deciles of the grade distribution, maintaining all other covariates at their mean. This procedure was repeated for the GPA and the standardized math score. Results are shown graphically in figure 5.1, where both marginal effects and 95% confidence intervals are reported; effects have to be interpreted in contrast to the reference case, the high track. Both grades present a consistent pattern, with a low track marginal effect decreasing as one moves up the grade distribution. Said differently, this implies that low track high achievers have a relatively similar expected number of years of training than their high track counterparts. However, differences appear between the two performance indicators, with the marginal effect of the low track remaining higher when considering standardized math scores.

As robustness checks, we estimate two alternative models. First, we estimate a two part Poisson logit hurdle model, in which the main difference is the assumption regarding the nature of zeros in the data. The hurdle model implies that people passing the hurdle (i.e., engaging in apprenticeship) always get a positive realization, whereas the ZIP model allows for two types of zeros as discussed.

[7] Unsurprisingly very similar results are also obtained when using either the history or geography GPA. Those results are available in appendix table E.2.

[8] Results reported in appendix table E.4.

Table 5.8: Zero inflated Poisson regression on the count of years of apprenticeship training using information on grades, selected results

		Poisson part	Logistic Part	Poisson part	Logistic Part
GPA	grade	0.062**	0.959***	0.096*	0.945***
	grade*low track			-0.050	-0.236*
	grade*delayed tracking			-0.088	0.480***
	low track	-0.101*	-2.001***	-0.124*	-2.080***
	delayed tracking	-0.113	-0.839***	-0.203**	-0.767***
	repeater	-0.070	-0.167	-0.084	-0.198
	age	0.051	-0.437***	0.054	-0.421***
	N		6'889		
Maths	grade	0.104***	0.676***	0.081	0.677***
	grade*low track			-0.002	-0.216*
	grade*delayed tracking			0.121	0.330**
	low track	-0.086	-1.974***	-0.079	-2.013***
	delayed tracking	-0.078	-0.492***	-0.036	-0.372***
	repeater	-0.098	-0.432**	-0.106	-0.440**
	age	0.040	-0.489***	0.044	-0.476***
	N		6'869		
PISA	grade	0.025*	0.014	1.697*	2.363*
	grade*low track			-1.676*	-2.441**
	grade*delayed tracking			-1.668*	-2.381*
	low track	-0.158	-2.295***	-0.197	-2.379***
	delayed tracking	-0.402**	-1.049***	-0.477**	-1.135***
	repeater	0.088	-0.508	0.014	-0.608
	age	0.089	-0.321*	0.113	-0.291
	N		1'540		

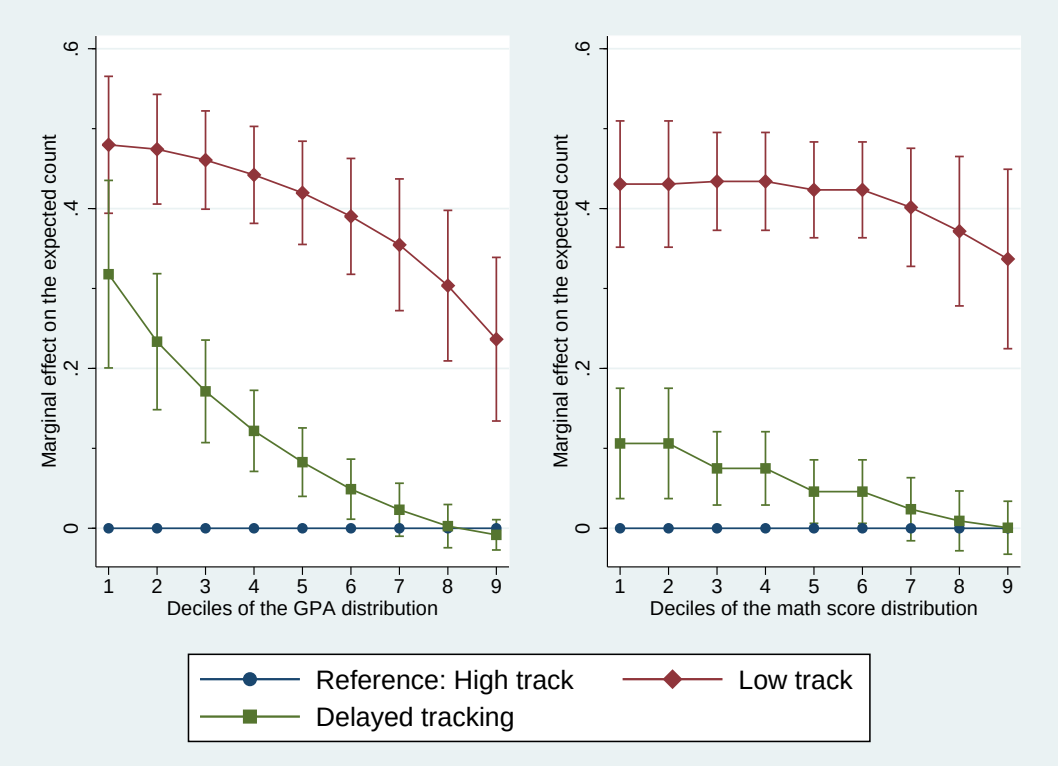
Legend: * 0.10 ** 0.05 *** 0.01

Note: three years of upper secondary schooling are considered. Results for other covariates are omitted. The ZIP is estimated with robust variance.

In any case, the substantive conclusions regarding the impact of both the low track and the grade are also supported by the hurdle model, as presented in appendix table E.3. Second, as pointed out by Staub and Winkelmann (2013), the ZIP model is not robust to misspecification and produces inconsistent estimates if assumptions about the data generating process are in fact violated. They thus propose a Poisson quasi likelihood framework, whereby only specifying the CEF, the quantities of interest (coefficients and semi elasticities) can be robustly estimated, though at the expense of precision. Results generally hold, although the small sample size of grades data and the large inflation factor render results rather imprecise. Full results are reported in appendix table E.5.

Summing up, this first set of results suggests that the accumulation of years of apprenticeship training is positively and strongly related to finishing middle school in the low track and that high achievers tend to refrain from engaging in dual vocational education and training. However, provided that they do choose apprenticeship

Figure 5.1: Conditional track marginal effects at different performance levels



Note: confidence intervals are set at the 95% level.

training, high track students accumulate more years of training.

5.3.2. Trajectories within dual VET

The goal of this section is to examine the smoothness of transitions to apprenticeship training, looking at apprentices' pathways. Our dependent variable, as described previously, orders trajectories from the smoothest ones to the most irregular ones, taking changes at the ISCO three-digit occupational level into account. We estimate a zero inflated ordered probit model[9] and report results for the variables of interest in table 5.9. The first two columns of table 5.9 present a reduced set of estimated coefficients, while the following columns display the corresponding marginal effects computed at the mean of all covariates for each modality of the dependent variable. The model structure implies that the marginal effect for the first category is of opposite sign as the estimated coefficient, while the reverse is true for the marginal effect attached to the last category. Note, however, that the direction of the effects

[9]Specification tests using information criteria favor the ZIOP compared to a simple ordered probit model. The latter are reported in appendix table E.6. According to Harris and Zao (2007), these tests are extremely reliable in picking up the right model.

for the interior categories can go both ways.

Estimates indicate that low track students are on the one hand more likely to get a positive measure of smoothness (probit part), which is consistent with their large proportions in apprenticeship training, but that they also tend to get a more irregular transition to dual vocational education than their high track counterparts (ordered part). This pattern is also observed for students who repeated a year during middle school: achieving a smooth apprenticeship transition seems more problematic for this group. Finally, older apprentices do not seem to accomplish smoother transitions.

Table 5.9: Zero inflated ordered probit model, selected results

	Ordered part	Binary part	MEM			
			y=0	y=1	y=2	y=3
low track	-0.5000***	1.9215***	0.1949***	-0.0060***	-0.0762***	-0.1128***
delayed tracking	-0.4158***	0.5879***	0.1624***	-0.0052***	-0.0643***	-0.0929***
repeater	-0.1605***	0.4043***	0.0637***	-0.0014**	-0.0236***	-0.0387***
age	0.0279	0.3745***	-0.0111	0.0002	0.0038	0.0071
cut 1	0.1385***					
cut 2	0.9084***					
N	42'463					
year dummies	yes					

Legend: * 0.10 ** 0.05 *** 0.01

Note: Dependent variable is a smoothness measure of apprenticeship transitions, as defined in table 5.3.
"MEM" stands for marginal effect at the mean. All other individual controls are included as well.
The model has been estimated using Nlogit 5.

In table 5.10, we exploit the additional information on grades and present, for each performance indicator, a selection of coefficients, once using the same specification as before and once adding an interaction term between the track and the relevant grade which, as before intends to capture the fact that grades may be track-specific. When looking at the first column of table 5.10, results indicate that the low track dummy appears significantly negative across all three indicators, suggesting that middle school low track students have difficulties achieving a smooth apprenticeship transition. Concerning the impact of performance, the two part structure of the model allows us to see the differential impact of performance on the selection equation on the one hand, and on the vocational smoothness on the other: while high achievers are less likely to get a positive smoothness measure, when engaging in dual VET, they manage smoother pathways. When adding an interaction term between the track and the relevant grade, results indicate that the positive effect of grade on smoothness mainly remains for high track students.

Table 5.10: Zero inflated ordered probit model using information on grades, selected results

		Ordered part	Probit Part	Ordered part	Probit Part
GPA	grade	0.1251*	-0.4528***	0.1960	-0.4674***
	grade*low track			-0.1873	0.2700*
	grade*delayed tracking			0.0327	-0.2717*
	low track	-0.5383***	1.2848***	-0.6221***	1.3654***
	delayed tracking	-0.1342	0.2204*	-0.2031	0.2015
	repeater	0.0735	-0.0538	0.0737	-0.0479
	age	-0.0218	0.2953***	-0.0375	0.3016***
	N		6'889		
Maths	grade	0.2292***	-0.3282***	0.3650***	-0.4017***
	grade*low track			-0.2668	0.2310*
	grade*delayed tracking			-0.0537	-0.0186
	low track	-0.4947***	1.1886***	-0.5309***	1.2756***
	delayed tracking	-0.0078	0.0593	0.0176	0.0240
	repeater	0.0808	0.0427	0.0942	0.0239
	age	-0.0614	0.3210***	-0.0536	0.3340***
	N		6'869		
PISA	grade	0.0001	0.0001	0.0085***	-0.0732
	grade*low track			-0.0084**	0.0721
	grade*delayed tracking			-0.0228***	0.7553
	low track	-0.7635**	1.6040***	2.0952***	9.8439
	delayed tracking	-1.7486***	1.5226***	3.4778***	-80.4664
	repeater	-0.2556	0.7413**	0.2354	4.1713
	age	0.4844**	-0.1841	0.3154***	-4.2900
	N		1'540		

Legend: * 0.10 ** 0.05 *** 0.01

Note: Dependent variable is a smoothness measure of apprenticeship transitions, as defined in table 5.3. All other individual controls are included as well.

The model has been estimated using Nlogit 5.

5.3.3. Further results

The goal of this subsection is to assess the robustness of our results to the inclusion of an additional control in both models. If high track students also get the best outcomes in vocational education, this could very well be driven by their advantageous set of non cognitive skills, which implies that omitting the latter from the model creates an omitted variable bias. For a single cohort (2003 cohort), we possess a measure of non cognitive skills, more specifically of their locus of control. Including this latter variable in the model will allow us to obtain cleaner estimates of the impact of cognitive skills, since the effect of non cognitive skills will now be picked up by the locus of control, a measure which has indeed been found to be correlated with other personality traits, such as the big five (Almlund et al.,2011).

Originally developed by Rotter (1966), the locus of control captures the ten-

dency of individuals to view life events as resulting from their own actions (internal locus) or rather from luck or fate (external locus). Internal individuals have usually more favorable outcomes, whether educational (e.g., Heineck and Silke, 2010), labor market related (e.g., Piatek and Pinger, 2010) or in other more general life domains such as health (Cobb-Clark et al., 2014).

Given the small sample size, we reduce the number of additional controls in the model to the following variables, middle school track, gender, "repeater" and age, and re-estimate both the zero inflated poisson and the zero inflated ordered probit models. Result of those estimations are displayed in table 5.11. In both models and as supported by both performance indicators, our results are robust to the inclusion of the locus of control as an additional covariate. Only the effect of the GPA in the Poisson part is no longer significant but this could be an issue of precision, with now fewer observations and a rather large proportion of zeros; the sign of the point estimate is nevertheless consistent with our previous results. As before, the picture is the following, at equal levels of locus of control, provided that they engage in apprenticeship training, high achievers get the best outcomes, in terms of both years of training accumulated and smoothness of vocational pathways. Evidence concerning the impact of the locus of control points toward a marginally higher importance of being internal in the accumulation of years of training but suggests a stronger impact of being internal on the probability to get any measure of smoothness. Moreover, these results are in line with Mueller and Wolter (2014), who find that ability matters independently from non cognitive skills when looking at outcomes on the apprenticeship market.

Finally, we highlight that all of our results are robust to the exclusion from the sample of individuals who could have completed a 2 year apprenticeship right after middle school. As discussed in section 5.2.2, this robustness check is necessary to show that, the negative effect of the low track and the positive effect of the grade on either the accumulation of years of training or the smoothness of vocational pathways, does not result from an upward bias due to the pathways of 2 year apprentices, as this latter group of students is heavily selected on the lower end of the achievement distribution. Although successful in their training program, from our point of view, these students can only (mechanically) accumulate 2 years of training and would never be able to achieve the smoothest pathway. In both the ZIP and the ZIOP models, all parameters of interest (i.e., the low track dummy and the grade) are not much affected, as one can see from appendix table E.7, and identification is thus not driven by this group of students.

Table 5.11: Robustness check: inclusion of non-cognitive skills, selected results

model		ZIP		ZIOP	
dep. variable		count of years of training		smoothness of voc. pathways	
		Poisson	Logit	Ordered	Probit
		(1)	(2)	(5)	(6)
GPA	grade	0.032	0.938***	0.200*	-0.380***
	locus of control	0.081*	-0.062	-0.120	0.126**
	low track	-0.082	-2.086***	-0.658***	0.908***
	age	0.045	-0.374***	-0.024	0.236***
	N	3,043		2,989	
Maths	grade	0.174***	0.565***	0.386***	-0.328***
	locus of control	0.073	0.100	-0.076	0.082
	low track	-0.159*	-2.288***	-1.094***	1.587***
	age	0.039	-0.420***	0.002	0.299***
	N	2,989		2,956	

Legend: * 0.10 ** 0.05 *** 0.01

Note: Controls additionally include gender and whether or not the student repeated a year during middle school. For the ZIP, variance is robust and the ZIOP has been estimated using Nlogit 5.

5.4. Conclusion

To remain an attractive pathway, vocational education and training faces certain challenges, such as keeping up with the pace of technological change and competing with other types of education for bright students. In this paper, we studied apprentices' pathways during the three years immediately following the end of compulsory school. We considered two dimensions, a more quantitative one (looking at the years of training accumulated) and more qualitative one (looking at the smoothness of vocational pathways), and examined how those pathways were affected by middle school track and grades. Looking at these two outcomes enabled us to shed some light on the type of students choosing apprenticeship training in a local setting combining the characteristics of a traditional VET country, i.e., where solid VET structures prevail, with those of a more tertiarized economy, i.e., where academic education is generally the "social norm".

Our results show that high track students refrain from engaging in apprenticeship training. However, those who do, accumulate more years of training. This pattern is also found for high achievers, a result robust to the use of three different performance indicators, including PISA scores. When looking at apprentices' pathways, provided that they participate in apprenticeship training, high track students and high achievers are more likely to get smooth vocational transitions, i.e., stay

longer in a given three-digit ISCO occupation. Both results carry through once non cognitive skills are added in the model.

If one of the goals of early tracking is to efficiently sort students into academic and vocational routes, the pattern of participation into apprenticeship training is consistent with the output of the school system: low track students represent the largest pool of apprentices. However, a finer look provides a more nuanced picture: academically more able students also do better on the vocational "market". This result hints towards a positive correlation between the ability of students to assimilate more abstract forms of learning compared to more contextualized forms of learning, the latter being supposedly more important in vocational education (Ryan, 1998); a statement which does not preclude the possibility that, in absolute terms, low achievers learn more in contextualized rather than abstract learning situations.

As the school system only sorts, and therefore tests, students' ability in abstract knowledge, a detailed analysis of comparative advantages based on this distinction is unfortunately impossible. Nevertheless, our results indicate that high achievers have an absolute advantage in both types of education. We can additionally refute the occupation related explanation, namely that students high in abstract learning ability sort themselves in occupations with a relative high demand of abstract knowledge and are (relatively) more successful in those occupations, because our smoothness measure is precisely occupation specific.

In the light of those results, much more should be learned about the (potentially non linear) relationship between ability in abstract and in contextualized knowledge and the predictive power of the latter with respect to vocational success. The widespread use of costly screening devices employed by firms, such as trial days, can thus be seen as a response to this particular lack of information.

6. Transitions within vocational education: the case of commercial training[1]

In this paper, I look at the horizontal permeability of the Swiss vocational education and training (VET) system, examining transitions across modes of training, i.e., between full time vocational schools and apprenticeship training. I focus on a specific occupation, commercial training, which represents the largest group of vocational students, both locally and nationally, and additionally constitutes the largest group of exclusively school-based vocational students. Thanks to a panel dataset following a cohort over 10 years after middle school, I can control for unobserved heterogeneity and use a correlated random effect model. Going from full-time to dual VET within commercial training increases chances to qualify, however students changing modes lose half a year in the process. These findings suggest that, although both parts of the Swiss VET system are working well, horizontal permeability between modes of training needs to be improved.
Keywords: apprenticeship training; within occupation transitions; correlated random effect models.

JEL classification: I20; I21; I28.

6.1. Introduction

In this chapter, I look at the horizontal permeability of the Swiss vocational education and training (VET) system, examining transitions across modes of training, i.e., between apprenticeship and full time vocational schools. In traditional apprenticeship countries, such as Germany, Switzerland or Austria to some extent, dual vocational education is the upper secondary norm and school based vocational education and training is mostly seen as either complementary to firm based training or as a temporary remedial solution for school leavers, the so-called transition system

[1]I would like to thank Anika Jansen for her help finding statistics for Germany and I am grateful to José V. Ramirez and Paul Ryan for many helpful discussions and comments. This work was presented at the Third Lisbon Research Workshop on Economics, Statistics and Econometrics of Education in Lisbon (2015). Any remaining error is mine.

in Germany or bridge courses in Switzerland. In this context, a transition across modes of training, if ever observed, should go only unilaterally from school to apprenticeship training. In addition, crafts and business associations in both countries strongly support the view that only company based vocational training can be successful in leading to occupational certification (Deissinger et al., 2011) and consider all main advantages of dual educational systems, such as low youth unemployment rate and a well adapted skilled workforce (Piopiunik and Ryan, 2012), as resulting from the strong complementarity between school and on-the-job learning.

However, dual systems have not run without hiccups during the last two decades: the increasing importance of the service sector, in which apprenticeship is less established than in the manufacturing sector (Culpepper and Thelen, 2008) and the overall decreased willingness of firms to train, have led to a deficit of apprenticeship places (Schweri and Mueller, 2007; Trampusch, 2010), leaving a substantial number of young school leavers without a viable and durable training option. In Germany and Switzerland, this tendency has provoked queuing and displacement on the training market, as, each year, members of older cohorts fill up some of the current training places (for Switzerland see, e.g., Stalder and Nägele, 2011 and for Germany, Hoeckel and Schwartz, 2010). In addition, structural mismatch between youngsters' aspirations and the requirements of training firms has provoked substantial imbalances between demand and supply of apprenticeship places. For example, the latest Swiss barometer of apprenticeship places foresees that demand for training exceeds supply in sectors such as health and social care, while the reverse situation is observed in agriculture or in the construction sector (SERI, 2014a). The combination of a relative shortage of places and sectoral mismatches explains, for a good part, the recent inflation of temporary transition structures between the end of compulsory school and the beginning of a certifying upper secondary education (Meyer, 2011). In Switzerland, each year 15% of a cohort ends up in this kind of remedial education (SKBF, 2014), while in Germany, it is around a third of all new VET entrants (Hoeckel and Schwartz, 2010).

This contemporary increase of transitory options has been a source of concern for political authorities in both countries, as those youngsters are seen as more at risk of dropping out of the educational system altogether without any upper secondary certification, which represents a further lifelong source of vulnerability in both economic and non economic terms (see Peracchi, 2006, for a survey of the educational wage premium and Lance, 2011, for a recent review of the non monetary benefits of education). In addition, vulnerable groups, such as low achievers, low socioeconomic status students and students with a migration background are over

represented in these types of temporary training structures (chapter 3 of this thesis; SKBF, 2014; Authoring Group Educational Reporting, 2012), challenging the equity of the educational system.

In this context, public authorities have started to envisage different solutions, or "contingency plans" (OECD, 2010a), to remedy these failings of the dual system. The first logical response has been to encourage more firms to take on apprentices, so as to increase the supply of places, for example implementing a levy on non training firms, allowing a more equitable division of training costs across firms (Bornemann, 2010). Nevertheless, public authorities can only provide more incentives for firms to train but ultimately this decision relies in the hand of the private sector. For this reason, governments have in parallel implemented other more direct measures to reform the dual system and to diversify pathways towards upper secondary qualification.

First, school based vocational education has emerged as an attractive alternative to dual training, as governments can (more) easily adjust the volume of provision so as to cater more closely students' needs. In this view, school based vocational education acts not only as a complement to apprenticeship training but stands as a rightful alternative pathway towards a vocational qualification. However, a successful school based vocational educational is not a given because in addition to the more general part of the dual curriculum, schools also have to provide students with more contextualized learning, supplementing the lack of strictly firm based training. This implies that schools have to keep up with technological innovation and adapt their training provision accordingly. Whether or not the public system might effectively succeed in providing this type of education will be assessed by the willingness of firms to employ full time VET graduates, relatively to their dual counterparts. Although evidence presented in Ryan (2001) suggests that qualifications acquired through apprenticeship generate better employment prospects, recent development in full time vocational education have leaned towards an increase in practical content, making school based VET more comparable to apprenticeship training. A recent study by Polidano and Tabasso (2014) indeed finds that workplace learning in full time Australian secondary vocational education indeed improves the chances of school completion, as well as the probability of a successful school-to-work transition. Even if the Australian vocational context might be quite different from the Germanic one, this is a first piece of evidence assessing the merits of such an approach.

Second, and this is a related point, the successful development of an equivalent school based pathway necessitates the existence of bridges between modes of

training and the realization that transitions can go both ways. This implies a horizontal permeability of the VET system, allowing individuals to easily and efficiently move within the system, without loosing any unnecessary amount of time in the process. In Germany, the insufficient permeability of the dual system has been recognized as one of the main structural weaknesses of the vocational system. The recently launched DECVET initiative intends to tackle this issue setting in place an ambitious system of credit transfer across modes of training, as well as across occupations (Bergzog et al., 2010).

Nevertheless, achieving a good permeability within the vocational educational system is challenging for several reasons. First, vocational education is a domain where emphasis has usually been put on courses and curricula rather than on "portable competences", i.e., either general or occupation specific human capital (Bergzog et al., 2010). Second, the definition and recognition of those competences directly involves many stakeholders, especially in dual systems, such as craft and business associations, the latter being seen as rather "structurally conservative" (Deissinger et al., 2011) and reluctant to accept changes perceived as eroding the dominance of their training prerogatives. With respect to Switzerland, the dual system has always been considered as more permeable than its German counterpart, due to a better integration of full time VET, probably because of its importance in non German speaking parts of the country (SERI, 2014b); however, we are quite far from a credit transfer system, such as the one now envisaged in Germany.

Given this institutional context, looking at transitions within vocational education appears relevant and surprisingly rather few empirical studies exist on the topic. A relative exception to this rule is the study conducted by Hupka and Stalder (2011) who looked at the differential impact of students' characteristics on their transitions to school-based education vis-à-vis company based training, using a representative Swiss dataset. Although a closely related topic, they did not consider transitions within vocational education. To the best of my knowledge, this is the first study looking at such a topic in a quantitative manner.

In this paper, I will restrict the dimensionality of the outcome and look only at transitions within a given occupation: commercial training ("Kaufmann/Employé de commerce"). A number of reasons motivate this choice. First, at both national and Cantonal levels, commercial apprenticeship is the largest VET domain in Switzerland with around 19% of all VET diploma awarded each year (Eberle et al., 2014). In comparison, it represents around 21% of all new training contracts concluded in Germany in 2013 (BiBB, 2013). Given the growing importance of the service sector in both countries, the dominance of commercial training is likely to

grow further in the future. Second, this field stands out, as a relatively large share of students qualify through school based VET, and even though full time commercial VET is more prevalent in non German speaking regions (SERI, 2014b), it is also well developed on the German speaking side, making it a relatively comparable occupational field across Swiss regions. The latter considerations imply that I focus on changes across training modes within an occupation in which both dual and full time vocational education are well established.

Finally, given its importance, commercial training has undergone major reforms, concerning both the structure and content of training, during the last ten years in Germany and in Switzerland but these two countries have gone in different directions. As reviewed by Pilz (2007), one major structural difference concerning commercial apprenticeship is the unified vs fragmented nature of this occupation across the two countries. In Switzerland, there is only one Federal VET certification ("Kaufmann") for all the fields that actually employ commercial apprentices and professionals, such as, for example, retail companies, public administrations, banks or insurance companies. This structure implies that field specific skills are left to the on-the-job training part of the curriculum, while the school part is thus (nearly) identical for all commercial apprentices, irrespectively of their company background. In contrast in Germany, there exist more than forty specialized apprenticeships in the commercial sector, such as in banking or in insurance services, and "each (specialization) has its own training regulations: curricula for the company and a special syllabus for the vocational school" (p.75, Pilz, 2007). Second, full time school based vocational training is regulated differently in the two countries. In Germany, although apprenticeship training is regulated at the Federal level, full time vocational schooling is a Land based responsibility (Deissinger, 2007), and, as such, varies across Lander. In Switzerland, however, the Federal act on VET, and the corresponding ordinances, concern both apprenticeship and exclusively school based training, implying a national harmonization of both curricula.

Interestingly, despite these important differences in the structure of vocational education between the two countries, the content of the full time curriculum is relatively close. First, contrary to its dual counterpart, full time vocational schooling in the commercial sector in Germany is far less specialized (Deissinger, 2007), making it rather more comparable to the Swiss uniform curriculum. Second, recent content wise developments have gone in a similar direction in both countries: vocational schools have started to introduce the so-called practice firms into the curriculum, as a means to "promote the employability of young people by developing skills in a more realistic learning environment" (p.191, Deissinger, 2006). Practice

firms are fictitious firms comprising all usual company departments and are supposed to replicate the on-the-job leaning part of the dual curriculum and to bring students more occupational competences. Baden-Württemberg introduced practice firms in vocational colleges on a large scale and the end of the 2000s (Deissinger, 2007) but this was done only very recently (2011) in the Canton of Geneva[2], my case study. This type of reform underscores the importance of entirely school based learning in commercial vocational education, where public authorities engage into making this path (more) appealing to both students and employers.

Using panel data following a cohort during 10 years after middle school, I estimate the impact of changing modes of training within commercial training, which essentially means going from full-time to dual VET, on the probability of obtaining an upper secondary diploma. Taking time invariant unobserved heterogeneity into account, I find a positive impact of switching training modes on the qualification probability. Changing modes of training is however associated with an extra half a year needed to qualify. These findings suggest that, although both parts of the Swiss VET system are working well, as a whole, the system lacks horizontal permeability.

This paper is structured as follows: the next section exposes the institutional framework of the Swiss vocational system and the reasons why transitions across modes of training may occur. The empirical framework, in which the data, the variables and the methodology used for the empirical analysis are detailed, is presented in section 6.3. Section 6.4 displays and discusses the empirical findings and the last section concludes.

6.2. Factors influencing moves across training modes

This section intends to lay out the relevant attributes of full time and dual vocational education and training in Switzerland that could, first, motivate the choice between those two routes and, more importantly, generate moves across them.

As an important preliminary note, neither the type of diploma nor the (theoretical) duration of studies are factors that could differentiate apprenticeship training from full time school based vocational education, as they are identical and defined at the Federal level.

Concerning differentiating factors and as mentioned in the introduction, a first major difference between school based vocational education and apprenticeship training is access to each of those two routes. As apprenticeship training is primarily a market driven mode of education, access relies entirely in the hands of firms.

[2]Information available on the Department of Education website.

Once taken on board by a firm, an apprentice is automatically admitted to the corresponding vocational school, irrespectively of middle school grades and track. For full time vocational students, access is precisely (and solely) conditioned on the latter two variables and, provided that they meet those formal admission requirements, students are automatically admitted (there is no restriction of access, as is the case in certain Cantons with upper secondary academic education, see Ryan et al., 2013).

This first major difference implies that access to full time vocational education is probably easier and more direct for most students, as there are no search costs associated with a transition from the lower secondary level to a full time vocational school. Consider the following case: a student intends to start an apprenticeship after middle school but is not able to find one (because, for example, of the scarcity of apprenticeship places in a given sector); he thus risks delaying entry in upper secondary education. To avoid such a state, he may then directly transition to full time vocational education instead, while continuing to look for an apprenticeship position. Once offered such an opportunity, he will change modes of training. In an occupation in which both routes lead to the same qualification, this differential mode of access is thus enough to generate moves across training modes[3].

Unfortunately for our purpose, only anecdotal evidence is available on the scarcity of training places in the commercial sector in Geneva, as the Swiss barometer does not contain any occupation and Canton specific data. However, as the proportion of apprentices (around 0.3) is small compared to their full time students counterparts, assuming some scarcity does not appear too strong of an assumption.

Second, setting aside the issue of access, the choice between the two modes of training may also depend on students' preferences over learning methods: some may prefer more contextualized learning, as is more frequent when learning on the job in an apprenticeship (Ryan, 1998), to more abstract forms of learning that would dominate the curriculum taught in vocational schools. Moreover, students may not always be aware of their preferences over the two learning methods from the start, as compulsory schooling is only based on abstract learning; so that, assuming they transition directly to full time vocational education, time spent at the vocational school may serve as a revealing period to students. Those who find that contextualized learning suit them best, may then start looking for an apprenticeship and switch modes of training when the opportunity arises. A symmetrical argument may also hold for transitions from apprenticeship to full time schooling, which would imply

[3]Full time training at a vocational school is, however, not possible in all occupations and for certain trades (e.g., painters, cooks) only apprenticeship training may lead to a Federal VET certificate (OFPC, 2011).

that students acted on their perceived preferences over learning methods and revised their judgment later on.

Regarding these differences of curriculum in commercial training, things have been evolving over the last 20 years in Switzerland, as mentioned in the introduction. The major turnpoint in commercial training was new the 2002 Federal law on vocational education and the corresponding ordinances, successively implemented in the field over the years. This major reform should normally end in 2015 with the complete implementation of the 2011 ordinance on commercial training (SERI, 2015). In this revised version, the core part of the curriculum is identical across the two routes, so that both apprentices and full time students study the same set of core subjects (namely, the local language, a foreign language(s), economics, and business administration). Professional experience is acquired on the job for apprentices and at school for full time students (through practice firms, for example), which implies that the professional experience acquired through schooling is inevitably more abstract than a in a real job. Finally, the full time curriculum additionally includes other more general (and thus abstract) subjects, such as geography for example. This description highlights the (expected) imbalance between abstract and contextualized learning across the two modes of training, which, despite the successive curriculum adjustments over the years, remained a salient differential feature.

Third, incomplete information on differential labor market prospects may also generate moves across modes of training. As apprenticeship is spent part time at a firm, employment prospects through internal labor markets are usually better than when qualifying through full time vocational education and training; Mohrenweiser and Backes-Gellner (2010) indeed find that, in Germany, 44% of companies hire nearly all of their apprentices, once the latter complete training.

Moreover, even absent any direct retention by the training firm, compared to full time vocational schooling, qualifications obtained through apprenticeship training may be more valued on the labor market and could still generate better employment prospects, as discussed in Ryan (2001). In addition, the recent study done by Hanushek, Woessmann and Zhang (2011) looks at life cycle employment patterns of general vis à vis vocational graduates and finds that, although vocational graduates are more likely to be employed at the beginning of their career, from age 50 and on, general graduates have better chances; a result even more marked for apprenticeship countries, such as Switzerland. Whether such a result might hold within vocational education in a given occupation, comparing the prospects of the two types of diploma holders (full time or dual) is plausible, and especially so given

that full time diploma holders should possess a larger amount of general (and thus more adaptable) skills, but not certain at the moment. Nevertheless, differential and evolving perceptions of employment prospects across modes of training are enough to generate moves.

Fourth, evolving aspirations concerning further education might also motivate students to change modes of training. Although both routes offer identical opportunities on paper, and logically so given that the diploma obtained is identical, in reality, transactions costs and effective study duration might differ. On the one hand, holders of a three year Federal VET certificate obtained through an apprenticeship may spend an additional year at the vocational school on a full time basis and prepare a vocational commercial Matura. This one year curriculum can also be done part time in a two year period. On the other hand, students qualifying through the full time route should normally decide from the beginning of their curriculum if they want to obtain a vocational Matura in addition to the certificate, because the curriculum is then different: all extra Matura classes are taken during the first three years and the fourth one is spent in a firm doing an internship.

Given these curriculum and practical differences, students changing their mind about further education along the way may switch training modes. For example, suppose a full time students started a three year curriculum and realized later on that, in fact, he wishes to obtain a tertiary qualification and to go to a University of applied sciences. For this to happen, he needs a vocational Matura first. Changing from full time to dual vocational education will open up this door for him, as for holders of a three year commercial VET certificate obtained through apprenticeship, the Matura curriculum is an independent option[4].

Finally, one last important differential aspect of apprenticeship training is of financial nature. While in training, apprentices receive a wage, although not a substantial one, whereas full time vocational students earn nothing. Ryan, Wagner, Teuber and Backes-Gellner (2013) found that Swiss (metal working) apprentices received an even lower compensation than their German counterparts, which amounted to around a fifth of a qualified worker's salary. This low wage implies that apprentices cannot fully support themselves while in training, and especially in Geneva where rents are high, but that this additional revenue may be used for discretionary spending, a possibly attractive feature to teenagers and in a potentially increasing

[4]To be precise, the 2011 ordinance (SERI, 2015) does foresee the possibility of transitions within dual commercial vocational education, from the 3 year (advanced) training program to the integrated three year curriculum, the latter leading to the simultaneous obtainment of both the VET certificate and the vocational Matura. Nevertheless, this type of transition is only possible for the highest achievers, given the very demanding nature of the integrated 3 year curriculum.

manner as students get older, motivating moves towards apprenticeship.

6.3. Empirical framework

6.3.1. Data

In this paper, I use a 10 year panel dataset following the upper secondary pathways of a cohort of 15 year old students in June 2004, i.e., in their last year of middle school, in Geneva, Switzerland. The dataset consists of exhaustive administrative data, the Geneva Schooling Database, on students' characteristics (including 9th grade grades) and school trajectories, which was linked to a subsequent diploma database to include information on qualification (type of diploma obtained and qualification year) for each student.

6.3.2. Variables

Given the focus on the subsample of commercial VET students, table 6.1 provides the distribution of variables and outcomes of interest across the different subsamples. The reference sample is the complete population cohort; the second subset is made up of individuals having at least a year of training in commercial VET (denoted "1+" in the table) and who thus represent the pool of potential commercial VET diploma holders, the third subsample encompasses all individuals who accumulate at least two years in commercial VET (denoted "2+"), and who are, therefore, capable of being moved across modes of training and, for the sake of completeness, in the last column I report the same set of statistics but only for commercial VET diploma holders.

Concerning the first outcome of interest, the first upper secondary qualification, as of 2013, around 78% of the cohort obtained an upper secondary diploma. This rate is substantially below the national target rate of 95% (Swiss Conference of Cantonal Ministers of Education, 2011). Nevertheless, it is possible that in a few years' time, some additional students may manage to get a diploma and that some others may in fact have qualified abroad, so that the true overall rate for this cohort is probably going to be higher. Keeping this caveat in mind, when looking at the variations of the qualification rate across samples, one can note that students totalizing at least two years of commercial vocational training are significantly more

Table 6.1: Selected descriptive statistics by subsample

		Full Cohort	CVET students		
			1+	2+	have qualified
Variable refers to	*N*	*3,299*	*850*	*667*	*439*
Upper secondary qualification	ever obtained a diploma	78.33	76.00	83.81	100.00
Type of upp. sec. qualification	full time VET diplomas	18.96	47.37	53.85	68.11
	of which in CVET	61.02	97.71	99.34	100.00
	dual VET diplomas	19.81	32.51	29.34	31.89
	of which in CVET	27.34	66.67	85.37	100.00
	general diplomas	57.12	16.56	13.24	0.00
Vocational mode of training	ever changed training modes	8.91	25.76	21.89	18.22
	if changed, from full time to dual	94.22	97.26	95.89	96.25
Time to first qualification	mean time to 1st qualification (year)	4.49	4.76	4.68	4.58
	mean n. of extra years to qualification	0.99	1.61	1.52	1.46
Lower secondary track	high track	59.93	51.77	57.42	61.50
	low track	21.21	28.54	23.84	21.64
	delayed tracking	18.86	19.69	18.74	16.86
Lower secondary GPA quartile	lowest achievers	24.46	32.59	29.99	29.38
	low achievers	24.37	33.29	32.53	32.35
	high achievers	24.49	24.47	26.09	27.79
	highest achievers	26.67	9.65	11.39	10.48

Data source: GSD Administrative data, 2003-2013.

Notes: Numbers represent percentages (when not otherwise specified). "CVET" stands for commercial vocational education and training. Diploma types do not sum to 100, as foreign diplomas are not included in the table.

The category "1+" ("2+") refer to students with at least a (two) year(s) spent in CVET.

Normal duration to qualify is 3 years, but may be 2 or 4 depending on the diploma obtained.

likely to qualify, which is not the case for the "1+" sample. Concerning the distribution of diploma holders across modes of training, the proportion of entirely school based students is quite high among commercial VET diploma holders, but one has to take into account that they also represent around 60% of all full time VET diploma holders. Put differently, for this cohort, 61% of all full time VET diploma were delivered in commercial VET.

Concerning changes across modes of training, they are rather seldom when looking at the complete cohort sample and when considering all occupations: only 9% of individuals ever changed modes. Nevertheless, this rate includes individuals changing occupations as well as modes of training and must therefore be considered with caution. When looking at commercial VET, changes are much more common, with around a quarter of students ever changing modes of training. Interestingly, changes are even more prevalent among commercial VET diploma holders, suggesting that changes within this occupation are worth examining. Moreover, when examining the pattern of changes across modes of training in commercial VET, data reveal that for this cohort at least, changes happen almost unidirectionally, from school based vocational education towards apprenticeship training. Note that all types of changes will be accounted for in the empirical analysis. This unidirectional pattern is, however, an interesting feature which would be worth further examining

using additional data on other cohorts.

With respect to the unadjusted mean time to the first qualification, it does not vary much across samples but this hides substantial variations when one considers the difference between effective and theoretical duration. All commercial VET students take at least an extra year and a half to qualify, substantially more than the average extra year for the complete cohort sample. More specifically, table 6.2 presents the distribution of the number of extra years needed to qualify, the second outcome of interest, for students with at least two years of commercial training, depending on whether or not they switched training modes. This variable corresponds to the difference between the theoretical number of years required for a certain qualification (usually three) and the effective number of years the student spent in upper secondary education before getting this qualification. This variable ranges from minus one for students who finished a year in advance to five extra years.

Finally, to get a sense of the achievement level across subsamples, all students were split according to their 9th grade GPA quartile. Interestingly, although the distribution of students across middle school tracks is not dramatically different from the whole cohort, the group of commercial VET students seems to be biased towards middle achievers, with the best students strongly underrepresented in all commercial VET samples. For more information, appendix table F.1 provides the distribution of a few other individual characteristics across subsamples.

Table 6.2: Distribution of the number of extra years needed to qualify for the subsample of students with at least two years of commercial VET, for those who did and did not change mode of training

	N. of years	N. of ids		Total
		stayers	changers	
Finished early	-1	13	0	13
On time	0	133	6	139
Finished with a delay of	1	147	21	168
	2	89	21	110
	3	33	28	61
	4	21	22	43
	5	10	15	25
Total		446	113	559

Datasource: GSD Administrative data, 2003-2013.

Notes: "Changers" refers to individuals who changed modes of training.

As of 2013, 108 individuals haven't qualified yet.

Table 6.3 presents a few additional summary statistics for the probability to qualify, on the estimation sample, i.e., all students totalling at least two years of commercial training. This variable is defined up until the first upper secondary qualification when it takes the value one. The number of years observed for each student therefore varies, from a minimum of three years to a maximum of ten, with most individuals observed either 6 or 7 periods (average is 6.6). Table 6.3 also highlights that most of the variation occurs within individuals over time.

Table 6.3: Probability to qualify for the subsample of students with at least two years of commercial VET: summary statistics

		Mean	Std. Dev.	Observations
Total	overall	0.127	0.333	N = 4405
Sources of variability				N. of ids = 672
	between		0.079	
	within		0.321	

Data source: GSD Administrative data, 2003-2013.

Notes: the average number of periods observed for each individual is 6.6.

6.3.3. Empirical strategy

To credibly estimate the effect of changes across training modes on the upper secondary qualification probability, one needs to take into account unobservable heterogeneity. For example, given that changes across modes are essentially moves towards apprenticeship training and given a potential scarcity of training places, unobserved professional or family networks might prove useful when finding an apprenticeship contract, implying that only resource-possessing individuals experience a switch across training modes and such individuals are more likely to qualify and to do so on time. In a linear setting, this could be easily dealt with using fixed effects, the latter allowing any kind of dependence between unobserved time invariant heterogeneity and the covariates. In the non linear case, treating fixed effects as parameters to estimate produces inconsistent results, the so-called incidental parameter problem: parameters of interest are inconsistently estimated with a fixed number of periods (T) and a large number of observations (N).

The usual approach is thus to specify a certain form of dependence between unobserved heterogeneity and the covariates. Consider the following unobserved effect model for the qualification probability of individual i at time t :

$$P(y_{it} = 1 \mid \mathbf{x}_{it},\, c_i) = G(\mathbf{x}'_{it}\boldsymbol{\beta} + c_i) \tag{6.1}$$

where y_{it} denotes qualification, $G(.)$ is a cumulative distribution function, usually either the normal cdf $\Phi()$ in the case of the probit model or the logistic one $\Lambda(.)$ for the logit model, $\mathbf{x}_{it}$ the set of covariates, including time and non time varying variables and c_i refers to the unobserved time constant heterogeneity. In this particular setting, there is only one time varying variable, the change across modes of training.

To identify the βs and partial effects, one needs additional assumptions. However, there is a tradeoff, the more assumptions one is willing to make, the more quantities one is able to estimate. Moreover, as these assumptions are needed for consistency, each additional assumption carries an extra weight. Following Wooldridge (2010), I proceed from the most restrictive model to the least restrictive one, each time specifying the particular set of assumptions and the estimable quantities.

First, assume that the characterizing cumulative distribution function in equation 6.1 is indeed normal (due to its more tractable nature, the probit model is often assumed to hold). The traditional random effect probit model relies on three main additional assumptions: i) strict exogeneity of the covariates conditional on c_i, ii) independence of responses (y_{it}) conditional on unobserved heterogeneity and the covariates, iii) unobserved heterogeneity is independent from the covariates and is normally distributed with mean zero and unknown variance σ_c. This last assumption is perhaps the strongest one and likely unrealistic in many empirical settings. Nevertheless, under this set of assumptions, the traditional random probit model permits one to estimate coefficients, the variance of unobserved heterogeneity and partial effects; the full set of quantities of interest. Relaxing assumption i) and ii) still allows to estimate the average partial effects with the so called pooled unobserved effect probit model but $\boldsymbol{\beta}$ and σ_c are no longer identified. One estimates instead a vector of scaled coefficients, $\boldsymbol{\beta}_c \equiv \boldsymbol{\beta}/\sqrt{1+\sigma_c^2}$.

In the eighties, Mundlak (1978) and Chamberlain (1980) proposed a different and more realistic form of dependence between c_i and $\mathbf{x}_{it}$, allowing for a (specific form of) correlation between unobserved heterogeneity and the covariates:

$$c_i \mid \mathbf{x}_i \sim N(\psi + \bar{\mathbf{x}}'_i\boldsymbol{\xi},\, \sigma_a^2) \tag{6.2}$$

where $\bar{\mathbf{x}}_i$ is the average of $\mathbf{x}_{it}$ over all periods. Equation 6.2 implies that the dependence between unobserved heterogeneity and the covariates is only (linearly)

channeled through the mean of c_i. Assumptions i), ii) and equation 6.2 characterize the correlated random effect probit model, which is simply estimated by adding the average of the time varying covariates to the estimated equation. This model allows to estimate all the quantities of interest (coefficients and average partial effects) and provides a straightforward test for the validity of assumption (iii). If the ξs appears insignificantly different from zero, then one gets the traditional random effect model as a special case.

Similarly, relaxing assumption (ii), i.e., relaxing the idiosyncratic serial independence assumption, still allows to estimate the partial effects but one can only identify a scaled coefficient vector $\boldsymbol{\beta}_a \equiv \boldsymbol{\beta}/\sqrt{1+\sigma_a^2}$.

Among the models considered here, the pooled correlated random effect probit model is the least restrictive in terms of model assumptions, while still allowing to estimate the average partial effects (APE) and is thus an appealing option. The main advantage of correlated random effect models is that all usual confounding factors when dealing with educational outcomes, such as personality traits (conscientiousness for example), motivation or ability are accounted for (in the sense that they are allowed to be correlated with the regressors), provided that they are time invariant. It has been showed that they can indeed be considered fixed over the sort of period considered here (see Almlund et al., 2011).

In a second time, to get a sense of the impact of changing modes of training on the time needed to qualify, I estimate a simple sample selection model à la Heckman (1979). This procedure is justified since the effective number of years spent in upper secondary education before qualifying is only observed for students who do qualify and that the qualification variable cannot be considered to be missing at random, i.e., error terms across both equations are correlated. If the errors are assumed to be jointly normally distributed, one can specify the complete log likelihood to estimate and, provided that the distributional assumptions are not violated, such a strategy produces efficient estimators (Amemiya, 1985).

The Heckman two step procedure relies on weaker distributional assumptions[5] and is therefore expected to be more robust (Cameron and Trivedi, 2005). In addition, it is computationally very easy: the selection bias is dealt with estimating selection stage inverse Mills ratios and adding them subsequently to the second stage outcome equation. While, theoretically, the full MLE model is identified through distributional assumptions, the credibility of the two step procedure relies on the availability of exclusion restrictions, otherwise the parameters of inter-

[5]Specifically, the univariate normality of the error term in the outcome equation and a linear dependence between the error terms across equations.

est are identified only through the non linearity of the inverse Mills ratios which is quite problematic (for a review on this issue, see Puhani, 2000).

6.4. Results

I now present estimates resulting from all models specified in the previous section, so as to compare the impact of the various assumptions on the estimated quantities.

Table 6.4 displays the first set of estimations, where the variable of interest, denoting changes across modes of training (irrespectively of their direction), is positive and significant across all specifications, suggesting a positive impact of changing modes on the probability to qualify. Moreover, the simple random effect model is strongly rejected as in both CRE models the time average "changed modes" variable appears significant, suggesting that unobserved heterogeneity is indeed correlated with the regressors. The linear probability model suggests that changing modes of training increases the qualification probability by about 19 percentage points, which corresponds to the within effect of changing modes. Both APEs estimated by CRE models are higher, with a 36 percentage point increase in the qualification probability. Such close APEs suggest that the additional assumption necessary for the MLE CRE probit, namely the independence of responses, does not seem too problematic. With respect to the magnitude of the APE, 36 percentage points represents a large impact, especially taking into account the fact that (time invariant) unobserved heterogeneity, such as family networks, motivation or ability, has been accounted for (in the sense that the latter are allowed to be correlated with the regresors). This result can therefore reflect the strong attraction and retention potential of apprenticeship training as a powerful medium of upper secondary qualification. However, the story does not end here. Even if a transition from full time vocational education appears as a positive event in increasing apprentices' qualification probability, one important drawback can be the potential cost associated with delayed qualification.

In a perfectly permeable system, going from full-time to dual vocational education within a given occupation should a priori not increase the number of years necessary to qualify. However, results presented in table 6.5 suggest that changing training modes is indeed associated with an increase in the qualification delay of around half a year, as supported by all specifications. One important caveat is, as always, the difficulty of finding a credible exclusion restriction. In both sample selection models, socio-economic status, gender and whether or not the

Table 6.4: The impact of changing training modes on the probability to qualify

Model	Linear	Probit		CRE Probit				Logit FE
Estimation Meth.	FE	Pooled MLE		Pooled MLE		MLE		MLE
		coefficient	APE	coefficient	APE	coefficient	APE	coefficient
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
changed modes	0.1964***	0.4298***	0.1059***	1.2263***	0.3613***	1.2263***	0.3613	2.7276***
		(0.0481)	(0.0137)	(0.0964)	(0.0317)	(0.1242)		(0.3731)
2nd gpa quartile		0.1271***	0.0245***	0.1221**		(0.1221*		
		(0.0493)	(0.0093)	(0.049)		(0.0627)		
3rd gpa quartile		0.1996***	0.0401***	0.1957***		0.1957***		
		(0.0517)	(0.0094)	(0.0515)		(0.0664)		
4th gpa quartile		0.2712***	0.0567***	0.2348***		0.2348***		
		(0.0669)	(0.0148)	(0.0603)		(0.0864)		
$\overline{\text{changed modes}}$				-2.8380***		-2.8383***		
				(0.2843)		(0.3485)		
LL		-1653.08		-1608.06		-1608.06		-903.03
scale factor						0.9999		
Observations				4405				3166
N. of ids				672				559

Notes: standard errors in parenthesis. For the linear model, pooled probit and pooled CRE the standard errors are robust to arbitrary serial correlation. Result for the constant term is omitted.

individual lives with both parents are used as exclusion restrictions. The idea is that such characteristics are likely to affect the probability of getting a diploma, but not the speed. The speed is assumed to depend only on the individual's ability, as captured by the GPA quartile. Results using such exclusion restrictions are reported in columns 4 and 5. Given that standard errors for the two part model account for the first stage estimation of the inverse Mills ratios, they are generally larger than in the MLE model. Nevertheless our variable of interest remains significant at the five percent level, which is acceptable given our very small sample size.

Although the MLE method does not formally require any exclusion restriction, the small sample size available makes this kind of strategy very fragile. I nevertheless report results of such an estimation in column 2. Additionally, out of three sample selection models, only the MLE with exclusion restrictions produces evidence of sample selection, as the estimated coefficient on the inverse Mills ratio is significant. This inconclusive evidence of sample selection explains why OLS results are so close to the three sample selection models considered.

Finally, the relative magnitude of the fourth and third GPA quartile coefficient to the changed modes dummy implies that only high achievers (fourth quartile) may, in the end, compensate the time cost imposed by the vocational education system when switching modes of training. Note that, as permeability across modes of training is not formally recognized, when a student changes modes of training, his situation is assessed on a case by case basis, implying that the level of achievement will most likely be factored in when deciding which classes the student must resit.

To summarize, even though movers need more years to qualify, they are still more likely to get an upper secondary diploma. There is, therefore, a strong evidence that, even though, changing modes of training increases the time to qualification, it does not hamper student's qualification prospects.

Table 6.5: The impact of changing training modes on the qualification delay

		Sample selection		
	OLS	MLE	MLE	Two step
changed modes	0.5380***	0.4843**	0.6784***	0.5477**
	(0.1872)	(0.2161)	(0.2247)	(0.2206)
2nd gpa quartile	-0.0458	-0.0397	0.2910	-0.0067
	(0.1648)	(0.1681)	(0.1880)	(0.2065)
3rd gpa quartile	-0.4194**	-0.3697**	0.0114	-0.3740*
	(0.1633)	(0.1826)	(0.1872)	(0.2267)
4th gpa quartile	-0.9356***	-0.8595***	-0.4158*	-0.8805***
	(0.1979)	(0.2274)	(0.2212)	(0.2817)
$\hat{\lambda}$		-0.0571	1.6708***	0.2287
		(0.4464)	(0.0639)	(0.7988)
N	559		672	
Exclusion restrictions	-	no	yes	yes

Notes: Dependent variable is the difference between effective and theoretical duration, as presented in table 6.2. Standard error are reported in parenthesis.
For the OLS and MLE models, variance is robust and for the two step estimator, standard errors take into account the first step estimation of λ, the inverse Mills ratio. Results for the selection equation are omitted.
SES, gender and family structure are used as exclusion restrictions.

6.5. Conclusion

This paper looks at the impact of a within occupation transition across modes of training on the qualification success of commercial vocational students in the Canton of Geneva, Switzerland. Commercial education is the largest field of vocational education at both the country and Cantonal levels and has the largest share of exclusively school based students. Allowing unobserved heterogeneity to be correlated with the regressors, I find that changing modes of training, which essentially means transitioning from full time to dual vocational education and training, increases students' qualification probability by a large magnitude (around 36 percentage points). Due to an obvious lack of permeability between modes of education, this type of transition is however associated with an extended delay towards qualification (amounting to around half a year).

Even though this transfer approach appears broadly desirable from a public policy perspective, the question remains as to whether or not firms might be willing to sponsor such a permeable training scheme, a crucial point given their importance within dual vocational education and training. If transitions are mostly going from vocational school to apprenticeship training, then firms would obviously gain from

a more permeable system: their newly recruited apprentice would not have to start the school based part of the curriculum all over again and only on-the-job training would remain. This is the clear win-win situation for all parties involved. If, however, some transitions were to go freely from apprenticeship training to vocational school or from one apprenticeship to another, within a given occupation, some firms might incur a cost as their initial investment in the apprentice might not be recouped, especially so if the move intervenes after the first year, the most training intensive and costly one for the training firm (Wolter and Ryan, 2011).

The permeability of the Swiss vocational system has often been highlighted as one of the key factors of its success (OECD, 2009); however, this flexibility only takes into account transitions across types of education, for example between academic and vocational education, and mostly at the interface of major educational cycles, i.e., between lower and upper secondary and between upper secondary and tertiary levels. So far, probably due to the dominance of apprenticeship training, transitions within vocational education have been relatively neglected. Nevertheless, the future development of vocational education is very likely to call for a reflection along those lines, redefining the concept of systemic permeability to take into account both horizontal (within) and vertical (between) moves. Re-evaluating the framework of assessment currently used will be one of the necessary steps: portable competences (either general or occupation specific human capital) need to be certified in a comparable manner across and within occupations, allowing a true flexibility in pathways. Vocational education in Germany is certainly moving in this direction; how successful such a reform might actually be remains, for now, an open question.

7. Concluding remarks

The four essays assembled in this thesis all looked at upper secondary school transitions using a common exhaustive dataset for the Canton of Geneva, each of them focusing on a particular aspect. Two cross cutting themes can nevertheless be identified: first, given the specificity of Switzerland with respect to vocational education and training, where almost two thirds of each cohort end up in this type of education at the upper secondary level, special attention was given to this educational route. This topic was studied descriptively and comparatively across Switzerland in chapter 2, while among empirical chapters, chapter 3 only touched upon this aspect but chapters 5 and 6 entirely focused on vocational education. Second, as in the rest of Switzerland, Geneva tracks students rather early in international comparison; the impact of this setting on subsequent transitions was discussed in chapters 3 and 5, and at greater length in chapter 4.

With respect to vocational education, the first essay highlighted that the integration of certain groups of migrants into the VET system can be problematic, even in a setting with a highly heterogeneous population. Second, although middle school low track students represent the natural pool of apprentices, their level of achievement within vocational education was shown to be more fragile than their high track counterparts in chapter 5. Third, movements within the vocational system are not yet recognized at the institutional level and, although beneficial in terms of qualification prospects, were proved costly in terms of foregone earnings in chapter 6. All three findings suggest that certain groups might struggle within the vocational world, the precise education type so often sold as the most suited for them. As discussed in chapter 2, it is certainly true that some of these challenges faced by the vocational system are somehow exacerbated in a Canton like Geneva, and that results on this particular topic may not directly transfer to certain Cantons but may apply more readily to some others. Nevertheless the convergence observed in some structural domains, such as economic structure and demographic composition, implies that issues identified in this thesis might prefigure what is to come at the country level, with the advantage of opening up ex ante policy design.

Concerning the impact of early tracking, it was found to determine the set

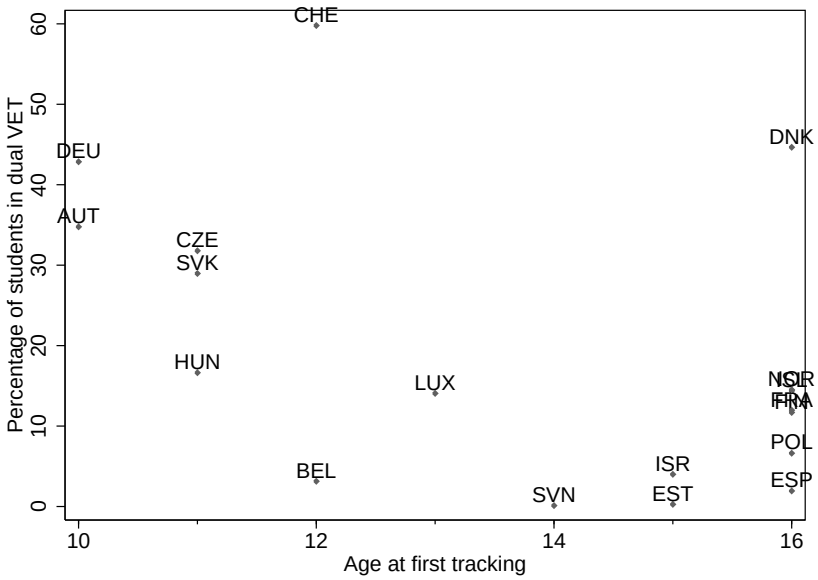
of transition opportunities in chapter 3; to increase the smoothness of subsequent upper secondary school transitions and especially so for low achievers in chapter 4, and to condition both participation to and outcomes within apprenticeship training in chapter 5. Taken together, these results highlight the multiple and differential impacts of early tracking and add to the on-going debate on whether or not tracking is actually beneficial to students. A debate especially relevant since tracking remains a choice variable and is, therefore, not set in stone; the specifics might very well vary over time, as they just did in 2011 in Geneva with the implementation of a unified tracking system at the Cantonal level.

A perhaps less often discussed issue is the relationship between early tracking and the importance of dual vocational education. Figure 7.1 displays such a relationship for all OECD countries for which data concerning the proportion of upper secondary students in dual vocational education are either available or simply exist. The relationship is negative: with the notable exception of Denmark, all apprenticeship countries (i.e., where more than 30% of 15-19 year-olds are enrolled in a dual program; OECD, 2013), namely Germany, Austria and Switzerland, along with the Czech Republic and Slovakia, track students before, or at, the age of twelve, with the earliest tracking age of 10 found in Austria and in Germany.

This relationship might suggest a form of institutional complementarity between these two features, the latter concept occurring "when the existence or the particular form taken by an institution in one area reinforces the presence, functioning, or efficiency of another institution in another area" (p.60, Amable, 2003). Does early tracking increase the efficiency or improve the functioning of the dual system? One could certainly find supporting arguments for this view: first, vocational skills imparted from a young age might be easier to learn, a "skills beget skills" type of story (Heckman and Kautz, 2013). Second, if vocational tracks not only impart students with well specified and appropriate skill sets (better functioning), but also last fewer years than other more academic tracks (as they indeed do in Germany for example), this may increase the efficiency of the whole school system, as compulsory years of schooling can be differentiated according to the ability, needs and vocation of different types of learners. In a historical perspective, this view is additionally consistent with the development of modern universalist school systems in continental Europe, which educated individuals in a "common utility" perspective, emphasizing before all the concepts of field of work and occupation (Meyser, 2004).

This discussion is, however, not complete without a further look at the main alternative to vocational education at the upper secondary level, academic educa-

Figure 7.1: Age at first tracking and the percentage of upper secondary students engaged in dual VET programs



Note: Percentages of students refer to the enrollment rate of 15-19 year olds in upper secondary dual VET programs (i.e., apprenticeship training) and only countries in which this proportion is greater than zero are reported in the figure. The cluster of countries in the lower right-hand side includes France, Finland, Norway and Iceland.
Data source: Age at first tracking from p.57, OECD (2012b) and enrollment rates from p.271, OECD (2013).

tion. Logically, the proportion of pupils attending a general or academic program is negatively related with the proportion of those following an apprenticeship program (see appendix figure G.1). So that, institutionally wise, the age at first tracking can also be seen as complementary to academic education. Mutatis mutandis, the efficiency arguments between early tracking and academic education might equally well apply.

Can one then go a step further than just recognize this tripartite institutional relationship between the age at first tracking and the inversely related proportions of dual VET and academic students? The most interesting question would probably be of causal nature, establishing which feature out of the three discussed here is more likely to precede and determine the other two.

In the absence of a detailed (country specific) historical analysis of these three institutions, the notion of institutional hierarchy can perhaps shed some light on this issue. In Amable's (2003) view, institutions "reflect the socio-political equilibrium of a society" (p.68) and "institutional hierarchy (is) thus such that the institutions on top are those that are most crucial for the socio-political groups that

constitute the dominant bloc, i.e. those where change is likely to modify substantially the distribution of income for individuals behind the socio-political groups" (p.69). As it happens, one of the main findings in the empirical literature on the effects of early tracking is its detrimental impact on equality, as early decided track placements are highly dependent on family background (e.g., Schuetz et al., 2008; OECD, 2012b). In the Effectively Maintained Inequality (EMI) framework (Lucas, 2001) presented in the introduction, tracking is precisely the type of qualitative feature used by a dominant group to reproduce inequality over generations. As presented in chapter 2, evidence concerning Switzerland appears quite in line with this conjecture, as access to academic upper secondary education is subject to rationing in certain Cantons (Ryan et al., 2013).

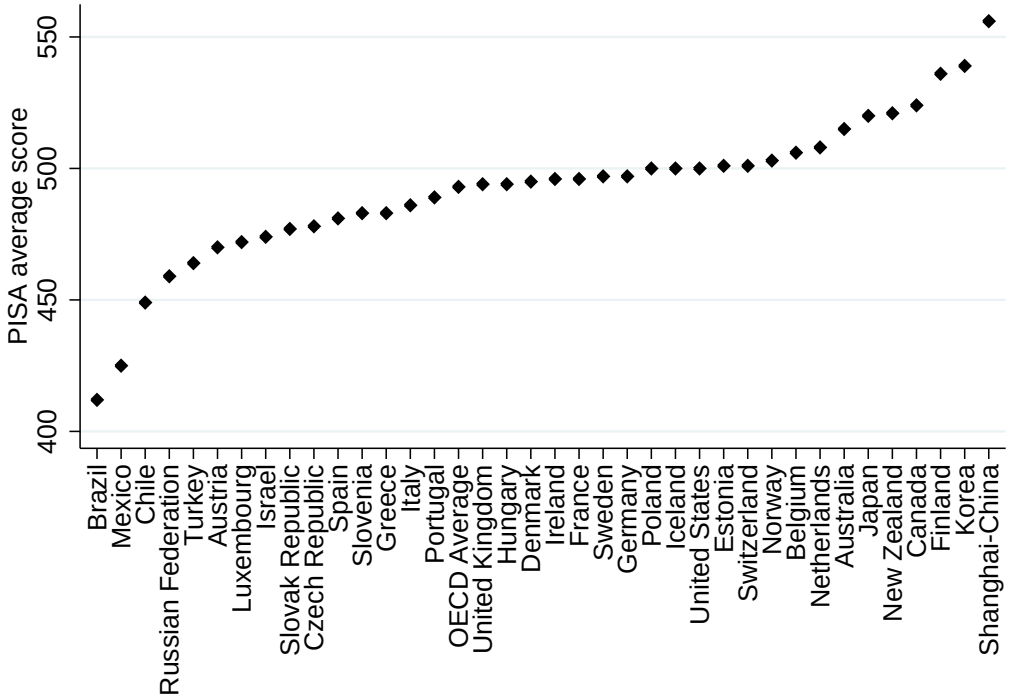
Admitting that early tracking (and the subsequent restriction of access to academic education) increases or simply reproduces inequality over time, in providing large proportions of youngsters with a valuable and recognized skill set, a *Beruf*, apprenticeship training might also impact inequality but in a leveling fashion. It turns out that the association between the Gini index and the proportions of students engaged in dual VET program is largely negative (see appendix figure G.2), which is, of course, only a mere indication but is in line with the generally favorable estimated (private) returns to apprenticeship training (e.g., Backes-Gellner, 2014).

Does early tracking in dual VET countries then only result from institutional path dependency? Can a well functioning apprenticeship system coexist with a less differentiated school system? A closer look at Denmark suggests a positive answer to both questions. Prior to the mid fifties, the Danish school system was also characterized by early tracking at the lower secondary level and "it is a common view that the schooling structure prior to 1958 limited access to further education especially for children from less educated backgrounds and for children from the countryside, which the 1958 reform helped to alleviate" (p.152, Arendt, 2005). All forms of streaming were then completely removed in 1975 (Arendt, 2005).

Transitions and pathways within a school system are always a form of constrained choice, as institutional features exert a heavy influence in structuring the set of possibilities. The extent of those constraints and their distribution within the population, however, result from a public choice; status quo and deliberate change are two sides of the same coin.

A. Appendix to chapter 1

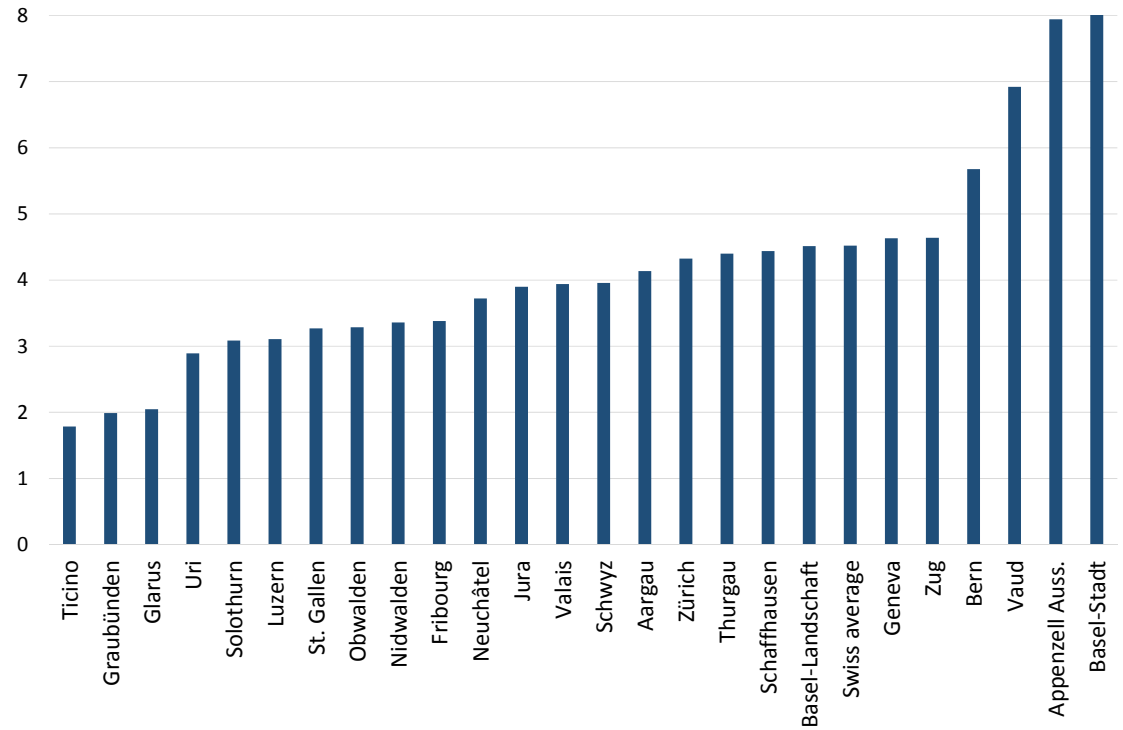
Figure A.1: Average PISA score in reading by country



Data source: PISA 2009 rankings, OECD (2011).
Note: For readability, only countries displayed in figure 1.1 are presented here.

B. Appendix to chapter 2

Figure B.1: Percentages of upper secondary students in remedial education by Canton in 2012-2013



Data source: Swiss Federal Statistical Office (2014b).
Note: Data for Appenzell Innerrhoden are excluded from the figure as, due to its small size, the Canton does not have any remedial education students.

C. Appendix to chapter 3

Table C.1: Impacts of controls, by track

		High School	Gen.School	FT VET	Dual VET	Remedial	Drop Out
	dep. var. mean	*68.6*	*4.8*	*16.2*	*3.9*	*1.8*	*4.8*
High	girl	11.33***	3.23***	-11.04***	-2.29***	-0.63***	-0.60**
track	repeater	-29.73***	8.23***	11.13***	5.45***	2.23***	2.69***
	N			30'533			
	dep. var. mean	*2.0*	*24.8*	*18.1*	*16.9*	*24.9*	*13.4*
Low	girl	0.65***	14.61***	-6.78***	-10.19***	1.25	0.46
track	repeater	0.06	-0.42	-1.24	0.79	0.19	0.62
	N			13'428			
	year dummies			yes			
	school dummies			yes			

Legend: * 0.10 ** 0.05 *** 0.01

Notes: Multinomial logit with transition choice as the dependent variable. Standard errors are computed using the delta method. All variables are held at their sample average and factor variables handled consistently.

Table C.2: Impacts of social capital, by track

		Academic	Gen.School	FT VET	Dual VET	Remedial	Drop Out
	dependent var. mean	*68.6*	*4.8*	*16.2*	*3.9*	*1.8*	*4.8*
High track	non-French speaker	3.67***	-1.69***	-1.05*	-1.07***	-0.19	0.33
	lives w. both parents	5.64***	-1.36***	-2.18***	-0.34	-0.55***	-1.21***
	from a foreign country	-0.92	0.02	-0.28	-0.34	-0.03	1.56***
	Spain and Italy	-14.43***	2.62***	9.00***	0.32	1.79***	0.70
	Portugal	-22.05***	5.28***	8.44***	3.42***	2.29***	2.62***
	Balkans & Turkey	-12.42***	1.36	10.71***	-0.35	1.97**	-1.27**
	Africa & Lat. America	-0.09	-0.03	-1.30	-2.65***	2.32***	1.74**
	EU 27	4.10***	-0.32	-3.06***	-2.04***	-0.20	1.52**
	Asia, N. America & M. East	4.80***	-1.37**	-4.13***	-2.67***	-0.12	3.48***
	N			30'244			
	dependent var. mean	*2.0*	*24.8*	*18.1*	*16.9*	*24.9*	*13.4*
Low track	non-French speaker	0.59**	-2.76**	2.12*	-2.09*	4.49***	-2.35**
	lives w. both parents	-0.21	0.84	4.70***	1.32*	-1.97**	-4.68***
	from a foreign country	-0.62**	2.81**	-0.57	0.20	-2.02	0.20
	Spain and Italy	-0.31	-1.33	-3.96***	1.13	4.25***	0.22
	Portugal	-0.07	0.72	-4.08***	0.57	2.25	0.60
	Balkans & Turkey	0.72	-5.07***	1.17	-4.82***	11.03***	-3.04**
	Africa & Lat. America	2.14***	-0.74	0.72	-13.45***	12.59***	-1.26
	EU 27	1.41*	-0.45	0.58	-6.01***	0.75	3.73*
	Asia, N. America & M. East	4.56**	-5.78*	4.51	-15.04***	12.43***	-0.69
	N			13'282			
	controls			yes			

Legend: * 0.10 ** 0.05 *** 0.01

Notes: Multinomial logit with transition choice as the dependent variable. Are included in the model: an interaction between all the categories of the "age at arrival" variable and the non-French speaker dummy. Age at arrival is omitted from the results. Controls are gender, repeater and year and school dummies. Standard errors are computed using the delta method. All variables are held at their sample average and factor variables handled consistently.

Table C.3: Robustness check: comparison of marginal effects of social capital components with and without a control for performance, high track students

	Academic	Gen.School	FT VET	Dual VET	Remedial	Drop Out
non-French speaker	4.51	-2.77*	-1.31	-0.63	0.11	0.09
lives w. both parents	5.69	-0.54	-4.01*	0.06	-0.39	-0.81
from a foreign country	0.01	1.03	0.09	-0.38	-0.12	-0.62
Spain and Italy	-12.02***	2.08*	8.42***	-0.87*	0.74*	1.66
Portugal	-13.05***	3.24**	7.00***	1.04	0.58	1.18
Balkans & Turkey	-6.06	0.99	7.46**	-0.64	0.43	-2.17***
Africa & Lat. America	0.44	-1.36	-0.35	-2.22***	0.09	3.40**
R. o. EU 27	3.2	-1.38	-3.75*	-1.33**	-0.27	3.53**
Asia, N. America & M. East	8.79***	-1.46	-5.45**	-1.77	-0.48***	0.37
arrival: 5-6 y. o.	1.23	-1.95	-0.34	-0.2	0.24	1.02
arrival: 7-8 y. o.	-9.95	4.27	3.71	-0.21	0.46	1.74
arrival: 9-12 y. o.	-1.16	-0.85	-3.15	1.89	0.17	3.1
arrival: 13-15 y. o.	-4.32	3.41	-5.47	1.78	0.27	4.34
N			8'839			
Percent correctly predicted			69.36			
GPA	35.13	-3.33	-12.18	-1.04	-0.02	-2.19
non-French speaker	4.56	-1.28**	-2.54	-0.58	0.00	-0.16
lives w. both parents	2.43	0.11	-2.26**	0.14	0.00	-0.42
from a foreign country	1.65	0.22	-0.82	-0.37	0.00	-0.67
Spain and Italy	-8.60***	0.79	7.18***	-0.69*	0.00	1.31
Portugal	-7.20***	0.95*	4.82**	0.67	0.00	0.75
Balkans & Turkey	-3.75	0.61	5.72*	-0.55	0.01	-2.04***
Africa & Lat. America	2.60	-0.63	-2.38	-1.76***	0.00	2.17*
EU 27	4.60**	-0.81***	-5.08***	-1.23***	0.00	2.53**
Asia, N. America & M. East	3.74	0.12	-3.26	-1.31**	-0.00*	0.71
arrival: 5-6 y. o.	1.71	-0.83*	-1.24	-0.20	0.00	0.56
arrival: 7-8 y. o.	-6.14	1.07	3.30	-0.19	0.00	1.95
arrival: 9-12 y. o.	-3.64	-0.05	-1.55	1.67	0.00	3.58
arrival: 13-15 y. o.	-4.66	1.36	-3.02	1.71	0.01	4.61
N			8'839			
Percent correctly predicted			73.30			
controls			yes			

Legend: * 0.10 ** 0.05 *** 0.01

Notes: Multinomial logit with transition choice as the dependent variable.

Controls are "gender", "repeater", SES, year and school dummies. Standard errors are computed using the delta method. All variables are held at their sample average and factor variables handled consistently.

Table C.4: Robustness check: comparison of marginal effects of social capital components with and without a control for performance, low track students

	Academic	Gen.School	FT VET	Dual VET	Remedial	Drop Out
non-French speaker	1.08*	-3.68**	5.37**	-4.58***	4.99**	-3.18**
lives w. both parents	-0.15	1.56	4.23**	0.26	-2.33	-3.57***
from a foreign country	-0.78	-1.35	1.26	0.81	0.96	-0.90
Spain and Italy	0.21	-1.96	-4.99*	-3.35*	11.29***	-1.19
Portugal	-0.56	-1.77	-2.42	-1.43	5.15*	1.04
Balkans & Turkey	-0.76	-0.61	2.59	-7.78***	8.08**	-1.52
Africa & Lat. America	2.76*	-0.94	0.62	-10.25***	11.41***	-3.60*
R. o. EU 27	1.23	2.62	-3.01	-5.70**	2.12	2.75
Asia, N. America & M. East	5.84	-7.22*	-3.43	-10.01***	16.97**	-2.16
arrival: 5-6 y. o.	-1.80***	0.32	-3.57	-0.74	4.05	1.74
arrival: 7-8 y. o.	-0.05	-4.04	-10.23***	-3.04	5.16	12.20**
arrival: 9-12 y. o.	-0.50	0.20	-2.02	0.00	-0.81	3.13
arrival: 13-15 y. o.	-0.44	2.12	1.49	-0.38	-1.26	-1.53
N			3'369			
Percent correctly predicted			39.75			
GPA	2.26***	9.43***	23.61***	-1.89**	-26.16***	-7.25***
non-French speaker	0.52	-3.47**	5.87**	-4.88***	5.17*	-3.21**
lives w. both parents	-0.05	1.52	4.52**	0.20	-2.68	-3.51***
from a foreign country	-0.28	-0.4	3.00	0.66	-1.37	-1.61
Spain and Italy	0.05	-2.26	-5.34*	-3.82*	12.20***	-0.82
Portugal	-0.26	-2.11	-3.57	-1.64	6.13*	1.45
Balkans & Turkey	-0.43	-1.35	0.45	-8.55***	10.86**	-0.98
Africa & Lat. America	2.03*	-0.53	2.11	-11.37***	11.20***	-3.44*
EU 27	1.12	3.8	-2.67	-6.26**	1.64	2.37
Asia, N. America & M. East	3.47	-6.88*	-1.74	-11.13***	18.59**	-2.31
arrival: 5-6 y. o.	-0.86**	-1.24	-5.38	-0.93	5.55	2.86
arrival: 7-8 y. o.	-0.09	-3.81	-9.75**	-3.38	5.21	11.82**
arrival: 9-12 y. o.	-0.29	-0.22	-1.70	0.03	-1.06	3.24
arrival: 13-15 y. o.	-0.66	-0.74	-3.46	-0.05	5.24	-0.32
N			3'369			
Percent correctly predicted			45.44			
controls			yes			

Legend: * 0.10 ** 0.05 *** 0.01

Notes: Multinomial logit with transition choice as the dependent variable.
Controls are "gender", "repeater", SES, year and school dummies. Standard errors are computed using the delta method. All variables are held at their sample average and factor variables handled consistently.

Table C.5: Social capital score: summary statistics

	N	mean	sd	min	max
All	43'527	1.23	1.62	0	7
High track	30'245	0.95	1.39	0	7
Low track	13'282	1.85	1.88	0	7

Notes: For each individual, the social capital score corresponds to the addition of: family structure (1 if does not live with both parents); language spoken at home (1 if not French); country of origin (1 if not Switzerland) and age at arrival (1 for children arrived between 4 and 5 years of age and increasing linearly to 4 for children arrived during middle school).

Table C.6: Impacts of dichotomized social capital endowments on conditional transition probabilities by track and group of migrants

		Acad.track	Gen.School	FT VET	Dual VET	Remedial	Drop Out
				High social capital			
	Swiss stdt	73.24	4.19	14.77	3.56	1.21	3.03
	std. error	*0.43*	*0.19*	*0.35*	*0.18*	*0.10*	*0.15*
High track	Italian/Spanish stdt	68.51	4.38	18.90	2.04	2.25	3.93
	std. error	*1.13*	*0.45*	*0.94*	*0.26*	*0.34*	*0.47*
	Portuguese stdt	67.46	4.80	15.75	2.29	2.32	7.38
	std. error	*1.75*	*0.68*	*1.25*	*0.42*	*0.54*	*1.10*
	Balkanian stdt	76.24	1.79	17.76	0.44	1.56	2.21
	std. error	*3.59*	*0.91*	*3.20*	*0.44*	*0.92*	*1.28*
	African stdt	77.99	3.15	8.44	0.88	3.69	5.86
	std. error	*2.60*	*1.01*	*1.73*	*0.51*	*1.14*	*1.45*
				Low social capital			
	Swiss stdt	72.29	3.45	13.55	2.88	1.39	6.44
	std. error	*1.18*	*0.45*	*0.90*	*0.41*	*0.28*	*0.61*
High track	Italian/Spanish stdt	68.12	3.40	17.33	1.64	1.88	7.63
	std. error	*2.09*	*0.72*	*1.62*	*0.41*	*0.49*	*1.23*
	Portuguese stdt	58.27	6.72	17.94	3.81	2.23	11.04
	std. error	*1.75*	*0.78*	*1.26*	*0.51*	*0.44*	*1.23*
	Balkanian stdt	66.71	3.94	20.62	1.95	2.02	4.76
	std. error	*2.33*	*0.78*	*1.96*	*0.53*	*0.58*	*1.06*
	African stdt	69.03	3.82	13.25	0.32	2.81	10.78
	std. error	*1.83*	*0.64*	*1.32*	*0.18*	*0.60*	*1.24*
				High social capital			
	Swiss stdt	1.32	25.35	18.65	18.87	21.69	14.13
	std. error	*0.19*	*0.81*	*0.71*	*0.73*	*0.74*	*0.63*
Low track	Italian/Spanish stdt	1.74	20.49	19.17	16.75	29.86	11.99
	std. error	*0.41*	*1.27*	*1.28*	*1.17*	*1.54*	*1.07*
	Portuguese stdt	2.12	23.19	20.92	12.82	25.08	15.87
	std. error	*0.63*	*1.99*	*1.74*	*1.44*	*1.85*	*1.75*
	Balkanian stdt	2.36	13.23	20.06	11.59	33.80	18.96
	std. error	*1.40*	*3.41*	*3.63*	*3.11*	*4.32*	*4.06*
	African stdt	4.79	21.74	18.25	3.79	36.80	14.64
	std. error	*1.59*	*3.08*	*2.87*	*1.34*	*3.68*	*2.71*
				Low social capital			
	Swiss stdt	1.95	21.74	18.00	12.52	25.38	20.41
	std. error	*0.50*	*1.71*	*1.52*	*1.32*	*1.77*	*1.68*
Low track	Italian/Spanish stdt	1.33	24.61	13.93	14.14	25.93	20.06
	std. error	*0.53*	*1.93*	*1.60*	*1.51*	*2.11*	*1.98*
	Portuguese stdt	1.52	23.40	13.38	16.61	27.52	17.57
	std. error	*0.38*	*1.29*	*1.02*	*1.13*	*1.45*	*1.28*
	Balkanian stdt	2.17	18.58	21.32	11.72	34.92	11.29
	std. error	*0.65*	*1.64*	*1.83*	*1.32*	*2.12*	*1.41*
	African stdt	2.87	22.25	17.08	3.86	36.78	17.16
	std. error	*0.64*	*1.66*	*1.47*	*0.70*	*1.95*	*1.54*

Notes: All numbers are in percent. Conditional probabilities are computed using two multinomial logit models (one for each track) with transition choice as the dependent variable. Social capital is entered as a dummy (with low social cap. the reference group) and interacted with all nationality groups. SES is set at the reference group, white collars. All other controls are held at their sample mean.

Table C.7: Dichotomized social capital endowments: conditional risk ratios between tracks

		Acad.track	Gen.School	FT VET	D.VET	Remedial	Drop Out
Swiss	High social K	58.83	0.15	0.70	0.19	0.05	0.22
	Low social K	58.08	0.42	1.03	0.24	0.06	0.43
Italians & Spaniards	High social K	59.72	0.24	1.18	0.14	0.09	0.27
	Low social K	56.20	0.63	1.65	0.18	0.09	0.50
Portugueses	High social K	42.09	0.30	1.11	0.26	0.11	0.38
	Low social K	36.92	0.73	1.45	0.29	0.10	0.66
Balkanians & Turks	High social K	31.50	0.21	0.93	0.17	0.07	0.20
	Low social K	31.01	0.58	1.36	0.22	0.07	0.39
Africans & Lat. Americans	High social K	22.45	0.14	0.57	0.13	0.09	0.35
	Low social K	22.15	0.39	0.83	0.16	0.10	0.69

Note: Conditional risk ratios are computed using conditional probabilities from two multinomial logit models; social capital is interacted with nationality groups. The relevant exposed group has a high amount of social capital while the relevant non-exposed group has a only a low amount of social capital, all other things equal.

D. Appendix to chapter 4

Table D.1: Descriptive statistics of independent variables

	tracked at 12		tracked at 13		
	percent	sd	percent	sd	p val.
repeater	8.41	0.278	11.29	0.316	0.000
arrival: before school	83.88	0.368	84.98	0.357	0.000
arrival: 5-6 y. o.	4.47	0.207	3.77	0.190	0.000
arrival: 7-8 y. o.	3.46	0.183	3.34	0.180	0.344
arrival: 9-12 y. o.	6.32	0.243	6.17	0.241	0.355
arrival: 13-15 y. o.	1.88	0.136	1.74	0.131	0.123
girl	50.87	0.500	49.65	0.500	0.000
lives w. both parents	74.27	0.437	73.66	0.440	0.031
non French-speaker	39.03	0.488	34.77	0.476	0.000
from a foreign country	20.97	0.407	19.86	0.399	0.000
Switzerland	63.57	0.481	66.41	0.472	0.000
Spain and Italy	11.61	0.320	11.62	0.320	0.959
Portugal	8.13	0.273	9.66	0.295	0.000
Balkans and Turkey	3.16	0.175	2.84	0.166	0.004
Africa and Lat. America	5.34	0.225	3.78	0.191	0.000
Rest of EU 27	4.93	0.216	3.88	0.193	0.000
Asia, N. America and Middle East	3.26	0.178	1.80	0.133	0.000
white collars	41.29	0.492	38.98	0.488	0.000
managerial worker	19.24	0.394	19.58	0.397	0.193
self employed	5.59	0.230	6.25	0.242	0.000
blue collars	29.72	0.457	31.14	0.463	0.000
misc. /NA	4.16	0.200	4.05	0.197	0.408

Data source: Geneva Schooling Database for 12 cohorts (1993-2007).

Notes: p-values report results from the result of the t test on the equality of means across the two sub-samples.

Table D.2: Robustness of baseline results: sensitivity of the estimate to each particular treated school

schools treated	1+2	2+3	1+3	1+2	2+3	1+3
	(1)	(2)	(3)	(4)	(5)	(6)
tracked at 13	0.021***	0.006	0.036***	0.026***	0.009	0.032***
	(0.004)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)
individual controls	yes					
school population controls		no			all	
N	77,964	78,110	78,850	77,964	78,110	78,850

Legend: * 0.10 ** 0.05 *** 0.01

Notes: OLS estimation on the probability to change route with robust variance. Year dummies are included.

Table D.3: Results when dividing the sample according to the first transition

		Acad. track	Gen. School	Prof. school	Apprenticeship
First set	tracked at 13	0.022***	-0.002	0.012	0.019
	R-squared	0.037	0.039	0.016	0.026
Second set	tracked at 13	0.026***	-0.004	0.002	0.018
	R-squared	0.039	0.041	0.019	0.027
Third set	tracked at 13	0.023***	-0.008	0.005	0.024
	R-squared	0.039	0.042	0.020	0.000
	Observations	42,546	9,486	14,400	6,894

Legend: * 0.10 ** 0.05 *** 0.01

Notes: OLS estimation on the probability to change route with robust variance on 12 cohorts. Sample is divided according to the first student's transition. First set only includes individual controls, while the second set additionally controls for middle school level proportions of SES and nationality groups. The third one adds proportions of all variables at the school level. Results for "remedial education" and "dropouts" are omitted.

Table D.4: Results by group of performance and first transition choice

	Academic track		Gen. School		Prof. School		Apprenticeship	
position rel. to median	below	above	below	above	below	above	below	above
tracked at 13	0.074***	0.004	0.05	-0.013	0.073*	0.017	0.079	-0.052
Observations	3,612	3,904	486	530	1,400	1,454	342	370
R-squared	0.038	0.036	0.08	0.069	0.032	0.048	0.106	0.049
indiv. controls	yes	yes	yes	yes	yes	yes	yes	yes

Legend: * 0.10 ** 0.05 *** 0.01

Notes: OLS estimation on the probability to change route with robust variance on 2 cohorts (2003 & 2004). Results for "remedial education" and "dropouts" are omitted.

Table D.5: Robustness of baseline results excluding droppouts and remedial education students as first transitions

	(1)	(2)	(3)	(4)
tracked at 13	0.011***	0.014***	0.017***	0.016***
repeater		0.109***	0.110***	0.111***
arrival: 5-6 y. o.		0.006	0.007	0.008
arrival: 7-8 y. o.		0.025**	0.025**	0.026***
arrival: 9-12 y. o.		0.017**	0.018**	0.017**
arrival: 13-15 y. o.		0.033**	0.034**	0.034**
girl		-0.015***	-0.015***	-0.015***
lives w. both parents		-0.052***	-0.052***	-0.052***
non-French speaker		-0.015***	-0.016***	-0.016***
from a foreign country		0.026***	0.027***	0.027***
Spain and Italy		0.028***	0.028***	0.028***
Portugal		0.056***	0.055***	0.055***
Balkans & Turkey		0.038***	0.034***	0.033***
Africa & Lat. America		0.057***	0.053***	0.053***
R. o. EU 27		0.019***	0.022***	0.022***
Asia, N. America & Middle East		0.019*	0.019*	0.019*
managerial workers		-0.032***	-0.026***	-0.026***
self employed		0.028***	0.028***	0.028***
blue collar workers		0.031***	0.030***	0.029***
misc. /NA		0.037***	0.036***	0.036***
school population controls	no	no	SES & nationality	All
N	73,970		73,326	

Legend: * 0.10 ** 0.05 *** 0.01

Notes: OLS estimation with robust variance on the probability to change route.

Year dummies are included.

Table D.6: Robustness of baseline results: weighted estimation

	OLS	PA
	(1)	(2)
tracked at 13	0.030***	0.031***
repeater	0.127***	0.125***
arrival: 5-6 y. o.	0.000	0.001
arrival: 7-8 y. o.	0.021	0.019
arrival: 9-12 y. o.	0.027**	0.022*
arrival: 13-15 y. o.	0.026	0.019
girl	-0.038***	-0.039***
lives w. both parents	-0.063***	-0.064***
non-French speaker	-0.017***	-0.017**
from a foreign country	0.022***	0.021**
Spain and Italy	0.048***	0.049***
Portugal	0.089***	0.087***
Balkans & Turkey	0.095***	0.092***
Africa & Lat. America	0.100***	0.094***
R. o. EU 27	0.012	0.014
Asia, N. America & Middle East	0.012	0.016
managerial workers	-0.048***	-0.052***
self employed	0.039***	0.040***
blue collar workers	0.053***	0.053***
misc. /NA	0.076***	0.069***
N	83,074	

Legend: * 0.10 ** 0.05 *** 0.01

Notes: Second stage weighted estimation by first stage propensity scores. For OLS, variance is robust and marginal effects at the mean are reported for PA estimation.
Year dummies are included.

Table D.7: Results by group of performance, first transition choice and node

	Relatively to median	Node	tracked at 13	N	R-squared
Academic track	Below	1st node	0.119***	1,806	0.057
		2nd node	0.035	1,806	0.018
	Above	1st node	0.014	1,952	0.086
		2nd node	-0.006	1,952	0.017
General school	Below	1st node	0.056	243	0.149
		2nd node	0.045	243	0.077
	Above	1st node	-0.068	265	0.095
		2nd node	0.041	265	0.100
Full time VET	Below	1st node	0.114*	700	0.046
		2nd node	0.032	700	0.034
	Above	1st node	-0.016	727	0.054
		2nd node	0.05	727	0.047
Apprenticeship	Below	1st node	0.215**	171	0.223
		2nd node	-0.044	171	0.155
	Above	1st node	-0.055	185	0.086
		2nd node	-0.058	185	0.087
Remedial	Below	1st node	0.008	333	0.079
		2nd node	-0.002	333	0.033
	Above	1st node	-0.022	384	0.074
		2nd node	0.046	384	0.035
Dropouts	Below	1st node	-0.152	71	0.267
		2nd node	0.096	71	0.391
	Above	1st node	0.089	78	0.305
		2nd node	-0.032	78	0.378

Legend: * 0.10 ** 0.05 *** 0.01

Notes: OLS estimation on the probability to change route with robust variance.

Year dummies are included.

E. Appendix to chapter 5

Table E.1: Model selection: elements of comparison between Poisson and ZIP models, full sample

	Poisson	Zero inflated Poisson
BIC	69849.73	60384.56
AIC	69564.07	59813.24
	test stat	p-val
Vuong statistic	54.170	0.000
N	42,463	

Table E.2: Zero inflated Poisson regression on the count of years of apprenticeship training, using information on grades, additional results

		Poisson part	Logistic Part
History	grade	0.077***	0.783***
	low track	-0.087	-1.989***
	delayed tracking	-0.083	-0.653***
	repeater	-0.079	-0.329*
	age	0.022	-0.567***
	N	7,021	
Geography	grade	0.087***	0.720***
	low track	-0.090*	-1.944***
	delayed tracking	-0.120	-0.642***
	repeater	-0.100	-0.408**
	age	0.042	-0.529***
	N	7,024	

Legend: * 0.10 ** 0.05 *** 0.01

Note: three years of upper secondary schooling are considered.

Results for other covariates are omitted.

The ZIP is estimated with robust variance.

Table E.3: Poisson Logit hurdle on the count of years of apprenticeship

	Poisson part	Logistic Part
low track	-0.054***	1.787***
delayed tracking	-0.128***	0.688***
repeater	-0.047**	0.337***
age	0.034***	0.450***
N	42,463	
grade	0.0752***	-0.788***
low track	-0.102**	1.642***
delayed tracking	-0.159**	0.722***
repeater	-0.093	0.1134
age	0.045	0.397***
N	6,889	

Legend: * 0.10 ** 0.05 *** 0.01
The model is estimated with robust standard error.
A positive coefficient in the logit part indicates
that the a given characteristic increases
the probability to cross the hurdle. Variance is robust.

Table E.4: Poisson and negative binomial regressions on the count of years of apprenticeship training, using information on grades

	Poisson		Negative Binomial	
	(1)	(2)	(3)	(4)
GPA	-0.512***		-0.620***	
Math score		-0.317***		-0.407***
low track	1.103***	1.142***	1.184***	1.193***
delayed tracking	0.474***	0.328***	0.456***	0.274***
repeater	0.060	0.154*	0.044	0.182*
age	0.269***	0.296***	0.318***	0.351***
N	6,889	6,869	6,889	6,869

Legend: * 0.10 ** 0.05 *** 0.01

Both models are estimated with robust variance. All other individual controls are included.

Table E.5: Specification check: comparison with a Poisson quasi likelihood model

	ZIP		PQL		ZIP		PQL		ZIP		PQL	
	count	inflation	count	inflation	count	inflation	count	inflation	count	inflation	count	inflation
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
GPA	0.062**	0.959***	-0.207***	1.537***								
Math score					0.104***	0.676***	-0.081*	1.529***				
low track	-0.101*	-2.001***	0.704***	-15.972***	-0.086	-1.974***	0.803***	-16.614***	-0.075***	-2.232***	0.538***	-2.942***
delayed tracking	-0.113	-0.839***	0.678***	0.568	-0.078	-0.492***	0.406**	0.544	-0.124***	-0.821***	0.359***	-0.242**
repeater	-0.070	-0.167	0.035	-0.054	-0.098	-0.432**	0.068	-0.880	-0.102***	-0.577***	-0.110***	-1.858***
age	0.051	-0.437***	0.220***	-0.372	0.040	-0.489***	0.259***	-0.293	0.018	-0.567***	0.117***	-0.767***
N	6,889				6,869				42,463			

Legend: * 0.10 ** 0.05 *** 0.01

For ZIP models, variance is robust. PQL models are estimated using Stata code provided by Winkelmann and Staub (2013).

Table E.6: Model selection: information criteria for ordered probit and ZIOP models, full sample

	Ordered Probit	ZIOP
BIC	41838.1	40911.9
AIC	41535.1	41500.5
N	42,463	

Table E.7: Robustness check: exclusion of students with 2 years of training right after middle school

model	ZIP		ZIOP	
dep. variable	count of years of training		smoothness of voc. pathways	
	Poisson	Logit	Ordered	Probit
	(1)	(2)	(5)	(6)
low track	-0.083***	-2.178***	-0.435***	2.198***
N	42,033			
GPA	0.072**	0.971***	0.134*	-0.483***
low track	-0.125*	-1.987***	-0.462***	1.310***
N	6,848			
Controls	yes			

Legend: * 0.10 ** 0.05 *** 0.01

Note: all individual controls are included in both models.
For the ZIP, variance is robust and the ZIOP
has been estimated using Nlogit 5.

F. Appendix to chapter 6

Table F.1: Distribution of selected covariates across subsamples

		Cohort	CVET students		
			1+ year	2+ years	have qualified
	N	3,299	850	667	439
Gender	girl	49.01	45.53	47.83	46.47
Family structure	lives with both parents	65.14	68.00	68.97	71.53
Language spoken at home	non French-speaker	35.07	48.24	45.88	48.06
Nationality groups					
	Switzerland	69.75	58.00	61.47	63.55
	Spain and Italy	7.27	10.59	10.04	12.53
	Portugal	9.46	12.71	11.99	11.16
	Balkans and Turkey	3.36	7.53	6.90	6.61
	Rest of EU 27	3.21	2.35	1.80	0.68
	Rest of the World	6.94	8.82	7.80	5.47
SES					
	white collars	40.97	37.34	38.38	36.90
	managerial workers	19.20	8.83	8.70	8.20
	self employed	5.27	7.18	7.95	8.43
	blue collars	29.64	40.05	39.13	41.23
	misc. /NA	4.93	6.60	5.85	5.24

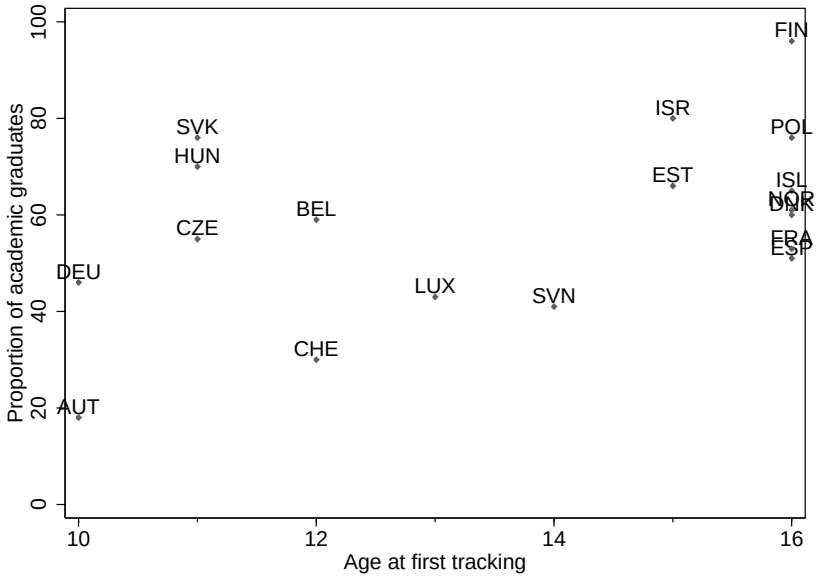
Datasource: GSD Administrative data, 2003-2013.

Notes: "CVET" stands for commercial vocational education and training.

The category "1+" ("2+") refer to students with at least a (two) year(s) spent in CVET.

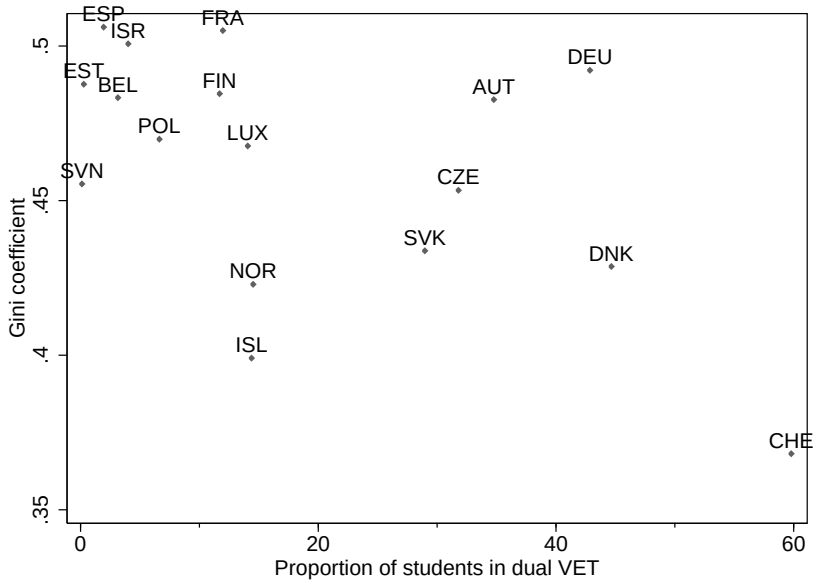
G. Appendix to chapter 7

Figure G.1: Age at first tracking and proportions of upper secondary academic graduates



Note: Upper secondary graduation rates are only reported for ISCED 3A programs, directly preparing students for university admission (type A higher education). Only country with available data on the proportion of students in dual VET are shown on the figure. This latter restriction has no impact on the qualitative message.
Data source: Age at first tracking from p.57, OECD (2012b) and upper secondary graduation rates from p. 50, OECD (2013).

Figure G.2: Gini coefficients and proportions of upper secondary students engaged in dual VET programs



Note: Proportions of students refer to the enrollment rate of 15-19 year olds in upper secondary dual VET programs (i.e., apprenticeship training). Gini coefficients refer to the year 2010 for most countries (2011 value was used when 2010 went missing) and to the income distribution before taxes and transfers.
Data source: Gini coefficients were extracted from the OECD database on "Income distribution and poverty" (2014) and enrollment rates from p.271, OECD (2013).

Glossary

Apprenticeship training ('Apprentissage'/ 'duale Berufsbildung') combines learning on the job and at a vocational school.

Canton ('Canton'/'Kanton') is a political entity granted a good degree of autonomy by the Federal State, the Swiss Confederation. Each Swiss Canton is a member of the Federal State. Equivalent to a German Land or a US State.

College-bound high school ('Collège'/'Gymnasium') Academic high school equivalent to the Gymnasium in Germany or to the Grammar School in the UK. It delivers the Matura, a diploma granting University admission.

Craft ('Métier'/'Beruf') occupation specific set of skills.

Federal VET certificate ('Certificat fédéral de capacité'/'eidgenössisches Fähigkeitszeugnis') is a three year vocational degree delivered by vocational schools granting access to further education (vocational Matura).

General school ('Ecole de Culture Générale') delivers lower level general knowledge. A three year certificate may be obtained, followed by a specialized Matura, which will grant access to selected Universities of Applied Science.

Academic Matura or simply the Matura('Maturité'/'Maturität') Federal academic high school level diploma delivered by Gymnasien ('Collèges' in Geneva) and granting an automatic access to University. Equivalent to the German Abitur.

Remedial education ('Solutions transitoires ou passerelles'/'Zwischenlösungen') is "at the interface between lower and upper secondary education" (p.110, SKBF, 2014) for individuals not managing a direct transition to a certifying upper secondary route.

Specialized Matura ('Maturité spécialisée'/'Fachmaturität') can be obtained when adding a one year specialized curriculum to a three year general knowledge certificate and is thus a four year diploma. It is delivered by upper secondary general schools and allows an automatic admission to the consecutive University of applied sciences.

University of applied sciences ('Hautes Ecoles Spécialisées'/'Fachhochschulen') are tertiary (A) vocational universities delivering both bachelor's and master's degrees.

Vocational Matura ('Maturité Professionnelle'/'Berufsmaturität') can be obtained when adding a one year curriculum to a three year Federal VET certificate and is thus a four year qualification. It is delivered by vocational schools and grants access to Universities of applied sciences.

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